City and Borough of Wrangell, Alaska

REQUEST FOR QUALIFICATIONS

WRANGELL WATER TREATMENT PLANT IMPROVEMENTS DESIGN

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SCOPE OF SERVICES: The City and Borough of Wrangell, Alaska ("CBW" and "Borough") hereby invites qualified firms ("Firm" or "Consultant") to submit their Proposal, with Statements of Qualifications, for engineering design services for the Wrangell Water Treatment Plant Improvements Design project.

The engineering firm will provide complete design, permitting, and construction administration and observation of a Dissolved Air Flotation (DAF) water treatment system, to replace the existing Slow Sand Filtration treatment system in Wrangell, Alaska. The engineering firm will be responsible for receiving approval for replacement and upgrades from Alaska Department of Environmental Conservation (ADEC).

This RFQ does not commit the Borough to award a contract, nor to pay any of the costs incurred in the preparation and submission of Proposals in anticipation of a contract. The Borough reserves the right to waive irregularities, at its sole discretion, and to accept or reject any or all Proposals for any reason.

PRE-PROPOSAL MEETING: A *mandatory* pre-proposal meeting will be held in the Borough Assembly Chambers, 205 Brueger Street, at **11:00 a.m., Alaska Time on September 16, 2020.** Firms interested in submitting a Proposal must attend. Other parties wishing to join by teleconference may do so by calling 253-215-8782 and enter Meeting ID: 466 259 8468 and Password: 438558.

QUESTIONS REGARDING THIS RFQ: All questions must be directed to the Capital Facilities Director, Amber Al-Haddad by phone at 907-874-3902 or by email at aal-haddad@wrangell.com. The Capital Facilities Director is the sole point of contact for all concerns pertaining to this procurement.

DEADLINE FOR PROPOSALS: All proposals must be sealed and delivered in person, by courier, or by U.S. Mail postage paid, to the Borough Clerk at the address below. Proposals must be received by the Borough Clerk prior to **2:00 p.m. Alaska Time on September 30, 2020**, or such later time as may be announced by addendum to plan holders any time prior to the submittal date. Proposals will be time-stamped by the Borough Clerk to establish the official time of receipt of each Proposal. Late Proposals are not to be accepted and shall be returned unopened. Faxed or emailed Proposals are not to be accepted and will be discarded, unread.

Acknowledgement of addenda may be delivered by fax or email, and confirmation of receipt of any submitted documents is the sole responsibility of the Proposer.

Proposal documents delivered in person or by US Postal or Courier Services must be delivered to:

In by Courier or In-Person Delivery:
Borough Clerk
City and Borough Wrangell
205 Brueger Street
Wrangell, AK 99929

If by U.S. Postal Service:
Borough Clerk
City and Borough of Wrangell
PO Box 531
Wrangell, AK 99929

TABLE OF CONTENTS

1.0 GENERAL TERMS AND CONDITIONS

1.1 Pre-Proposal

Proposers should carefully examine this entire RFQ, its addenda, and all related materials and data referenced herein. Proposers shall be fully aware of the nature of the work and the conditions likely to be encountered in performing the work. This duty of full preparation falls to each Proposer. It shall be presumed that each proposer has fulfilled this duty.

1.2 Proposal Format

Proposals are to be prepared in such a way as to provide a straightforward and concise delineation of the Proposer's capability to satisfy the requirements of this RFQ.

1.3 Proposal Development and Submittal

Submit sealed responses, one (1) original, three (3) copies, and one (1) single PDF file on a flash drive, of the complete Statement of Qualifications, serving as the Proposal package, to the City and Borough of Wrangell. Include one (1) copy of the Cost Proposal in a separate, sealed envelope. Proposals shall be completely sealed in an envelope clearly marked with the company name. All Proposals submitted shall be binding upon the contractor, if accepted by the Borough.

Please note that overnight delivery from the Lower 48 (Contiguous U.S.) states is generally not available to Wrangell. Proposers should anticipate a minimum of four to five days delivery time for express, priority or expedited delivery services. No allowance may be requested for miscalculation resulting in late delivery.

All materials submitted in response to this RFQ shall become the property of the City and Borough of Wrangell. One copy shall be retained for the official files of the Borough and shall become public record after award of the Contract.

Proposals are to be prepared in such a manner as to provide a straightforward, concise delineation of the Proposer's capabilities to satisfy the requirements of this RFQ. Emphasis should be concentrated on conformance to the RFQ instructions, responsiveness to the RFQ requirements, and on completeness and clarity of content.

This solicitation does not commit the Borough to select any Consultant for the requested services. All costs associated with the respondents' preparations, submission and oral presentations shall be the responsibility of the Proposer.

1.4 Signature Requirement

Proposals must be signed by any of the following:

- An officer or other agent of a corporate vendor, if authorized to sign contracts on its behalf; or
- A member of a partnership; or
- An owner of a privately-owned vendor; or
- Other agent, if properly authorized by a power of attorney or equivalent document.

The name and title of the individual(s) signing the Proposal must be clearly shown immediately below the signature.

Such acceptable signature shall be construed as binding the submitting party to the Proposal.

1.5 Questions

Questions must be submitted in writing, via email to aal-haddad@wrangell.com, no later than one week prior to the due date of the RFQ submittal.

1.6 Standard Contract Language

Attached to this RFQ is the Agreement between Owner and Engineer for Professional Services (EJCDC No. E-500, 2014 Edition), which should be carefully reviewed by Proposers, as it is the form of Agreement into which the CBW shall require the selected Consultant to enter, in the event their Proposal is accepted.

1.7 Addenda

No oral change or interpretation of any provision contained in this RFQ is valid. Written addenda will be issued when changes, clarifications, or amendments to RFQ document are deemed necessary by the Borough.

Proposer shall acknowledge receipt of each addendum in the space provided on the Proposal Form. Only a Proposal acknowledging receipt of all addenda may be considered responsive, unless the addendum, in the opinion of the Borough Manager, would have no material effect on the terms of the Proposal. No lobbying may be made of the Borough Manager.

1.8 Modifications of Proposals

Modifications to the Proposal, prior to the bid opening, will be accepted by the Borough, and binding upon the responding firm, where the modification:

a. Is received by the Borough Clerk prior to the deadline, either by fax to number 907-874-3952 or by email to clerk@wrangell.com.
b. Is sealed in an envelope clearly stating Water Treatment Plant Improvements Design and the name of the responding firm.
c. Is signed by the same individual who signed the original submittal.

Further, the modification document shall include a copy of each page of the original submittal, which the responding firm seeks to modify, and the respondent's signature clearly set out in ink on each page. Should there be more than one submittal modification from a responding firm, the last modification received prior to the deadline shall be opened and applied to the submittal. All earlier modifications shall be returned to the responding firm unopened.

Any modification, which fails to meet any requirement of this section, shall be rejected and the submittal shall be considered as if no modification had been attempted.

1.9 Late Submissions

Proposals not received prior to the date and time specified in the RFQ, or otherwise modified by Addendum shall not be considered and will be returned unopened after recommendation of award.

1.10 Withdrawal of Proposals

At any time prior to the scheduled closing time for receipt of RFQ submittals, any responding firm may withdraw its submittal, either by appearing in person and requesting return of the Proposal or by written request, addressed to the Borough Clerk. However, a Proposal shall not be withdrawn after opening without the written consent of the Borough.

1.11 Proposal Acceptance Period

It is anticipated that award will be announced within 30 calendar days of the proposal submittal date; however, all offers must be irrevocable for 60 days following the proposal submission date. The CBW is under no obligation to accept a deficient proposal or to accept any proposal if none or fewer than two are found to be acceptable. All acceptances are subject to appropriation by the Borough Assembly and grant rules.

1.12 Right to Reject / Award

The Borough may reject any or all Proposals, if the Borough Manager determines that it is in the best interest of the Borough, and may waive irregularities, other than the requirements for timeliness and manual signature, if the irregularities do not affect the competitive advantage of any Proposer.

Award will be made to the most qualified Proposer, whose offer is deemed most advantageous to the Borough, all evaluation criteria considered. The Borough may choose to interview only the top-ranking firms as based on proposal review and scores. Unsuccessful offeror will be notified.

1.13 Time is of the Essence

Time shall be of the essence in this contract.

1.14 Licenses and Certifications

Proposers shall include all business and professional licensing numbers associated with each firm and individual proposed to perform under the contract.

Before a Proposal is considered for award, a Proposer will be required to submit current documentation of the same as issued by, or under authority of, the State of Alaska. If documentation is from an outside jurisdiction, such documentation submitted must be of a form accepted as valid by the State of Alaska for performance in Alaska.

Such documentation shall include, but is not limited to, a current Alaska business license for the business to be conducted, applicable professional licenses, registrations, and all necessary certificates.

1.15 Invoicing and Payment

Unless otherwise agreed, the payment terms are Net 30 days following satisfactory acceptance of services provided and upon receipt of invoice, whichever is later. Original invoices are to be mailed to the Accounts Payable division of the City and Borough of Wrangell, with an emailed copy to the Project Manager. The Contract Number and Project Name must be stated on the invoice; otherwise, payment may be delayed.

1.16 Choice of Law and Jurisdiction

The laws of the State of Alaska shall govern this RFQ, and any legal action brought thereon shall be filed and adjudicated in the First Judicial District in Wrangell, Alaska.

The Borough reserves its right to litigate in all circumstances and will reject mandatory arbitration clauses.

1.17 Conflicts of Interest

No member of the governing body of the City and Borough of Wrangell or other officer, employee or agent of the Borough who exercises any functions or responsibilities in connection with the carrying out of the project shall have any personal interests, direct or indirect, in any ensuing contract as a result of this Request for Qualifications, without first disclosing his/her potential conflict of interest, by submitting a letter to the Clerk's Office establishing their "intent to do business with the Borough". The contractor for itself and its principal employees, officers, agents, directors, and shareholders further covenants that neither the contractor nor any of the listed classes of individuals has nor shall acquire any interest, direct or indirect, in the project, direct or indirect, to which the contract pertains which would conflict in any manner or degree with the performance of its work hereunder. The selected Proposer further covenants that in its performance of the contract no person having such interest shall be employed, without first disclosing his/her potential conflict.

1.18 Disclosure of Proposal Contents

The City and Borough of Wrangell, a municipal corporation and political subdivision of the State of Alaska, is subject to the Alaska Public Records Act codified at AS 40.25.100-220, and the public records provisions in the CBW Charter, section 4.5. The contents of Proposals submitted in response to this RFQ will be kept confidential until the top ranked Proposer is announced. Immediately following announcement, all Proposals become public information. Trade secrets and other proprietary data contained in a Proposal may be held confidential, to the extent allowed by law, by the Purchasing Officer, upon request in writing by a Proposer and proper marking in the proposal. Material considered confidential by the Proposer must be clearly identified and marked (page, section, etc.) by the Proposer, and the Proposer must include a brief statement that sets out the reasons for confidentiality. Marking the entire Proposal confidential is not acceptable and may be cause for the Borough to reject your Proposal as non- responsive.

1.19 Freedom of Information Act

The City and Borough of Wrangell is responsible for meeting Freedom of Information Act (FOIA), Title 5 of the United States Code, Section 522 (5 U.S.C. §522) (Public Law 89-554), requirements regarding its records. The regulations governing the U.S. Department of Commerce under 15 C.F.R. part 4 set forth the requirements and procedures that recipients of federal funding must follow in order to make the requested material, information, and records publicly available. Unless prohibited by law and to the extent required under the FOIA, contents of applications and other information submitted by the Consultant may be released in response to a written request for federal records that cites FOIA.

2.0 SPECIAL CONDITIONS

2.1 Insurance Requirements

A. Consultant shall maintain, in good-standing, the insurance described in subsection (B) of this section. Before entering into an Agreement, Consultant shall furnish Borough with a Certificate of Insurance showing proof of insurance in accordance with subsection (B) of this section in a form acceptable to Borough.

B. Consultant shall provide the following types of insurance, listed at parts 1-4 of this section, the minimum limits of not less than those stated below. Borough shall be named as additional insured on all insurance policies except workers' compensation and professional liability contracts, and Consultant shall provide Borough with a Certificate of Insurance showing “The City and Borough of Wrangell, Alaska” as an additional insured.

   1. Workers' compensation and employer's liability coverage as required by Alaska law.

   2. Comprehensive general liability, including contractual, property damage, bodily injury, premises operations including explosion, collapse and underground; products and complete operations, broad form property damage and personal injury coverages in amounts no less than $1,000,000 per occurrence and $2,000,000 aggregate.

   3. Comprehensive automobile liability, bodily injury and property damage, including all owned, hired and non-owned automobiles in amounts no less than $1,000,000 each occurrence and $2,000,000 aggregate.

   4. Architects or Engineers professional liability in the amount of $1,000,000. The Consultant agrees to be responsible for any damages arising from any defects in design or negligence in the performance of the Resident Inspector. Liability insurance must also provide coverage for such damages.

C. Each policy of insurance required by this section shall provide for no less than thirty (30) days' advance notice to Borough prior to cancellation.

2.2 Hold Harmless and Indemnity

To the fullest extent permitted by law, Consultant shall indemnify, defend, and hold harmless the Borough, its elected and appointed officials, employees, and volunteers, from and against any suit, action, claim, damages, or liability of any kind and of any nature, including death, arising out of any act, error or omission or any claim of, or liability for, negligent acts, errors, and omissions of the Consultant under this agreement. Pursuant to this section, the Consultant is not required to indemnify, defend, or hold harmless the Borough for a claim of, or liability for, the independent negligent acts, errors, and omissions of the Borough. If there is a claim of, or liability for, a joint negligent act, error, or omission of the Consultant and the Borough, the indemnification, defense, and hold harmless obligation of this section shall be apportioned on a comparative fault basis. In this section, “Consultant” and “Borough” include the employees, agents, and subcontractors who are directly responsible, respectively, to each. In this section, “independent negligent acts, errors, and omissions” means negligence other than in the Borough’s selection, administration, monitoring, or controlling of the Consultant, or in approving or accepting the Consultant’s work.

2.3 Goals for Women and Minorities in Construction

Department of Labor regulations set forth in 41 C.F.R. § 60-4 establish goals and timetables for participation of minorities and women in the construction industry. These regulations apply to all federally assisted construction contracts in excess of $10,000. The Recipient shall comply with these regulations and shall obtain compliance with 41 C.F.R. § 60-4 from contractors and subcontractors employed in the completion of the Project by including such notices, clauses and provisions in the Solicitations for Offers or Bids as required by 41 C.F.R. § 60-4. The goal for the participation of women in each trade area shall be as follows: From April 1, 1981, until further notice: 6.9 percent.

A list of currently approved Minority or Disadvantaged Women Business Enterprise contractors may be obtained by contacting:

Office of Equal Opportunity
632 W. Sixth Avenue, Suite 620
P.O. Box 196650
Anchorage, AK 99519-6650
907-343-4895

2.4 Owner and Engineer Agreement

The Agreement between Owner and Engineer for Professional Services (EJCDC No. E-500, 2014 Edition) shall be the Agreement between the Borough and the selected Consultant.

The Consultant shall be required to follow those standards set forth in the competitive procurement standards of 2 C.F.R. Part 200, including but not limited to:

- The fee for basic Engineer Services will be a lump sum or an agreed maximum, and no part of the fees for other services will be based on a cost-plus-a-percentage-of-cost or a cost using a multiplier.
- The fee for basic Project Inspection Services will be a lump sum or an agreed

maximum, and no part of the fees for other services will be based on a cost-plus-a-percentage-of-cost or a cost using a multiplier.

2.5 Procurement of Federally Funded Projects

All procurement transactions, including the procurement of engineering services, shall be in accordance with Federal regulations adopted by the Department of Commerce at 2 C.F.R. Part 200 and the EDA regulations contained in 13 C.F.R. Chapter III, especially 13 C.F.R. Part 305 and 13 C.F.R. section 302.17 (“Conflicts of Interest”).

2.6 Archeological and Historical Resources

If during investigative activities or construction of the project, historical and archeological resources, including burial grounds and artifacts are discovered, all work shall immediately cease in the area until contact is made with the State Historic Preservation Officer. SHPO's instruction for the preservation of resources must be followed.

2.7 Migratory Birds

To ensure ground-disturbing activities do not result in "take" of an active nest or migratory bird protected under the Migratory Bird Treaty Act, the Recipient shall include in the bid documents the following recommendations and requirements of the U.S. Fish and Wildlife Service: No vegetation clearing April 15 through July 15

2.8 National Pollutant Discharge Elimination System (NPDES) Permit

Prior to solicitation of bids, the Recipient shall provide documentation satisfactory to the Economic Development Administration (EDA) that the National Pollutant Discharge Elimination System permit (in this case likely a construction general permit) has been obtained or is not applicable or that the bid documents include language requiring the contractor to obtain the permit prior to the start of construction. If the contractor obtains the permit, then prior to initial disbursement of any construction costs, the Recipient shall provide EDA with satisfactory documentation that the permit has been obtained.

2.9 American Iron and Steel (AIS)

Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) applies an American Iron and Steel requirement to this project. All iron and steel products used in this project must be produced in the United States. The term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. Regulation applicable to the project is outlined in the attached RUS Bulletin 1780-35.

2.10 Buy America

Consistent with Executive Order 13858, Strengthening Buy-American Preferences for Infrastructure Projects, this project requires, to the greatest extent practicable, iron and aluminum as well as steel, cement, and other manufactured products produced in the United

States in every contract, subcontract, purchase order, or sub-award applicable to this federally -funded project.

3.0 INTRODUCTION AND SCOPE OF WORK

3.1 Purpose

The Borough is soliciting Proposals from qualified firms to provide engineering design services for the Wrangell Water Treatment Plant Improvements project, located in Wrangell, Alaska. Based on a mutually agreed upon program and budget, the Consultant's services shall consist of the duties associated with a phased design program.

3.2 Project Background

The Wrangell Water Treatment Plant serves to treat and deliver the drinking water for the community of Wrangell, which has approximately 721 residential water users and 154 commercial water users, including schools, the hospital, clinics, senior housing, local, state and federal offices, harbors, the airport, the community swimming pool, two seafood processors and visiting passenger cruise ships.

Wrangell’s surface water source is comprised of two mountain lakes, an upper and a lower reservoir, with a combined volume of 66,700,000 gallons. The reservoirs have thus far consistently supplied water to the community with little drought-related interruptions; however, with an increase in dry periods, the lakes’ shorelines and banks become exposed, increasing erosion, which affects the raw water quality. In general, Wrangell’s raw water enters the plant with elevated levels of turbidity, organics, color, iron, and manganese, as well as low pH and alkalinity levels.

To supply potable water, Wrangell owns and operates a Class 2 Public Water System (PWS ID No. AK2120143), under which the current water treatment plant was constructed in 1999 and features an ozonation process followed by roughing filter, slow-sand filtration and disinfection.

In 2016 Wrangell completed a water plant pilot study through which a Dissolved Air Floatation (DAF) treatment system was evaluated. The project was extended to include the development of a Preliminary Engineering Report (PER) to identify the pilot study’s findings and develop conceptual design criteria based on recommendations for a Water Treatment Plant Improvements project. The recommended alternatives identified in the PER were to construct a Dissolved Air Filtration (DAF) with Multimedia Filtration water treatment system.

The City and Borough of Wrangell has obtained funding for the engineering design and construction for a new DAF water treatment plant, which would be constructed mostly within the footprint of the existing water treatment plant, located along Wood Street in Wrangell, Alaska.

Required services and deliverables produced by this project’s engineering design phase shall include a detailed and comprehensive engineering design for the construction of the new water treatment facility. Design for this project shall replace the Slow Sand Filtration treatment system with a Dissolved Air Flotation (DAF) and Multimedia Filtration treatment system.

Design for this project shall consider the preferred DAF project and all associated processes and components for the new treatment facility, as outlined in the Preliminary Engineering Report, and evaluate the conceptual design criteria to ensure success with improved drinking water quality, improved treatment capacity for compliance with all drinking water regulations, and improved production capacity to meet the community's growing water demands. The final design criteria shall ensure that water treatment with this DAF plant has the capacity to treat the projected 20-year peak water demands, have adequate functional redundancy for maintenance, and have adequate backwash and waste disposal.

The project shall be delivered under one construction phase; however, due to the multiple funding sources for the project, the Engineer will be required to assist the Owner in identifying and maintaining allocation of project costs to the funding agency responsible for the specific project components.

The Borough has accepted an EDA grant, a USDA loan, and a USDA grant for the design and construction of this water treatment plant project. A total of $9.1 million is available to design and construct a Dissolved Air Flotation (DAF) treatment plant.

All aspects of the project shall comply with the requirements of the funding agencies as well as all local, state, and federal regulations related to the various engineering design criteria of the project.

3.3 Scope of Work

The Consultant shall have the responsibility for complete and final engineering design, to obtain required environmental and permitting approvals, and to provide construction administration and inspection services. Design work shall begin immediately following an award, and the goal is to advertise for construction by May, 2021.

Based on a mutually agreed upon program and budget, the Consultant's services shall consist of the normal duties associated with a design-bid-build phased project delivery method. Without limiting the creativity and thoroughness of the Consultant, the scope of work for this project shall generally include the following:

A. Engineering Design services for the Dissolved Air Flotation water treatment system:

1. Pre-Engineering Design

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:
   i. 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.
   ii. 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.

iii. 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.

2. Engineering Design

a. Perform detailed engineering design and conduct workshops with key Borough staff to review design at key stages, as proposed by Consultant.
b. Consultant shall perform planning, designing, and engineering of the construction project. Consultant shall submit 35%, 65% and 95% design drawings, specifications, bid schedule and project cost estimates, in conformance with applicable federal and state requirements and applicable codes. Project design to include all environmental, civil, structural, mechanical, electrical, controls and related systems.
c. Conduct a field design survey and geotechnical investigation of the site for the purpose of determining civil engineering design. Supervise any required subsurface explorations such as borings and soil tests to determine amounts of rock excavation or foundation conditions.
d. Design a temporary water treatment necessary to replace the roughing filter process and maintain continuous operation of the existing treatment plant, during construction, until the new system has been commissioned and performance-tested for 30 days.
e. Prepare estimate of quantities to include mobilization, demolition, earthwork, water treatment system work, and other associated bid item summaries.
f. Review, for inclusion in the construction documents, the federal agencies' requirements related to construction projects, including "Buy America" and "American Iron and Steel" regulations.
g. Review, for inclusion in both the design and the construction work, the federal agencies' requirements related to environmental requirements.
h. Obtain necessary ADEC Approval to Construct. The Consultant shall be responsible for developing and submitting an Engineering Review Plans to ADEC for approvals related to the water treatment system improvements, Owner will pay for fees. A professional engineer registered in the State of Alaska must stamp all design drawings.
i. Obtain necessary Environmental Permits. The Consultant shall be responsible for developing and submitting environmental permits necessary for the work. The environmental permits and /or consultation which have already been conducted are:
   i. National Environmental Protection Agency (NEPA) review
   ii. A Section 106 of the National Historic Preservation Act (NHPA) review by the State Historical Preservation Office (SHPO), with findings concurrent

with “No Historical Properties Affected.”

iii. A complete Environmental Review, including a US Army Corps of Engineers’ Jurisdictional Determination with a finding of “no navigable waters of the U.S. within Rivers and Harbors Act jurisdiction in the review area.”

j. Update project schedule and cost estimates, as necessary.

3. Construction Bidding Assistance

   a. Prepare and tender construction bidding documents, including Project Manual and 11” x 17” drawing sets. Eight (8) complete construction document sets shall be published.
   b. Participate in public meetings.
   c. Supervise the construction bid advertising, conduct the pre-bid meeting, issue addenda.
   d. Evaluate bids, prepare bid tabulations, and recommend a construction contract award. Advising on issuance of Notice to Proceed.

B. Construction Management services through the provision of engineering assistance, construction administration and onsite inspection services for the Dissolved Air Flotation water treatment system. Such services will begin at the Construction Contractor's start date and extend through commissioning of the treatment plant, and shall include the following:

1. Construction Administration

   a. Conduct the pre-construction conference and weekly progress meetings, complete with agendas and meeting minutes.
   b. Participate in public meetings.
   c. Responding to DCVR's.
   d. Review and approve all contractor submittals, change orders, and progress pay requests, recommending further approval by the Borough and the funding agencies.
   e. Prepare quarterly reports, to be submitted to the federal funding agencies, covering the general progress of the project and describing any problems or factors contributing to delay.
   f. Perform substantial completion inspection by all engineers of record for their respective design discipline.
   g. Prepare and manage punch list.
   h. Provide reproducible plan drawings to the Borough upon project completion.
   i. Perform final completion inspection, testing, and commissioning of the new treatment system and associated processes.
   j. Prepare a final report and submit certified “as built” drawings to the Borough.
   k. Obtain ADEC-required Temporary Approval to Operate, as well as the Final Approval to Operate. The Consultant shall be responsible for developing and submitting Engineering Review Plans to ADEC for approvals related to the water treatment system improvements, Owner will pay for fees. A professional engineer registered in the State of Alaska must stamp all design drawings.
   l. Prepare an operation and maintenance manual.
   m. Perform a one-year warranty inspection.

2. Resident Inspector

   a. Provide one full-site Resident Inspector for the duration of the construction project, providing on-site observation and inspection of construction work.
   b. Ensures construction complies with plans, specifications, and all other contract documents.
   c. Assists Owner, Engineer and Contractor to resolve technical and contractual issues.
   d. Prepare daily construction inspection reports.
   e. Consult with the Borough regarding construction progress and quality.
   f. Note: The consulting engineer shall submit a resume of qualifications of the proposed Resident Inspector to the Owner and the funding agencies, for acceptance in writing. The Resident Inspector will work under the technical supervision of the project engineer and the role and responsibilities will be defined in writing.

The design work is anticipated to begin as soon as possible, but no later than April 30, 2021.

3.4 Deliverable Conditions

All documents for this project, including specifications, shall be in a format and on media approved by the Borough using the latest CAD and Microsoft Office Products. Upon completion, Owner shall be furnished with a CD of all documents in their original format and pdf format as well as one each 11" x 17" and 22" x 34" to scale As-Built drawings. All documents shall remain the property of the Borough, and the Borough shall be entitled to editable formats of all documents generated.

3.5 Additional Services

Additional Services shall consist of providing any other services not included in the Consultant's basic services and must be authorized by a change order, signed by both parties, and compensated at either the rate listed in the Consultant's Fee Schedule for Additional Services or as negotiated for each additional service occurrence. Fee Schedules for each Consultant and their Subconsultants shall be included with their Cost Proposal.

3.6 Timeline

• Advertise for Design Proposals	August 27, 2020
• Mandatory Pre-Proposal Meeting in Wrangell	September 16, 2020
• Final Questions Due	September 23, 2020
• Proposals due to Borough Clerk	September 30, 2020
• Assembly approval of award for design services	October 13, 2020
• Intent to Award	October 14, 2020

- Notice to Proceed — October 30, 2020
- Schematic Phase complete — December 31, 2020
- Design Development Phase complete — February 26, 2021
- Construction Documents / Cost Estimate Phase complete — April 15, 2021
- Bid Documents complete / Construction solicitation begins — April 30, 2021

All ADEC approvals must be received prior to Notice to Proceed being given for the Construction Phase. The construction contract advertisement will be a minimum of 30 days.

4.0 PROPOSAL AND SUBMISSION REQUIREMENTS

Forms submitting qualifications to perform the work noted will be evaluated based upon the firm's experience, personnel knowledge and experience with similar projects, references, and responses to other criteria in the RFQ. Qualifications for subconsultants shall be included. To achieve a uniform review process and obtain the maximum degree of comparability, it is required that the Proposals be organized in the manner specified below.

4.1 Capability to Perform

- The Proposal must be accompanied by a cover letter, signed by a corporate officer or other individual who has the authority to bind the firm. An unsigned proposal is grounds for rejection.
- The cover letter should include an introduction and history of the firm and a summary statement of professional qualifications, including areas of expertise.
- Include the address of office that will manage project, length of time in business, firm's legal structure, firm's commitment to provide necessary resources to perform and complete project in a timely manner.
- Briefly state your firm's understanding of the services to be performed, the commitment to perform the work, and a statement why the firm believes itself to be best qualified to perform the services specified.
- List names of the persons who are authorized to make representations for your firm, their titles, address, and telephone numbers, and identify the primary contact person.

4.2 Experience and Qualifications of the Firm

- Provide a general statement describing the types of services offered by the firm, location of main and branch offices, number of years in business and number of employees in each department, and include licenses and certification numbers both for the firm and for each of the individuals proposed to perform the required services.
- Detail the firm's expertise and experience in similar projects of the same scale, for which they have executed, that demonstrate relevant experience.
- Provide a list of public sector clients for whom you have performed similar engineering design during the past five years that demonstrates experience with the type of project described in this RFQ. Include a summary of the projects' scope of work and

deliverables, owner name, and the address, phone number and email of a reference for each project. The firm should also demonstrate how it interacts with municipal clients and provides and exchanges information relative to the requirements.

- Describe any significant or unique awards received or accomplishments in previous, similar projects.
- Provide information on change in ownership and management of the firm over the past five years and describe how the firm has provided continuity of services for their clients during the transitions.

4.3 Experience and Qualifications of Key Project Staff and Subconsultants

- Identify the project manager who will be responsible for the day-to-day management of project tasks and will be the Owner's primary point of contact.
- Identify key project staff, both with the Firm and with Subconsultants, with their roles within the project clearly identified, as well as those key staff for subconsultants expected to provide services on behalf of the firm.
- Identify Proposed Resident Inspector,
- Provide a qualifications synopsis, resume, active professional license or registration, and other experience and qualifications that are relative to this project for each of the individuals referenced. Be specific about the proposed staff regarding their experience and qualifications on projects of similar size and scope.
- The Proposal should discuss the current workload of proposed staff and the organization's ability to perform the services within the established timeline.

4.4 Methodologies, Approach, Timeline

- Provide detailed information on the firm's methodology in meeting the scope of work requirements provided for in this RFQ, which provides interest and insight to the specific details of the project. This should consist of a detailed work plan indicating the tasks to be accomplished, the resources that will be utilized, and the timeline for completion.
- Describe overall approach to executing the project, which should include any proposed innovative concepts that may enhance value and quality, including cost containment approaches to budget sensitivity, efficiency, completeness, pertinence of the tasks, and logic of the overall approach.

4.5 Cost Proposal

Consultant shall provide a Fixed-Fee Cost Proposal for all services required in Section 3.0, Scope of Work. The Cost proposal shall with a detailed breakdown in spreadsheet format by discipline and man hours, including hourly billable rates for staff assigned to the project. The breakdown of the Cost Proposal shall provide for compensation based on specific milestones. The Cost Proposal shall include the signed and fully executed Summary Cost Proposal Form included in Section 10.0.

The Cost Proposal portion of the submission should be submitted in a separate sealed envelope included in the sealed envelope containing the larger Proposal. Provide a Fixed Fee cost for all services required in Section 3.0 (Scope of Work).

Costs will be evaluated using a ratio method after all qualitative scoring is completed. The Proposal with the lowest cost receives the maximum points allowed. All other Proposals receive a percentage of the points available based on their cost relationship to the lowest Cost Proposal. The following formula will be used:

- Lowest Cost Proposal/Cost Proposal being evaluated (x) maximum points available = awarded points for Cost criteria.

The Cost Proposal will be opened, and the cost score calculated after the scores of the other evaluation criteria have been calculated.

5.0 PROPOSAL EVALUATION PROCESS

5.1 Evaluation Process

The Borough will designate a Selection Committee to review and evaluate the Statements of Qualifications submitted in response to this RFQ and will be responsible for selecting the most qualified firms and to enter into contracts with the highest ranked firms. The Selection Committee may be comprised of any combination of Borough staff, consultants, or citizens, or other non-city persons, all of whom have the appropriate experience and knowledge relating to the services sought by this solicitation, while striving to ensure a well-balanced committee.

A responsive proposal is one which follows the requirements of the RFQ, includes all documentation, is submitted in the format outlined in the RFQ, is of timely submission, and has the appropriate signatures, as required, on each document.

Each firm should submit the requested documents with their response that evidence capability to provide the services required for Committee review for short-listing purposes. The weighted scoring criteria for selection contained below in this RFQ, shall be the basis of selection. The Selection Committee shall have the option to perform interviews and request additional information resulting from the initial evaluation. A second score sheet, with the same categories and score points used for the first evaluation, will be used to score those firms interviewed as a second evaluation. The final recommendation for selection will be based on the total of all evaluators' scores achieved on the second rating.

The Selection Committee will rank order at least three (3) firms. The firm whose Proposal is ranked highest, subject to concurrence from the USDA and the EDA funding agencies and approval by the Borough Manager, may be invited to enter into final negotiations with the Borough for the purposes of contract award.

Consultant must demonstrate in their proposal that they have a clear understanding of the RFQ requirements. Consultants should articulate in the proposal how they will fulfill the services required under the RFQ. The evaluation criteria used to evaluate Proposals, and their associated point values, are as follows:

- Capability to Perform 10 Points
- Experience and Qualifications of the Firm 20 Points
- Experience and Qualifications of Key Project 20 Points

	Staff and Subconsultants		
•	Methodologies, Approach, Timeline	30	Points
•	Cost	20	Points
	Total Points	100	Points

5.2 Qualitative Rating Factor

Firms will be ranked using the following qualitative rating factors, excluding cost, for each RFQ criteria:

1.0 = Outstanding

.8 = Excellent

.6 = Good

.4 = Fair

.2 = Poor

0.0 = Unsatisfactory

The rating factor for each criteria category, with the exception of cost, will be multiplied against the points available to determine the total points for that category.

6.0 SELECTION PROCESS

The Proposer with the highest total evaluation points will be invited to enter contract negotiations with the City and Borough of Wrangell. If an agreement cannot be reached with the highest ranked Proposer, the Borough shall notify the Proposer and terminate the negotiations. If Proposals are submitted by one or more other proposers determined to be qualified, negotiations may then be conducted with such other Proposers in the order of their respective rankings. This process may continue until successful negotiations are achieved. The City and Borough of Wrangell reserves the right to reject any or all Proposals submitted.

7.0 APPEAL PROCESS

Any aggrieved bidder, within five days after an award of contract, may appeal to the Borough Assembly for a hearing, with notice to interested parties, for redetermination and final award in accordance with law.

8.0 AGREEMENT

The entire Agreement between the Borough and the Consultant for the work shall be comprised of the following sections incorporated by reference:

A. Agreement between Owner and Engineer for Professional Services (EJCDC No. E-500, 2014 Edition)
B. RUS Bulletin 1780-26, Guidance for the Use of Engineers Joint Contract Documents Committee (EJCDC) Documents on Water and Waste Disposal Projects with RUS Financial Assistance
C. RUS Bulletin 1780-35, Guidance for the Implementation of American Iron and Steel (AIS)
D. Consultant's Proposal, including Cost Proposal and Fee Schedule
E. Insurance Certificates
F. Addenda Numbers __________ to _________, inclusive
G. Change Orders which may be delivered or issued after the date of the Agreement

9.0 SUPPLEMENTAL DOCUMENTS

A. Agreement between Owner and Engineer for Professional Services (EJCDC No. E-500, 2014 Edition)
B. RUS Bulletin 1780-26, Guidance for the Use of Engineers Joint Contract Documents Committee (EJCDC) Documents on Water and Waste Disposal Projects with RUS Financial Assistance
C. RUS Bulletin 1780-35, Guidance for the Implementation of American Iron and Steel (AIS)
D. Preliminary Engineering Report
E. Environmental Review
F. Record Drawings of Existing Water Treatment Plant
G. Maps

10.0 SUMMARY COST PROPOSAL FORM

Consultant shall provide a Fixed-Fee Cost Proposal with a detailed breakdown, by discipline and man hours, in spreadsheet format, and shall include hourly billable rates for staff assigned to the project. The breakdown of the Cost Proposal shall provide for compensation based on specific milestones.

The Consultant's Cost Proposal shall be accompanied by this Summary Cost Proposal Form, signed by a corporate officer or other individual who has the authority to bind the firm. An unsigned Summary Cost Proposal Form is grounds for rejection.

Additional Services requested will be compensated in accordance with the General Conditions of the Agreement and with the Consultant's Fee Schedule for this project. Fee Schedules for each Consultant and their Subconsultants shall be included with their Cost Proposal.

<u>Consultant Services</u>

Pre-Engineering Design	$________________
Engineering Design	$________________
Construction Bidding Assistance	$________________
Construction Administration	$________________
Resident Inspector	$________________
Proposed Total Fixed Fee	$________________

Consultant has examined the solicitation documents in full, including the following Addenda, receipt of which is hereby acknowledged by the undersigned:

Addendum Number	Addendum Issue Date
______________________	______________________
______________________	______________________
______________________	______________________
______________________	______________________

Consultant hereby represents that if awarded a contract they will enter into and execute a contract with the City and Borough of Wrangell for the professional services referenced in this Request for Qualifications at the compensation stated above.

By executing this Proposal, I certify that I have the authority to bind the Consulting Firm who is submitting this Proposal.

Consultant Signature: ____

____
Printed Name and Title

____
Printed Firm Name

____
Date:

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

License Agreement

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EJCDC Copyright Administrator
c/o National Society of Professional Engineers
1420 King Street
Alexandria, VA 22314
Phone: (703) 684-2845
Fax: (703) 836-4875
e-mail: aschwartz@nspe.org

You acknowledge that you have read this License Agreement, understand it and agree to be bound by its terms and conditions. You further agree that it is the complete and exclusive statement of the License Agreement and supersedes any proposal or prior agreement, oral or written, and any other communications between us relating to the subject matter of this License Agreement.

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(202) 347-7474
www.acec.org

American Society of Civil Engineers
1801 Alexander Bell Drive, Reston, VA 20191-4400
(800) 548-2723
www.asce.org

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

AGREEMENT
BETWEEN OWNER AND ENGINEER
FOR PROFESSIONAL SERVICES

Prepared by

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ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

Issued and Published Jointly by

ACEC

AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASCE®

AMERICAN SOCIETY OF CIVIL ENGINEERS

National Society of Professional Engineers®

This Agreement has been prepared for use with EJCDC® C-700, Standard General Conditions of the Construction Contract, 2013 Edition. Their provisions are interrelated, and a change in one may necessitate a change in the other. For guidance on the completion and use of this Agreement, see EJCDC® E-001, Commentary on the EJCDC Engineering Services Agreements, 2013 Edition.

National Society of Professional Engineers

1420 King Street, Alexandria, VA 22314-2794

(703) 684-2882

www.nspe.org

American Council of Engineering Companies

1015 15th Street N.W., Washington, DC 20005

(202) 347-7474

www.acec.org

American Society of Civil Engineers

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TABLE OF CONTENTS

AGREEMENT
BETWEEN OWNER AND ENGINEER
FOR PROFESSIONAL SERVICES

THIS IS AN AGREEMENT effective as of [ ] ("Effective Date") between
[ ] ("Owner") and
[ ] ("Engineer").

Owner's Project, of which Engineer's services under this Agreement are a part, is generally identified as follows:
[ ]
("Project").

Other terms used in this Agreement are defined in Article 7.

Engineer's services under this Agreement are generally identified as follows: [ ]

Owner and Engineer further agree as follows:

ARTICLE 1 – SERVICES OF ENGINEER

1.01 *Scope*

A. Engineer shall provide, or cause to be provided, the services set forth herein and in Exhibit A.

ARTICLE 2 – OWNER'S RESPONSIBILITIES

2.01 *General*

A. Owner shall have the responsibilities set forth herein and in Exhibit B.

B. Owner shall pay Engineer as set forth in Article 4 and Exhibit C.

C. Owner shall be responsible for all requirements and instructions that it furnishes to Engineer pursuant to this Agreement, and for the accuracy and completeness of all programs, reports, data, and other information furnished by Owner to Engineer pursuant to this Agreement. Engineer may use and rely upon such requirements, programs, instructions, reports, data, and information in performing or furnishing services under this Agreement, subject to any express limitations or reservations applicable to the furnished items.

D. Owner shall give prompt written notice to Engineer whenever Owner observes or otherwise becomes aware of:

1. any development that affects the scope or time of performance of Engineer's services;

2. the presence at the Site of any Constituent of Concern; or

3. any relevant, material defect or nonconformance in: (a) Engineer's services, (b) the Work, (c) the performance of any Constructor, or (d) Owner's performance of its responsibilities under this Agreement.

ARTICLE 3 – SCHEDULE FOR RENDERING SERVICES

3.01 *Commencement*

A. Engineer is authorized to begin rendering services as of the Effective Date.

3.02 *Time for Completion*

A. Engineer shall complete its obligations within a reasonable time. Specific periods of time for rendering services, or specific dates by which services are to be completed, are provided in Exhibit A, and are hereby agreed to be reasonable.

B. If, through no fault of Engineer, such periods of time or dates are changed, or the orderly and continuous progress of Engineer's services is impaired, or Engineer's services are delayed or suspended, then the time for completion of Engineer's services, and the rates and amounts of Engineer's compensation, shall be adjusted equitably.

C. If Owner authorizes changes in the scope, extent, or character of the Project or Engineer's services, then the time for completion of Engineer's services, and the rates and amounts of Engineer's compensation, shall be adjusted equitably.

D. Owner shall make decisions and carry out its other responsibilities in a timely manner so as not to delay the Engineer's performance of its services.

E. If Engineer fails, through its own fault, to complete the performance required in this Agreement within the time set forth, as duly adjusted, then Owner shall be entitled, as its sole remedy, to the recovery of direct damages, if any, resulting from such failure.

ARTICLE 4 – INVOICES AND PAYMENTS

4.01 *Invoices*

A. *Preparation and Submittal of Invoices:* Engineer shall prepare invoices in accordance with its standard invoicing practices and the terms of Exhibit C. Engineer shall submit its invoices to Owner on a monthly basis. Invoices are due and payable within 30 days of receipt.

4.02 *Payments*

A. *Application to Interest and Principal:* Payment will be credited first to any interest owed to Engineer and then to principal.

B. *Failure to Pay*: If Owner fails to make any payment due Engineer for services and expenses within 30 days after receipt of Engineer's invoice, then:

1. amounts due Engineer will be increased at the rate of 1.0% per month (or the maximum rate of interest permitted by law, if less) from said thirtieth day; and

2. Engineer may, after giving seven days written notice to Owner, suspend services under this Agreement until Owner has paid in full all amounts due for services, expenses, and other related charges. Owner waives any and all claims against Engineer for any such suspension.

C. *Disputed Invoices:* If Owner disputes an invoice, either as to amount or entitlement, then Owner shall promptly advise Engineer in writing of the specific basis for doing so, may withhold only that portion so disputed, and must pay the undisputed portion subject to the terms of Paragraph 4.01.

D. *Sales or Use Taxes:* If after the Effective Date any governmental entity takes a legislative action that imposes additional sales or use taxes on Engineer's services or compensation under this Agreement, then Engineer may invoice such additional sales or use taxes for reimbursement by Owner. Owner shall reimburse Engineer for the cost of such invoiced additional sales or use taxes; such reimbursement shall be in addition to the compensation to which Engineer is entitled under the terms of Exhibit C.

ARTICLE 5 – OPINIONS OF COST

5.01 *Opinions of Probable Construction Cost*

A. Engineer's opinions (if any) of probable Construction Cost are to be made on the basis of Engineer's experience, qualifications, and general familiarity with the construction industry. However, because Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over contractors' methods of determining prices, or over competitive bidding or market conditions, Engineer cannot and does not guarantee that proposals, bids, or actual Construction Cost will not vary from opinions of probable Construction Cost prepared by Engineer. If Owner requires greater assurance as to probable Construction Cost, then Owner agrees to obtain an independent cost estimate.

5.02 *Designing to Construction Cost Limit*

A. If a Construction Cost limit is established between Owner and Engineer, such Construction Cost limit and a statement of Engineer's rights and responsibilities with respect thereto will be specifically set forth in Exhibit F to this Agreement.

5.03 *Opinions of Total Project Costs*

A. The services, if any, of Engineer with respect to Total Project Costs shall be limited to assisting the Owner in tabulating the various categories that comprise Total Project Costs. Engineer assumes no responsibility for the accuracy of any opinions of Total Project Costs.

ARTICLE 6 – GENERAL CONSIDERATIONS

6.01 *Standards of Performance*

A. *Standard of Care:* The standard of care for all professional engineering and related services performed or furnished by Engineer under this Agreement will be the care and skill ordinarily used by members of the subject profession practicing under similar circumstances at the same time and in the same locality. Engineer makes no warranties, express or implied, under this Agreement or otherwise, in connection with any services performed or furnished by Engineer.

B. *Technical Accuracy:* Owner shall not be responsible for discovering deficiencies in the technical accuracy of Engineer's services. Engineer shall correct deficiencies in technical accuracy without additional compensation, unless such corrective action is directly attributable to deficiencies in Owner-furnished information.

C. *Consultants:* Engineer may retain such Consultants as Engineer deems necessary to assist in the performance or furnishing of the services, subject to reasonable, timely, and substantive objections by Owner.

D. *Reliance on Others:* Subject to the standard of care set forth in Paragraph 6.01.A, Engineer and its Consultants may use or rely upon design elements and information ordinarily or customarily furnished by others, including, but not limited to, specialty contractors, manufacturers, suppliers, and the publishers of technical standards.

E. *Compliance with Laws and Regulations, and Policies and Procedures:*

1. Engineer and Owner shall comply with applicable Laws and Regulations.

2. Engineer shall comply with any and all policies, procedures, and instructions of Owner that are applicable to Engineer's performance of services under this Agreement and that Owner provides to Engineer in writing, subject to the standard of care set forth in Paragraph 6.01.A, and to the extent compliance is not inconsistent with professional practice requirements.

3. This Agreement is based on Laws and Regulations and Owner-provided written policies and procedures as of the Effective Date. The following may be the basis for modifications to Owner's responsibilities or to Engineer's scope of services, times of performance, or compensation:

   a. changes after the Effective Date to Laws and Regulations;

   b. the receipt by Engineer after the Effective Date of Owner-provided written policies and procedures;

   c. changes after the Effective Date to Owner-provided written policies or procedures.

F. Engineer shall not be required to sign any document, no matter by whom requested, that would result in the Engineer having to certify, guarantee, or warrant the existence of conditions whose existence the Engineer cannot ascertain. Owner agrees not to make resolution of any dispute with the Engineer or payment of any amount due to the Engineer in any way contingent upon the Engineer signing any such document.

G. The general conditions for any construction contract documents prepared hereunder are to be EJCDC® C-700 "Standard General Conditions of the Construction Contract" (2013 Edition), prepared by the Engineers Joint Contract Documents Committee, unless expressly indicated otherwise in Exhibit J or elsewhere in this Agreement.

H. Engineer shall not at any time supervise, direct, control, or have authority over any Constructor's work, nor shall Engineer have authority over or be responsible for the means, methods, techniques, sequences, or procedures of construction selected or used by any Constructor, or the safety precautions and programs incident thereto, for security or safety at the Site, nor for any failure of a Constructor to comply with Laws and Regulations applicable to that Constructor's furnishing and performing of its work. Engineer shall not be responsible for the acts or omissions of any Constructor.

I. Engineer neither guarantees the performance of any Constructor nor assumes responsibility for any Constructor's, failure to furnish and perform the Work in accordance with the Construction Contract Documents.

J. Engineer shall not be responsible for any decision made regarding the Construction Contract Documents, or any application, interpretation, clarification, or modification of the Construction Contract Documents, other than those made by Engineer or its Consultants.

K. Engineer is not required to provide and does not have any responsibility for surety bonding or insurance-related advice, recommendations, counseling, or research, or enforcement of construction insurance or surety bonding requirements.

L. Engineer's services do not include providing legal advice or representation.

M. Engineer's services do not include (1) serving as a "municipal advisor" for purposes of the registration requirements of Section 975 of the Dodd-Frank Wall Street Reform and Consumer Protection Act (2010) or the municipal advisor registration rules issued by the Securities and Exchange Commission, or (2) advising Owner, or any municipal entity or other person or entity, regarding municipal financial products or the issuance of municipal securities, including advice with respect to the structure, timing, terms, or other similar matters concerning such products or issuances.

N. While at the Site, Engineer, its Consultants, and their employees and representatives shall comply with the applicable requirements of Contractor's and Owner's safety programs of which Engineer has been informed in writing.

6.02 *Design Without Construction Phase Services*

A. Engineer shall be responsible only for those Construction Phase services expressly required of Engineer in Exhibit A, Paragraph A1.05. With the exception of such expressly required services, Engineer shall have no design, Shop Drawing review, or other obligations during construction, and Owner assumes all responsibility for the application and interpretation of the Construction Contract Documents, review and response to Contractor claims, Construction Contract administration, processing of Change Orders and submittals, revisions to the Construction Contract Documents during construction, construction observation and review, review of Contractor's payment applications, and all other necessary Construction Phase administrative, engineering, and professional services. Owner waives all claims against the Engineer that may be connected in any way to Construction Phase administrative, engineering, or professional services except for those services that are expressly required of Engineer in Exhibit A.

6.03 *Use of Documents*

A. All Documents are instruments of service, and Engineer shall retain an ownership and property interest therein (including the copyright and the right of reuse at the discretion of the Engineer) whether or not the Project is completed.

B. If Engineer is required to prepare or furnish Drawings or Specifications under this Agreement, Engineer shall deliver to Owner at least one original printed record version of such Drawings and Specifications, signed and sealed according to applicable Laws and Regulations.

C. Owner may make and retain copies of Documents for information and reference in connection with the use of the Documents on the Project. Engineer grants Owner a limited license to use the Documents on the Project, extensions of the Project, and for related uses of the Owner, subject to receipt by Engineer of full payment due and owing for all services relating to preparation of the Documents, and subject to the following limitations: (1) Owner acknowledges that such Documents are not intended or represented to be suitable for use on the Project unless completed by Engineer, or for use or reuse by Owner or others on extensions of the Project, on any other project, or for any other use or purpose, without written verification or adaptation by Engineer; (2) any such use or reuse, or any modification of the Documents, without written verification, completion, or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Owner's sole risk and without liability or legal exposure to Engineer or to its officers, directors, members, partners, agents, employees, and Consultants; (3) Owner shall indemnify and hold harmless Engineer and its officers, directors, members, partners, agents, employees, and Consultants from all claims, damages, losses, and expenses, including attorneys' fees, arising out of or resulting from any use, reuse, or modification of the Documents without written verification, completion, or adaptation by Engineer; and (4) such limited license to Owner shall not create any rights in third parties.

D. If Engineer at Owner's request verifies the suitability of the Documents, completes them, or adapts them for extensions of the Project or for any other purpose, then Owner shall compensate Engineer at rates or in an amount to be agreed upon by Owner and Engineer.

6.04 *Electronic Transmittals*

A. Owner and Engineer may transmit, and shall accept, Project-related correspondence, Documents, text, data, drawings, information, and graphics, in electronic media or digital format, either directly, or through access to a secure Project website, in accordance with a mutually agreeable protocol.

B. If this Agreement does not establish protocols for electronic or digital transmittals, then Owner and Engineer shall jointly develop such protocols.

C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

6.05 *Insurance*

A. Engineer shall procure and maintain insurance as set forth in Exhibit G. Engineer shall cause Owner to be listed as an additional insured on any applicable general liability insurance policy carried by Engineer.

B. Owner shall procure and maintain insurance as set forth in Exhibit G. Owner shall cause Engineer and its Consultants to be listed as additional insureds on any general liability policies carried by Owner, which are applicable to the Project.

C. Owner shall require Contractor to purchase and maintain policies of insurance covering workers' compensation, general liability, motor vehicle damage and injuries, and other insurance necessary to protect Owner's and Engineer's interests in the Project. Owner shall require Contractor to cause Engineer and its Consultants to be listed as additional insureds with respect to such liability insurance purchased and maintained by Contractor for the Project.

D. Owner and Engineer shall each deliver to the other certificates of insurance evidencing the coverages indicated in Exhibit G. Such certificates shall be furnished prior to commencement of Engineer's services and at renewals thereafter during the life of the Agreement.

E. All policies of property insurance relating to the Project, including but not limited to any builder's risk policy, shall allow for waiver of subrogation rights and contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insured thereunder or against Engineer or its Consultants. Owner and Engineer waive all rights against each other, Contractor, the Consultants, and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by any builder's risk policy and any other property insurance relating to the Project. Owner and Engineer shall take appropriate measures in other Project-related contracts to secure waivers of rights consistent with those set forth in this paragraph.

F. All policies of insurance shall contain a provision or endorsement that the coverage afforded will not be canceled or reduced in limits by endorsement, and that renewal will not be refused, until at least 10 days prior written notice has been given to the primary insured. Upon receipt of such notice, the receiving party shall promptly forward a copy of the notice to the other party to this Agreement.

G. At any time, Owner may request that Engineer or its Consultants, at Owner's sole expense, provide additional insurance coverage, increased limits, or revised deductibles that are more protective than those specified in Exhibit G. If so requested by Owner, and if commercially available, Engineer shall obtain and shall require its Consultants to obtain such additional insurance coverage, different limits, or revised deductibles for such periods of time as requested by Owner, and Exhibit G will be supplemented to incorporate these requirements.

6.06 *Suspension and Termination*

A. *Suspension:*

1. *By Owner*: Owner may suspend the Project for up to 90 days upon seven days written notice to Engineer.

2. *By Engineer*: Engineer may, after giving seven days written notice to Owner, suspend services under this Agreement if Owner has failed to pay Engineer for invoiced services and expenses, as set forth in Paragraph 4.02.B, or in response to the presence of Constituents of Concern at the Site, as set forth in Paragraph 6.10.D.

B. *Termination*: The obligation to provide further services under this Agreement may be terminated:

1. For cause,

a. by either party upon 30 days written notice in the event of substantial failure by the other party to perform in accordance with the terms hereof through no fault of the terminating party.

b. by Engineer:

1) upon seven days written notice if Owner demands that Engineer furnish or perform services contrary to Engineer's responsibilities as a licensed professional; or

2) upon seven days written notice if the Engineer's services for the Project are delayed or suspended for more than 90 days for reasons beyond Engineer's control, or as the result of the presence at the Site of undisclosed Constituents of Concern, as set forth in Paragraph 6.10.D.

3) Engineer shall have no liability to Owner on account of such termination.

c. Notwithstanding the foregoing, this Agreement will not terminate under Paragraph 6.06.B.1.a if the party receiving such notice begins, within seven days of receipt of such notice, to correct its substantial failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt thereof; provided, however, that if and to the extent such substantial failure cannot be reasonably cured within such 30 day period, and if such party has diligently attempted to cure the same and thereafter continues diligently to cure the same, then the cure period provided for herein shall extend up to, but in no case more than, 60 days after the date of receipt of the notice.

2. For convenience, by Owner effective upon Engineer's receipt of notice from Owner.

C. *Effective Date of Termination:* The terminating party under Paragraph 6.06.B may set the effective date of termination at a time up to 30 days later than otherwise provided to allow Engineer to demobilize personnel and equipment from the Site, to complete tasks whose value would otherwise be lost, to prepare notes as to the status of completed and uncompleted tasks, and to assemble Project materials in orderly files.

D. *Payments Upon Termination:*

1. In the event of any termination under Paragraph 6.06, Engineer will be entitled to invoice Owner and to receive full payment for all services performed or furnished in accordance with this Agreement and all Reimbursable Expenses incurred through the effective date of termination. Upon making such payment, Owner shall have the limited right to the use of Documents, at Owner's sole risk, subject to the provisions of Paragraph 6.03.

2. In the event of termination by Owner for convenience or by Engineer for cause, Engineer shall be entitled, in addition to invoicing for those items identified in Paragraph 6.06.D.1, to invoice Owner and receive payment of a reasonable amount for services and expenses directly attributable to termination, both before and after the effective date of termination, such as reassignment of personnel, costs of terminating contracts with Engineer's Consultants, and other related close-out costs, using methods and rates for Additional Services as set forth in Exhibit C.

6.07 *Controlling Law*

A. This Agreement is to be governed by the Laws and Regulations of the state in which the Project is located.

[Note to User: If necessary, modify this provision to identify a specific controlling jurisdiction if other than the state where the Project is located; if multiple states are involved; or to identify controlling jurisdictions other than a state, such as a U.S. territory, commonwealth, or tribal jurisdiction/domestic dependent nation.]

6.08 *Successors, Assigns, and Beneficiaries*

A. Owner and Engineer are hereby bound and the successors, executors, administrators, and legal representatives of Owner and Engineer (and to the extent permitted by Paragraph 6.08.B the assigns of Owner and Engineer) are hereby bound to the other party to this Agreement and to the successors, executors, administrators and legal representatives (and said assigns) of such other party, in respect of all covenants, agreements, and obligations of this Agreement.

B. Neither Owner nor Engineer may assign, sublet, or transfer any rights under or interest (including, but without limitation, money that is due or may become due) in this

Agreement without the written consent of the other party, except to the extent that any assignment, subletting, or transfer is mandated by law. Unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under this Agreement.

C. Unless expressly provided otherwise in this Agreement:

1. Nothing in this Agreement shall be construed to create, impose, or give rise to any duty owed by Owner or Engineer to any Constructor, other third-party individual or entity, or to any surety for or employee of any of them.

2. All duties and responsibilities undertaken pursuant to this Agreement will be for the sole and exclusive benefit of Owner and Engineer and not for the benefit of any other party.

3. Owner agrees that the substance of the provisions of this Paragraph 6.08.C shall appear in the Construction Contract Documents.

6.09 *Dispute Resolution*

A. Owner and Engineer agree to negotiate all disputes between them in good faith for a period of 30 days from the date of notice prior to invoking the procedures of Exhibit H or other provisions of this Agreement, or exercising their rights at law.

B. If the parties fail to resolve a dispute through negotiation under Paragraph 6.09.A, then either or both may invoke the procedures of Exhibit H. If Exhibit H is not included, or if no dispute resolution method is specified in Exhibit H, then the parties may exercise their rights at law.

6.10 *Environmental Condition of Site*

A. Owner represents to Engineer that as of the Effective Date to the best of Owner's knowledge no Constituents of Concern, other than those disclosed in writing to Engineer, exist at or adjacent to the Site.

B. If Engineer encounters or learns of an undisclosed Constituent of Concern at the Site, then Engineer shall notify (1) Owner and (2) appropriate governmental officials if Engineer reasonably concludes that doing so is required by applicable Laws or Regulations.

C. It is acknowledged by both parties that Engineer's scope of services does not include any services related to unknown or undisclosed Constituents of Concern. If Engineer or any other party encounters, uncovers, or reveals an undisclosed Constituent of Concern, then Owner shall promptly determine whether to retain a qualified expert to evaluate such condition or take any necessary corrective action.

D. If investigative or remedial action, or other professional services, are necessary with respect to undisclosed Constituents of Concern, or if investigative or remedial action beyond that reasonably contemplated is needed to address a disclosed or known Constituent of Concern, then Engineer may, at its option and without liability for consequential or any other damages, suspend performance of services on the portion of the Project affected thereby until such portion of the Project is no longer affected.

E. If the presence at the Site of undisclosed Constituents of Concern adversely affects the performance of Engineer's services under this Agreement, then the Engineer shall have the option of (1) accepting an equitable adjustment in its compensation or in the time of completion, or both; or (2) terminating this Agreement for cause on seven days notice.

F. Owner acknowledges that Engineer is performing professional services for Owner and that Engineer is not and shall not be required to become an "owner," “arranger,” “operator,” “generator,” or “transporter” of hazardous substances, as defined in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, which are or may be encountered at or near the Site in connection with Engineer's activities under this Agreement.

6.11 *Indemnification and Mutual Waiver*

A. *Indemnification by Engineer:* To the fullest extent permitted by Laws and Regulations, Engineer shall indemnify and hold harmless Owner, and Owner's officers, directors, members, partners, agents, consultants, and employees, from losses, damages, and judgments (including reasonable consultants' and attorneys' fees and expenses) arising from third-party claims or actions relating to the Project, provided that any such claim, action, loss, damages, or judgment is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Engineer or Engineer's officers, directors, members, partners, agents, employees, or Consultants. **This indemnification provision is subject to and limited by the provisions, if any, agreed to by Owner and Engineer in Exhibit I, “Limitations of Liability."**

B. *Indemnification by Owner:* Owner shall indemnify and hold harmless Engineer and its officers, directors, members, partners, agents, employees, and Consultants as required by Laws and Regulations **and to the extent (if any) required in Exhibit I, “Limitations of Liability.”**

C. *Environmental Indemnification:* To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Engineer and its officers, directors, members, partners, agents, employees, and Consultants from all claims, costs, losses, damages, actions, and judgments (including reasonable consultants' and attorneys fees and expenses) caused by, arising out of, relating to, or resulting from a Constituent of Concern at, on, or under the Site, provided that (1) any such claim, cost, loss, damages, action, or judgment is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, and (2) nothing in this paragraph shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence or willful misconduct.

D. *No Defense Obligation:* The indemnification commitments in this Agreement do not include a defense obligation by the indemnitor unless such obligation is expressly stated.

E. *Percentage Share of Negligence:* To the fullest extent permitted by Laws and Regulations, a party's total liability to the other party and anyone claiming by, through, or under the other party for any cost, loss, or damages caused in part by the negligence of the party and in part by the negligence of the other party or any other negligent entity or individual, shall not exceed the percentage share that the party's negligence bears to the total negligence of Owner, Engineer, and all other negligent entities and individuals.

F. *Mutual Waiver:* To the fullest extent permitted by Laws and Regulations, Owner and Engineer waive against each other, and the other's employees, officers, directors, members, agents, insurers, partners, and consultants, any and all claims for or entitlement to special, incidental, indirect, or consequential damages arising out of, resulting from, or in any way related to this Agreement or the Project, from any cause or causes.

6.12 *Records Retention*

A. Engineer shall maintain on file in legible form, for a period of five years following completion or termination of its services, all Documents, records (including cost records), and design calculations related to Engineer's services or pertinent to Engineer's performance under this Agreement. Upon Owner's request, Engineer shall provide a copy of any such item to Owner at cost.

6.13 *Miscellaneous Provisions*

A. *Notices:* Any notice required under this Agreement will be in writing, addressed to the appropriate party at its address on the signature page and given personally, by registered or certified mail postage prepaid, or by a commercial courier service. All notices shall be effective upon the date of receipt.

B. *Survival:* All express representations, waivers, indemnifications, and limitations of liability included in this Agreement will survive its completion or termination for any reason.

C. *Severability:* Any provision or part of the Agreement held to be void or unenforceable under any Laws or Regulations shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Engineer, which agree that the Agreement shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

D. *Waiver:* A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Agreement.

E. *Accrual of Claims:* To the fullest extent permitted by Laws and Regulations, all causes of action arising under this Agreement shall be deemed to have accrued, and all statutory periods of limitation shall commence, no later than the date of Substantial Completion.

ARTICLE 7 – DEFINITIONS

7.01 *Defined Terms*

A. Wherever used in this Agreement (including the Exhibits hereto) terms (including the singular and plural forms) printed with initial capital letters have the meanings indicated in the text above, in the exhibits, or in the following definitions:

1. *Addenda*—Written or graphic instruments issued prior to the opening of bids which clarify, correct, or change the bidding requirements or the proposed Construction Contract Documents.

2. *Additional Services*—The services to be performed for or furnished to Owner by Engineer in accordance with Part 2 of Exhibit A of this Agreement.

3. *Agreement*—This written contract for professional services between Owner and Engineer, including all exhibits identified in Paragraph 8.01 and any duly executed amendments.

4. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Construction Contract.

5. *Basic Services*—The services to be performed for or furnished to Owner by Engineer in accordance with Part 1 of Exhibit A of this Agreement.

6. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Construction Contract Price or the Construction Contract Times, or other revision to the Construction Contract, issued on or after the effective date of the Construction Contract.

7. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth in the Construction Contract, seeking an adjustment in Construction Contract Price or Construction Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Construction Contract Documents or the acceptability of Work under the Construction Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Construction Contract.

8. *Constituent of Concern*—Asbestos, petroleum, radioactive material, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. ("CERCLA"); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5501 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. ("RCRA"); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, State, or local statute, law, rule, regulation, ordinance,

resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

9. *Construction Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.

10. *Construction Contract Documents*—Those items designated as "Contract Documents" in the Construction Contract, and which together comprise the Construction Contract.

11. *Construction Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Construction Contract Documents.

12. *Construction Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve milestones, if any, in the Construction Contract; (b) achieve Substantial Completion; and (c) complete the Work.

13. *Construction Cost*—The cost to Owner of the construction of those portions of the entire Project designed or specified by or for Engineer under this Agreement, including construction labor, services, materials, equipment, insurance, and bonding costs, and allowances for contingencies. Construction Cost does not include costs of services of Engineer or other design professionals and consultants; cost of land or rights-of-way, or compensation for damages to property; Owner's costs for legal, accounting, insurance counseling, or auditing services; interest or financing charges incurred in connection with the Project; or the cost of other services to be provided by others to Owner. Construction Cost is one of the items comprising Total Project Costs.

14. *Constructor*—Any person or entity (not including the Engineer, its employees, agents, representatives, and Consultants), performing or supporting construction activities relating to the Project, including but not limited to Contractors, Subcontractors, Suppliers, Owner's work forces, utility companies, other contractors, construction managers, testing firms, shippers, and truckers, and the employees, agents, and representatives of any or all of them.

15. *Consultants*—Individuals or entities having a contract with Engineer to furnish services with respect to this Project as Engineer's independent professional associates and consultants; subcontractors; or vendors.

16. *Contractor*—The entity or individual with which Owner enters into a Construction Contract.

17. *Documents*—Data, reports, Drawings, Specifications, Record Drawings, building information models, civil integrated management models, and other deliverables, whether in printed or electronic format, provided or furnished in appropriate phases by Engineer to Owner pursuant to this Agreement.

18. *Drawings*—That part of the Construction Contract Documents that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date*—The date indicated in this Agreement on which it becomes effective, but if no such date is indicated, the date on which this Agreement is signed and delivered by the last of the parties to sign and deliver.

20. *Engineer*—The individual or entity named as such in this Agreement.

21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Construction Contract Price or the Construction Contract Times.

22. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

23. *Owner*—The individual or entity named as such in this Agreement and for which Engineer's services are to be performed. Unless indicated otherwise, this is the same individual or entity that will enter into any Construction Contracts concerning the Project.

24. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the services to be performed or furnished by Engineer under this Agreement are a part.

25. *Record Drawings*—Drawings depicting the completed Project, or a specific portion of the completed Project, prepared by Engineer as an Additional Service and based on Contractor's record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications, as delivered to Engineer and annotated by Contractor to show changes made during construction.

26. *Reimbursable Expenses*—The expenses incurred directly by Engineer in connection with the performing or furnishing of Basic Services and Additional Services for the Project.

27. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site during the Construction Phase. As used herein, the term Resident Project Representative or "RPR" includes any assistants or field staff of Resident Project Representative. The duties and responsibilities of the Resident Project Representative, if any, are as set forth in Exhibit D.

28. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

29. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Construction Contract Documents.

30. *Site*—Lands or areas to be indicated in the Construction Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands furnished by Owner which are designated for the use of Contractor.

31. *Specifications*—The part of the Construction Contract Documents that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

32. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

33. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Construction Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

34. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

35. *Total Project Costs*—The total cost of planning, studying, designing, constructing, testing, commissioning, and start-up of the Project, including Construction Cost and all other Project labor, services, materials, equipment, insurance, and bonding costs, allowances for contingencies, and the total costs of services of Engineer or other design professionals and consultants, together with such other Project-related costs that Owner furnishes for inclusion, including but not limited to cost of land, rights-of-way, compensation for damages to properties, Owner's costs for legal, accounting, insurance counseling, and auditing services, interest and financing charges incurred in connection with the Project, and the cost of other services to be provided by others to Owner.

36. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Construction Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Construction Contract Documents.

37. *Work Change Directive*—A written directive to Contractor issued on or after the effective date of the Construction Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

B. *Day*:

1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.

ARTICLE 8 – EXHIBITS AND SPECIAL PROVISIONS

8.01 *Exhibits Included:*

A. Exhibit A, Engineer’s Services.

B. Exhibit B, Owner’s Responsibilities.

C. Exhibit C, Payments to Engineer for Services and Reimbursable Expenses.

D. Exhibit D, Duties, Responsibilities and Limitations of Authority of Resident Project Representative.

E. Exhibit E, Notice of Acceptability of Work.

F. Exhibit F, Construction Cost Limit.

G. Exhibit G, Insurance.

H. Exhibit H, Dispute Resolution.

I. Exhibit I, Limitations of Liability.

J. Exhibit J, Special Provisions.

K. Exhibit K, Amendment to Owner-Engineer Agreement.

[NOTE TO USER: If an exhibit is not to be included in the specific agreement, indicate "not used " after that exhibit in the list above.]

8.02 *Total Agreement*

A. This Agreement, (together with the exhibits included above) constitutes the entire agreement between Owner and Engineer and supersedes all prior written or oral understandings. This Agreement may only be amended, supplemented, modified, or canceled by a written instrument duly executed by both parties. Amendments should be based whenever possible on the format of Exhibit K to this Agreement.

8.03 *Designated Representatives*

A. With the execution of this Agreement, Engineer and Owner shall designate specific individuals to act as Engineer’s and Owner’s representatives with respect to the services to be performed or furnished by Engineer and responsibilities of Owner under this Agreement. Such an individual shall have authority to transmit instructions, receive information, and render decisions relative to this Agreement on behalf of the respective party whom the individual represents.

8.04 *Engineer's Certifications*

A. Engineer certifies that it has not engaged in corrupt, fraudulent, or coercive practices in competing for or in executing the Agreement. For the purposes of this Paragraph 8.04:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the selection process or in the Agreement execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the selection process or the execution of the Agreement to the detriment of Owner, or (b) to deprive Owner of the benefits of free and open competition;

3. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the selection process or affect the execution of the Agreement.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, the Effective Date of which is indicated on page 1.

Owner: [ ]

By: [ ]
Print name: [ ]
Title: [ ]
Date Signed: [ ]

Address for Owner's receipt of notices:
[ ]

Designated Representative (Paragraph 8.03.A):
[ ]
Title: [ ]
Phone Number: [ ]
E-Mail Address: [ ]

Engineer: [ ]

By: [ ]
Print name: [ ]
Title: [ ]
Date Signed: [ ]

Engineer License or Firm's Certificate No. (if required):
[ ]
State of: [ ]

Address for Engineer's receipt of notices:
[ ]

Designated Representative (Paragraph 8.03.A):
[ ]
Title: [ ]
Phone Number: [ ]
E-Mail Address: [ ]

This is **EXHIBIT A**, consisting of [ ] pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated [ ].

Engineer's Services

Article 1 of the Agreement is supplemented to include the following agreement of the parties.

Engineer shall provide Basic and Additional Services as set forth below.

PART 1 – BASIC SERVICES

A1.01 *Study and Report Phase*

A. Engineer shall:

1. Consult with Owner to define and clarify Owner's requirements for the Project, including design objectives and constraints, space, capacity and performance requirements, flexibility, and expandability, and any budgetary limitations, and identify available data, information, reports, facilities plans, and site evaluations.

   a. If Owner has already identified one or more potential solutions to meet its Project requirements, then proceed with the study and evaluation of such potential solutions: [ ] ***[List the specific potential solutions here.]***

   b. If Owner has not identified specific potential solutions for study and evaluation, then assist Owner in determining whether Owner's requirements, and available data, reports, plans, and evaluations, point to a single potential solution for Engineer's study and evaluation, or are such that it will be necessary for Engineer to identify, study, and evaluate multiple potential solutions.

   c. If it is necessary for Engineer to identify, study, and evaluate multiple potential solutions, then identify [ ] ***[insert specific number]*** alternative solutions potentially available to Owner, unless Owner and Engineer mutually agree that some other specific number of alternatives should be identified, studied, and evaluated.

2. Identify potential solution(s) to meet Owner's Project requirements, as needed.

3. Study and evaluate the potential solution(s) to meet Owner's Project requirements.

4. Visit the Site, or potential Project sites, to review existing conditions and facilities, unless such visits are not necessary or applicable to meeting the objectives of the Study and Report Phase.

5. Advise Owner of any need for Owner to obtain, furnish, or otherwise make available to Engineer additional Project-related data and information, for Engineer's use in the study and evaluation of potential solution(s) to Owner's Project requirements, and preparation of a related report.

6. After consultation with Owner, recommend to Owner the solution(s) which in Engineer's judgment meet Owner's requirements for the Project.

7. Identify, consult with, and analyze requirements of governmental authorities having jurisdiction to approve the portions of the Project to be designed or specified by Engineer, including but not limited to mitigating measures identified in an environmental assessment for the Project.

8. Prepare a report (the "Report") which will, as appropriate, contain schematic layouts, sketches, and conceptual design criteria with appropriate exhibits to indicate the agreed-to requirements, considerations involved, and Engineer's recommended solution(s). For each recommended solution Engineer will provide the following, which will be separately itemized: opinion of probable Construction Cost; proposed allowances for contingencies; the estimated total costs of design, professional, and related services to be provided by Engineer and its Consultants; and, on the basis of information furnished by Owner, a tabulation of other items and services included within the definition of Total Project Costs.

9. Advise Owner of any need for Owner to provide data or services of the types described in Exhibit B, for use in Project design, or in preparation for Contractor selection and construction.

10. When mutually agreed, assist Owner in evaluating the possible use of building information modeling; civil integrated management; geotechnical baselining of subsurface site conditions; innovative design, contracting, or procurement strategies; or other strategies, technologies, or techniques for assisting in the design, construction, and operation of Owner's facilities. The subject matter of this paragraph shall be referred to in Exhibit A and B as "Project Strategies, Technologies, and Techniques."

11. If requested to do so by Owner, assist Owner in identifying opportunities for enhancing the sustainability of the Project, and pursuant to Owner's instructions plan for the inclusion of sustainable features in the design.

12. Use ASCE 38, "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data" as a means to advise the Owner on a recommended scope of work and procedure for the identification and mapping of existing utilities.

13. Develop a scope of work and survey limits for any topographic and other surveys necessary for design.

14. Perform or provide the following other Study and Report Phase tasks or deliverables: [ ] ***[List any such tasks or deliverables here.]***

15. Furnish [ ] review copies of the Report and any other Study and Report Phase deliverables to Owner within [ ] days of the Effective Date and review it with Owner. Within [ ] days of receipt, Owner shall submit to Engineer any comments regarding the furnished items.

16. Revise the Report and any other Study and Report Phase deliverables in response to Owner's comments, as appropriate, and furnish [ ] copies of the revised Report and

any other Study and Report Phase deliverables to the Owner within [ ] days of receipt of Owner's comments.

B. Engineer's services under the Study and Report Phase will be considered complete on the date when Engineer has delivered to Owner the revised Report and any other Study and Report Phase deliverables.

A1.02 *Preliminary Design Phase*

A. After acceptance by Owner of the Report and any other Study and Report Phase deliverables; selection by Owner of a recommended solution; issuance by Owner of any instructions of for use of Project Strategies, Technologies, and Techniques, or for inclusion of sustainable features in the design; and indication by Owner of any specific modifications or changes in the scope, extent, character, or design requirements of the Project desired by Owner, (1) Engineer and Owner shall discuss and resolve any necessary revisions to Engineer's compensation (through application of the provisions regarding Additional Services, or otherwise), or the time for completion of Engineer's services, resulting from the selected solution, related Project Strategies, Technologies, or Techniques, sustainable design instructions, or specific modifications to the Project, and (2) upon written authorization from Owner, Engineer shall:

1. Prepare Preliminary Design Phase documents consisting of final design criteria, preliminary drawings, outline specifications, and written descriptions of the Project.

2. In preparing the Preliminary Design Phase documents, use any specific applicable Project Strategies, Technologies, and Techniques authorized by Owner during or following the Study and Report Phase, and include sustainable features, as appropriate, pursuant to Owner's instructions.

3. Provide necessary field surveys and topographic and utility mapping for Engineer's design purposes. Comply with the scope of work and procedure for the identification and mapping of existing utilities selected and authorized by Owner pursuant to advice from Engineer based on ASCE 38, "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data," as set forth in Paragraph A1.01.A.12 above. If no such scope of work and procedure for utility mapping has been selected and authorized, then at a minimum the utility mapping will include Engineer contacting utility owners and obtaining available information.

4. Visit the Site as needed to prepare the Preliminary Design Phase documents.

5. Advise Owner if additional reports, data, information, or services of the types described in Exhibit B are necessary and assist Owner in obtaining such reports, data, information, or services.

6. Continue to assist Owner with Project Strategies, Technologies, and Techniques that Owner has chosen to implement.

7. Based on the information contained in the Preliminary Design Phase documents, prepare a revised opinion of probable Construction Cost, and assist Owner in tabulating the various cost categories which comprise Total Project Costs.

8. Obtain and review Owner's instructions regarding Owner's procurement of construction services (including instructions regarding advertisements for bids, instructions to bidders, and requests for proposals, as applicable), Owner's construction contract practices and requirements, insurance and bonding requirements, electronic transmittals during construction, and other information necessary for the finalization of Owner's bidding-related documents (or requests for proposals or other construction procurement documents), and Construction Contract Documents. Also obtain and review copies of Owner's design and construction standards, Owner's standard forms, general conditions (if other than EJCDC® C-700, Standard General Conditions of the Construction Contract, 2013 Edition), supplementary conditions, text, and related documents or content for Engineer to include in the draft bidding-related documents (or requests for proposals or other construction procurement documents), and in the draft Construction Contract Documents, when applicable.

[Note to User: Some owners prefer to handle the preparation of bidding (procurement) and construction contract documents with little or no involvement by the Engineer (other than with respect to Engineer's preparation or furnishing of the Drawings, Specifications, and other design and technical documents), relying either on Owner's in-house staff and legal counsel for such services, or on third-parties such as a construction manager. When such is the case, the task item above, and related items in the Final Design Phase (Paragraph A1.03 below) and in Exhibit B, Owner's Responsibilities, should be modified to fit the requirements of the specific project.]

9. Perform or provide the following other Preliminary Design Phase tasks or deliverables: [ ] ***[List any such tasks or deliverables here.]***

10. Furnish [ ] review copies of the Preliminary Design Phase documents, opinion of probable Construction Cost, and any other Preliminary Design Phase deliverables to Owner within [ ] days of authorization to proceed with this phase, and review them with Owner. Within [ ] days of receipt, Owner shall submit to Engineer any comments regarding the furnished items.

11. Revise the Preliminary Design Phase documents, opinion of probable Construction Cost, and any other Preliminary Design Phase deliverables in response to Owner's comments, as appropriate, and furnish to Owner [ ] copies of the revised Preliminary Design Phase documents, revised opinion of probable Construction Cost, and any other deliverables within [ ] days after receipt of Owner's comments.

B. Engineer's services under the Preliminary Design Phase will be considered complete on the date when Engineer has delivered to Owner the revised Preliminary Design Phase documents, revised opinion of probable Construction Cost, and any other Preliminary Design Phase deliverables.

A1.03 *Final Design Phase*

A. After acceptance by Owner of the Preliminary Design Phase documents, revised opinion of probable Construction Cost as determined in the Preliminary Design Phase, and any other Preliminary Design Phase deliverables, subject to any Owner-directed modifications or changes in the scope, extent, character, or design requirements of or for the Project, and upon written authorization from Owner, Engineer shall:

1. Prepare final Drawings and Specifications indicating the scope, extent, and character of the Work to be performed and furnished by Contractor.

2. Visit the Site as needed to assist in preparing the final Drawings and Specifications.

3. Provide technical criteria, written descriptions, and design data for Owner's use in filing applications for permits from or approvals of governmental authorities having jurisdiction to review or approve the final design; assist Owner in consultations with such authorities; and revise the Drawings and Specifications in response to directives from such authorities, as appropriate.

4. Advise Owner of any recommended adjustments to the opinion of probable Construction Cost.

5. After consultation with Owner, include in the Construction Contract Documents any specific protocols for the transmittal of Project-related correspondence, documents, text, data, drawings, information, and graphics, in electronic media or digital format, either directly, or through access to a secure Project website. Any such protocols shall be applicable to transmittals between and among Owner, Engineer, and Contractor during the Construction Phase and Post-Construction Phase, and unless agreed otherwise shall supersede any conflicting protocols previously established for transmittals between Owner and Engineer.

6. Assist Owner in assembling known reports and drawings of Site conditions, and in identifying the technical data contained in such reports and drawings upon which bidders or other prospective contractors may rely.

7. In addition to preparing the final Drawings and Specifications, assemble drafts of other Construction Contract Documents based on specific instructions and contract forms, text, or content received from Owner.

8. Prepare or assemble draft bidding-related documents (or requests for proposals or other construction procurement documents), based on the specific bidding or procurement-related instructions and forms, text, or content received from Owner.

9. Perform or provide the following other Final Design Phase tasks or deliverables: [ ] ***[List any such tasks or deliverables here.]***

10. Furnish for review by Owner, its legal counsel, and other advisors, [ ] copies of the final Drawings and Specifications, assembled drafts of other Construction Contract Documents, the draft bidding-related documents (or requests for proposals or other construction procurement documents), and any other Final Design Phase deliverables, within [ ] days of authorization to proceed with the Final Design Phase, and review them with Owner. Within [ ] days of receipt, Owner shall submit to Engineer any comments regarding the furnished items, and any instructions for revisions.

11. Revise the final Drawings and Specifications, assembled drafts of other Construction Contract Documents, the draft bidding-related documents (or requests for proposals or other construction procurement documents), and any other Final Design Phase deliverables in accordance with comments and instructions from the Owner, as appropriate, and submit [ ] final copies of such documents to Owner within [ ] days after receipt of Owner's comments and instructions.

B. Engineer's services under the Final Design Phase will be considered complete on the date when Engineer has delivered to Owner the final Drawings and Specifications, other assembled Construction Contract Documents, bidding-related documents (or requests for proposals or other construction procurement documents), and any other Final Design Phase deliverables.

C. In the event that the Work designed or specified by Engineer is to be performed or furnished under more than one prime contract, or if Engineer's services are to be separately sequenced with the work of one or more prime Contractors (such as in the case of fast-tracking), Owner and Engineer shall, prior to commencement of the Final Design Phase, develop a schedule for performance of Engineer's services during the Final Design, Bidding or Negotiating, Construction, and Post-Construction Phases in order to sequence and coordinate properly such services as are applicable to the work under such separate prime contracts. This schedule is to be prepared and included in or become an amendment to Exhibit A whether or not the work under such contracts is to proceed concurrently.

D. The number of prime contracts for Work designed or specified by Engineer upon which the Engineer's compensation has been established under this Agreement is [ ]. If more prime contracts are awarded, Engineer shall be entitled to an equitable increase in its compensation under this Agreement.

A1.04 *Bidding or Negotiating Phase*

A. After acceptance by Owner of the final Drawings and Specifications, other Construction Contract Documents, bidding-related documents (or requests for proposals or other construction procurement documents), and the most recent opinion of probable Construction Cost as determined in the Final Design Phase, and upon written authorization by Owner to proceed, Engineer shall:

1. Assist Owner in advertising for and obtaining bids or proposals for the Work, assist Owner in issuing assembled design, contract, and bidding-related documents (or requests for proposals or other construction procurement documents) to prospective contractors, and, where applicable, maintain a record of prospective contractors to which documents have been issued, attend pre-bid conferences, if any, and receive and process contractor deposits or charges for the issued documents.

2. Prepare and issue Addenda as appropriate to clarify, correct, or change the issued documents.

3. Provide information or assistance needed by Owner in the course of any review of proposals or negotiations with prospective contractors.

4. Consult with Owner as to the qualifications of prospective contractors.

5. Consult with Owner as to the qualifications of ubcontractors, suppliers, and other individuals and entities proposed by prospective contractors, for those portions of the Work as to which review of qualifications is required by the issued documents.

6. If the issued documents require, the Engineer shall evaluate and determine the acceptability of "or equals" and substitute materials and equipment proposed by prospective contractors, provided that such proposals are allowed by the bidding-related documents (or requests for proposals or other construction procurement documents) prior to award of contracts for the Work. Services under this paragraph are subject to the provisions of Paragraph A2.02.A.2 of this Exhibit A.

7. Attend the bid opening, prepare bid tabulation sheets to meet Owner's schedule, and assist Owner in evaluating bids or proposals, assembling final contracts for the Work for execution by Owner and Contractor, and in issuing notices of award of such contracts.

8. If Owner engages in negotiations with bidders or proposers, assist Owner with respect to technical and engineering issues that arise during the negotiations.

9. Perform or provide the following other Bidding or Negotiating Phase tasks or deliverables: [ ] ***[List any such tasks or deliverables here.]***

B. The Bidding or Negotiating Phase will be considered complete upon commencement of the Construction Phase or upon cessation of negotiations with prospective contractors (except as may be required if Exhibit F is a part of this Agreement).

A1.05 *Construction Phase*

A. Upon successful completion of the Bidding and Negotiating Phase, and upon written authorization from Owner, Engineer shall:

1. *General Administration of Construction Contract:* Consult with Owner and act as Owner's representative as provided in the Construction Contract. The extent and limitations of the duties, responsibilities, and authority of Engineer shall be as assigned in EJCDC® C-700, Standard General Conditions of the Construction Contract (2013 Edition), prepared by the Engineers Joint Contract Documents Committee, or other construction general conditions specified in this Agreement. If Owner, or Owner and Contractor, modify the duties, responsibilities, and authority of Engineer in the Construction Contract, or modify other terms of the Construction Contract having a direct bearing on Engineer, then Owner shall compensate Engineer for any related increases in the cost to provide Construction Phase services. Engineer shall not be required to furnish or perform services contrary to Engineer's responsibilities as a licensed professional. All of Owner's instructions to Contractor will be issued through Engineer, which shall have authority to act on behalf of Owner in dealings with Contractor to the extent provided in this Agreement and the Construction Contract except as otherwise provided in writing.

2. *Resident Project Representative (RPR):* Provide the services of an RPR at the Site to assist the Engineer and to provide more extensive observation of Contractor's work. Duties, responsibilities, and authority of the RPR are as set forth in Exhibit D. The furnishing of such RPR's services will not limit, extend, or modify Engineer's responsibilities or

authority except as expressly set forth in Exhibit D**.** ***[If Engineer will not be providing the services of an RPR, then delete this Paragraph 2 by inserting the word "DELETED" after the paragraph title, and do not include Exhibit D as part of the Agreement.]***

3. *Selection of Independent Testing Laboratory:* Assist Owner in the selection of an independent testing laboratory to perform the services identified in Exhibit B, Paragraph B2.01.

4. *Pre-Construction Conference:* Participate in a pre-construction conference prior to commencement of Work at the Site.

5. *Electronic Transmittal Protocols:* If the Construction Contract Documents do not specify protocols for the transmittal of Project-related correspondence, documents, text, data, drawings, information, and graphics, in electronic media or digital format, either directly, or through access to a secure Project website, then together with Owner and Contractor jointly develop such protocols for transmittals between and among Owner, Contractor, and Engineer during the Construction Phase and Post-Construction Phase.

6. *Original Documents:* If requested by Owner to do so, maintain and safeguard during the Construction Phase at least one original printed record version of the Construction Contract Documents, including Drawings and Specifications signed and sealed by Engineer and other design professionals in accordance with applicable Laws and Regulations. Throughout the Construction Phase, make such original printed record version of the Construction Contract Documents available to Contractor and Owner for review.

7. *Schedules:* Receive, review, and determine the acceptability of any and all schedules that Contractor is required to submit to Engineer, including the Progress Schedule, Schedule of Submittals, and Schedule of Values.

8. *Baselines and Benchmarks:* As appropriate, establish baselines and benchmarks for locating the Work which in Engineer's judgment are necessary to enable Contractor to proceed.

9. *Visits to Site and Observation of Construction:* In connection with observations of Contractor's Work while it is in progress:

   a. Make visits to the Site at intervals appropriate to the various stages of construction, as Engineer deems necessary, to observe as an experienced and qualified design professional the progress of Contractor's executed Work. Such visits and observations by Engineer, and the Resident Project Representative, if any, are not intended to be exhaustive or to extend to every aspect of the Work or to involve detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in this Agreement and the Construction Contract Documents, but rather are to be limited to spot checking, selective sampling, and similar methods of general observation of the Work based on Engineer's exercise of professional judgment, as assisted by the Resident Project Representative, if any. Based on information obtained during such visits and observations, Engineer will determine in general if the Work is proceeding in accordance with the Construction Contract Documents, and Engineer shall keep Owner informed of the progress of the Work.

b. The purpose of Engineer's visits to the Site, and representation by the Resident Project Representative, if any, at the Site, will be to enable Engineer to better carry out the duties and responsibilities assigned to and undertaken by Engineer during the Construction Phase, and, in addition, by the exercise of Engineer's efforts as an experienced and qualified design professional, to provide for Owner a greater degree of confidence that the completed Work will conform in general to the Construction Contract Documents and that Contractor has implemented and maintained the integrity of the design concept of the completed Project as a functioning whole as indicated in the Construction Contract Documents. Engineer shall not, during such visits or as a result of such observations of the Work, supervise, direct, or have control over the Work, nor shall Engineer have authority over or responsibility for the means, methods, techniques, sequences, or procedures of construction selected or used by any Constructor, for security or safety at the Site, for safety precautions and programs incident to any Constructor's work in progress, for the coordination of the Constructors' work or schedules, nor for any failure of any Constructor to comply with Laws and Regulations applicable to furnishing and performing of its work. Accordingly, Engineer neither guarantees the performance of any Constructor nor assumes responsibility for any Constructor's failure to furnish or perform the Work, or any portion of the Work, in accordance with the Construction Contract Documents.

10. *Defective Work:* Reject Work if, on the basis of Engineer's observations, Engineer believes that such Work is defective under the terms and standards set forth in the Construction Contract Documents. Provide recommendations to Owner regarding whether Contractor should correct such Work or remove and replace such Work, or whether Owner should consider accepting such Work as provided in the Construction Contract Documents.

11. *Compatibility with Design Concept:* If Engineer has express knowledge that a specific part of the Work that is not defective under the terms and standards set forth in the Construction Contract Documents is nonetheless not compatible with the design concept of the completed Project as a functioning whole, then inform Owner of such incompatibility, and provide recommendations for addressing such Work.

12. *Clarifications and Interpretations:* Accept from Contractor and Owner submittal of all matters in question concerning the requirements of the Construction Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Construction Contract Documents. With reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Construction Contract Documents.

13. *Non-reviewable Matters:* If a submitted matter in question concerns the Engineer's performance of its duties and obligations, or terms and conditions of the Construction Contract Documents that do not involve (1) the performance or acceptability of the Work under the Construction Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer will not provide a decision or interpretation.

14. *Field Orders:* Subject to any limitations in the Construction Contract Documents, Engineer may prepare and issue Field Orders requiring minor changes in the Work.

15. *Change Orders and Work Change Directives:* Recommend Change Orders and Work Change Directives to Owner, as appropriate, and prepare Change Orders and Work Change Directives as required.

16. *Differing Site Conditions:* Respond to any notice from Contractor of differing site conditions, including conditions relating to underground facilities such as utilities, and hazardous environmental conditions. Promptly conduct reviews and prepare findings, conclusions, and recommendations for Owner's use.

17. *Shop Drawings, Samples, and Other Submittals:* Review and approve or take other appropriate action with respect to Shop Drawings, Samples, and other required Contractor submittals, but only for conformance with the information given in the Construction Contract Documents and compatibility with the design concept of the completed Project as a functioning whole as indicated by the Construction Contract Documents. Such reviews and approvals or other action will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions and programs incident thereto. Engineer shall meet any Contractor's submittal schedule that Engineer has accepted.

18. *Substitutes and "Or-equal":* Evaluate and determine the acceptability of substitute or "or-equal" materials and equipment proposed by Contractor, but subject to the provisions of Paragraph A2.02.A.2 of this Exhibit A.

19. *Inspections and Tests:*

    a. Receive and review all certificates of inspections, tests, and approvals required by Laws and Regulations or the Construction Contract Documents. Engineer's review of such certificates will be for the purpose of determining that the results certified indicate compliance with the Construction Contract Documents and will not constitute an independent evaluation that the content or procedures of such inspections, tests, or approvals comply with the requirements of the Construction Contract Documents. Engineer shall be entitled to rely on the results of such inspections and tests.

    b. As deemed reasonably necessary, request that Contractor uncover Work that is to be inspected, tested, or approved.

    c. Pursuant to the terms of the Construction Contract, require special inspections or testing of the Work, whether or not the Work is fabricated, installed, or completed.

20. *Change Proposals and Claims:* (a) Review and respond to Change Proposals. Review each duly submitted Change Proposal from Contractor and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties

that the Engineer will not resolve the Change Proposal. (b) Provide information or data to Owner regarding engineering or technical matters pertaining to Claims.

21. *Applications for Payment:* Based on Engineer's observations as an experienced and qualified design professional and on review of Applications for Payment and accompanying supporting documentation:

    a. Determine the amounts that Engineer recommends Contractor be paid. Recommend reductions in payment (set-offs) based on the provisions for set-offs stated in the Construction Contract. Such recommendations of payment will be in writing and will constitute Engineer's representation to Owner, based on such observations and review, that, to the best of Engineer's knowledge, information and belief, Contractor's Work has progressed to the point indicated, the Work is generally in accordance with the Construction Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Construction Contract Documents, and to any other qualifications stated in the recommendation), and the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work. In the case of unit price Work, Engineer's recommendations of payment will include final determinations of quantities and classifications of the Work (subject to any subsequent adjustments allowed by the Construction Contract Documents).

    b. By recommending payment, Engineer shall not thereby be deemed to have represented that observations made by Engineer to check the quality or quantity of Contractor's Work as it is performed and furnished have been exhaustive, extended to every aspect of Contractor's Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in this Agreement. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment including final payment will impose on Engineer responsibility to supervise, direct, or control the Work, or for the means, methods, techniques, sequences, or procedures of construction or safety precautions or programs incident thereto, or Contractor's compliance with Laws and Regulations applicable to Contractor's furnishing and performing the Work. It will also not impose responsibility on Engineer to make any examination to ascertain how or for what purposes Contractor has used the money paid to Contractor by Owner; to determine that title to any portion of the Work, including materials or equipment, has passed to Owner free and clear of any liens, claims, security interests, or encumbrances; or that there may not be other matters at issue between Owner and Contractor that might affect the amount that should be paid.

22. *Contractor's Completion Documents:* Receive from Contractor, review, and transmit to Owner maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance required by the Construction Contract Documents, certificates of inspection, tests and approvals, and Shop Drawings, Samples, and other data approved as provided under Paragraph A1.05.A.17. Receive from Contractor, review, and transmit to Owner the annotated record documents which are to be assembled by Contractor in accordance with the Construction Contract Documents

to obtain final payment. The extent of Engineer's review of record documents shall be to check that Contractor has submitted all pages.

23. *Substantial Completion:* Promptly after notice from Contractor that Contractor considers the entire Work ready for its intended use, in company with Owner and Contractor, visit the Site to review the Work and determine the status of completion. Follow the procedures in the Construction Contract regarding the preliminary certificate of Substantial Completion, punch list of items to be completed, Owner's objections, notice to Contractor, and issuance of a final certificate of Substantial Completion. Assist Owner regarding any remaining engineering or technical matters affecting Owner's use or occupancy of the Work following Substantial Completion.

24. *Other Tasks:* Perform or provide the following other Construction Phase tasks or deliverables: [ ] ***[List any such tasks or deliverables here.]***

25. *Final Notice of Acceptability of the Work:* Conduct a final visit to the Project to determine if the Work is complete and acceptable so that Engineer may recommend, in writing, final payment to Contractor. Accompanying the recommendation for final payment, Engineer shall also provide a notice to Owner and Contractor in the form attached hereto as Exhibit E ("Notice of Acceptability of Work") that the Work is acceptable (subject to the provisions of the Notice and Paragraph A1.05.A.21.b) to the best of Engineer's knowledge, information, and belief, and based on the extent of the services provided by Engineer under this Agreement.

26. *Standards for Certain Construction-Phase Decisions:* Engineer will render decisions regarding the requirements of the Construction Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth in the Construction Contract for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

B. *Duration of Construction Phase:* The Construction Phase will commence with the execution of the first Construction Contract for the Project or any part thereof and will terminate upon written recommendation by Engineer for final payment to Contractors. If the Project involves more than one prime contract as indicated in Paragraph A1.03.D, then Construction Phase services may be rendered at different times in respect to the separate contracts. Subject to the provisions of Article 3, Engineer shall be entitled to an equitable increase in compensation if Construction Phase services (including Resident Project Representative services, if any) are required after the original date for completion and readiness for final payment of Contractor as set forth in the Construction Contract.

A1.06 *Post-Construction Phase*

A. Upon written authorization from Owner during the Post-Construction Phase, Engineer shall:

1. Together with Owner, visit the Project to observe any apparent defects in the Work, make recommendations as to replacement or correction of defective Work, if any, or the need to repair of any damage to the Site or adjacent areas, and assist Owner in

consultations and discussions with Contractor concerning correction of any such defective Work and any needed repairs.

2. Together with Owner, visit the Project within one month before the end of the Construction Contract's correction period to ascertain whether any portion of the Work or the repair of any damage to the Site or adjacent areas is defective and therefore subject to correction by Contractor.

3. Perform or provide the following other Post-Construction Phase tasks or deliverables: [ ] ***[List any such tasks or deliverables here.]***

B. The Post-Construction Phase services may commence during the Construction Phase and, if not otherwise modified in this Exhibit A, will terminate twelve months after the commencement of the Construction Contract's correction period.

PART 2 – ADDITIONAL SERVICES

A2.01 *Additional Services Requiring Owner's Written Authorization*

A. If authorized in writing by Owner, Engineer shall provide Additional Services of the types listed below. These services are not included as part of Basic Services and will be paid for by Owner as indicated in Exhibit C.

1. Preparation of applications and supporting documents (in addition to those furnished under Basic Services) for private or governmental grants, loans, or advances in connection with the Project; preparation or review of environmental assessments and impact statements; review and evaluation of the effects on the design requirements for the Project of any such statements and documents prepared by others; and assistance in obtaining approvals of authorities having jurisdiction over the anticipated environmental impact of the Project.

2. Services to make measured drawings of existing conditions or facilities, to conduct tests or investigations of existing conditions or facilities, or to verify the accuracy of drawings or other information furnished by Owner or others.

3. Services resulting from significant changes in the scope, extent, or character of the portions of the Project designed or specified by Engineer, or the Project's design requirements, including, but not limited to, changes in size, complexity, Owner's schedule, character of construction, or method of financing; and revising previously accepted studies, reports, Drawings, Specifications, or Construction Contract Documents when such revisions are required by changes in Laws and Regulations enacted subsequent to the Effective Date or are due to any other causes beyond Engineer's control.

4. Services resulting from Owner's request to evaluate additional Study and Report Phase alternative solutions beyond those agreed to in Paragraph A1.01.A.1 and 2.

5. Services required as a result of Owner's providing incomplete or incorrect Project information to Engineer.

6. Providing renderings or models for Owner's use, including services in support of building information modeling or civil integrated management.

7. Undertaking investigations and studies including, but not limited to:

   a. detailed consideration of operations, maintenance, and overhead expenses;

   b. the preparation of feasibility studies (such as those that include projections of output capacity, utility project rates, project market demand, or project revenues) and cash flow analyses, provided that such services are based on the engineering and technical aspects of the Project, and do not include rendering advice regarding municipal financial products or the issuance of municipal securities;

   c. preparation of appraisals;

   d. evaluating processes available for licensing, and assisting Owner in obtaining process licensing;

   e. detailed quantity surveys of materials, equipment, and labor; and

   f. audits or inventories required in connection with construction performed or furnished by Owner.

8. Furnishing services of Consultants for other than Basic Services.

9. Providing data or services of the types described in Exhibit B, when Owner retains Engineer to provide such data or services instead of Owner furnishing the same.

10. Providing the following services:

    a. Services attributable to more prime construction contracts than specified in Paragraph A1.03.D.

    b. Services to arrange for performance of construction services for Owner by contractors other than the principal prime Contractor, and administering Owner's contract for such services.

11. Services during out-of-town travel required of Engineer, other than for visits to the Site or Owner's office as required in Basic Services (Part 1 of Exhibit A).

12. Preparing for, coordinating with, participating in and responding to structured independent review processes, including, but not limited to, construction management, cost estimating, project peer review, value engineering, and constructibility review requested by Owner; and performing or furnishing services required to revise studies, reports, Drawings, Specifications, or other documents as a result of such review processes.

13. Preparing additional bidding-related documents (or requests for proposals or other construction procurement documents) or Construction Contract Documents for alternate bids or cost estimates requested by Owner for the Work or a portion thereof.

14. Assistance in connection with bid protests, rebidding, or renegotiating contracts for construction, materials, equipment, or services, except when such assistance is required to complete services required by Paragraph 5.02.A and Exhibit F.

15. Preparing conformed Construction Contract Documents that incorporate and integrate the content of all Addenda and any amendments negotiated by Owner and Contractor.

16. Providing Construction Phase services beyond the original date for completion and readiness for final payment of Contractor, but only if such services increase the total quantity of services to be performed in the Construction Phase, rather than merely shifting performance of such services to a later date.

17. Preparing Record Drawings, and furnishing such Record Drawings to Owner.

18. Supplementing Record Drawings with information regarding the completed Project, Site, and immediately adjacent areas obtained from field observations, Owner, utility companies, and other reliable sources.

19. Conducting surveys, investigations, and field measurements to verify the accuracy of Record Drawing content obtained from Contractor, Owner, utility companies, and other sources; revise and supplement Record Drawings as needed.

20. Preparation of operation, maintenance, and staffing manuals.

21. Protracted or extensive assistance in refining and adjusting of Project equipment and systems (such as initial startup, testing, and balancing).

22. Assistance to Owner in training Owner's staff to operate and maintain Project equipment and systems.

23. Assistance to Owner in developing systems and procedures for (a) control of the operation and maintenance of Project equipment and systems, and (b) related recordkeeping.

24. Preparing to serve or serving as a consultant or witness for Owner in any litigation, arbitration, lien or bond claim, or other legal or administrative proceeding involving the Project.

25. Overtime work requiring higher than regular rates.

26. Providing construction surveys and staking to enable Contractor to perform its work other than as required under Paragraph A1.05.A.8; any type of property surveys or related engineering services needed for the transfer of interests in real property; and providing other special field surveys.

27. Providing more extensive services required to enable Engineer to issue notices or certifications requested by Owner.

28. Extensive services required during any correction period, or with respect to monitoring Contractor's compliance with warranties and guarantees called for in the Construction Contract (except as agreed to under Basic Services).

29. Other additional services performed or furnished by Engineer not otherwise provided for in this Agreement.

A2.02 *Additional Services Not Requiring Owner's Written Authorization*

A. Engineer shall advise Owner that Engineer is commencing to perform or furnish the Additional Services of the types listed below. For such Additional Services, Engineer need not request or obtain specific advance written authorization from Owner. Engineer shall cease performing or furnishing such Additional Services upon receipt of written notice to cease from Owner.

1. Services in connection with Work Change Directives and Change Orders to reflect changes requested by Owner.

2. Services in making revisions to Drawings and Specifications occasioned by the acceptance of substitute materials or equipment other than "or equal" items; services after the award of the Construction Contract in evaluating and determining the acceptability of a proposed "or equal" or substitution which is found to be inappropriate for the Project; evaluation and determination of an excessive number of proposed "or equals" or substitutions, whether proposed before or after award of the Construction Contract.

3. Services resulting from significant delays, changes, or price increases occurring as a direct or indirect result of materials, equipment, or energy shortages.

4. Additional or extended services arising from (a) the presence at the Site of any Constituent of Concern or items of historical or cultural significance, (b) emergencies or acts of God endangering the Work, (c) damage to the Work by fire or other causes during construction, (d) a significant amount of defective, neglected, or delayed Work, (e) acceleration of the progress schedule involving services beyond normal working hours, or (f) default by Contractor.

5. Services (other than Basic Services during the Post-Construction Phase) in connection with any partial utilization of the Work by Owner prior to Substantial Completion.

6. Evaluating unreasonable or frivolous requests for interpretation or information (RFIs), Change Proposals, or other demands from Contractor or others in connection with the Work, or an excessive number of RFIs, Change Proposals, or demands.

7. Reviewing a Shop Drawing or other Contractor submittal more than three times, as a result of repeated inadequate submissions by Contractor.

8. While at the Site, compliance by Engineer and its staff with those terms of Owner's or Contractor's safety program provided to Engineer subsequent to the Effective Date that exceed those normally required of engineering personnel by federal, State, or local safety authorities for similar construction sites.

This is **EXHIBIT B**, consisting of [ ] pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated [ ].

Owner's Responsibilities

Article 2 of the Agreement is supplemented to include the following agreement of the parties.

B2.01 In addition to other responsibilities of Owner as set forth in this Agreement, Owner shall at its expense:

A. Provide Engineer with all criteria and full information as to Owner's requirements for the Project, including design objectives and constraints, space, capacity and performance requirements, flexibility, and expandability, and any budgetary limitations.

B. Give instructions to Engineer regarding Owner's procurement of construction services (including instructions regarding advertisements for bids, instructions to bidders, and requests for proposals, as applicable), Owner's construction contract practices and requirements, insurance and bonding requirements, electronic transmittals during construction, and other information necessary for the finalization of Owner's bidding-related documents (or requests for proposals or other construction procurement documents), and Construction Contract Documents. Furnish copies (or give specific directions requesting Engineer to use copies already in Engineer's possession) of all design and construction standards, Owner's standard forms, general conditions (if other than EJCDC® C-700, Standard General Conditions of the Construction Contract, 2013 Edition), supplementary conditions, text, and related documents and content for Engineer to include in the draft bidding-related documents (or requests for proposals or other construction procurement documents), and draft Construction Contract Documents, when applicable. Owner shall have responsibility for the final content of (1) such bidding-related documents (or requests for proposals or other construction procurement documents), and (2) those portions of any Construction Contract other than the design (as set forth in the Drawings, Specifications, or otherwise), and other engineering or technical matters; and Owner shall seek the advice of Owner's legal counsel, risk managers, and insurance advisors with respect to the drafting and content of such documents.

C. Furnish to Engineer any other available information pertinent to the Project including reports and data relative to previous designs, construction, or investigation at or adjacent to the Site.

D. Following Engineer's assessment of initially-available Project information and data and upon Engineer's request, obtain, furnish, or otherwise make available (if necessary through title searches, or retention of specialists or consultants) such additional Project-related information and data as is reasonably required to enable Engineer to complete its Basic and Additional Services. Such additional information or data would generally include the following:

1. Property descriptions.

2. Zoning, deed, and other land use restrictions.

3. Utility and topographic mapping and surveys.

4. Property, boundary, easement, right-of-way, and other special surveys or data, including establishing relevant reference points.

5. Explorations and tests of subsurface conditions at or adjacent to the Site; geotechnical reports and investigations; drawings of physical conditions relating to existing surface or subsurface structures at the Site; hydrographic surveys, laboratory tests and inspections of samples, materials, and equipment; with appropriate professional interpretation of such information or data.

6. Environmental assessments, audits, investigations, and impact statements, and other relevant environmental, historical, or cultural studies relevant to the Project, the Site, and adjacent areas.

7. Data or consultations as required for the Project but not otherwise identified in this Agreement.

E. Arrange for safe access to and make all provisions for Engineer to enter upon public and private property as required for Engineer to perform services under the Agreement.

F. Recognizing and acknowledging that Engineer's services and expertise do not include the following services, provide, as required for the Project:

1. Accounting, bond and financial advisory (including, if applicable, "municipal advisor" services as described in Section 975 of the Dodd-Frank Wall Street Reform and Consumer Protection Act (2010) and the municipal advisor registration rules issued by the Securities and Exchange Commission), independent cost estimating, and insurance counseling services.

2. Legal services with regard to issues pertaining to the Project as Owner requires, Contractor raises, or Engineer reasonably requests.

3. Such auditing services as Owner requires to ascertain how or for what purpose Contractor has used the money paid.

G. Provide the services of an independent testing laboratory to perform all inspections, tests, and approvals of samples, materials, and equipment required by the Construction Contract Documents (other than those required to be furnished or arranged by Contractor), or to evaluate the performance of materials, equipment, and facilities of Owner, prior to their incorporation into the Work with appropriate professional interpretation thereof. Provide Engineer with the findings and reports generated by testing laboratories, including findings and reports obtained from or through Contractor.

H. Provide reviews, approvals, and permits from all governmental authorities having jurisdiction to approve all phases of the Project designed or specified by Engineer and such reviews, approvals, and consents from others as may be necessary for completion of each phase of the Project.

I. Advise Engineer of the identity and scope of services of any independent consultants employed by Owner to perform or furnish services in regard to the Project, including, but not limited to, cost estimating, project peer review, value engineering, and constructibility review.

J. If Owner designates a construction manager or an individual or entity other than, or in addition to, Engineer to represent Owner at the Site, define and set forth as an attachment to this Exhibit B the duties, responsibilities, and limitations of authority of such other party and the relation thereof to the duties, responsibilities, and authority of Engineer.

K. If more than one prime contract is to be awarded for the Work designed or specified by Engineer, then designate a person or entity to have authority and responsibility for coordinating the activities among the various prime Contractors, and define and set forth the duties, responsibilities, and limitations of authority of such individual or entity and the relation thereof to the duties, responsibilities, and authority of Engineer as an attachment to this Exhibit B that is to be mutually agreed upon and made a part of this Agreement before such services begin.

L. Inform Engineer in writing of any specific requirements of safety or security programs that are applicable to Engineer, as a visitor to the Site.

M. Examine all alternative solutions, studies, reports, sketches, Drawings, Specifications, proposals, and other documents presented by Engineer (including obtaining advice of an attorney, risk manager, insurance counselor, financial/municipal advisor, and other advisors or consultants as Owner deems appropriate with respect to such examination) and render in writing timely decisions pertaining thereto.

N. Inform Engineer regarding any need for assistance in evaluating the possible use of Project Strategies, Technologies, and Techniques, as defined in Exhibit A.

O. Advise Engineer as to whether Engineer's assistance is requested in identifying opportunities for enhancing the sustainability of the Project.

P. Place and pay for advertisement for Bids in appropriate publications.

Q. Furnish to Engineer data as to Owner's anticipated costs for services to be provided by others (including, but not limited to, accounting, bond and financial, independent cost estimating, insurance counseling, and legal advice) for Owner so that Engineer may assist Owner in collating the various cost categories which comprise Total Project Costs.

R. Attend and participate in the pre-bid conference, bid opening, pre-construction conferences, construction progress and other job related meetings, and Site visits to determine Substantial Completion and readiness of the completed Work for final payment.

S. Authorize Engineer to provide Additional Services as set forth in Part 2 of Exhibit A of the Agreement, as required.

T. Perform or provide the following: [ ] ***[List any other Owner responsibilities here.]***

Exhibit C

Payments to Engineer for Services and Reimbursable Expenses

[Notes to User]

Preparing a Project-specific Exhibit C: In Exhibit C, the parties must specify how the Engineer will be compensated for its services. EJCDC's E-500 as published contains a lengthy Exhibit C, comprised of numerous options for detailing the Engineer's compensation. In preparing a Project-specific professional services agreement, retain only the few pages from Exhibit C that will apply to the agreement that is being prepared, and discard the rest. At the end of the agreement preparation process, Exhibit C should typically be approximately five to eight pages long.

Exhibit C Compensation Packets: EJCDC breaks the Engineer's compensation into three categories: (1) compensation for Basic Services, as defined in Exhibit A (but not including services of a Resident Project Representative, if any); (2) compensation for the services of a Resident Project Representative, if any; and (3) compensation for any Additional Services, as defined in Exhibit A. There are typically several possible ways of paying for services; Exhibit C includes "Compensation Packets" for the various methods. Each Compensation Packet contains the terms and conditions that apply to the specific means of compensation, and when appropriate incorporates appendices for hourly rates and reimbursable expenses.

1. The six Compensation Packets included in E-500's Exhibit C for Basic Services are:

   - Lump Sum (Compensation Packet BC-1)
   - Standard Hourly Rates (Compensation Packet BC-2)
   - Percentage of Construction Costs (Compensation Packet BC-3)
   - Direct Labor Costs Times a Factor (Compensation Packet BC-4)
   - Direct Labor Costs Plus Overhead Plus a Fixed Fee (Compensation Packet BC-5)
   - Salary Costs Times a Factor (Compensation Packet BC-6)

   During the drafting process the user should **select one** of these six Compensation Packets and **discard (delete) the remaining five.**

2. The choices for compensating a Resident Project Representative are similar, with five RPR Compensation Packets available:

   - Lump Sum (Compensation Packet RPR-1)
   - Standard Hourly Rates (Compensation Packet RPR-2)
   - Percentage of Construction Costs (Compensation Packet RPR-3)
   - Direct Labor Costs Times a Factor (Compensation Packet RPR-4)
   - Salary Costs Times a Factor (Compensation Packet RPR-5)

During the drafting process the user should **select one** of these five RPR Compensation Packets and **discard (delete) the remaining four**.

3. The choices for compensating the Engineer for Additional Services are narrower:

- Standard Hourly Rates (Compensation Packet AS-1)
- Direct Labor Costs Times a Factor (Compensation Packet AS-2)
- Salary Costs Times a Factor (Compensation Packet AS-3)

The user should **select one** of these three Additional Services Compensation Packets and **discard (delete) the remaining two.**

Compensation Decision Guide: The Compensation Decision Guide that is included on the following pages presents further guidance on the process of selecting the pages to retain for the specific contract, including appendices for hourly rates and reimbursable expenses, if applicable.

Example: If Basic Services (other than RPR) will be compensated using Lump Sum; RPR services using Direct Labor Times a Factor; and Additional Services using Standard Hourly Rates; then to form Exhibit C use Compensation Packet BC-1; Compensation Packet RPR-4; Compensation Packet AS-1; and Appendices 1 and 2.

1. Compensation for Basic Services as described in Exhibit A, Part I (other than for Resident Project Representative services, which are separately addressed in item 2 immediately below).

Decision Question: Which method of compensation is to be used?

	Lump Sum	**Standard Hourly Rates**	**Percentage of Construction Costs**	**Direct Labor Costs Times a Factor**	**Direct Labor Costs Plus Overhead Plus a Fixed Fee**	**Salary Costs Times a Factor**
Use This Base Compensation Packet	Packet BC-1	Packet BC-2	Packet BC-3	Packet BC-4	Packet BC-5	Packet BC-6
Include This Appendix	Appendix 1 (if applicable)	Appendices 1 and 2	Appendix 1 (if applicable)	Appendix 1	Appendix 1	Appendix 1

2. Compensation for services of Resident Project Representative (as described in Exhibit A, Paragraph A1.05.A.2, and in Exhibit D).

Decision Question: Which method of compensation is to be used?

	Lump Sum	**Standard Hourly Rates**	**Percentage of Construction Costs**	**Direct Labor Costs Times a Factor**	**Salary Costs Times a Factor**
Use This RPR Compensation Packet	Packet RPR-1	Packet RPR-2	Packet RPR-3	Packet RPR-4	Packet RPR-5
Include This Appendix	Appendix 1 (if applicable)	Appendices 1 and 2	Appendix 1 (if applicable)	Appendix 1	Appendix 1

3. Compensation for Additional Services (as described in Exhibit A, Part 2)

Decision Question: Which method of compensation is to be used?

	Standard Hourly Rates	**Direct Labor Costs Times a Factor**	**Salary Costs Times a Factor**
Use This Additional Services Compensation Packet	Packet AS-1	Packet AS-2	Packet AS-3
Include This Appendix	Appendices 1 and 2	Appendix 1	Appendix 1

This is **EXHIBIT C**, consisting of [ ] pages, referred to in and part of the Agreement between Owner and Engineer for Professional Services dated [ ].

Payments to Engineer for Services and Reimbursable Expenses
COMPENSATION PACKET BC-1: Basic Services – Lump Sum

Article 2 of the Agreement is supplemented to include the following agreement of the parties:

ARTICLE 2 – OWNER'S RESPONSIBILITIES

C2.01 *Compensation for Basic Services (other than Resident Project Representative) – Lump Sum Method of Payment*

A. Owner shall pay Engineer for Basic Services set forth in Exhibit A, except for services of Engineer's Resident Project Representative, if any, as follows:

1. A Lump Sum amount of $[ ] based on the following estimated distribution of compensation:

   a. Study and Report Phase $[ ]

   b. Preliminary Design Phase $[ ]

   c. Final Design Phase $[ ]

   d. Bidding and Negotiating Phase $[ ]

   e. Construction Phase $[ ]

   f. Post-Construction Phase $[ ]

2. Engineer may alter the distribution of compensation between individual phases noted herein to be consistent with services actually rendered, but shall not exceed the total Lump Sum amount unless approved in writing by the Owner.

3. The Lump Sum includes compensation for Engineer's services and services of Engineer's Consultants, if any. Appropriate amounts have been incorporated in the Lump Sum to account for labor costs, overhead, profit, expenses (other than any expressly allowed Reimbursable Expenses), and Consultant charges.

4. In addition to the Lump Sum, Engineer is also entitled to reimbursement from Owner for the following Reimbursable Expenses (see Appendix 1 for rates or charges): [ ] ***[List any such expenses here, or indicate "None." If "None" then the reference to Appendix 1 may be deleted.]*** .

5. The portion of the Lump Sum amount billed for Engineer's services will be based upon Engineer's estimate of the percentage of the total services actually completed during the

billing period. If any Reimbursable Expenses are expressly allowed, Engineer may also bill for any such Reimbursable Expenses incurred during the billing period.

B. *Period of Service:* The compensation amount stipulated in Compensation Packet BC-1 is conditioned on a period of service not exceeding [ ] months. If such period of service is extended, the compensation amount for Engineer's services shall be appropriately adjusted.

This is **EXHIBIT C**, consisting of [ ] pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated [ ].

Payments to Engineer for Services and Reimbursable Expenses
COMPENSATION PACKET BC-2: Basic Services – Standard Hourly Rates

Article 2 of the Agreement is supplemented to include the following agreement of the parties:

ARTICLE 2 – OWNER'S RESPONSIBILITIES

C2.01 *Compensation For Basic Services (other than Resident Project Representative) – Standard Hourly Rates Method of Payment*

A. Owner shall pay Engineer for Basic Services set forth in Exhibit A, except for services of Engineer's Resident Project Representative, if any, as follows:

1. An amount equal to the cumulative hours charged to the Project by each class of Engineer's personnel times Standard Hourly Rates for each applicable billing class for all services performed on the Project, plus Reimbursable Expenses and Engineer's Consultants' charges, if any.

2. The Standard Hourly Rates charged by Engineer constitute full and complete compensation for Engineer's services, including labor costs, overhead, and profit; the Standard Hourly Rates do not include Reimbursable Expenses or Engineer's Consultants' charges.

3. Engineer's Reimbursable Expenses Schedule and Standard Hourly Rates are attached to this Exhibit C as Appendices 1 and 2.

4. The total compensation for services under Paragraph C2.01 is estimated to be $[ ] based on the following estimated distribution of compensation:

a. Study and Report Phase $[ ]

b. Preliminary Design Phase $[ ]

c. Final Design Phase $[ ]

d. Bidding or Negotiating Phase $[ ]

e. Construction Phase $[ ]

f. Post-Construction Phase $[ ]

5. Engineer may alter the distribution of compensation between individual phases of the work noted herein to be consistent with services actually rendered, but shall not exceed

the total estimated compensation amount unless approved in writing by Owner. See also C2.03.C.2 below.

6. The total estimated compensation for Engineer's services included in the breakdown by phases as noted in Paragraph C2.01.A.3 incorporates all labor, overhead, profit, Reimbursable Expenses, and Engineer's Consultants' charges.

7. The amounts billed for Engineer's services under Paragraph C2.01 will be based on the cumulative hours charged to the Project during the billing period by each class of Engineer's employees times Standard Hourly Rates for each applicable billing class, plus Reimbursable Expenses and Engineer's Consultants' charges.

8. The Standard Hourly Rates and Reimbursable Expenses Schedule will be adjusted annually (as of [ ]) to reflect equitable changes in the compensation payable to Engineer.

C2.02 *Compensation For Reimbursable Expenses*

A. Owner shall pay Engineer for all Reimbursable Expenses at the rates set forth in Appendix 1 to this Exhibit C.

B. Reimbursable Expenses include the expenses identified in Appendix 1 and the following: transportation (including mileage), lodging, and subsistence incidental thereto; providing and maintaining field office facilities including furnishings and utilities; toll telephone calls, mobile phone charges, and courier charges; reproduction of reports, Drawings, Specifications, bidding-related or other procurement documents, Construction Contract Documents, and similar Project-related items; and Consultants' charges. In addition, if authorized in advance by Owner, Reimbursable Expenses will also include expenses incurred for the use of highly specialized equipment.

C. The amounts payable to Engineer for Reimbursable Expenses will be the Project-related internal expenses actually incurred or allocated by Engineer, plus all invoiced external Reimbursable Expenses allocable to the Project, the latter multiplied by a factor of [ ].

C2.03 *Other Provisions Concerning Payment*

A. Whenever Engineer is entitled to compensation for the charges of Engineer's Consultants, those charges shall be the amounts billed by Engineer's Consultants to Engineer times a factor of [ ].

B. *Factors:* The external Reimbursable Expenses and Engineer's Consultants' factors include Engineer's overhead and profit associated with Engineer's responsibility for the administration of such services and costs.

C. *Estimated Compensation Amounts:*

1. Engineer's estimate of the amounts that will become payable for specified services are only estimates for planning purposes, are not binding on the parties, and are not the minimum or maximum amounts payable to Engineer under the Agreement.

2. When estimated compensation amounts have been stated herein and it subsequently becomes apparent to Engineer that the total compensation amount thus estimated will be exceeded, Engineer shall give Owner written notice thereof, allowing Owner to consider its options, including suspension or termination of Engineer's services for Owner's convenience. Upon notice, Owner and Engineer promptly shall review the matter of services remaining to be performed and compensation for such services. Owner shall either exercise its right to suspend or terminate Engineer's services for Owner's convenience, agree to such compensation exceeding said estimated amount, or agree to a reduction in the remaining services to be rendered by Engineer, so that total compensation for such services will not exceed said estimated amount when such services are completed. If Owner decides not to suspend the Engineer's services during the negotiations and Engineer exceeds the estimated amount before Owner and Engineer have agreed to an increase in the compensation due Engineer or a reduction in the remaining services, then Engineer shall be paid for all services rendered hereunder.

D. To the extent necessary to verify Engineer's charges and upon Owner's timely request, Engineer shall make copies of such records available to Owner at cost.

This is **EXHIBIT C**, consisting of [ ] pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated [ ].

Payments to Engineer for Services and Reimbursable Expenses
COMPENSATION PACKET BC-3: Basic Services – Percentage of Construction Cost

Article 2 of the Agreement is supplemented to include the following agreement of the parties:

ARTICLE 2 – OWNER'S RESPONSIBILITIES

C2.01 *Compensation for Basic Services (other than Resident Project Representative) – Percentage of Construction Cost Method of Payment*

A. Owner shall pay Engineer for Basic Services set forth in Exhibit A, except for services of Engineer's Resident Project Representative, if any, as follows:

1. *General:* An amount equal to [ ] percent of the Construction Cost. This amount includes compensation for Engineer's Services and services of Engineer's Consultants, if any. The percentage of Construction Cost noted herein accounts for labor, overhead, profit, and expenses (other than any expressly allowed Reimbursable Expenses).

2. As a basis for payment to Engineer, Construction Cost will be based on one or more of the following determinations with precedence in the order listed for Work designed or specified by Engineer:

   a. For Work designed or specified and incorporated in the completed Project, the actual final price of the Construction Contract(s), as duly adjusted by Change Orders.

   b. For Work designed or specified but not constructed, the lowest bona fide Bid received from a qualified bidder for such Work; or, if the Work is not bid, the lowest bona fide negotiated proposal for such Work.

   c. For Work designed or specified but not constructed upon which no such Bid or proposal is received, Engineer's most recent opinion of probable Construction Cost.

   d. Labor furnished by Owner for the Project will be included in the Construction Cost at current market rates including a reasonable allowance for overhead and profit. Materials and equipment furnished by Owner will be included at current market prices.

   e. For purposes of determining Construction Cost under this provision, no deduction is to be made from Construction Contract pricing on account of any penalty, liquidated damages, or other amounts withheld from payments to Contractor(s).

3. *Reimbursable Expenses:* In addition to the Percentage of Construction Cost, Engineer is also entitled to reimbursement from Owner for the following Reimbursable Expenses

(see Appendix 1 for rates or charges): [ ] ***[List any such expenses here, or indicate "None." If "None" then the reference to Appendix 1 may be deleted.]*** .

4. *Progress Payments:*

   a. The portion of the amounts billed for Engineer's services that is on account of the Percentage of Construction Cost will be based upon Engineer's estimate of the percentage of the total services actually completed during the billing period. If any Reimbursable Expenses are expressly allowed, Engineer may also bill for any such Reimbursable Expenses incurred during the billing period.

   b. Upon conclusion of each phase of Basic Services, Owner shall pay such additional amount, if any, as may be necessary to bring total compensation paid during such phase on account of the percentage of Construction Cost to the following estimated percentages of total compensation payable on account of the percentage of Construction Cost for all phases of Basic Services:

Study and Report Phase	**[ ]%**
Preliminary Design Phase	**[ ]%**
Final Design Phase	**[ ]%**
Bidding or Negotiating Phase	**[ ]%**
Construction Phase	**[ ]%**
Post-Construction Phase	**[ ]%**
	100%

   c. Engineer may alter the distribution of compensation between individual phases of the work noted herein to be consistent with services actually rendered, but shall not exceed the total estimated compensation amount unless approved in writing by Owner.

This is **EXHIBIT C**, consisting of **[ ]** pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated **[ ]**.

Payments to Engineer for Services and Reimbursable Expenses
COMPENSATION PACKET BC-4: Basic Services – Direct Labor Costs Times a Factor

Article 2 of the Agreement is supplemented to include the following agreement of the parties:

ARTICLE 2 – OWNER'S RESPONSIBILITIES

C2.01 *Compensation for Basic Services (other than Resident Project Representative) – Direct Labor Costs Times a Factor Method of Payment*

A. Owner shall pay Engineer for Basic Services set forth in Exhibit A, except for services of Engineer's Resident Project Representative, if any, as follows:

1. An amount equal to Engineer's Direct Labor Costs times a factor of [ ] for the services of Engineer's personnel engaged on the Project, plus Reimbursable Expenses, estimated to be $[ ], and Engineer's Consultant's charges, if any, estimated to be $[ ].

2. Engineer's Reimbursable Expenses Schedule is attached to this Exhibit C as Appendix 1.

3. The total compensation for services under Paragraph C2.01 is estimated to be $[ ] based on the following distribution of compensation:

   a. Study and Report Phase $[ ]

   b. Preliminary Design Phase $[ ]

   c. Final Design Phase $[ ]

   d. Bidding or Negotiating Phase $[ ]

   e. Construction Phase $[ ]

   f. Post-Construction Phase $[ ]

4. Engineer may alter the distribution of compensation between individual phases of the work noted herein to be consistent with services actually rendered, but shall not exceed the total estimated compensation amount unless approved in writing by Owner. See Paragraph C2.03.C.2 below.

5. The total estimated compensation for Engineer's services included in the breakdown by phases as noted in Paragraph C2.01.A.3, incorporates all labor, overhead, profit, Reimbursable Expenses, and Engineer's Consultant's charges.

6. The portion of the amounts billed for Engineer's services which are related to services rendered on a Direct Labor Costs times a Factor basis will be billed based on the applicable Direct Labor Costs for the cumulative hours charged to the Project by Engineer's principals and employees multiplied by the above-designated factor, plus Reimbursable Expenses and Engineer's Consultant's charges incurred during the billing period.

7. Direct Labor Costs means salaries and wages paid to Engineer's employees but does not include payroll-related costs or benefits.

8. Direct Labor Costs and the factor applied to Direct Labor Costs will be adjusted annually (as of [ ]) to reflect equitable changes to the compensation payable to Engineer.

C2.02 *Compensation for Reimbursable Expenses*

A. Owner shall pay Engineer for all Reimbursable Expenses at the rates set forth in Appendix 1 to this Exhibit C.

B. Reimbursable Expenses include the expenses identified in Appendix 1 and the following: transportation (including mileage), lodging, and subsistence incidental thereto; providing and maintaining field office facilities including furnishings and utilities; toll telephone calls, mobile phone charges, and courier charges; reproduction of reports, Drawings, Specifications, bidding-related or other procurement documents, Construction Contract Documents, and similar Project-related items; and Consultants' charges. In addition, if authorized in advance by Owner, Reimbursable Expenses will also include expenses incurred for the use of highly specialized equipment.

C. The amounts payable to Engineer for Reimbursable Expenses will be the Project-related internal expenses actually incurred or allocated by Engineer, plus all invoiced external Reimbursable Expenses allocable to the Project, the latter multiplied by a factor of [ ].

D. The Reimbursable Expenses Schedule will be adjusted annually (as of [ ]) to reflect equitable changes in the compensation payable to Engineer.

C2.03 *Other Provisions Concerning Payment*

A. Whenever Engineer is entitled to compensation for the charges of Engineer's Consultants, those charges shall be the amounts billed by Engineer's Consultants to Engineer times a factor of [ ].

B. *Factors:* The external Reimbursable Expenses and Engineer's Consultant's factors include Engineer's overhead and profit associated with Engineer's responsibility for the administration of such services and costs.

C. *Estimated Compensation Amounts:*

1. Engineer's estimate of the amounts that will become payable for specified services are only estimates for planning purposes, are not binding on the parties, and are not the minimum or maximum amounts payable to Engineer under the Agreement.

2. When estimated compensation amounts have been stated herein and it subsequently becomes apparent to Engineer that the total compensation amount thus estimated will be exceeded, Engineer shall give Owner written notice thereof, allowing Owner to consider its options, including suspension or termination of Engineer's services for Owner's convenience. Upon notice, Owner and Engineer promptly shall review the matter of services remaining to be performed and compensation for such services. Owner shall either exercise its right to suspend or terminate Engineer's services for Owner's convenience, agree to such compensation exceeding said estimated amount, or agree to a reduction in the remaining services to be rendered by Engineer, so that total compensation for such services will not exceed said estimated amount when such services are completed. If Owner decides not to suspend Engineer's services during the negotiations and Engineer exceeds the estimated amount before Owner and Engineer have agreed to an increase in the compensation due Engineer or a reduction in the remaining services, then Engineer shall be paid for all services rendered hereunder.

3. To the extent necessary to verify Engineer's charges and upon Owner's timely request, Engineer shall make copies of such records available to Owner at cost.

This is **EXHIBIT C**, consisting of [ ] pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated [ ].

Payments to Engineer for Services and Reimbursable Expenses
COMPENSATION PACKET BC-5: Basic Services – Direct Labor Costs Plus Overhead Plus a Fixed Fee

Article 2 of the Agreement is supplemented to include the following agreement of the parties:

ARTICLE 2 – OWNER'S RESPONSIBILITIES

C2.01 *Compensation for Basic Services (other than Resident Project Representative) – Direct Labor Costs Plus Overhead Plus a Fixed Fee Method of Payment*

A. Owner shall pay Engineer for Basic Services set forth in Exhibit A, except for services of Engineer's Resident Project Representative, if any, as follows:

1. An amount equal to Engineer's Direct Labor Costs plus overhead for the services of Engineer's personnel engaged directly on the Project, plus Reimbursable Expenses estimated to be $[ ], plus Engineer's Consultant's charges, if any, estimated to be $[ ], plus a fixed fee of $[ ].

2. Engineer's Reimbursable Expenses Schedule is attached to this Exhibit C as Appendix 1.

3. The total compensation for services under Paragraph C2.01 is estimated to be $[ ] based on the following estimated distribution of compensation:

   a. Study and Report Phase $[ ]

   b. Preliminary Design Phase $[ ]

   c. Final Design Phase $[ ]

   d. Bidding or Negotiating Phase $[ ]

   e. Construction Phase $[ ]

   f. Post-Construction Phase $[ ]

4. Engineer may alter the distribution of compensation between individual phases of the work noted herein to be consistent with services actually rendered, but shall not exceed the total estimated compensation amount unless approved in writing by Owner. See Paragraph C2.03.C.2 below.

5. The total estimated compensation for Engineer's services, included in the breakdown by phases as noted in Paragraph C2.01.A.3, incorporates all labor, overhead, fixed fees, Reimbursable Expenses, and Engineer's Consultant's charges.

6. The portion of the amounts billed for Engineer's services will be based on the applicable Direct Labor Costs for the cumulative hours charged to the Project during the billing period by Engineer's employees plus overhead, Reimbursable Expenses, Engineer's Consultant's charges, and the proportionate portion of the fixed fee.

7. Direct Labor Costs means salaries and wages paid to Engineer's employees but does not include payroll-related costs or benefits.

8. Overhead shall be computed as a percentage of Direct Labor Costs. The Overhead factor to be applied to Direct Labor Costs shall be: [ ]. Such Overhead factor shall include or otherwise account for the cost of customary and statutory benefits including, but not limited to, social security contributions, unemployment, excise and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation, and holiday pay applicable thereto; the cost of general and administrative overhead which includes salaries and wages of employees engaged in business operations not directly chargeable to projects, plus non-Project operating costs, including but not limited to, business taxes, legal, rent, utilities, office supplies, insurance, and other operating costs. Fixed fee is the lump sum amount paid to Engineer by Owner as margin or profit and will only be adjusted by an amendment to this agreement.

9. Direct Labor Costs and Overhead applied to Direct Labor Costs will be adjusted annually (as of [ ]) to reflect equitable changes in the compensation payable to Engineer.

C2.02 *Compensation for Reimbursable Expenses*

A. Owner shall pay Engineer for all Reimbursable Expenses at the rates set forth in Appendix 1 to this Exhibit C.

B. Reimbursable Expenses include the expenses identified in Appendix 1 and the following: transportation (including mileage), lodging, and subsistence incidental thereto; providing and maintaining field office facilities including furnishings and utilities; toll telephone calls, mobile phone charges, and courier charges; reproduction of reports, Drawings, Specifications, bidding-related or other procurement documents, Construction Contract Documents, and similar Project-related items; and Consultants' charges. In addition, if authorized in advance by Owner, Reimbursable Expenses will also include expenses incurred for the use of highly specialized equipment.

C. The amounts payable to Engineer for Reimbursable Expenses will be the Project-related internal expenses actually incurred or allocated by Engineer, plus all invoiced external Reimbursable Expenses allocable to the Project, the latter multiplied by a factor of [ ].

D. The Reimbursable Expenses Schedule will be adjusted annually (as of [ ]) to reflect equitable changes in the compensation payable to Engineer.

C2.03 *Other Provisions Concerning Payment*

A. Whenever Engineer is entitled to compensation for the charges of Engineer's Consultants, those charges shall be the amounts billed by Engineer's Consultants to Engineer times a factor of [ ].

B. *Factors:* The external Reimbursable Expenses and Engineer's Consultant's factors include Engineer's overhead and profit associated with Engineer's responsibility for the administration of such services and costs.

C. *Estimated Compensation Amounts:*

1. Engineer's estimate of the amounts that will become payable for specified services are only estimates for planning purposes, are not binding on the parties, and are not the minimum or maximum amounts payable to Engineer under the Agreement.

2. When estimated compensation amounts have been stated herein and it subsequently becomes apparent to Engineer that the total compensation amount thus estimated will be exceeded, Engineer shall give Owner written notice thereof, allowing Owner to consider its options, including suspension or termination of Engineer's services for Owner's convenience. Upon notice, Owner and Engineer promptly shall review the matter of services remaining to be performed and compensation for such services. Owner shall either exercise its right to suspend or terminate Engineer's services for Owner's convenience, agree to such compensation exceeding said estimated amount, or agree to a reduction in the remaining services to be rendered by Engineer, so that total compensation for such services will not exceed said estimated amount when such services are completed. If Owner decides not to suspend Engineer's services during negotiations and Engineer exceeds the estimated amount before Owner and Engineer have agreed to an increase in the compensation due Engineer or a reduction in the remaining services, then Engineer shall be paid for all services rendered hereunder.

D. To the extent necessary to verify Engineer's charges and upon Owner's timely request, Engineer shall make copies of such records available to Owner at cost.

This is **EXHIBIT C**, consisting of [ ] pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated [ ].

Payments to Engineer for Services and Reimbursable Expenses
COMPENSATION PACKET BC-6: Basic Services – Salary Costs Times a Factor

Article 2 of the Agreement is supplemented to include the following agreement of the parties:

ARTICLE 2 – OWNER'S RESPONSIBILITIES

C2.01 *Compensation for Basic Services (other than Resident Project Representative) – Salary Costs Times a Factor Method of Payment*

A. Owner shall pay Engineer for Basic Services set forth in Exhibit A, except for services of Engineer's Resident Project Representative, if any, as follows:

1. An amount equal to Engineer's Salary Costs times a factor of [ ] for all Basic Services by principals and employees engaged directly on the Project, plus Reimbursable Expenses, estimated to be $[ ], and Engineer's Consultant's charges, if any, estimated to be $[ ].

2. Engineer's Reimbursable Expenses Schedule is attached to this Exhibit C as Appendix 1.

3. The total compensation for services under Paragraph C2.01 is estimated to be $[ ] based on the following assumed distribution of compensation:

a.	Study and Report Phase	$[ ]
b.	Preliminary Design Phase	$[ ]
c.	Final Design Phase	$[ ]
d.	Bidding or Negotiating Phase	$[ ]
e.	Construction Phase	$[ ]
f.	Post-Construction Phase	$[ ]

4. Engineer may alter the distribution of compensation between individual phases of the work noted herein to be consistent with services actually rendered, but shall not exceed the total estimated compensation amount unless approved in writing by Owner. See also Paragraph C2.03.C.2 below.

5. The total compensation for Engineer's services, included in the breakdown by phases as noted in Paragraph C2.01.A.3, incorporates all labor, overhead, profit, Reimbursable Expenses, and Engineer's Consultant's charges.

6. The portion of the amounts billed for Engineer's services will be based on the applicable Salary Costs for the cumulative hours charged to the Project incurred during the billing period by Engineer's principals and employees multiplied by the above designated factor, plus Reimbursable Expenses and Engineer's Consultant's charges.

7. Salary Costs means salaries and wages paid to Engineer's employees plus the cost of customary and statutory benefits including, but not limited to, social security contributions, unemployment, excise and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation, and holiday pay applicable thereto.

8. Salary Costs and the factor applied to Salary Costs will be adjusted annually (as of [ ]) to reflect equitable changes in the compensation payable to Engineer.

C2.02 *Compensation for Reimbursable Expenses*

A. Owner shall pay Engineer for all Reimbursable Expenses at the rates set forth in Appendix 1 to this Exhibit C.

B. Reimbursable Expenses include the expenses identified in Appendix 1 and the following: transportation (including mileage), lodging, and subsistence incidental thereto; providing and maintaining field office facilities including furnishings and utilities; toll telephone calls, mobile phone charges, and courier charges; reproduction of reports, Drawings, Specifications, bidding-related or other procurement documents, Construction Contract Documents, and similar Project-related items; and Consultants' charges. In addition, if authorized in advance by Owner, Reimbursable Expenses will also include expenses incurred for the use of highly specialized equipment.

C. The amounts payable to Engineer for Reimbursable Expenses will be the Project-related internal expenses actually incurred or allocated by Engineer, plus all invoiced external Reimbursable Expenses allocable to the Project, the latter multiplied by a factor of [ ].

D. The Reimbursable Expenses Schedule will be adjusted annually (as of [ ]) to reflect equitable changes in the compensation payable to Engineer.

C2.03 *Other Provisions Concerning Payment*

A. Whenever Engineer is entitled to compensation for the charges of Engineer's Consultants, those charges shall be the amounts billed by Engineer's Consultants to Engineer times a factor of [ ].

B. *Factors:* The external Reimbursable Expenses and Engineer's Consultant's factors include Engineer's overhead and profit associated with Engineer's responsibility for the administration of such services and costs.

C. *Estimated Compensation Amounts:*

1. Engineer's estimate of the amounts that will become payable for specified services are only estimates for planning purposes, are not binding on the parties, and are not the minimum or maximum amounts payable to Engineer under the Agreement.

2. When estimated compensation amounts have been stated herein and it subsequently becomes apparent to Engineer that the total compensation amount thus estimated will be exceeded, Engineer shall give Owner written notice thereof, allowing Owner to consider its options, including suspension or termination of Engineer's services for Owner's convenience. Upon notice, Owner and Engineer promptly shall review the matter of services remaining to be performed and compensation for such services. Owner shall either exercise its right to suspend or terminate Engineer's services for Owner's convenience, agree to such compensation exceeding said estimated amount, or agree to a reduction in the remaining services to be rendered by Engineer, so that total compensation for such services will not exceed said estimated amount when such services are completed. If Owner decides not to suspend Engineer's services during the negotiations and Engineer exceeds the estimated amount before Owner and Engineer have agreed to an increase in the compensation due Engineer or a reduction in the remaining services, then Engineer shall be paid for all services rendered hereunder.

D. To the extent necessary to verify Engineer's charges and upon Owner's timely request, Engineer shall make copies of such records available to Owner at cost.

COMPENSATION PACKET RPR-1:
Resident Project Representative – Lump Sum

Article 2 of the Agreement is supplemented to include the following agreement of the parties:

C2.04 *Compensation for Resident Project Representative Basic Services – Lump Sum Method of Payment*

A. Owner shall pay Engineer for Resident Project Representative Basic Services as follows:

1. *Resident Project Representative Services*: For services of Engineer's Resident Project Representative, if any, under Paragraph A1.05 of Exhibit A, the Lump Sum amount of $[ ]. The Lump Sum includes compensation for the Resident Project Representative's services. Appropriate amounts have been incorporated in the Lump Sum to account for labor costs, overhead, profit, and expenses (other than any expressly allowed Reimbursable Expenses) related to the Resident Project Representative's Services.

2. *Reimbursable Expenses:* In addition to the Lump Sum, Engineer is also entitled to reimbursement from Owner for the following RPR Reimbursable Expenses (see Appendix 1 for rates or charges): [ ] ***[List any such expenses here, or indicate "None." If "None" then the reference to Appendix 1 may be deleted.]*** .

3. *Resident Project Representative Schedule:* The Lump Sum amount set forth in Paragraph C2.04.A.1 above is based on full-time RPR services on an eight-hour workday Monday through Friday over a [ ] day construction schedule. Modifications to the schedule shall entitle Engineer to an equitable adjustment of compensation for RPR services.

COMPENSATION PACKET RPR-2:
Resident Project Representative – Standard Hourly Rates

Article 2 of the Agreement is supplemented to include the following agreement of the parties:

C2.04 *Compensation for Resident Project Representative Basic Services – Standard Hourly Rates Method of Payment*

A. *Owner shall pay Engineer for Resident Project Representative Basic Services as follows:*

1. *Resident Project Representative Services:* For services of Engineer's Resident Project Representative under Paragraph A1.05.A of Exhibit A, an amount equal to the cumulative hours charged to the Project by each class of Engineer's personnel times Standard Hourly Rates for each applicable billing class for all Resident Project Representative services performed on the Project, plus related Reimbursable Expenses and Engineer's Consultant's charges, if any. The total compensation under this paragraph is estimated to be $[ ] based upon full-time RPR services on an eight-hour workday, Monday through Friday, over a [ ] day construction schedule.

B. *Compensation for Reimbursable Expenses:*

1. For those Reimbursable Expenses that are not accounted for in the compensation for Basic Services under Paragraph C2.01, and are directly related to the provision of Resident Project Representative or Post-Construction Basic Services, Owner shall pay Engineer at the rates set forth in Appendix 1 to this Exhibit C.

2. Reimbursable Expenses include the expenses identified in Appendix 1 and the following: transportation (including mileage), lodging, and subsistence incidental thereto; providing and maintaining field office facilities including furnishings and utilities; subsistence and transportation of Resident Project Representative and assistants; toll telephone calls, mobile phone charges, and courier charges; reproduction of reports, Drawings, Specifications, bidding-related or other procurement documents, Construction Contract Documents, and similar Project-related items. In addition, if authorized in advance by Owner, Reimbursable Expenses will also include expenses incurred for the use of highly specialized equipment.

3. The amounts payable to Engineer for Reimbursable Expenses, if any, will be those internal expenses related to the Resident Project Representative Basic Services that are actually incurred or allocated by Engineer, plus all invoiced external Reimbursable Expenses allocable to such services, the latter multiplied by a factor of [ ].

4. The Reimbursable Expenses Schedule will be adjusted annually (as of [ ]) to reflect equitable changes in the compensation payable to Engineer.

C. *Other Provisions Concerning Payment Under this Paragraph C2.04:*

1. Whenever Engineer is entitled to compensation for the charges of Engineer's Consultants, those charges shall be the amounts billed by Engineer's Consultants to Engineer times a factor of [ ].

2. *Factors*: The external Reimbursable Expenses and Engineer's Consultant's factors include Engineer's overhead and profit associated with Engineer's responsibility for the administration of such services and costs.

3. *Estimated Compensation Amounts*:

   a. Engineer's estimate of the amounts that will become payable for specified services are only estimates for planning purposes, are not binding on the parties, and are not the minimum or maximum amounts payable to Engineer under the Agreement.

   b. When estimated compensation amounts have been stated herein and it subsequently becomes apparent to Engineer that the total compensation amount thus estimated will be exceeded, Engineer shall give Owner written notice thereof, allowing Owner to consider its options, including suspension or termination of Engineer's services for Owner's convenience. Upon notice Owner and Engineer promptly shall review the matter of services remaining to be performed and compensation for such services. Owner shall either exercise its right to suspend or terminate Engineer's services for Owner's convenience, agree to such compensation exceeding said estimated amount, or agree to a reduction in the remaining services to be rendered by Engineer, so that total compensation for such services will not exceed said estimated amount when such services are completed. If Owner decides not to suspend Engineer's services during negotiations and Engineer exceeds the estimated amount before Owner and Engineer have agreed to an increase in the compensation due Engineer or a reduction in the remaining services, then Engineer shall be paid for all services rendered hereunder.

4. To the extent necessary to verify Engineer's charges and upon Owner's timely request, Engineer shall make copies of such records available to Owner at cost.

COMPENSATION PACKET RPR-3:
Resident Project Representative – Percentage of Construction Cost

Article 2 of the Agreement is supplemented to include the following agreement of the parties:

C2.04 *Compensation for Resident Project Representative Basic Services – Percentage of Construction Cost Method of Payment*

A. Owner shall pay Engineer for:

1. *Resident Project Representative Services:* For services of Engineer's Resident Project Representative under Paragraph A1.05.A of Exhibit A of the Agreement, an amount equal to [ ] percent of the Construction Cost. This amount includes compensation for Resident Project Representative's services, and those of any assistants to the Resident Project Representative. The percentage of Construction Cost noted herein accounts for labor costs, overhead, profit, and expenses (other than any expressly allowed Reimbursable Expenses). The total compensation under this Paragraph is estimated to be $[ ], based upon full-time RPR services on an eight-hour workday, Monday through Friday, over a [ ] day construction schedule.

2. As a basis for payment to Engineer, Construction Cost will be based on one or more of the following determinations with precedence in the order listed for Work designed or specified by Engineer.

   a. For Work designed or specified and incorporated in the completed Project, the actual final price of the Construction Contract(s), as duly adjusted by Change Orders.

   b. For Work designed or specified but not constructed, the lowest bona fide Bid received from a qualified bidder for such Work; or, if the Work is not Bid, the lowest bona fide negotiated proposal for such Work.

   c. For Work designed or specified but not constructed upon which no such Bid or proposal is received, Engineer's most recent opinion of probable Construction Cost.

   d. Labor furnished by Owner for the Project will be included in the Construction Cost at current market rates including a reasonable allowance for overhead and profit. Materials and equipment furnished by Owner will be included at current market prices.

   e. For purposes of determining Construction Cost under this provision, no deduction is to be made from Construction Contract price on account of any penalty, liquidated damages, or other amounts withheld from payments to Contractor(s).

3. *Reimbursable Expenses:* In addition to the Percentage of Construction Cost, Engineer is also entitled to reimbursement from Owner for the following RPR Reimbursable Expenses (see Appendix 1 for rates or charges): [ ] ***[List any such expenses here, or indicate "None." If "None" then the reference to Appendix 1 may be deleted.]*** .

COMPENSATION PACKET RPR-4:
Resident Project Representative – Direct Labor Times a Factor

Article 2 of the Agreement is supplemented to include the following agreement of the parties:

C2.04 *Compensation for Resident Project Representative Basic Services – Direct Labor Costs Times a Factor Method of Payment*

A. Owner shall pay Engineer for:

1. *Resident Project Representative Services:* For services of Engineer's Resident Project Representative under Paragraph A1.05.A.2 of Exhibit A of the Agreement, an amount equal to Engineer's Direct Labor Costs times a factor of [ ] for the services of Engineer's personnel engaged directly in resident Project representation, plus related Reimbursable Expenses and Engineer's Consultant's charges, if any. The total compensation under this paragraph is estimated to be $[ ], based upon full-time RPR services on an eight-hour workday, Monday through Friday, over a [ ] day construction schedule.

B. *Compensation for Reimbursable Expenses:*

1. For those Reimbursable Expenses that are not accounted for in the compensation for Basic Services under Paragraph C2.01, and are directly related to the provision of Resident Project Representative or Post-Construction Basic Services, Owner shall pay Engineer at the rates set forth in Appendix 1 to this Exhibit C.

2. Reimbursable Expenses include the expenses identified in Appendix 1 and the following: transportation (including mileage), lodging, and subsistence incidental thereto; providing and maintaining field office facilities including furnishings and utilities; subsistence and transportation of Resident Project Representative and assistants; toll telephone calls, mobile phone charges, and courier charges; reproduction of reports, Drawings, Specifications, bidding-related or other procurement documents, Construction Contract Documents, and similar Project-related items. In addition, if authorized in advance by Owner, Reimbursable Expenses will also include expenses incurred for computer time and the use of other highly specialized equipment.

3. The amounts payable to Engineer for Reimbursable Expenses, if any, will be those internal expenses related to the Resident Project Representative Basic Services that are actually incurred or allocated by Engineer, plus all invoiced external Reimbursable Expenses allocable to such services, the latter multiplied by a factor of [ ].

4. The Reimbursable Expenses Schedule will be adjusted annually (as of [ ]) to reflect equitable changes in the compensation payable to Engineer.

C. *Other Provisions Concerning Payment Under this Paragraph C2.04:*

1. Whenever Engineer is entitled to compensation for the charges of Engineer's Consultants, those charges shall be the amounts billed by Engineer's Consultants to Engineer times a factor of [ ].

2. *Factors:* The external Reimbursable Expenses and Engineer's Consultant's factors include Engineer's overhead and profit associated with Engineer's responsibility for the administration of such services and costs.

3. *Estimated Compensation Amounts:*

   a. Engineer's estimate of the amounts that will become payable for specified services are only estimates for planning purposes, are not binding on the parties, and are not the minimum or maximum amounts payable to Engineer under the Agreement.

   b. When estimated compensation amounts have been stated herein and it subsequently becomes apparent to Engineer that the total compensation amount thus estimated will be exceeded, Engineer shall give Owner written notice thereof, allowing Owner to consider its options, including suspension or termination of Engineer's services for Owner's convenience. Upon notice, Owner and Engineer promptly shall review the matter of services remaining to be performed and compensation for such services. Owner shall either exercise its right to suspend or terminate Engineer's services for Owner's convenience, agree to such compensation exceeding said estimated amount, or agree to a reduction in the remaining services to be rendered by Engineer, so that total compensation for such services will not exceed said estimated amount when such services are completed. If Owner decides not to suspend Engineer's services during negotiations and Engineer exceeds the estimated amount before Owner and Engineer have agreed to an increase in the compensation due Engineer or a reduction in the remaining services, then Engineer shall be paid for all services rendered hereunder.

4. To the extent necessary to verify Engineer's charges and upon Owner's timely request, Engineer shall make copies of such records available to Owner at cost.

COMPENSATION PACKET RPR-5:
Resident Project Representative – Salary Costs Times a Factor

Article 2 of the Agreement is supplemented to include the following agreement of the parties:

C2.04 *Compensation for Resident Project Representative Basic Services – Salary Costs Times a Factor Method of Payment*

A. Owner shall pay Engineer for:

1. *Resident Project Representative Services:* For services of Engineer's Resident Project Representative, if any, under Paragraph A1.05.A.2 of Exhibit A, an amount equal to the Engineer's Salary Costs times a factor of [ ] for services of Engineer's personnel engaged directly in resident Project representation, plus related Reimbursable Expenses and Engineer's Consultant's charges, if any. The total compensation under this paragraph is estimated to be $[ ], based upon RPR services on an eight-hour workday, Monday through Friday, over a [ ] day construction schedule.

B. *Compensation for Reimbursable Expenses:*

1. For those Reimbursable Expenses that are not accounted for in the compensation for Basic Services under Paragraph C2.01 and are directly related to the provision of Resident Project Representative or Post-Construction Basic Services, Owner shall pay Engineer at the rates set forth in Appendix 1 to this Exhibit C.

2. Reimbursable Expenses include the expenses identified in Appendix 1 and the following: transportation (including mileage), lodging, and subsistence incidental thereto; providing and maintaining field office facilities including furnishings and utilities; subsistence and transportation of Resident Project Representative and assistants; toll telephone calls, mobile phone charges, and courier charges; reproduction of reports, Drawings, Specifications, bidding-related or other procurement documents, Construction Contract Documents, and similar Project-related items. In addition, if authorized in advance by Owner, Reimbursable Expenses will also include expenses incurred for the use of highly specialized equipment.

3. The amounts payable to Engineer for Reimbursable Expenses, if any, will be those internal expenses related to the Resident Project Representative or Basic Services that are actually incurred or allocated by Engineer, plus all invoiced external Reimbursable Expenses allocable to such services, the latter multiplied by a factor of [ ].

4. The Reimbursable Expenses Schedule will be adjusted annually (as of [ ]) to reflect equitable changes in the compensation payable to Engineer.

C. *Other Provisions Concerning Payment Under this Paragraph C2.04:*

1. Whenever Engineer is entitled to compensation for the charges of Engineer's Consultants, those charges shall be the amounts billed by Engineer's Consultants to Engineer times a factor of [ ].

2. *Factors:* The external Reimbursable Expenses and Engineer's Consultant's factors include Engineer's overhead and profit associated with Engineer's responsibility for the administration of such services and costs.

3. *Estimated Compensation Amounts:*

   a. Engineer's estimate of the amounts that will become payable for specified services are only estimates for planning purposes, are not binding on the parties, and are not the minimum or maximum amounts payable to Engineer under the Agreement.

   b. When estimated compensation amounts have been stated herein and it subsequently becomes apparent to Engineer that the total compensation amount thus estimated will be exceeded, Engineer shall give Owner written notice thereof, allowing Owner to consider its options, including suspension or termination of Engineer's services for Owner's convenience. Upon notice, Owner and Engineer promptly shall review the matter of services remaining to be performed and compensation for such services. Owner shall either exercise its right to suspend or terminate Engineer's services for Owner's convenience, agree to such compensation exceeding said estimated amount, or agree to a reduction in the remaining services to be rendered by Engineer, so that total compensation for such services will not exceed said estimated amount when such services are completed. If Owner decides not to suspend Engineer's services during the negotiations and Engineer exceeds the estimated amount before Owner and Engineer have agreed to an increase in the compensation due Engineer or a reduction in the remaining services, then Engineer shall be paid for all services rendered hereunder.

4. To the extent necessary to verify Engineer's charges and upon Owner's timely request, Engineer shall make copies of such records available to Owner at cost.

COMPENSATION PACKET AS-1:
Additional Services – Standard Hourly Rates

Article 2 of the Agreement is supplemented to include the following agreement of the parties:

C2.05 Compensation for Additional Services – Standard Hourly Rates Method of Payment

A. Owner shall pay Engineer for Additional Services, if any, as follows:

1. *General*: For services of Engineer's personnel engaged directly on the Project pursuant to Paragraph A2.01 or A2.02 of Exhibit A, except for services as a consultant or witness under Paragraph A2.01.A.20, (which if needed shall be separately negotiated based on the nature of the required consultation or testimony) an amount equal to the cumulative hours charged to the Project by each class of Engineer's personnel times Standard Hourly Rates for each applicable billing class for all Additional Services performed on the Project, plus related Reimbursable Expenses and Engineer's Consultant's charges, if any.

B. *Compensation For Reimbursable Expenses:*

1. For those Reimbursable Expenses that are not accounted for in the compensation for Basic Services under Paragraph C2.01 and are directly related to the provision of Additional Services, Owner shall pay Engineer at the rates set forth in Appendix 1 to this Exhibit C.

2. Reimbursable Expenses include the expenses identified in Appendix 1 and the following categories: transportation (including mileage), lodging, and subsistence incidental thereto; providing and maintaining field office facilities including furnishings and utilities; toll telephone calls, mobile phone charges, and courier charges; reproduction of reports, Drawings, Specifications, bidding-related or other procurement documents, Construction Contract Documents, and similar Project-related items; and Consultants' charges. In addition, if authorized in advance by Owner, Reimbursable Expenses will also include expenses incurred for the use of highly specialized equipment.

3. The amounts payable to Engineer for Reimbursable Expenses, if any, will be the Additional Services-related internal expenses actually incurred or allocated by Engineer, plus all invoiced external Reimbursable Expenses allocable to such Additional Services, the latter multiplied by a factor of [ ].

4. The Reimbursable Expenses Schedule will be adjusted annually (as of [ ]) to reflect equitable changes in the compensation payable to Engineer.

C. *Other Provisions Concerning Payment for Additional Services:*

1. Whenever Engineer is entitled to compensation for the charges of Engineer's Consultants, those charges shall be the amounts billed by Engineer's Consultants to Engineer times a factor of [ ].

2. *Factors:* The external Reimbursable Expenses and Engineer's Consultant's Factors include Engineer's overhead and profit associated with Engineer's responsibility for the administration of such services and costs.

3. To the extent necessary to verify Engineer's charges and upon Owner's timely request, Engineer shall make copies of such records available to Owner at cost.

COMPENSATION PACKET AS-2:
Additional Services – Direct Labor Costs Times a Factor

Article 2 of the Agreement is supplemented to include the following agreement of the parties:

C2.05 *Compensation for Additional Services – Direct Labor Costs Times a Factor Method of Payment*

A. Owner shall pay Engineer for Additional Services as follows:

1. *General:* For services of Engineer's personnel engaged directly on the Project pursuant to Paragraph A2.01 or A2.02 of Exhibit A of the Agreement, except for services as a consultant or witness under Paragraph A2.01.A.24 (which if needed shall be separately negotiated based on the nature of the required consultation or testimony), an amount equal to Engineer's Direct Labor Costs times a factor of [ ], plus related Reimbursable Expenses and Engineer's Consultant's charges, if any.

B. *Compensation for Reimbursable Expenses:*

1. For those Reimbursable Expenses that are not accounted for in the compensation for Basic Services under Paragraph C2.01 and are directly related to the provision of Additional Services, Owner shall pay Engineer at the rates set forth in Appendix 1 to this Exhibit C.

2. Reimbursable Expenses include the expenses identified in Appendix 1 and the following categories: transportation (including mileage), lodging, and subsistence incidental thereto; providing and maintaining field office facilities including furnishings and utilities; toll telephone calls, mobile phone charges, and courier charges; reproduction of reports, Drawings, Specifications, bidding-related or other procurement documents, Construction Contract Documents, and similar Project-related items; and Consultants' charges. In addition, if authorized in advance by Owner, Reimbursable Expenses will also include expenses incurred for and the use of highly specialized equipment.

3. The amounts payable to Engineer for Reimbursable Expenses, if any, will be the Additional Services-related internal expenses actually incurred or allocated by Engineer, plus all invoiced external Reimbursable Expenses allocable to such Additional Services, the latter multiplied by a factor of [ ].

4. The Reimbursable Expenses Schedule will be adjusted annually (as of [ ]) to reflect equitable changes in the compensation payable to Engineer.

C. *Other Provisions Concerning Payment for Additional Services:*

1. Whenever Engineer is entitled to compensation for the charges of Engineer's Consultants, those charges shall be the amounts billed by Engineer's Consultants to Engineer times a factor of [ ].

2. *Factors:* The external Reimbursable Expenses and Engineer's Consultant's factors include Engineer's overhead and profit associated with Engineer's responsibility for the administration of such services and costs.

3. To the extent necessary to verify Engineer's charges and upon Owner's timely request, Engineer shall make copies of such records available to Owner at cost.

COMPENSATION PACKET AS-3:
Additional Services – Salary Costs Times a Factor

Article 2 of the Agreement is supplemented to include the following agreement of the parties:

C2.05 *Compensation for Additional Services – Salary Costs Times a Factor Method of Payment*

A. Owner shall pay Engineer for Additional Services as follows:

1. *General:* For services of Engineer's personnel engaged directly on the Project pursuant to Paragraph A2.01 or A2.02 of Exhibit A, except for services as a consultant or witness under Paragraph A2.01.A.24 (which if needed shall be separately negotiated based on the nature of the required consultation or testimony), an amount equal to the cumulative hours charged to the Project by each Engineer's personnel times the Engineer's applicable Salary Costs times a factor of [ ], plus related Reimbursable Expenses and Engineer's Consultant's charges, if any.

B. *Compensation for Reimbursable Expenses:*

1. For those Reimbursable Expenses that are not accounted for in the compensation for Basic Services under Paragraph C2.01 and are directly related to the provision of Additional Services, Owner shall pay Engineer at the rates set forth in Appendix 1 to this Exhibit C.

2. Reimbursable Expenses include the expenses identified in Appendix 1 and the following: transportation (including mileage), lodging, and subsistence incidental thereto; providing and maintaining field office facilities including furnishings and utilities; toll telephone calls, mobile phone charges, and courier charges; reproduction of reports, Drawings, Specifications, bidding-related or other procurement documents, Construction Contract Documents, and similar Project-related items; and Consultants' charges. In addition, if authorized in advance by Owner, Reimbursable Expenses will also include expenses incurred for and the use of highly specialized equipment.

3. The amounts payable to Engineer for Reimbursable Expenses, if any, will be the Additional Services-related internal expenses actually incurred or allocated by Engineer, plus all invoiced external Reimbursable Expenses allocable to Additional Services, the latter multiplied by a factor of [ ].

4. The Reimbursable Expenses Schedule will be adjusted annually (as of [ ]) to reflect equitable changes in the compensation payable to Engineer.

C. *Other Provisions Concerning Payment for Additional Services:*

1. Whenever Engineer is entitled to compensation for the charges of Engineer's Consultants, those charges shall be the amounts billed by Engineer's Consultants to Engineer times a factor of [ ].

2. *Factors:* The external Reimbursable Expenses and Engineer's Consultant's factors include Engineer's overhead and profit associated with Engineer's responsibility for the administration of such services and costs.

3. To the extent necessary to verify Engineer's charges and upon Owner's timely request, Engineer shall make copies of such records available to Owner at cost.

This is **Appendix 1 to EXHIBIT C**, consisting of [ ] pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated [ ].

Reimbursable Expenses Schedule

Reimbursable Expenses are subject to review and adjustment per Exhibit C. Rates and charges for Reimbursable Expenses as of the date of the Agreement are:

8"x11" Copies/Impressions		$ [ ]/page
Copies of Drawings		$ [ ]/sq. ft.
Mileage (auto)		$ [ ]/mile
Air Transportation		at cost
CAD Charge		$ [ ]/hour
Laboratory Testing		at cost
Health and Safety Level D		$ [ ]/day
Health and Safety Level C		$ [ ]/day
Meals and Lodging		at cost

[Note to User: Customize this Schedule to reflect anticipated reimbursable expenses on this specific Project.]

This is **Appendix 2 to EXHIBIT C**, consisting of [ ] pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated [ ].

Standard Hourly Rates Schedule

A. *Standard Hourly Rates:*

1. Standard Hourly Rates are set forth in this Appendix 2 to this Exhibit C and include salaries and wages paid to personnel in each billing class plus the cost of customary and statutory benefits, general and administrative overhead, non-project operating costs, and operating margin or profit.

2. The Standard Hourly Rates apply only as specified in Article C2.

B. *Schedule:*

Hourly rates for services performed on or after the date of the Agreement are:

Billing Class VIII	**$[ ]/hour**
Billing Class VII	**[ ]/hour**
Billing Class VI	**[ ]/hour**
Billing Class V	**[ ]/hour**
Billing Class IV	**[ ]/hour**
Billing Class III	**[ ]/hour**
Billing Class II	**[ ]/hour**
Billing Class I	**[ ]/hour**
Non-administrative Support Staff	**[ ]/hour**

[Note to User: The categories above (Billing Classes VIII through I) are traditional hourly rate classes for engineering services, but the classes themselves do not currently have widely accepted or understood meanings or definitions. Many approaches are possible for establishing the hourly rates that will be charged. These include defining the categories (for example, "Billing Class VI—Assistant Project Manager"), or using the engineering firm's own professional classifications. If hourly rates are ascribed to specific individuals, the user should ensure that changes in professional personnel and rates are allowable over the Project's course.]

This is **EXHIBIT D**, consisting of [ ] pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated [ ].

[Note to User: Delete this Exhibit D if Engineer will not be providing Resident Project Representative Services under Paragraph A1.05.A.2.]

Duties, Responsibilities, and Limitations of Authority of Resident Project Representative

Article 1 of the Agreement is supplemented to include the following agreement of the parties:

ARTICLE 1 - SERVICES OF ENGINEER

D1.01 *Resident Project Representative*

A. Engineer shall furnish a Resident Project Representative ("RPR") to assist Engineer in observing progress and quality of the Work. The RPR may provide full time representation or may provide representation to a lesser degree. RPR is Engineer's representative at the Site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR's actions.

B. Through RPR's observations of the Work, including field checks of materials and installed equipment, Engineer shall endeavor to provide further protection for Owner against defects and deficiencies in the Work. However, Engineer shall not, as a result of such RPR observations of the Work, supervise, direct, or have control over the Work, nor shall Engineer (including the RPR) have authority over or responsibility for the means, methods, techniques, sequences, or procedures of construction selected or used by any Constructor, for security or safety at the Site, for safety precautions and programs incident to the Work or any Constructor's work in progress, for the coordination of the Constructors' work or schedules, or for any failure of any Constructor to comply with Laws and Regulations applicable to the performing and furnishing of its work. The Engineer (including RPR) neither guarantees the performances of any Constructor nor assumes responsibility for any Constructor's failure to furnish and perform the Work, or any portion of the Work, in accordance with the Construction Contract Documents. In addition, the specific terms set forth in Exhibit A, Paragraph A1.05, of this Agreement are applicable.

C. The duties and responsibilities of the RPR are as follows:

1. *General:* RPR's dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor. RPR shall generally communicate with Owner only with the knowledge of and under the direction of Engineer.

2. *Schedules:* Review the progress schedule, schedule of Shop Drawing and Sample submittals, schedule of values, and other schedules prepared by Contractor and consult with Engineer concerning acceptability of such schedules.

3. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.

4. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.

5. *Liaison:*

   a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Construction Contract Documents.

   b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

   c. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.

6. *Clarifications and Interpretations:* Receive from Contractor submittal of any matters in question concerning the requirements of the Construction Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Construction Contract Documents. Report to Engineer regarding such RFIs. Report to Engineer when clarifications and interpretations of the Construction Contract Documents are needed, whether as the result of a Contractor RFI or otherwise. Transmit Engineer's clarifications, interpretations, and decisions to Contractor. ,

7. *Shop Drawings and Samples:*

   a. Record date of receipt of Samples and Contractor-approved Shop Drawings.

   b. Receive Samples that are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.

   c. Advise Engineer and Contractor of the commencement of any portion of the Work requiring a Shop Drawing or Sample submittal, if RPR believes that the submittal has not been received from Contractor, or has not been approved by Contractor or Engineer.

8. *Proposed* M*odifications:* Consider and evaluate Contractor's suggestions for modifications to the Drawings or Specifications, and report such suggestions, together with RPR's recommendations, if any, to Engineer. Transmit Engineer's response (if any) to such suggestions to Contractor.

9. *Review of Work; Defective Work:*

a. Report to Engineer whenever RPR believes that any part of the Work is defective under the terms and standards set forth in the Construction Contract Documents, and provide recommendations as to whether such Work should be corrected, removed and replaced, or accepted as provided in the Construction Contract Documents.

b. Inform Engineer of any Work that RPR believes is not defective under the terms and standards set forth in the Construction Contract Documents, but is nonetheless not compatible with the design concept of the completed Project as a functioning whole, and provide recommendations to Engineer for addressing such Work. ; and

c. Advise Engineer of that part of the Work that RPR believes should be uncovered for observation, or requires special testing, inspection, or approval.

10. *Inspections, Tests, and System Start-ups:*

a. Consult with Engineer in advance of scheduled inspections, tests, and systems start-ups.

b. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.

c. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.

d. Observe whether Contractor has arranged for inspections required by Laws and Regulations, including but not limited to those to be performed by public or other agencies having jurisdiction over the Work.

e. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work, record the results of these inspections, and report to Engineer.

11. *Records*:

a. Maintain at the Site orderly files for correspondence, reports of job conferences, copies of Construction Contract Documents including all Change Orders, Field Orders, Work Change Directives, Addenda, additional Drawings issued subsequent to the execution of the Construction Contract, RFIs, Engineer's clarifications and interpretations of the Construction Contract Documents, progress reports, approved Shop Drawing and Sample submittals, and other Project-related documents.

b. Prepare a daily report or keep a diary or log book, recording Contractor's hours on the Site, Subcontractors present at the Site, weather conditions, data relative to questions of Change Orders, Field Orders, Work Change Directives, or changed conditions, Site visitors, deliveries of equipment or materials, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer.

c. Upon request from Owner to Engineer, photograph or video Work in progress or Site conditions.

d. Record and maintain accurate, up-to-date lists of the names, addresses, fax numbers, e-mail addresses, websites, and telephone numbers (including mobile numbers) of all Contractors, Subcontractors, and major Suppliers of materials and equipment.

e. Maintain records for use in preparing Project documentation.

f. Upon completion of the Work, furnish original set of all RPR Project documentation to Engineer.

12. *Reports:*

a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the progress schedule and schedule of Shop Drawing and Sample submittals.

b. Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.

c. Furnish to Engineer and Owner copies of all inspection, test, and system start-up reports.

d. Immediately inform Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, possible force majeure or delay events, damage to property by fire or other causes, or the discovery of any potential differing site condition or Constituent of Concern.

13. *Payment Requests:* Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the schedule of values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

14. *Certificates, Operation and Maintenance Manuals:* During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Contract Documents to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

15. *Completion*:

a. Participate in Engineer's visits to the Site regarding Substantial Completion, assist in the determination of Substantial Completion, and prior to the issuance of a Certificate of Substantial Completion submit a punch list of observed items requiring completion or correction.

b. Participate in Engineer's visit to the Site in the company of Owner and Contractor, to determine completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.

c. Observe whether all items on the final punch list have been completed or corrected, and make recommendations to Engineer concerning acceptance and issuance of the Notice of Acceptability of the Work (Exhibit E).

D. Resident Project Representative shall not:

1. Authorize any deviation from the Construction Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in this Agreement.

3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers, or any Constructor.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of the Work, by Contractor or any other Constructor.

5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.

8. Authorize Owner to occupy the Project in whole or in part.

This is **EXHIBIT E**, consisting of [ ] pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated [ ].

*[**Notes to User***

1. Exhibit A, Paragraph A1.05.A.25 of this Agreement indicates that in connection with recommending final payment of the Construction Contractor, the Engineer will also provide a notice to Owner and Contractor of the acceptability of the Work, subject to stated limitations. The form for that purpose, "Notice of Acceptability of Work," is attached on the following pages of this Exhibit E.

2. The Notice of Acceptability of Work should be served in compliance with the requirements for service of notice under the Construction Contract. See Paragraph 18.01, Giving Notice, of EJCDC C-700 (2013), Standard General Conditions of the Construction Contract.]

NOTICE OF ACCEPTABILITY OF WORK

PROJECT:

OWNER:

CONTRACTOR:

OWNER'S CONSTRUCTION CONTRACT IDENTIFICATION:

EFFECTIVE DATE OF THE CONSTRUCTION CONTRACT:

ENGINEER:

NOTICE DATE:

To: ____

Owner

And To: ____

Contractor

From: ____

Engineer

The Engineer hereby gives notice to the above Owner and Contractor that Engineer has recommended final payment of Contractor, and that the Work furnished and performed by Contractor under the above Construction Contract is acceptable, expressly subject to the provisions of the related Contract Documents, the Agreement between Owner and Engineer for Professional Services dated ______, and the following terms and conditions of this Notice:

CONDITIONS OF NOTICE OF ACCEPTABILITY OF WORK

The Notice of Acceptability of Work ("Notice") is expressly made subject to the following terms and conditions to which all those who receive said Notice and rely thereon agree:

1. This Notice is given with the skill and care ordinarily used by members of the engineering profession practicing under similar conditions at the same time and in the same locality.

2. This Notice reflects and is an expression of the Engineer's professional opinion.

3. This Notice is given as to the best of Engineer's knowledge, information, and belief as of the Notice Date.

4. This Notice is based entirely on and expressly limited by the scope of services Engineer has been employed by Owner to perform or furnish during construction of the Project (including observation of the Contractor's work) under Engineer's Agreement with Owner, and applies only to facts that are within Engineer's knowledge or could reasonably have been ascertained by Engineer as a result of carrying out the responsibilities specifically assigned to Engineer under such Agreement.

5. This Notice is not a guarantee or warranty of Contractor's performance under the Construction Contract, an acceptance of Work that is not in accordance with the related Contract Documents, including but not limited to defective Work discovered after final inspection, nor an assumption of responsibility for any failure of Contractor to furnish and perform the Work thereunder in accordance with the Construction Contract Documents, or to otherwise comply with the Construction Contract Documents or the terms of any special guarantees specified therein.

6. This Notice does not relieve Contractor of any surviving obligations under the Construction Contract, and is subject to Owner's reservations of rights with respect to completion and final payment.

By: ______________________________

Title: ______________________________

Dated: ______________________________

This is **EXHIBIT F**, consisting of [ ] pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated [ ].

Construction Cost Limit

Paragraph 5.02 of the Agreement is supplemented to include the following agreement of the parties:

F5.02 *Designing to Construction Cost Limit*

A. Owner and Engineer hereby agree to a Construction Cost limit in the amount of $[ ].

B. A bidding or negotiating contingency of [ ] percent will be added to any Construction Cost limit established.

C. The acceptance by Owner at any time during Basic Services of a revised opinion of probable Construction Cost in excess of the then-established Construction Cost limit will constitute a corresponding increase in the Construction Cost limit.

D. Engineer will be permitted to determine what types and quality of materials, equipment and component systems are to be included in the Drawings and Specifications. Engineer may make reasonable adjustments in the scope, extent, and character of the Project to the extent consistent with the Project requirements and sound engineering practices, to bring the Project within the Construction Cost limit.

E. If the Bidding or Negotiating Phase has not commenced within three months after completion of the Final Design Phase, or if industry-wide prices are changed because of unusual or unanticipated events affecting the general level of prices or times of delivery in the construction industry, the established Construction Cost limit will not be binding on Engineer. In such cases, Owner shall consent to an adjustment in the Construction Cost limit commensurate with any applicable change in the general level of prices in the construction industry between the date of completion of the Final Design Phase and the date on which proposals or Bids are sought.

F. If the lowest bona fide proposal or Bid exceeds the established Construction Cost limit, Owner shall (1) give written approval to increase such Construction Cost limit, or (2) authorize negotiating or rebidding the Project within a reasonable time, or (3) cooperate in revising the Project's scope, extent, or character to the extent consistent with the Project’s requirements and with sound engineering practices. In the case of (3), Engineer shall modify the Construction Contract Documents as necessary to bring the Construction Cost within the Construction Cost Limit. Owner shall pay Engineer’s cost to provide such modification services, including the costs of the services of its Consultants, all overhead expenses reasonably related thereto, and Reimbursable Expenses, but without profit to Engineer on account of such services. The providing of such services will be the limit of Engineer’s responsibility in this regard and, having done so, Engineer shall be entitled to payment for services and expenses in accordance with this Agreement and will not otherwise be liable for damages attributable to the lowest bona fide proposal or bid exceeding the established Construction Cost limit.

This is **EXHIBIT G**, consisting of [ ] pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated [ ].

Insurance

Paragraph 6.05 of the Agreement is supplemented to include the following agreement of the parties:

G6.05 *Insurance*

A. The limits of liability for the insurance required by Paragraph 6.05.A and 6.05.B of the Agreement are as follows:

1. By Engineer:

a. Workers' Compensation: Statutory

b. Employer's Liability --

1) Bodily injury, each accident: $[ ]
2) Bodily injury by disease, each employee: $[ ]
3) Bodily injury/disease, aggregate: $[ ]

c. General Liability --

1) Each Occurrence (Bodily Injury and Property Damage): $[ ]
2) General Aggregate: $[ ]

d. Excess or Umbrella Liability --

1) Per Occurrence: $[ ]
2) General Aggregate: $[ ]

e. Automobile Liability --Combined Single Limit (Bodily Injury and Property Damage):

$[ ]

f. Professional Liability –

1) Each Claim Made $[ ]
2) Annual Aggregate $[ ]

g. Other (specify): $[ ]

2. By Owner:

a. Workers' Compensation: Statutory

b. Employer's Liability --

1) Bodily injury, Each Accident $[ ]
2) Bodily injury by Disease, Each Employee $[ ]
3) Bodily injury/Disease, Aggregate $[ ]

c. General Liability --

1) General Aggregate: $[ ]
2) Each Occurrence (Bodily Injury and Property Damage): $[ ]

d. Excess Umbrella Liability

1) Per Occurrence: $[ ]
2) General Aggregate: $[ ]

e. Automobile Liability – Combined Single Limit (Bodily Injury and Property Damage):

$[ ]

f. Other (specify): $[ ]

B. *Additional Insureds:*

1. The following individuals or entities are to be listed on Owner's general liability policies of insurance as additional insureds:

a. [ ]
Engineer

b. [ ]
Engineer's Consultant

c. [ ]
Engineer's Consultant

d. [ ]
[other]

2. During the term of this Agreement the Engineer shall notify Owner of any other Consultant to be listed as an additional insured on Owner's general liability policies of insurance.

3. The Owner shall be listed on Engineer's general liability policy as provided in Paragraph 6.05.A.

This is **EXHIBIT H**, consisting of [ ] pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated [ ].

Dispute Resolution

Paragraph 6.09 of the Agreement is supplemented to include the following agreement of the parties:

[NOTE TO USER: Select one of the two alternatives provided.]

H6.08 *Dispute Resolution*

A. *Mediation*: Owner and Engineer agree that they shall first submit any and all unsettled claims, counterclaims, disputes, and other matters in question between them arising out of or relating to this Agreement or the breach thereof ("Disputes") to mediation by ***[here insert name of mediator, or mediation service]***. Owner and Engineer agree to participate in the mediation process in good faith. The process shall be conducted on a confidential basis, and shall be completed within 120 days. If such mediation is unsuccessful in resolving a Dispute, then (1) the parties may mutually agree to a dispute resolution of their choice, or (2) either party may seek to have the Dispute resolved by a court of competent jurisdiction.

[or]

A. *Arbitration:* All Disputes between Owner and Engineer shall be settled by arbitration in accordance with the ***[insert the name of a specified arbitration service or organization here]*** rules effective at the Effective Date, subject to the conditions stated below. This agreement to arbitrate and any other agreement or consent to arbitrate entered into in accordance with this Paragraph H6.09.A will be specifically enforceable under prevailing law of any court having jurisdiction.

1. Notice of the demand for arbitration must be filed in writing with the other party to the Agreement and with the ***[specified arbitration service or organization].*** The demand must be made within a reasonable time after the Dispute has arisen. In no event may the demand for arbitration be made after the date when institution of legal or equitable proceedings based on such Dispute would be barred by the applicable statute of limitations.

2. All demands for arbitration and all answering statements thereto which include any monetary claims must contain a statement that the total sum or value in controversy as alleged by the party making such demand or answering statement is not more than $[ ] (exclusive of interest and costs). The arbitrators will not have jurisdiction, power, or authority to consider, or make findings (except in denial of their own jurisdiction) concerning any Dispute if the amount in controversy in such Dispute is more than $[ ] (exclusive of interest and costs), or to render a monetary award in response thereto against any party which totals more than $[ ] (exclusive of interest and costs). Disputes that are not subject to arbitration under this paragraph may be resolved in any court of competent jurisdiction.

3. The rules of any arbitration shall be supplemented to include the following: The award rendered by the arbitrators shall be in writing, and shall include (a) a precise breakdown of the award, and (b) a written explanation of the award specifically citing the Agreement provisions deemed applicable and relied on in making the award.

4. The award rendered by the arbitrators will be consistent with the Agreement of the parties and final, and judgment may be entered upon it in any court having jurisdiction thereof, and will not be subject to appeal or modification.

5. If a Dispute in question between Owner and Engineer involves the work of a Contractor, Subcontractor, or consultants to the Owner or Engineer (each a "Joinable Party"), and such Joinable Party has agreed contractually or otherwise to participate in a consolidated arbitration concerning this Project, then either Owner or Engineer may join such Joinable Party as a party to the arbitration between Owner and Engineer hereunder. Nothing in this Paragraph H6.09.A.5 nor in the provision of such contract consenting to joinder shall create any claim, right, or cause of action in favor of the Joinable Party and against Owner or Engineer that does not otherwise exist.

This is **EXHIBIT I**, consisting of [ ] pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated [ ].

Limitations of Liability

Paragraph 6.11 of the Agreement is supplemented to include the following agreement of the parties:

A. *Limitation of Engineer's Liability*

[NOTE TO USER: Select one of the three alternatives listed below for I6.11. A.1]

1. *Engineer's Liability Limited to Stated Amount, or Amount of Engineer's Compensation:* To the fullest extent permitted by Laws and Regulations, and notwithstanding any other provision of this Agreement, the total liability, in the aggregate, of Engineer and Engineer's officers, directors, members, partners, agents, employees, and Consultants, to Owner and anyone claiming by, through, or under Owner for any and all injuries, claims, losses, expenses, costs, or damages whatsoever arising out of, resulting from, or in any way related to the Project, Engineer's or its Consultants' services. or this Agreement, from any cause or causes whatsoever, including but not limited to the negligence, professional errors or omissions, strict liability, breach of contract, indemnity obligations, or warranty express or implied, of Engineer or Engineer's officers, directors, members, partners, agents, employees, or Consultants, shall not exceed the total amount of $[ ] or the total compensation received by Engineer under this Agreement, whichever is greater. Higher limits are available for an additional fee.

[or]

1. *Engineer's Liability Limited to Amount of Engineer's Compensation:* To the fullest extent permitted byLaws and Regulations, and notwithstanding any other provision of this Agreement, the total liability, in the aggregate, of Engineer and Engineer's officers, directors, members, partners, agents, employees, and Consultants, to Owner and anyone claiming by, through, or under Owner for any and all claims, losses, costs, or damages whatsoever arising out of, resulting from, or in any way related to the Project or the Agreement from any cause or causes, including but not limited to the negligence, professional errors or omissions, strict liability, breach of contract, indemnity obligations, or warranty express or implied of Engineer or Engineer's officers, directors, members, partners, agents, employees, or Consultants shall not exceed the total compensation received by Engineer under this Agreement.

[or]

1. *Engineer's Liability Limited to Amount of Insurance Proceeds:* Engineer shall procure and maintain insurance as required by and set forth in Exhibit G to this Agreement. Notwithstanding any other provision of this Agreement, and to the fullest extent

permitted byLaws and Regulations, the total liability, in the aggregate, of Engineer and Engineer's officers, directors, members, partners, agents, employees, and Consultants to Owner and anyone claiming by, through, or under Owner for any and all claims, losses, costs, or damages whatsoever arising out of, resulting from, or in any way related to the Project or the Agreement from any cause or causes, including but not limited to the negligence, professional errors or omissions, strict liability, breach of contract, indemnity obligations, or warranty express or implied, of Engineer or Engineer's officers, directors, members, partners, agents, employees, or Consultants (hereafter "Owner's Claims"), shall not exceed the total insurance proceeds paid on behalf of or to Engineer by Engineer's insurers in settlement or satisfaction of Owner's Claims under the terms and conditions of Engineer's insurance policies applicable thereto (excluding fees, costs and expenses of investigation, claims adjustment, defense, and appeal), up to the amount of insurance required under this Agreement. If no such insurance coverage is provided with respect to Owner's Claims, then the total liability, in the aggregate, of Engineer and Engineer's officers, directors, members, partners, agents, employees, and Consultants to Owner and anyone claiming by, through, or under Owner for any and all such uninsured Owner's Claims shall not exceed $[ ].

[NOTE TO USER: If appropriate and desired, include I6.11.A.2 below as a supplement to Paragraph 6.11, which contains a mutual waiver of damages applicable to the benefit of both Owner and Engineer.]

2. *Exclusion of Special, Incidental, Indirect, and Consequential Damages:* To the fullest extent permitted by Laws and Regulations, and notwithstanding any other provision in the Agreement, consistent with the terms of Paragraph 6.11, the Engineer and Engineer's officers, directors, members, partners, agents, Consultants, and employees shall not be liable to Owner or anyone claiming by, through, or under Owner for any and all claims for or entitlement to special, incidental, indirect, or consequential damages arising out of, resulting from, or in any way related to this Agreement or the Project, from any cause or causes, including but not limited to:

[NOTE TO USER: List here particular types of damages that may be of special concern because of the nature of the project or specific circumstances, e.g., cost of replacement power, loss of use of equipment or of the facility, loss of profits or revenue, loss of financing, regulatory fines, etc.]

[NOTE TO USER: the above exclusion of consequential and other damages can be converted to a limitation on the amount of such damages, following the format of Paragraph I6.11.A.1 above, by providing that "Engineer's total liability for such damages shall not exceed $_______."]

[NOTE TO USER: Many professional service agreements contain mutual indemnifications. If the parties elect to provide a mutual counterpart to the indemnification of Owner by Engineer in Paragraph 6.11.A, then supplement

Paragraph 6.11.B by including the following indemnification of Engineer by Owner as Paragraph I6.11.B.]

B. *Indemnification by Owner*: To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Engineer and its officers, directors, members, partners, agents, employees, and Consultants from and against any and all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to the Project, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Owner or Owner's officers, directors, members, partners, agents, employees, consultants, or others retained by or under contract to the Owner with respect to this Agreement or to the Project.

This is **EXHIBIT J**, consisting of [ ] pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated [ ].

Special Provisions

Paragraph(s) [ ] of the Agreement is/are amended to include the following agreement(s) of the parties:

This is **EXHIBIT K**, consisting of [ ] pages, referred to in and part of the **Agreement between Owner and Engineer for Professional Services** dated [ ].

AMENDMENT TO OWNER-ENGINEER AGREEMENT
Amendment No. _____

The Effective Date of this Amendment is: ______.

Background Data

Effective Date of Owner-Engineer Agreement:

Owner:

Engineer:

Project:

Nature of Amendment: [Check those that are applicable and delete those that are inapplicable.]

____ Additional Services to be performed by Engineer

____ Modifications to services of Engineer

____ Modifications to responsibilities of Owner

____ Modifications of payment to Engineer

____ Modifications to time(s) for rendering services

____ Modifications to other terms and conditions of the Agreement

Description of Modifications:

Here describe the modifications, in as much specificity and detail as needed. Use an attachment if necessary.

Agreement Summary:

Original agreement amount:	$______________
Net change for prior amendments:	$______________
This amendment amount:	$______________
Adjusted Agreement amount:	$______________

Change in time for services (days or date, as applicable): ______

The foregoing Agreement Summary is for reference only and does not alter the terms of the Agreement, including those set forth in Exhibit C.

Owner and Engineer hereby agree to modify the above-referenced Agreement as set forth in this Amendment. All provisions of the Agreement not modified by this or previous Amendments remain in effect.

OWNER:		ENGINEER:	
By:		By:	
Print name:		Print name:	
Title:		Title:	
Date Signed:		Date Signed:	

UNITED STATES DEPARTMENT OF AGRICULTURE
Rural Utilities Service
RUS BULLETIN 1780-26

SUBJECT: **Guidance for the Use of Engineers Joint Contract Documents Committee (EJCDC) Documents on Water and Waste Disposal Projects with RUS Financial Assistance**

TO: Rural Development State Directors, RUS Program Directors, and State Engineers

EFFECTIVE DATE: Date of approval.

OFFICE OF PRIMARY INTEREST: Engineering and Environmental Staff, Water and Environmental Programs

INSTRUCTIONS: This Bulletin replaces RUS Bulletin 1780-26, dated April 19, 2017.

AVAILABILITY: This Bulletin, as well as any Rural Development instruction or Rural Utilities Service (RUS) instructions, regulations, or forms referenced in this Bulletin are available at any Rural Development State Office. The State Office staff is familiar with the use of the documents in their States and can answer specific questions on Rural Development requirements.

This Bulletin is available on the Rural Utilities Service website at https://www.rd.usda.gov/publications/regulations-guidelines/bulletins/water-and-environmental

PURPOSE: This Bulletin assists Rural Development staff in providing information and guidance to applicants and professional consultants in the development of engineering agreements and construction contracts that are legally sufficient, ensure appropriate services are provided at a reasonable fee, and expedite the achievement of the applicant's goals. This update amends language to support compliance with 2 CFR Part 200.

MODIFICATIONS: Rural Development State Offices may modify this guidance when appropriate to comply with state statutes and regulations in accordance with the procedures outlined at Rural Development Instruction 2006-B (2006.55).

Scott Barringer 9/7/17

SCOTT BARRINGER Date
Acting Assistant Administrator
Water and Environmental Programs

TABLE OF CONTENTS

INDEX

Agreement for Engineering Services
Construction Contract Documents
Water and Waste Disposal Facilities

ABBREVIATIONS

CFR – Code of Federal Regulations
EJCDC – Engineers Joint Contract Documents Committee
EO – Executive Order
OGC – Office of General Counsel
PL – Public Law
RD – Rural Development
RPR – Resident Project Representative
RUS – Rural Utilities Service
USC – United States Code
USDA – United States Department of Agriculture
WWD – Water and Waste Disposal

1 GENERAL

a Approved Documents. Subject to the modifications indicated in this Bulletin, the Engineers Joint Contract Documents Committee (EJCDC) developed the following documents which were previously approved by the Rural Utilities Service (RUS) for procurement of professional and construction services by loan and grant recipients:

(1) Agreement between Owner and Engineer for Professional Services (EJCDC No. E-500, 2014 Edition)

(2) Agreement between Owner and Contractor for Construction Contract (Stipulated Price) (EJCDC No. C-520 (Rev 1), 2013 Edition)

(3) Standard General Conditions of the Construction Contract (EJCDC No. C-700 (Rev 1), 2013 Edition)

b Associated Documents. In addition to items 2 and 3, there are also associated construction contract documents, some of which are available through EJCDC and its member organizations and some of which are to be developed by the engineer based on instructions in this Bulletin.

c Alternative Documents. Recipients not wishing to use EJCDC documents may submit alternative documents for review and consideration. Such documents must be modified to meet all federal and state requirements and must be approved for each project by the Agency and the USDA Office of General Counsel (OGC). When modified as described in this Bulletin, the EJCDC documents listed above have been determined to meet such requirements and generally do not require OGC approval.

2 AVAILABILITY

The EJCDC documents are available online from any of the sponsoring organizations: the National Society of Professional Engineers (www.nspe.org); American Council of Engineering Companies (www.acec.org); and American Society of Civil Engineers (www.asce.org); or directly from EJCDC (www.ejcdc.org). EJCDC documents are proprietary and include a license agreement. RUS offices will not distribute EJCDC documents for any purpose other than training or to illustrate the appropriate use of the integrated set of documents on RUS financially assisted projects.

3 PRIOR VERSIONS OF EJCDC DOCUMENTS

a Project-specific EJCDC documents approved prior to the effective date of this Bulletin are still considered approved. This Bulletin does not retroactively change the status of an individual document already approved.

b Approval of Previous Engineering Agreements. The approval of a previous edition EJCDC engineering agreement must be used with the most current construction series documents.

c Phase Out of Previous Editions. The most recent EJCDC documents should be used for WWD projects.

4 PURPOSE

a Use by Staff. This Bulletin is to be used by Rural Development staff in providing information and guidance to applicants and professional consultants in the development of agreements that are legally sufficient, ensure appropriate services are provided for a reasonable fee, and expedite the achievement of the applicant's goals.

b Assembly of Documents. This Bulletin consists of exhibits with required modifications that when combined with the standard EJCDC documents and appropriate drawings, specifications and other required documents, create a complete set of engineering and construction contracts for use with WWD projects. However, the documents in these exhibits are not to be used as a substitute for the careful evaluation of the requirements for a project. The owner, their engineer, and legal counsel, with RD consultation, must determine the best approach for a successful outcome.

5 OWNER RESPONSIBILITY

a Verify Bulletin is Current. Before an applicant or consultant proceeds with the development of an engineering agreement or a set of construction contract documents, they should contact the Rural Development State Office to verify they have the most current information specific to the type of project and state or other jurisdiction where the project is located.

b Contractual and Administrative Issues. The Owner is responsible for the settlement of all contractual and administrative issues arising out of procurement entered into in support of a loan or grant. These include, but are not limited to: source evaluation; protests; disputes; and claims. Matters concerning violations of laws are to be referred to the applicable local, state, or Federal authority.

c Modifications. It is RUS policy that applicants use the EJCDC documents with minimal modification. However, RUS recognizes each project is unique and that modifications may be required to satisfy project requirements or state statutes. If changes must be made to the standard documents to address project-specific issues, they must be made via bold type additions and deletions with strike-outs or addenda showing all revisions. Because the EJCDC documents are fully integrated, when making a modification in one document applicants must ensure that appropriate modifications are made in all affected documents.

6 USE OF EXHIBITS

The following explains the purpose of each Exhibit to this Bulletin.

a THE ENGINEERING AGREEMENT - MODIFICATIONS FOR RUS FUNDED PROJECTS: This exhibit explains the use of the EJCDC Owner – Engineer Agreement for RUS funded projects and includes instructions for modification and review of the Agreement Between Owner and Engineer for Professional Services (EJCDC E-500 (2014)).

b REVISIONS TO EJCDC E-500: This exhibit contains the list of revisions to the E-500 (2014), “Agreement Between Owner and Engineer for Professional Services” for RUS funded WWD projects. The exhibit consists of a checklist of changes that must be made to the standard EJCDC documents to ensure they comply with Agency requirements. The actual changes must be made using either bold type additions and deletions with strike-outs or addenda showing all revisions.

c RUS CERTIFICATION PAGE: This exhibit consists of a certification, to be signed by the engineer and owner, stating the fees for engineering services and certifying that the required changes were made to the Owner – Engineer Agreement. This certification is to be attached as the last page of the Owner-Engineer Agreement.

d THE CONSTRUCTION CONTRACT AND BIDDING DOCUMENTS – MODIFICATIONS FOR RUS FUNDED PROJECTS: This exhibit explains the use of the EJCDC construction contract and bidding documents. It includes a table of all the required documents and instruction for modification and review of these documents.

e ENGINEER’S DEVELOPMENT OF INSTRUCTIONS TO BIDDERS: This exhibit contains instructions for the engineer to develop Instructions to Bidders using C-200 (Rev 1) (2013), “Suggested Instructions to Bidders” and a checklist of modifications included in the exhibit.

f ENGINEER’S DEVELOPMENT OF BID FORM: This exhibit contains a checklist of changes that must be made by the engineer to the C-410 (2013), “Bid Form for Construction Contracts”.

g ENGINEER’S DEVELOPMENT OF AGREEMENT BETWEEN OWNER AND CONTRACTOR: This exhibit contains a checklist of changes that must be made by the engineer to C-520 (Rev 1) (2013), “Agreement between Owner and Contractor for Construction Contract (Stipulated Price)”.

h ENGINEER’S DEVELOPMENT OF SUPPLEMENTARY CONDITIONS: This exhibit contains instructions for the engineer to develop Supplementary Conditions using C-800 (Rev 1) (2013), “Guide to the Preparation of Supplementary Conditions” and a checklist of modifications included in the exhibit.

i CERTIFICATE OF OWNER’S ATTORNEY AND AGENCY CONCURRENCE: This exhibit consists of two certificates, on a single page, to be attached to the construction contract and signed upon execution. The first is a certificate signed by the owner’s attorney and the second is the State Engineer’s concurrence in the executed construction contract. This certificate is to be attached after the Owner-Contractor Agreement (C-520 (Rev 1) (2013)) in the construction contract.

j ENGINEER’S CERTIFICATION OF FINAL PLANS AND SPECIFICATIONS: This exhibit is a certification by the engineer to the owner and RD that the plans and specifications have been completed in accordance with RUS requirements. This certificate is to be provided to the Agency with the final plans and specifications prior to advertisement for bids.

THE ENGINEERING AGREEMENT
MODIFICATIONS FOR RUS FUNDED PROJECTS

1 PURPOSE

This exhibit explains the use of the EJCDC Owner – Engineer Agreement for RUS funded projects and includes instructions for modification and review of the Agreement Between Owner and Engineer for Professional Services (EJCDC E-500 (2014)).

2 GENERAL INFORMATION

The EJCDC has developed a 2014 edition of the Owner-Engineer Agreement that, when assembled as described in this Bulletin, is acceptable for use on WWD projects funded by RUS.

3 INSTRUCTIONS

a Process. Instructions to modify EJCDC E-500 (2014) prior to use on RUS funded WWD projects are as follows:

(1) Engineer must attach the list of "Revisions to the EJCDC E-500 (2014)" to the Agreement as an addendum or make the specific changes listed using bold type additions and deletions with strike-outs.
(2) Engineer must include the "RUS Certification Page" in the Agreement (Exhibit C of this Bulletin).
(3) Project-specific requirements may be added to Exhibit J of E-500 (2014).
(4) Owner and Engineer must select a payment method from Exhibit C of E-500 (2014) (see below).
(5) Owner and Engineer must sign the Agreement and complete and sign the RUS Certification Page (Exhibit C of this Bulletin).
(6) Agency must review to ensure changes were made as required or revisions were attached and that the certification is attached, completed, and acceptable.
(7) Agency completes and signs the RUS Certification page.

b Approval. The executed Owner-Engineer Agreement must be approved by Rural Development prior to Agency concurrence in any payment of RUS funding for engineering services.

c Subsurface Utility Data. ASCE 38, "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data," is mentioned in Exhibits A and B of the Agreement. Note that the use of this ASCE standard is optional, but the scope of engineering services in this Agreement includes the Engineer discussing whether or not the standard will be used on a given project.

d Payment for Services. The standard Exhibit C from E-500 (2014), "Payments to Engineer for Services and Reimbursable Expenses," should be used along with the E-500 (2014) Owner-Engineer Agreement, but only the following Compensation Packets are allowed for use with RUS funded projects (other compensation packets are not allowed):

(1) Allowed for Basic Services:
Lump Sum (Compensation Packet BC-1)
Standard Hourly Rates (Compensation Packet BC-2)

(2) Allowed for RPR Services:
Lump Sum (Compensation Packet RPR-1)
Standard Hourly Rates (Compensation Packet RPR-2)

(3) Allowed for Additional Services:
Standard Hourly Rates (Compensation Packet AS-1)

f Insurance. Exhibit G (to E-500), "Insurance," amounts should be established by the Owner based on advice from the Owner's attorney or a risk manager hired by the Owner.

g Limitations of Liability. Exhibit I (to E-500 (2014)), "Limitations of Liability," is permissible to be used on RUS funded projects.

REVISIONS TO EJCDC E-500

- Amend paragraph 4.01.A by inserting the following text after the first sentence: “Invoices must include a breakdown of services provided.”

- In paragraph 6.04.B replace “shall” with “may”.

- Modify paragraph 7.01.A.25 by striking “, as an Additional Service.”

- Add paragraph 7.01.A.38 to the Agreement as follows:

  Agency – The Rural Utilities Service or any designated representative of Rural Utilities Service, including USDA, Rural Development.

- Add paragraph 8.05 to the Agreement as follows:

  8.05 Federal Requirements

  A. Agency Concurrence. Signature of a duly authorized representative of the Agency in the space provided on the signature page of EJCDC form E-500 (2014) hereof does not constitute a commitment to provide financial assistance or payments hereunder but does signify that this Agreement conforms to Agency’s applicable requirements. This Agreement shall not be effective unless the Funding Agency’s designated representative concurs. No amendment to this Agreement shall be effective unless the Funding Agency’s designated representative concurs.

  B. Audit and Access to Records. Owner, Agency, the Comptroller General of the United States, or any of their duly authorized representatives, shall have access to any books, documents, papers, and records of the Engineer which are pertinent to the Agreement, for the purpose of making audits, examinations, excerpts, and transcriptions. Engineer shall maintain all required records for three years after final payment is made and all other pending matters are closed.

  C. Restrictions on Lobbying. Engineer and each Consultant shall comply with “*Byrd anti-lobbying amendment (31 U.S.C. 1352)*” if they are recipients of engineering services contracts and subcontracts that exceed $100,000 at any tier. If applicable, Engineer must complete a certification form on lobbying activities related to a specific Federal loan or grant that is a funding source for this Agreement. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant, or any other applicable award. Each tier shall disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Certifications and disclosures are forwarded from tier to tier up to the Owner. Necessary certification and disclosure forms shall be provided by Owner.

  D. Suspension and Debarment. Engineer certifies, by signing this Agreement, that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from participation in this transaction by any Federal department or agency. Engineer will not contract with any Consultant for this project if it or its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency. Necessary certification forms shall be provided by the Owner. The Engineer will complete and submit a form AD-1048, "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – lower tier transactions," to the Owner who will forward it the USDA, Rural Development processing office.

Modifications to Exhibit A of the Agreement

- Replace paragraph A1.01.A.1.b with "In addition, Engineer must identify, study, and evaluate multiple potential alternative solutions potentially available to Owner, unless Owner and Engineer mutually agree with Agency concurrence that only one feasible solution exists. The number of alternative solutions should be appropriate to the specific project as concurred in by the Agency."

- Delete paragraph A1.01.A.1.c.

- Insert the following additional text at the end of Article A1.01.A.8: "The Report mentioned in paragraph 1.01.A.8 of Exhibit A to the Agreement is the Preliminary Engineering Report as defined in RUS Bulletin 1780-2. This document must meet customary professional standards as required by 7 CFR 1780.55. The Report must be concurred in by the Agency."

- Modify paragraph A1.01.A.10 by inserting "and approved by the Agency" after "When mutually agreed."

- If applicable, add the following immediately after paragraph A1.01.A.14: "Provide an Environmental Report as defined at 7 CFR 1970 or other Agency approved format. The Environmental Report must be concurred in by the Agency."

- Replace paragraph A1.01.A.16 with "Revise the Report and any other Study and Report Phase deliverables in response to Owner's and Agency's comments, as appropriate, and furnish three (3) written copies and one (1) electronic copy of the revised Report and any other Study and Report Phase deliverables to the Owner within [ ] days of receipt of Owner's and Agency's comments."

- Modify paragraph A1.02.A by inserting "and concurrence by Agency" after the words "acceptance by Owner."

- Modify paragraph A1.02.A.2 by inserting "and Agency" after "authorized by Owner."

- Add the following to the end of paragraph A1.02.A.8: "Engineer must also incorporate all Agency regulations, forms, and design and construction standards applicable to the project in development of the documents indicated in this Article."

- Add the following immediately after paragraph A1.03.A.9: "The Engineer shall identify the building codes and accessibility standards used in the design and indicate them on the drawings and specifications and certify that the final drawings and specifications comply with those standards."

- Modify paragraph A1.03.A.10 by adding the "and Agency" after the word "counsel."

- Insert paragraph A1.03.A.12 stating, "Provide the Owner and Agency with a written certification that the final Drawings and Specifications, other assembled Construction Contract Documents, bidding-related documents (or requests for proposals or other construction procurement documents), and any other Final Design Phase deliverables comply with all requirements of Agency. Use the Engineer's Certification of Final Plans and Specifications (Attachment J of the RUS Bulletin 1780-26) for this purpose."

- Modify paragraph A1.03.B by deleting the period at the end of the paragraph and adding: "and all final design phase deliverables have been accepted by Owner."

- Add the following to the end of paragraph A1.04.A.2: "Obtain Agency concurrence on any addenda that modify the bidding documents. Obtain prior concurrence where possible."

- Replace paragraph A1.04.A.6 with the following: "The Engineer shall evaluate and determine the acceptability of "or equals" and substitute materials and equipment proposed by prospective contractors prior to award of contracts for the Work. Engineer shall issue a bid addendum for any and all approved "or equals" and substitutes. Review of substitutes and "or equals" shall be in accordance with the General Conditions of the Construction Contract and applicable Agency regulations. Services under this paragraph are subject to the provisions of Paragraph A2.02.A.2 of this Exhibit A."

- Add the following sentence immediately after paragraph A1.04.A.9: "Upon award of the Construction Contract, the Engineer shall furnish to Owner five executed copies of the Contract Documents and one electronic copy of the signed documents, including Drawings and Specifications."

- Paragraph A1.05.A.4: Insert "and chair" after "Participate in" regarding the preconstruction conference.

- Delete "If requested by Owner to do so" from Article A1.05.A.6 regarding the Engineer maintaining a set of Drawings and Specifications.

- Insert paragraph A1.05.A.9.c stating "The visits described in Article A1.05.A.9.a shall be at least monthly and the Engineer shall document all visits to the project with copies furnished to the Owner and Agency."

- Add the following text at the end of paragraph A1.05.A.18: "Review of substitutes and "or equals" shall be in accordance with the General Conditions of the Construction Contract and applicable Agency regulations."

- Insert paragraph A1.05.A.24.a: "Upon Substantial Completion, the Engineer shall provide a copy of the Certificate of Substantial Completion to the Agency."

- Modify paragraph A1.05.A.22 by striking the words "Receive from Contractor, review, and transmit to Owner the annotated record documents which are to be assembled by Contractor in accordance with the Construction Contract Documents to obtain final payment. The extent of Engineer's review of record documents shall be to check that Contractor has submitted all pages."

- Add the following to the end of paragraph A1.05.A.22: "Receive from Contractor and review the annotated record documents which are to be assembled by Contractor in accordance with the Construction Contract Documents to obtain final payment. The Engineer shall prepare Record Drawings, and furnish such Record Drawings to Owner."

- Add the following text after "preparation or review of environmental assessments and impact statements" in A2.01.A.1: "not including preparation of the Environmental Report defined under Basic Services."

- Replace the period at the end of Article A2.01.A.4 with a comma and add the following text to the end of the Article: "but only if the Owner's request is made after completion of the Study and Report Phase."

- Mark paragraph A2.01.A.17 as "[Deleted]."

- Replace paragraph A2.02.A.2 with the following: "Services in making revisions to Drawings and Specifications occasioned by the acceptance of substitute materials or equipment other than "or equal" items; evaluation and determination of an excessive number of proposed "or equals" or substitutions, whether proposed before or after award of the Construction Contract."

<u>Modifications to Exhibit C of the Agreement</u>

- Modify Exhibit C, Compensation Packet BC-1, paragraph C2.01.A.2, by adding "and Agency" after "approved in writing by the Owner."

- Modify Exhibit C, Compensation Packet BC-2, paragraph C2.01.A.5, by inserting "and Agency" after "approved in writing by Owner."

- Modify Exhibit C, Compensation Packet BC-2, paragraph C2.01.A.8, by inserting the following text at the end of the paragraph, "Changes will not be effective unless and until concurred in by the Owner and Agency."

- Modify Exhibit C, Compensation Packet BC-1, paragraph C2.01,B by inserting "with concurrence of the Owner and Agency" after "the compensation amount for Engineer's services shall be appropriately adjusted."

- Modify text of Exhibit C, Compensation Packet BC-2, paragraph C2.03.C.2 by inserting "and Agency" after Owner in "Engineer shall give Owner written notice thereof."

- Add paragraph C2.04.A.2 to Exhibit C, Compensation Packet RPR-2, by adding the following text to the end of the paragraph: "If rate(s) for RPR services is not indicated in

Appendix Two to Exhibit C, “Standard Hourly Rates Schedule,” the Standard Hourly Rate for RPR services is $______ per hour.”

- Modify Exhibit C, Compensation Packet RPR-1, paragraph C2.04.A.3 by inserting the following text at the end of the paragraph, “Changes will not be effective unless and until concurred in by the Owner and Agency.”

- Modify Exhibit C, Compensation Packet RPR-2, paragraph 2.04.B.4, by inserting the following text at the end of the paragraph, “Changes will not be effective unless and until concurred in by the Owner and Agency.”

- Modify Exhibit C, Compensation Guide RPR-2, paragraph 2.04.C.3.B by inserting “and Agency” after Owner in “Engineer shall give Owner written notice thereof.”

- Modify Exhibit C, Compensation Packet RPR-2, paragraph C2.04.C.4 by deleting “at cost” and inserting “at no cost” at the end of the paragraph.

- Modify Exhibit C, Compensation Packet AS-1, paragraph C2.05.B.4, by inserting the following text at the end of the paragraph, “Changes will not be effective unless and until concurred in by the Owner and Agency.”

- Modify Exhibit C, Compensation Packet AS-1, paragraph C2.05.C.3 by deleting “at cost” and inserting “at no cost” at the end of the paragraph.

<u>Modifications to Exhibit D of the Agreement</u>

- Add the following to the end of Exhibit D, Article D1.01.A: “Full time Resident Project Representation is required unless requested in writing by the Owner and waived in writing by the Agency.”

- Mark paragraph D1.01.C.12.b as [Deleted] regarding Resident Project representative role in Change Orders, Work Change Directives, and Field Orders.

Optional Exhibits: F, H, J

<u>Modifications to Exhibit F of the Agreement</u>

- Add the following to the end of Exhibit F, Article F5.02.D: “Engineers determinations on types and quality of materials, equipment, and component systems to be included in the Drawings and Specifications are subject to approval by Agency in accordance with requirements of 7 CFR 1780, including open and free competition.”

RUS CERTIFICATION PAGE

PROJECT NAME:____

The Engineer and Owner hereby concur in the Funding Agency required revisions to E-500 (2014). In addition, Engineer certifies to the following:

All modifications required by RUS Bulletin 1780-26 have been made in accordance with the terms of the license agreement, which states in part that the Engineer "must plainly show all changes to the Standard EJCDC Text, using 'Track Changes' (redline/strikeout), highlighting, or other means of clearly indicating additions and deletions." Such other means may include attachments indicating changes (e.g. Supplementary Conditions modifying the General Conditions).

SUMMARY OF ENGINEERING FEES

Note that the fees indicated on this table are only a summary and if there is a conflict with any provision of Exhibit C, the provisions there overrule the values on this table. Fees shown in will not be exceeded without the concurrence of the Agency.

Basic Services	$______________________
Resident Project Observation	$______________________
Additional Services	$______________________
TOTAL:	$______________________

Any adjustments to engineering fees or changes to maximum estimated values must be approved by the Agency and must include a table of what specific category or categories of fees are being changed, what fees were before and after the change, and the resulting total fee.

Engineer Date

Name and Title

Owner Date

Name and Title

Agency Concurrence:

As lender or insurer of funds to defray the costs of this Contract, and without liability for any payments thereunder, the Agency hereby concurs in the form, content, and execution of this Agreement.

Agency Representative Date

Name and Title

THE CONSTRUCTION CONTRACT AND BIDDING DOCUMENTS MODIFICATIONS FOR RUS FUNDED PROJECTS

1 PURPOSE

This exhibit explains the use of the EJCDC construction contract and bidding documents. It includes a table of all the required documents and instruction for modification and review of these documents.

2 GENERAL INFORMATION

The EJCDC has developed a 2013 edition of the Construction Series (Owner-Contractor) documents that when assembled as described in this Bulletin is acceptable for use on WWD projects funded by RUS. All contract documents must be approved by the USDA, Rural Development State Engineer prior to advertisement for bids, the Agency must concur in award, and the executed contract documents must be approved by the USDA, Rural Development State Engineer prior to Agency concurrence in any payment of RUS funding for construction services. A copy of the signature page on the last page of this exhibit must be used for this purpose.

3 INSTRUCTIONS

A Assembly of Documents. Bid packages must be assembled in accordance with the following notes, requirements of Exhibits E through J, and the table below:

B Indicating Revised Text. Although the following instructions direct that changes be made to various EJCDC construction documents, actual changes to EJCDC standard language must be made using either bold type additions or deletions with strike-outs or addenda showing all revisions.

C General Conditions. The EJCDC General Conditions (C-700 (Rev 1) (2013)) should not be modified. Changes to C-700 (Rev 1) (2013) should only be made via the Supplementary Conditions, except in unusual cases as approved by the USDA RD State Engineer.

D EJCDC Suggested Language. The Instruction to Bidders and Supplementary General Conditions must be developed by the Engineer based on EJCDC guidance documents and the instructions and Exhibits below. The USDA RD State Engineer must verify that the instructions and Exhibits below were followed prior to any advertisement for bids.

E EJDCDC Standard Language. The Bid Form and the Agreement Between Owner and Contractor are standard documents from EJCDC, but must be modified before use on an RUS funded project as explained below. The USDA RD State Engineer must verify that the instructions and Exhibits below were followed prior to advertisement for bidding.

F Project Signs. It is customary that project signs identifying the Owner, Contractor, Engineer, and Funding Agencies be displayed during project construction. The sign requirements are not included in the Supplementary Conditions, but should be a part of the specifications prepared by the Engineer. The Engineer should contact the Rural Development State Office for specific requirements and include the sign standard in the bid package.

Note that at least five copies of the executed construction contracts documents (two for Agency, one for Engineer, one for Contractor, and one for Owner) must be submitted to the RD State Office for review and acceptance before issuance of the Notice to Proceed.

Assembling the Construction Contract and Bidding Documents

Advertisement for Bids	Use EJCDC C-111 (2013).
Instructions to Bidders	Engineer will develop the Instructions to Bidders using the Suggested Instructions to Bidders for Construction Contracts (EJCDC C-200 (Rev 1), 2013) as modified by this Bulletin.
Qualifications Statement	Use EJCDC C-451 (2013).
Bid Form	Use EJCDC C-410 (2013) as modified by this Bulletin.
Bid Bond	Use EJCDC C-430 (2013).
Notice of Award	Use EJCDC C-510 (Rev 1) (2013). Owner must obtain concurrence of Agency prior to announcing award.
Agreement Between Owner and Contractor (Stipulated Price)	Use EJCDC C-520 (Rev 1) (2013) as modified by this Bulletin.
Standard General Conditions of the Construction Contract	Use EJCDC C-700 (Rev 1) (2013). Modifications to C-700 (Rev 1) (2013) should be made in the Supplementary Conditions, not in C-700 (Rev 1) (2013) itself.
Supplementary Conditions	Engineer will develop the Supplementary Conditions using the Guide to the Preparation of Supplementary Conditions (EJCDC C-800 (Rev 1) (2013)) as modified by this Bulletin.
Performance Bond	Use EJCDC C-610 (2013). Note that the bond must be at least 100% of the bid amount.
Payment Bond	Use EJCDC C-615 (2013). Note that the bond must be at least 100% of the bid amount.
Application for Payment	Use EJCDC C-620 (2013). This documents is pre-approved for use per 7 CFR 1780.76(e).
Change Order	Use EJCDC C-941 (2013). This documents is pre-approved for use per 7 CFR 1780.76(h)(2).
Notice to Proceed	Use EJCDC C-550 (2013).
Certificate of Substantial Completion	Use EJCDC C-625 (2013).
Compliance Statement	Use Form RD 400-6.
Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – Lower Tier Covered Transactions	Use Form AD-1048.
Certification for Contracts, Grants, and Loans	Use Exhibit A-1 of RD Instruction 1940-Q.
Construction Project Sign	Template provided by RD State Office.
Certificate of Owner's Attorney	Use template provided in Exhibit I of this Bulletin.
Engineer's Certification of Final Plans and Specifications	Use template provided in Exhibit J of this Bulletin.

ENGINEER'S DEVELOPMENT OF INSTRUCTIONS TO BIDDERS

The Engineer will develop the Instructions to Bidders using the Suggested Instructions to Bidders (EJCDC C-200 (Rev 1), 2013) and using the instructions provided in this Bulletin. In addition, the Engineer must ensure that any applicable state or federal wage rate requirements are added to the Instructions to Bidders (ITB) at Article 24. The USDA, Rural Utilities Service, Water and Waste Disposal program does not require the use of Davis Bacon Wage rates in most cases, but other sources of federal funds may.

- ITB 3.01 The second suggested version of 3.01 is not acceptable for use on RUS funded projects. Owners must not preclude entities from submitting bids.

- ITB 8.01 Bid security must be equal to 5% of the Bidder's maximum Bid price.

- ITB 9.01 The second suggested version of 9.01(applicable to Price-plus-Time bids) is not acceptable for use on RUS funded projects.

- ITB 11 The following text shall be used for Article 11:

ARTICLE 11 – SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract for the Work, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, and those "or-equal" or substitute materials and equipment subsequently approved by Engineer prior to the submittal of Bids and identified by Addendum. No item of material or equipment will be considered by Engineer as an "or- equal" or substitute unless written request for approval has been submitted by Bidder and has been received by Engineer at least 15 days prior to the date for receipt of Bids in the case of a proposed substitute and 5 days prior in the case of a proposed "or-equal." Each such request shall comply with the requirements of Paragraphs 7.04 and 7.05 of the General Conditions. The burden of proof of the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any such proposed item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approvals made in any other manner. Substitutes and "or-equal" materials and equipment may be proposed by Contractor in accordance with Paragraphs 7.04 and 7.05 of the General Conditions after the Effective Date of the Contract.

11.02 All prices that Bidder sets forth in its Bid shall be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

11.03 If an award is made, Contractor shall be allowed to submit proposed substitutes and "or-equals" in accordance with the General Conditions.

- ITB 12.01 Do not include this first paragraph of Article 12.

- ITB 12.02 Do not include this second paragraph of Article 12.

- ITB 12.03 Insert the following text at the beginning of the third paragraph of Article 12, "If required by the bid documents."

- ITB 12.05 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.

- ITB 12.06 The Contractor shall not award work to Subcontractor(s) in excess of the limits stated in SC 7.06A.

- ITB 14.01 The fourth suggested version of 14.01 (for cost-plus-fee bids) is not acceptable for use on RUS funded projects.

- ITB 14.04 Do not include Article 14.04 (applicable only to Price-plus-Time bids).

- ITB 19.03.B The fourth suggested version of 19.03.B (for Cost-plus-Fee bids) will not be used.

- ITB 19.03.C Will not be used (applicable only to Price-plus-Time bids).

- ITB 24 The following text must be used for Article 24:

ARTICLE 24 FEDERAL REQUIREMENTS

24.01 Federal requirements at Article 19 of the Supplementary Conditions apply to this Contract.

ENGINEER'S DEVELOPMENT OF BID FORM

Development of the Bid Form must be based on the Bid Form for Construction Contracts (EJCDC C-410, 2013) as modified below.

- In Article 5, "Basis of Bid," do not use the Suggested Formats for Price-plus-Time Bids or Cost-plus-Fee bids.

- Use the first version of Article 6.01 regarding "Time of Completion."

- Add the following additional required Attachments to Article 7.01, "Attachments to this Bid":

H. If Bid amount exceeds $10,000, signed Compliance Statement (RD 400-6). Refer to specific equal opportunity requirements set forth in the Supplemental General Conditions;

I. If Bid amount exceeds $25,000, signed Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions (AD-1048);

J. If Bid amount exceeds $100,000, signed RD Instruction 1940-Q, Exhibit A-1, Certification for Contracts, Grants, and Loans.

ENGINEER'S DEVELOPMENT OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

Development of the Agreement between Owner and Contractor must be based on EJCDC C-520 (Rev 1), 2013, as modified below:

- Delete paragraph 4.04 in its entirety and insert the following in its place:

  [Deleted]

- Amend paragraph 6.02.A.1.a by adding 95 to the blank.

- Amend paragraph 6.02.A.1.a by deleting the period at the end of the first sentence, replacing it with a semicolon, and by striking out the following text: "If the Work has been 50 percent completed as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage;"

- Amend paragraph 6.02.A.1.b by adding 95 to the blank.

- Amend paragraph 6.02.B by inserting "of the entire construction to be provided under the Contract Documents" after "Substantial Completion."

ENGINEER'S DEVELOPMENT OF SUPPLEMENTARY CONDITIONS

The Engineer will develop Supplementary Conditions using the guidance from the Guide to the Preparation of Supplementary Conditions (EJCDC C-800 (Rev 1), 2013), instructions provided in this Bulletin, and by adding other project-specific supplementary conditions as required for the project.

The Supplementary Conditions document that is developed for a specific Project is the contractual means by which the Standard General Conditions (EJCDC C-700 (Rev 1), 2013) are modified and supplemented for the Project. The references in the Supplementary Conditions items below (and in EJCDC C-800 (Rev 1) (2013) as published) to adding, amending, or supplementing are referring to the paragraphs of C-700 (Rev 1) (2013). Thus the first item below, SC-1.01.A.8, is a contractual provision that adds the stated language ("The Change Order form to be used etc.") to Paragraph 1.01.A.8 of C-700 (Rev 1) (2013).

As in C-800 (Rev 1) (2013) itself, the actual Supplementary Conditions (contract terms) are shown in bold as modified below. Also included below are a few Guidance Notes to assist in development of the Project-specific Supplementary Conditions document. The Guidance Notes are not in bold.

The Supplementary Conditions items that follow are mandatory for each specific Project, unless noted otherwise. In most cases they are new (supplemental) SC items; in a few cases, they replace or expand on a Supplementary Condition item that is in EJCDC C-800 (Rev 1) (2013), as published.

In addition to including the items that follow in the Supplementary Conditions document for the specific Project, the Engineer (in cooperation with the Owner) also should follow the guidance of EJCDC C-800 (Rev 1) (2013), as published, to develop other SC items for inclusion in the Project-specific Supplementary Conditions document; as the published guidance indicates, some of the published SC items are mandatory, or require additional Project-specific input, such as insurance coverage limits. Other SC items in C-800 (Rev 1) (2013) as published are optional but in many cases will be useful for the specific Project.

Include the following RUS-mandated Supplementary Conditions (or follow the Guidance Notes provided) in the Supplementary Conditions document for the specific Project:

- SC 1.01.A.8 Add the following language at the end of last sentence of Paragraph 1.01.A.8:

  The Change Order form to be used on this Project is EJCDC C-941. Agency approval is required before Change Orders are effective.

- SC 1.01.A.48 Add the following language at the end of the last sentence of Paragraph 1.01.A.48:

  A Work Change Directive cannot change Contract Price or Contract Times without a subsequent Change Order.

- SC 1.01.A.49 Add the following new Paragraph after Paragraph 1.01.A.48:

  Abnormal Weather Conditions – Conditions of extreme or unusual weather for a given region, elevation, or season as determined by Engineer. Extreme or unusual weather that is typical for a given region, elevation, or season should not be considered Abnormal Weather Conditions.

□ SC 1.01.A.50 Add the following new Paragraph after Paragraph 1.01.A.49:

Agency - The Project is financed in whole or in part by USDA Rural Utilities Service pursuant to the Consolidated Farm and Rural Development Act (7 USC Section 1921 et seq.). The Rural Utilities Service programs are administered through the USDA Rural Development offices; therefore, the Agency for these documents is USDA Rural Development.

□ SC 2.02.A Amend the first sentence of Paragraph 2.02.A. to read as follows:

Owner shall furnish to Contractor five copies of the Contract Documents (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF).

□ SC 2.06.B (Non-mandatory). Guidance Note: If the parties do not intend to develop electronic or digital transmittal protocols, then Paragraph 2.06B of the General Conditions may be deleted. Use the following Supplementary Condition in such case:

□ SC- 2.06.B Delete Paragraph 2.06.B and replace it with the term [**Deleted**].

Guidance Note, continued: If the use of electronic data, electronic media, or electronic project monitoring is planned for this Project, then the parties may develop a protocol with the assistance of the Engineer or Consensus DOCS form 200.2 may be added to the Construction Contract as an Exhibit. If Consensus DOCS form 200.2 will be used, then include the following Supplementary Condition:

SC-2.06.B Add the following language to the end of 2.06.B:

Special requirements for electronic data apply to this Project. See attached Exhibit entitled "Electronic Communications Protocol Addendum," Consensus DOCS form 200.2.

□ SC 4.01.A Amend the last sentence of Paragraph 4.01.A by striking out the following words:

In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier.

□ SC 4.05.C.2 Amend Paragraph 4.05.C.2 by striking out the following text: "abnormal weather conditions;" and inserting the following text:

Abnormal Weather Conditions;

□ SC 5.03 Guidance Note: Amend Paragraph 5.03 using one of the suggested Paragraphs SC 5.03 in EJCDC C-800 (Rev 1) (2013), concerning reports and drawings of conditions at the Site, and any Technical Data in the reports and drawings on whose accuracy the Contractor may rely.

□ SC 5.06 Guidance Note: Amend Paragraph 5.06 using one of the suggested Paragraphs SC 5.06 from EJCDC C-800 (Rev 1) (2013), concerning reports and drawings regarding Hazardous Environmental

Conditions at the Site, and any Technical Data in those reports and drawings on whose accuracy the Contractor may rely.

- SC 6.03 Guidance Note: Amend Paragraph 6.03 identifying specific insurance coverage requirements using guidance from EJCDC C-800 (Rev 1) (2013).

- SC 7.04.A Amend the third sentence of Paragraph 7.04.A by striking out the following words:

  Unless the specification or description contains or is followed by words reading that no like, equivalent, or 'or-equal' item is permitted.

- SC 7.04.A.1 Amend the last sentence of Paragraph a.3 by striking out "and;" and adding a period at the end of Paragraph a.3.

- SC 7.04.A.1 Delete paragraph 7.04.A.1.a.4 in its entirety and insert the following in its place:

  [Deleted]

- SC 7.06.A Amend Paragraph 7.06.A by adding the following text to the end of the Paragraph:

  The Contractor shall not award work valued at more than fifty percent of the Contract Price to Subcontractor(s), without prior written approval of the Owner.

- SC 7.06.B Delete paragraph 7.06.B in its entirety and insert the following in its place:

  [Deleted]

- SC 7.06.E Amend the second sentence of Paragraph 7.06.E by striking out **"Owner may also require Contractor to retain specific replacements; provided, however, that".**

- SC 10.03 Guidance Note: Amend Paragraph 10.03 using one of the two alternatives presented in C-800's (Rev 1) (2013) section on SC 10.03 (either the Engineer will provide Resident Project Representative services on the Project, with specific authority and responsibilities, or Engineer will not provide Resident Project Representative services).

- SC 11.07.C Add the following new Paragraph after Paragraph 11.07.B:

  All Contract Change Orders must be concurred in by Agency before they are effective.

- SC 13.02.C Delete Paragraph 13.02.C in its entirety and insert the following in its place:

  [Deleted]

- SC 15.01.B Amend the second sentence of Paragraph 15.01.B.1 by striking out the following text: **"a bill of sale, invoice, or other."**

- SC 15.01.B.3 Add the following language at the end of paragraph 15.01.B.3:

No payments will be made that would deplete the retainage, place in escrow any funds that are required for retainage, or invest the retainage for the benefit of the Contractor.

☐ SC 15.01.B.4 Add the following new Paragraph after Paragraph 15.01.B.3:

The Application for Payment form to be used on this Project is EJCDC C-620. The Agency must approve all Applications for Payment before payment is made.

☐ SC 15.01.D.1 Delete Paragraph 15.01.D.1 in its entirety and insert the following in its place:

The Application for Payment with Engineer's recommendations will be presented to the Owner and Agency for consideration. If both the Owner and Agency find the Application for Payment acceptable, the recommended amount less any reduction under the provisions of Paragraph 15.01.E will become due twenty (20) days after the Application for Payment is presented to the Owner, and the Owner will make payment to the Contractor.

☐ SC 15.02.A Amend Paragraph 15.02.A by striking out the following text: **"no later than seven days after the time of payment by Owner"** and insert **"no later than the time of payment by Owner."**

☐ SC 18.09 Add the following new paragraph after Paragraph 18.08:

Tribal Sovereignty. No provision of this Agreement will be construed by any of the signatories as abridging or debilitating any sovereign powers of the {insert name of Tribe} Tribe; affecting the trust-beneficiary relationship between the Secretary of the Interior, Tribe, and Indian landowner(s); or interfering with the government-to-government relationship between the United States and the Tribe.

☐ SC 19 Add Article 19 titled **"FEDERAL REQUIREMENTS"**

☐ SC 19.01 Add the following language as Paragraph 19.01 with the title **"Agency Not a Party":**

A. This Contract is expected to be funded in part with funds provided by Agency. Neither Agency, nor any of its departments, entities, or employees is a party to this Contract.

☐ SC 19.02 Add the following sections after Article 19.01 with the title **"Contract Approval":**

A. Owner and Contractor will furnish Owner's attorney such evidence as required so that Owner's attorney can complete and execute the following "Certificate of Owner's Attorney" (Exhibit I of RUS Bulletin 1780-26) before Owner submits the executed Contract Documents to Agency for approval.

B. Concurrence by Agency in the award of the Contract is required before the Contract is effective.

☐ SC 19.03 Add the following language after Article 19.02.B with the title **"Conflict of Interest"**:

A. Contractor may not knowingly contract with a supplier or manufacturer if the individual or entity who prepared the plans and specifications has a corporate or

financial affiliation with the supplier or manufacturer. Owner's officers, employees, or agents shall not engage in the award or administration of this Contract if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when: (i) the employee, officer or agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has a financial interest or other interest in or a tangible personal benefit from the Contractor. Owner's officers, employees, or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from Contractor or subcontractors.

- SC 19.04 Add the following language after Article 19.03.A with the title **"Gratuities"**:

A. If Owner finds after a notice and hearing that Contractor, or any of Contractor's agents or representatives, offered or gave gratuities (in the form of entertainment, gifts, or otherwise) to any official, employee, or agent of Owner or Agency in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, Owner may, by written notice to Contractor, terminate this Contract. Owner may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which Owner bases such findings shall be an issue and may be reviewed in proceedings under the dispute resolution provisions of this Contract.

B. In the event this Contract is terminated as provided in paragraph 19.04.A, Owner may pursue the same remedies against Contractor as it could pursue in the event of a breach of this Contract by Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, Owner may pursue exemplary damages in an amount (as determined by Owner) which shall not be less than three nor more than ten times the costs Contractor incurs in providing any such gratuities to any such officer or employee.

- SC 19.05 Add the following language after Article 19.04.B with the title "**Small, Minority and Women's Businesses**":

A. Contracting with small and minority businesses, women's business enterprises, and labor surplus area firms. If Contractor intends to let any subcontracts for a portion of the work, Contractor must take all necessary affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible. Affirmative steps must include:

(1) Placing qualified small and minority businesses and women's business enterprises on solicitation lists;
(2) Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;
(3) Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses, and women's business enterprises;

(4) Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises;

(5) Using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce; and

 SC 19.06 Add the following after Article 19.05.A.(5) with the title **"Anti-Kickback":**

A. Contractor shall comply with the Copeland Anti-Kickback Act (40 U.S.C 3145) as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Buildings or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that Contractor or subcontractor must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. Owner shall report all suspected or reported violations to Agency.

 SC 19.07 Add the following after Article 19.06.A with the title **"Clean Air Act (42 U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended":**

A. Contractor to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

 SC 19.08 Add the following after Article 19.07.A with the title **"Equal Employment Opportunity":**

A. The Contract is considered a federally assisted construction contract. Except as otherwise provided under 41 CFR Part 60, all contracts that meet the definition of "federally assisted construction contract" in 41 CFR Part 60-1.3 must include the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

 SC 19.09 Add the following after Article 19.08.A with the title **"Byrd Anti-Lobbying Amendment (31 U.S.C. 1352)":**

A. Contractors that apply or bid for an award exceeding $100,000 must file the required certification (RD Instruction 1940-Q, Exhibit A-1). The Contractor certifies to the Owner and every subcontractor certifies to the Contractor that it will not and has not used Federal appropriated funds to pay any person or organization

for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining the Contract if it is covered by 31 U.S.C. 1352. The Contractor and every subcontractor must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the Owner. Necessary certification and disclosure forms shall be provided by Owner.

☐ SC 19.10 Add the following after Article 19.09.A with the title **"Environmental Requirements":**

When constructing a Project involving trenching and/or other related earth excavations, Contractor shall comply with the following environmental conditions:

A. Wetlands – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert wetlands.

B. Floodplains – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert 100-year floodplain areas (Standard Flood Hazard Area) delineated on the latest Federal Emergency Management Agency Floodplain Maps, or other appropriate maps, e.g., alluvial soils on NRCS Soil Survey Maps.

C. Historic Preservation – Any excavation by Contractor that uncovers an historical or archaeological artifact or human remains shall be immediately reported to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the State Historic Preservation Officer (SHPO).

D. Endangered Species – Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of Contractor, Contractor will immediately report this evidence to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the U.S. Fish and Wildlife Service.

E. Mitigation Measures – The following environmental mitigation measures are required on this Project: {Insert mitigation measures here}.

☐ SC 19.11 Add the following after Article 19.10.E. with the title **"Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708)":**

A. Where applicable, for contracts awarded by the Owner in excess of $100,000 that involve the employment of mechanics or laborers, the Contractor must comply with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, the Contractor must compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the

worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

☐ SC 19.12 Add the following after Article 19.11.A. with the title **"Debarment and Suspension (Executive Orders 12549 and 12689)":**

A. A contract award (see 2 CFR 180.220) must not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

☐ SC 19.13 Add the following after Article 19.12.A. with the title **"Procurement of recovered materials":**

A. The Contractor must comply with 2 CFR Part 200.322, "Procurement of recovered materials."

CERTIFICATE OF OWNER'S ATTORNEY AND AGENCY CONCURRENCE

CERTFICATE OF OWNER'S ATTORNEY

PROJECT NAME: ____________________

CONTRACTOR NAME: ____________________

I, the undersigned, ____________________________________, the duly authorized and acting legal representative of ____, do hereby certify as follows: I have examined the attached Contract(s) and performance and payment bond(s) and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements is adequate and has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with the terms, conditions, and provisions thereof.

____

Name Date

AGENCY CONCURRENCE

As lender or insurer of funds to defray the costs of this Contract, and without liability for any payments thereunder, the Agency hereby concurs in the form, content, and execution of this Agreement.

____

Agency Representative Date

____

Name

ENGINEER'S CERTIFICATION OF FINAL PLANS AND SPECIFICATIONS

PROJECT NAME:____

The final Drawings and Specifications, other assembled Construction Contract Documents, bidding-related documents (or requests for proposals or other construction procurement documents), and any other Final Design Phase deliverables, comply with all requirements of the U.S. Department of Agriculture, Rural Utilities Service, to the best of my knowledge and professional judgment.

If the Engineers Joint Contract Documents Committee (EJCDC) documents have been used, all modifications required by RUS Bulletin 1780-26 have been made in accordance with the terms of the license agreement, which states in part that the Engineer "must plainly show all changes to the Standard EJCDC Text, using 'Track Changes' (redline/strikeout), highlighting, or other means of clearly indicating additions and deletions." Such other means may include attachments indicating changes (e.g. Supplementary Conditions modifying the General Conditions).

____

Engineer Date

____

Name and Title

UNITED STATES DEPARTMENT OF AGRICULTURE
Rural Utilities Service
RUS BULLETIN 1780-35

SUBJECT: **Guidance for the Implementation of American Iron and Steel (AIS) Requirements with Rural Utilities Service (RUS) Financial Assistance**

TO: Rural Development (RD) state directors, RUS program directors, and state engineers.

EFFECTIVE DATE: Date of approval.

OFFICE OF PRIMARY INTEREST: Engineering and Environmental Staff (EES), Water and Environmental Programs (WEP).

INSTRUCTIONS: This is a new Bulletin and does not replace any existing RUS Bulletin.

AVAILABILITY: This Bulletin, as well as any RD or RUS instructions, regulations, or forms referenced in this Bulletin are available at any RD State Office. The State Office staff is familiar with the use of the documents in their States and can answer specific questions on RD requirements.

This Bulletin is available on the RUS website at https://www.rd.usda.gov/publications/regulations-guidelines/bulletins/water-and-environmental.

PURPOSE: This Bulletin assists RD staff in providing information and guidance to applicants, professional consultants, general contractors, and manufacturers regarding the AIS Requirements mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference. The intended outcome of this Bulletin is to instruct and inform RD State Office staff and others on how to implement these requirements to ensure compliance with the AIS requirements.

MODIFICATIONS: RD State Offices may modify this guidance when appropriate to comply with state statutes and regulations in accordance with the procedures outlined at RD Instruction 2006-B (2006.55).

Kellie M. Kubena

for SCOTT BARRINGER
Acting Assistant Administrator
Water and Environmental Programs

August 30, 2017
Date

TABLE OF CONTENTS

Exhibits:

A AMERICAN IRON & STEEL COMPLIANCE STATEMENT

B ENGINEER’S CERTIFICATION OF COMPLIANCE

C GENERAL CONTRACTOR’S (PRIME) CERTIFICATION OF COMPLIANCE

D EXAMPLE OF A MANUFACTURER’S CERTIFICATION LETTER OF COMPLIANCE

E EXAMPLES OF MUNICIPAL CASTINGS

F EXAMPLES OF CONSTRUCTION MATERIALS

G EXAMPLES OF NON-CONSTRUCTION MATERIALS

H INFORMATIONAL CHECKLIST FOR PROJECT SPECIFIC WAIVER REQUEST

I EXAMPLE COST TABLE FOR A PROJECT COST WAIVER

J CHECKLIST FOR STATE ENGINEERS

ABBREVIATIONS

AIS – American Iron and Steel
ANTHC – Alaska Native Tribal Health Consortium
AWWA – American Water Works Association
CFR – Code of Federal Regulations
EO – Executive Order
NIST – National Institute of Standards and Technology
NSF – National Sanitation Foundation
OGC – Office of General Counsel
PL – Public Law
PER – Preliminary Engineering Report
RAVG – Rural Alaska Village Grant
RD – Rural Development
RUS – Rural Utilities Service
USC – United States Code
USDA – United States Department of Agriculture
WEP – Water and Environmental Programs
WWD – Water and Waste Disposal

DEFINITIONS

"Assistance recipient" is the entity that receives funding assistance from programs required to comply with Section 746 Division A Title VII of the Consolidated Appropriations Act of 2017 (Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference. This term includes owner and/or applicant.

"Certifications" means the following:

- *Manufacturers'* certification is documentation provided by the manufacturer or fabricator to various entities stating that the iron and steel products to be used in the project are produced in the United States in accordance with American Iron and Steel (AIS) Requirements. If items are purchased via a supplier, distributor, vendor, etc. vs. from the manufacturer or fabricator directly, then the supplier, distributor, vendor, etc. will be responsible for obtaining and providing these certification letters to the parties purchasing the products.
- *Engineers*' certification is documentation that plans, specifications, and bidding documents comply with AIS.
- *Contractors'* certification is documentation submitted upon substantial completion of the project that all iron and steel products installed were produced in the United States.

"Coating" means a covering that is applied to the surface of an object. If a coating is applied to the external surface of a domestic iron or steel component, and the application takes place outside of the United States, said product would be considered a compliant product under the AIS requirements. Any coating processes that are applied to the external surface of iron and steel components that would otherwise be AIS compliant would not disqualify the product from meeting the AIS requirements regardless of where the coating processes occur, provided that final assembly of the product occurs in the United States. This exemption only applies to coatings on the *external surface* of iron and steel components. It does not apply to coatings or linings on internal surfaces of iron and steel products, such as the lining of lined pipes. All manufacturing processes for lined pipes, including the application of pipe lining, must occur in the United States for the product to be compliant with AIS requirements.

"Construction materials" are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered "structural steel". See Exhibit F for examples.
Note: Mechanical and electrical components, equipment and systems are not considered construction materials. See definition of mechanical and electrical equipment.

"Consulting engineer" is an individual or entity with which the owner has contracted to perform engineering/architectural services for water and waste projects funded by the programs subject to AIS requirements).

"De minimis incidental components" are various miscellaneous low-cost components that are essential for, but incidental to, the construction and are incorporated into the physical structure of

the project. Examples of incidental components could include small washers, screws, fasteners (such as "off the shelf" nuts and bolts), miscellaneous wire, corner bead, ancillary tube, signage, trash bins, door hardware etc.
Costs for such de minimis incidental components cumulatively may comprise no more than a total of five percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed one percent of the total cost of the materials used in and incorporated into a project.

"General contractor" is the individual or entity with which the applicant has contracted (*or is expected to*) to perform construction services (or for water and waste projects funded by the programs subject to AIS requirements). This includes bidders, contractors that have received an award from the applicant and any party having a direct contractual relationship with the owner/applicant. A general contractor is often referred to as the prime contractor.

"Iron and steel products" are defined as the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. Only items on the above list made primarily of iron or steel, permanently incorporated into the project must be produced in the United States. For example trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

"Manufacturers" meaning a supplier, fabricator, distributor, materialman, or vendor is an entity with which the applicant, general contractor or with any subcontractor has contracted to furnish materials or equipment to be incorporated in the project by the applicant, contractor or a subcontractor.

"Manufacturing processes" are processes such as melting, refining, forming, rolling, drawing, finishing, and fabricating. Further, if a domestic iron and steel product is taken out of the United States for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components do not have to be of domestic origin. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-U.S. sources.

"Mechanical equipment" is typically that which has motorized parts and/or is powered by a motor. "Electrical equipment" is typically any machine powered by electricity and includes components that are part of the electrical distribution system. AIS does apply to mechanical equipment.

"Minor components" are components *within* an iron and/or steel product otherwise compliant with the American Iron and Steel requirements. This is different from the de minimis definition where de minimis pertains to the entire project and the minor component definition pertains to a single product. This waiver, would allow non-domestically produced miscellaneous minor components comprising <u>up to five percent</u> of the <u>total material cost</u> of an otherwise domestically produced iron and steel product to be used. However, unless a separate waiver for a product has been approved, all other iron and steel components in said product must still meet the AIS requirements. This waiver does not exempt the whole product from the AIS requirements only minor components within said product and the iron or steel components of the product must be produced domestically. Valves and hydrants are also subject to the cost ceiling requirements described here. Examples of minor components could include items such pins and springs in valves/hydrants, bands/straps in couplings, and other low cost items such as small fasteners etc.

"Municipal castings" are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and solid waste infrastructure. See Exhibit E for examples.

"National Office" refers to the office responsible for the oversight and administration of the program nationally. The National Office sets policy, develops program regulations, and provides training and technical assistance to help the state offices administer the program. The National Office is located in Washington, D.C.

"Owner" is the individual or entity with which the general contractor has contracted regarding the work, and which has agreed to pay the general contractor for the performance of the work, pursuant to the terms of the contract for water and waste projects funded by the programs subject to AIS requirements. For the purpose of this Bulletin, this term is synonymous with the term "applicant" as defined in 7 CFR 1780.7 (a) (1), (2) and (3) and is an entity receiving financial assistance from the programs subject to the AIS requirements.

"Pass through Entities" is an entity that provides a subaward to a loan and/or grant recipient to carry out part of a Federal program. Examples are grantees utilizing the Revolving Loan Program and Household Water Well Program and Alaska Native Tribal Health Consortium (ANTHC) or the State of Alaska from the RAVG Program.

"Primarily iron or steel" is defined as a product made of greater than 50 percent iron or steel, measured by cost. The cost should be based on the material costs. An exception to this definition is reinforced precast concrete (see Definitions). All technical specifications and applicable industry standards (e.g. NIST, NSF, AWWA) must be met. If a product is determined to be less than 50 percent iron and steel, the AIS requirements do not apply.

For example, the cost of a fire hydrant includes:
(1) The cost of materials used for the iron portion of a fire hydrant (e.g. bonnet, body and shoe); and
(2) The cost to pour and cast to create those components (e.g. labor and energy).

Not included in the cost are:
(1) The additional material costs for the non-iron and steel internal workings of the hydrant (e.g. stem, coupling, valve, seals, etc.); and
(2) The cost to assemble the internal workings into the hydrant body.

"Produced in the United States" means that the production in the United States of the iron or steel products used in the project requires that all manufacturing processes must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives.

"Project" is the total undertaking to be accomplished for the applicant by consulting engineers, general contractors, and others, including the planning, study, design, construction, testing, commissioning, and start-up, and of which the work to be performed under the contract is a part. A project includes all activity that an applicant is undertaking to be financed in whole or part by programs subject to AIS requirements. The intentional splitting of projects into separate and smaller contracts or obligations to avoid AIS requirements is prohibited.

"Reinforced Precast Concrete" may not consist of at least 50 percent iron or steel, but the reinforcing bar and wire must be produced in the United States and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the United States. The cement and other raw materials used in concrete production are not required to be of domestic origin. If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered to be a construction material and must be produced in the United States.

"Steel" means an alloy that includes at least 50 percent iron, between 0.02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel, and other specialty steels.

"Structural steel" is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees, and zees. Other shapes include but are not limited to, H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

"Ultimate recipient" is a loan or grant recipient receiving funds from a pass-through entity. Examples include: (1) a loan recipient from the Revolving Loan Fund; (2) a loan recipient from the Household Water Well Program; and (3) a grant recipient from ANTHC or the State of Alaska from the RAVG Program.

"United States" means each of the several states, the District of Columbia, and each Federally Recognized Indian Tribe.

1 BACKGROUND

a Section 746 Division A Title VII of the Consolidated Appropriations Act of 2017 (Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference, applies a new American Iron and Steel (AIS) requirement to the following programs:

(1) Water and Waste Disposal Loan and Grant program;

(2) Guaranteed Loan Funds;

(3) Revolving Loan Funds;

(4) Emergency Community Water Assistance Grants;

(5) Section 306C Colonias and Tribal Set-Aside Grants;

(6) Rural Alaskan Native Village Grants;

(7) Household Water Well System Grants; and

(8) Rural Economic Area Partnership Zone projects.

b The basic concept of this new requirement is that all iron and steel products used in projects funded by RUS WEP must be produced in the United States. Iron and steel products are specifically defined and does not include every item consisting of any quantity of iron and/or steel.

c Statutory Language: SEC. 746 Division A Title VII the Consolidated Appropriations Act of 2017.
(a)(1) No Federal funds made available for this fiscal year for the rural water, waste water, waste disposal, and solid waste management programs authorized by sections 306, 306A, 306C, 306D, 306E, and 310B of the Consolidated Farm and Rural Development Act (7 U.S.C. 1926 et seq.) shall be used for a project for the construction, alteration, maintenance, or repair of a public water or wastewater system unless all of the iron and steel products used in the project are produced in the United States.
(2) In this section, the term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) Subsection (a) shall not apply in any case or category of cases in which the Secretary of Agriculture (in this section referred to as the “Secretary”) or the designee of the Secretary finds that—
(1) applying subsection (a) would be inconsistent with the public interest;
(2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or
(3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Secretary or the designee receives a request for a waiver under this section, the Secretary or the designee shall make available to the public on an informal basis a copy of the request and information available to the Secretary or the designee concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Secretary or the designee shall make the request and accompanying information available by electronic means, including on the official public Internet Web site of the Department.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

(e) The Secretary may retain up to 0.25 percent of the funds appropriated in this Act for “Rural Utilities Service—Rural Water and Waste Disposal Program Account” for carrying out the provisions described in subsection (a)(1) for management and oversight of the requirements of this section.

(f) Subsection (a) shall not apply with respect to a project for which the engineering plans and specifications include use of iron and steel products otherwise prohibited by such subsection if the plans and specifications have received required approvals from State agencies prior to the date of enactment of this Act.

(g) For purposes of this section, the terms “United States” and “State” shall include each of the several States, the District of Columbia, and each federally recognized Indian tribe.

d American Iron and Steel (AIS) refers to requirements mandated by Section 746 Division A Title VII of the Consolidated Appropriations Act of 2017 (Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference.

e The statute refers to Section 746 Division A Title VII of the Consolidated Appropriations Act of 2017 (Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference.

2 APPLICABILITY

a. The requirements of AIS apply only to projects that construct, alter, enlarge, extend, maintain, repair or otherwise improve rural water, sanitary sewage, solid waste disposal, and storm wastewater disposal facilities.

b. The requirements apply to projects using funds from programs listed in Section 1 a of this Bulletin. Any amount of funding from these programs requires compliance with the AIS requirements. Use of funds from these programs is not allowed unless the requirements for AIS are met for the <u>entire</u> project. Projects that leverage funds from other funding sources are also subject the requirements.

c. The requirements apply in the United States as defined in Section 746 (g) of the statute and therefore do not apply to projects located in Puerto Rico, the Virgin Islands, or the Western Pacific Territories.

d. The requirements apply to any used AIS products to be constructed in the project.

e. The requirements do not apply to projects for which any funds were obligated on or before May 5, 2017. The requirements therefore do not apply to subsequent obligations of funds for projects which had an initial obligation of funds on or before May 5, 2017.

f. The requirements do not apply to contracts which were executed prior to or on May 5, 2017, regardless of the date of obligation.

g. The requirements do not apply to projects for which contracts were executed and/or construction is already underway and/or completed prior to applying to USDA funding.

h. The requirements do not apply to products primarily composed of iron and/or steel (composed of more than 50 percent) if they are not listed in the statute.

i. The requirements do not apply to raw materials used in the production of iron or steel such as iron ore, limestone, scrap iron and scrap steel.

j. The requirements do not apply to any items that are at the construction site temporarily, such as scaffolding, trench boxes, or equipment temporarily used or stored on site.

k. The requirements do not apply when the sole purpose of the loan and/or grant is to fund non-construction activities such as capacity/connection fees or the acquisition of a system.

l The requirements supersede any regulation on full and open competition stated in 7 CFR 1780.70 (b) and 2 CFR Part 200.319. For example, if an iron and steel product that is compliant with AIS is made by only one manufacturer provided documentation is submitted and verified, sole source procurement of said product may be used.

m The requirements only apply to the final product as delivered to the work site and incorporated into the project. The need for compliance of an item with AIS depends on whether or not the final assembled product is listed. Components of a final product even if they are listed, do not need to comply with the AIS requirements. In the case of an assembled product where the primary component is not listed in the 2017 Consolidated Appropriations Act and includes components/appurtenances that are specifically listed, said assembled product is not subject to AIS (e.g. pump assembly).

3 IMPLEMENTATION (Agency, Owner, Engineer, General Contractor, Manufacturers et. al., Pass through Entities, Ultimate Recipients)

a There are several parties involved in compliance with the AIS requirements and some requirements are specific to a party.

b The parties that have one or more responsibilities under AIS include: the Agency, funding recipients under the Water and Waste Disposal Loan and Grant program and Guaranteed Loan Program, consulting engineers, construction contractors, suppliers, distributors, manufacturers, lenders under the Guaranteed Loan Program; grantees under the revolving loan program, Household Water Well program, and grantees under the 306C, ECWAG programs, and RAVG programs, as well as loan recipients under the Revolving Loan and Household Water Well program.

c For exceptions please see Section 2.

4 RESPONSIBILITIES UNDER THE WATER & WASTE DISPOSAL (WWD) LOAN & GRANT PROGRAM: *AGENCY RESPONSIBILITIES*

a <u>State Director</u>:

(1) ***Approve*** and set aside a sufficient budget for travel so that Area Specialists and State Engineers can perform their responsibilities under this section.

b Community Programs Director:

(1) ***Ensure*** that all Grant Agreements, Letters of Conditions, Loan Resolutions and Conditional Commitments for Guarantees, include appropriate language prior to obligation of funds (see Section 17).

(2) ***Budget*** for travel so that State Engineers (as applicable) can perform their responsibilities under this section.

c State Engineer:

(1) ***Ensure*** that the cost estimates in the PER reflect AIS requirements.

(2) ***Ensure*** that agreements for engineering services include AIS language (see Section 16).

(3) ***Ensure*** that plans, specifications and bidding documents include required language (see Section 16).

(4) ***Obtain*** engineer's certification letter where the consulting engineer certifies that plans, specifications, and bidding documents comply with AIS and commits that bid addenda, executed contracts and change orders will comply with AIS (see Exhibit B).

(5) Monitoring: For each project, ***perform*** a site visit during active construction and complete the AIS checklist (see Exhibit J). Provide an electronic copy to National Office upon final payment.

(6) Change orders and partial payment estimates: ***Verify*** the consulting engineer, general contractor and owner have signed C-941 and C-620 of EJCDC and manufacturers' certifications letters (as applicable) (see Exhibit D) are included with the submittal.

(7) Substantial completion of project: ***Obtain*** a copy of the contractor's certification letter (see Exhibit C). ***Obtain*** a list of manufacturers from the consulting engineer for AIS products used in the project (including manufacturer name and location, product(s)) and provide an electronic copy to the National Office Engineer(s).

(8) *Special cases:*

(a) Where owner provides their own engineering and/or construction services, ***obtain*** copies of engineers', contractors' (prepared by the owner), and manufacturers' certification letters (as applicable) for the Agency to insert into the Agency file.

(b) Where owner directly procures AIS products, ***obtain*** copies of manufacturers' certification letters for the Agency to insert into the Agency file.

d Area Office Specialist:

(1) Pre-construction Conference: ***Read*** a statement outlining the AIS requirements (see Exhibit A) during the conference.

(2) Guaranteed Program: ***Ensure*** that conditional commitments include AIS language (i.e. Section 17 a)

(3) Partial payment estimates: ***Verify*** that the consulting engineer, general contractor and owner have signed C-620 of EJCDC.

5 OWNER RESPONSIBILITIES

a Owners are ultimately responsible for compliance with AIS requirements.

(1) ***Sign*** loan resolutions, grant agreements and letters of intent to meet conditions which include AIS language, accepting AIS requirements in those documents and in the letter of conditions.

(2) ***Sign*** agreements for engineering services, executed construction contracts and all other appropriate and necessary documents which include AIS language.

(3) ***Acknowledge*** responsibility for compliance with AIS requirements by signing change orders (i.e. C-941 of EJCDC) and partial payment estimates (i.e. C-620 of EJCDC).

(4) <u>Substantial completion of project</u>: ***Obtain*** the certification letters from the consulting engineer and ***maintain*** this documentation for the life of the loan.

(5) <u>*Special Cases*</u>

(a) Where the owner provides their own engineering and/or construction services, ***provide*** copies of engineers' (see Exhibit B), contractors' (see Exhibit C), and manufacturers' certification letters (see Exhibit D) (*as applicable*) to the Agency. All certification letters must be kept in the engineer's project file and on site during construction. For Owner Construction (Force Account), all AIS clauses from Section 16 must be included in the Agreement for Engineering Services.

(b) Where the owner directly procures AIS products, the owner must:

(i) ***Include*** clauses from Section 17 a not including 17 a (1) in the procurement contracts.

(ii) ***Obtain*** manufacturers' certification letters and provide copies to consulting engineers and contractors.

6 CONSULTING ENGINEER RESPONSIBILITIES

(1) ***Include*** costs of compliance with AIS in engineering fees (if appropriate) and in engineer's opinions of probable cost and associated revisions.

(2) Agreements for engineering services: ***Include*** AIS language (see Section 16).

(3) <u>Plans, specifications, bidding documents and bid addenda</u>: ***Include*** required AIS language (see Section 16). For any AIS products specified by brand names, ***obtain*** a manufacturer's certification letter (see Exhibit D) from the manufacturer to verify the products comply with AIS.

(4) ***Certify*** that plans, specifications, and bidding documents comply with AIS and ***commit*** that bid addenda, executed contracts and change orders will comply with AIS and ***submit*** a letter to the Agency <u>prior</u> to authorization to advertise for bids (see Exhibit B).

(5) <u>Award</u>: ***Provide*** copies of manufacturers' certification letters to the general contractor on any specified brand name AIS products in the plans, specifications and bidding documents including any bid addenda.

(6) Shop drawing submittal: ***Review*** shop drawings and change orders to ensure compliance with AIS. For shops drawings under consideration for any brand name, equal and/or substitute, and any iron and steel products subject to AIS, ***obtain*** a manufacturers' certification letter (see Exhibit D) from the general contractor to verify the products comply with AIS.
(7) ***Keep*** all certification letters (including those from the engineer, contractor and any manufacturer providing AIS products) in the engineer's project file.
(8) Change Order: For any change order under consideration for any AIS products, ***obtain*** a manufacturer's certification letter (see Exhibit D) from parties submitting the change proposal to ensure compliance with AIS.
(9) ***Acknowledge*** responsibility for compliance with AIS requirements by signing change orders (i.e. C-941 of EJCDC) and partial payment estimates (i.e. C-620 of EJCDC).
(10) Substantial completion of project: ***Obtain*** the contractors' certification letter (see Exhibit C) and copies of manufacturers' certification letters for all AIS products used in the project. ***Provide*** copies of engineer's, contractors', and manufacturers' certification letters to the owner and copy of contractor's certification letter to the Agency. ***Provide*** a list of manufacturers to the RD State Engineer for AIS products used in the project (including manufacturer name and location, product(s)).

7 CONSTRUCTION CONTRACTOR RESPONSIBILITIES

a Construction contractors must use and install iron and steel products that are compliant with AIS as part of the permanent work.

(1) Bid submittal: for proposed equals and substitutes, ***provide*** manufacturers' certification letter (see Exhibit D) to verify the products comply with AIS.
(2) Award: ***Obtain*** copies of manufacturers' certification letters (see Exhibit D) from the consulting engineer for brand name products specified by the consulting engineer.
(3) Shop drawing submittal: For proposed equals, substitutes and any iron and steel product subject to AIS, ***provide*** manufacturers' certification letters (see Exhibit D) to verify the products comply with AIS.
(4) Prior to construction: ***Ensure*** that copies of manufacturers' certification letters including those from others (e.g. consulting engineer, owner, etc.) for any AIS products to be used in the project is in the project file on site prior to installation.
(5) Change Order: For any AIS products proposed in a change proposal, ***provide*** manufacturers' certification letter (see Exhibit D) to the consulting engineer to verify the products comply with AIS.
(6) ***Acknowledge*** responsibility for compliance with AIS requirements by signing change orders (i.e. C-941 of EJCDC) and partial payment estimates (i.e. C-620 of EJCDC).

(7) ***Keep*** all manufacturer certification letters (including those from the engineer, general contractor and any manufacturer providing AIS products) on site during construction in the construction project file.

(8) Substantial completion of the project: ***Provide*** the general contractor's certification (see Exhibit C) letter to the engineer that all iron and steel products installed comply with AIS. This certification is to be submitted upon substantial completion of the project to the project engineer.

8 MANUFACTURER, SUPPLIER, DISTRIBUTOR RESPONSIBILITIES

(1) If iron and steel products are produced in the United States as defined in this Bulletin, ***prepare*** (*applicable to manufacturers and fabricators) or* ***obtain*** (*applicable to suppliers, distributors, vendors, etc.)* manufacturers' certification letters (see Exhibit D) and make available upon request to consulting engineers, general contractors, etc.

9 PASS THROUGH ENTITIES (e.g. Grantees utilizing the Revolving Loan Program and Household Water Well Program)

(1) ***Sign*** Grant Agreements which include AIS language (See Section 17).
(2) ***Include*** AIS language in loan agreement their borrowers (See Section 17 a).
(3) ***Monitor*** for compliance.
(4) ***Perform*** corrective actions to ensure compliance where needed.

10 ULTIMATE RECIPIENT (e.g. Loan Recipients under Revolving Loan Program, Homeowners under the Household Water Well Program)

a Loan recipients are ultimately responsible for compliance with AIS requirements.
(1) ***Sign*** loan agreements which include AIS language (see Section 17 a).
(2) ***Include*** required AIS language (see Section 17 a) in any agreements for engineering services and contracts for construction services and procurement of AIS products.
(3) ***Obtain*** manufacturers' certification letters for AIS products and include a copy in project files.

b Homeowners are ultimately responsible for compliance with AIS requirements.
(1) ***Sign*** a loan agreement accepting responsibility to ensure AIS products used to construct, refurbish, or service individually-owned household water well systems are produced in the United States.
(2) ***Obtain*** manufacturers' certification letters (see Exhibit D) from contracted service providers (e.g. well driller) and maintain a copy on-site for the duration of the loan.

11 RESPONSIBILITIES UNDER THE GUARANTEED LOAN PROGRAM

AIS applies to projects funded by Section 306A – Guaranteed Loan Program.

a Lenders are responsible to ensure that ultimate recipients comply with AIS requirements.

b Loan recipients are ultimately responsible for compliance with AIS requirements.

c Project specialists will ensure that conditional commitments include AIS language (i.e. Section 17 a)

12 ECWAG

AIS applies to projects funded by ECWAG.

a If construction contracts were awarded and/or executed or construction began prior to application, these projects are not subject to AIS (see Section 2).

b If construction contracts were awarded and/or executed or construction began during the application process, these projects are subject to AIS.

13 SECTION 306C COLONIAS AND TRIBAL SET-ASIDE GRANTS

AIS applies to projects funded by Section 306 C including Colonias and Tribes.

14 RURAL ALASKAN NATIVE VILLAGE GRANTS

AIS applies to projects funded by Section 306 D – the Rural Alaskan Native Village Grant Program.

a *Special* Cases:

(1) If a project is administered by Alaska RD State Office, please ***follow*** this Bulletin.

(2) If the project is administered by the State of Alaska or ANTHC:

(a) ***Sign*** grant agreements and letters of intent to meet conditions which include AIS language (See Section 17), accepting AIS requirements in those documents and in the letter of conditions.

(b) ***Include*** AIS language in grant agreement their grantees (See Section 17 a).

(c) ***Monitor*** for compliance.

(d) ***Perform*** corrective actions to ensure compliance where needed.

15 RURAL ECONOMIC AREA PARTNERSHIP ZONE (REAP)

AIS applies to projects funded by Section 310 B – REAP.

16 CONTRACT PROVISIONS

To ensure compliance with the AIS requirements specific AIS contract language must be included in each contract including agreements for engineering services, construction contract documents and purchase agreements prepared by the owner.

a Agreement Between Owner and Engineer for Professional Services (EJCDC E-500, 2014)

(1) (E-500, Article 5.01.A)
Add *the following to 5.01.A*: "Opinions of Probable Cost and any revisions thereof should reflect compliance with American Iron & Steel requirements mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference."

(2) (E-500, Article 5.03.B)
Add *paragraph 5.03.B*: "Opinions of Total Project Costs and any revisions thereof should reflect compliance with American Iron & Steel requirements mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference."

(3) (E-500, Exhibit A.1.03.A.13):
Add *paragraph A.1.03.A.13*: "Services required to determine and certify that to the best of the Engineer's knowledge and belief all iron and steel products referenced in engineering analysis, the Plans, Specifications, Bidding Documents, and associated Bid Addenda requiring design revisions are either produced in the United States or are the subject of an approved waiver; and services required to determine to the best of the engineer's knowledge and belief that approved substitutes, equals, and all iron and steel products proposed in the shop drawings, Change Orders and Partial Payment Estimates are either produced in the United States or are the subject of an approved waiver under Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference. The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. The deminimis and minor components waiver *{add project specific waivers as applicable}* apply to this contract."

(4) (E-500, Exhibit A.1.04.A.10)
Add *paragraph A.1.04.A.10*: "Provide copies of Manufacturers' Certification letters to the Bidders on any brand name iron and steel products along with the Plans, Specifications and Bidding Documents. Manufacturers' Certification Letters are to be included in the Bidding

Documents and must be kept in the engineer's project file and on site during construction."

(5) (E-500, Exhibit A.1.04.11)
Add *paragraph A.1.04.A.11*: "Provide copies of Manufacturers' Certification letters to the Contractor on any brand name iron and steel products along with the Plans, Specifications, Bidding Documents including any Bid Addenda and Change Orders. Manufacturers' Certification Letters must be kept in the engineer's project file and on site during construction."

(6) (E-500, Exhibit A.1.05.A.17)
Modify *A.1.05.A.17 by adding the following prior to the first sentence*: "Review and approve or take other appropriate action with respect to Shop Drawings, Samples, and other required Contractor submittals to ensure compliance with American and Iron Steel requirements mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference. Any iron and steel products included in any submittal by the General Contractor, must include a Manufacturers' Certification letter to verify the products were produced in the United States. Copies of Manufacturers' Certification letters must be kept in the engineer's project file and on site during construction."

(7) (E-500, Exhibit A.1.05.A.18)
Add *the following to A.1.05.A.18 to the end of the paragraph as amended by RUS Bulletin 1780-26*: "Prior to approval of any substitute "or equal" obtain a Manufacturers' Certification letter to verify the products were produced in the United States. Manufacturers' Certification letters must be kept in the engineer's project file and on site during construction to ensure compliance with American and Iron Steel requirements mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference, if applicable."

(8) (E-500, Exhibit A.1.05.A.19)
Add *subparagraph A.1.05.A.19.d*: "Receive and review all Manufacturers' Certification Letters for materials required to comply with American and Iron Steel requirements mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference to verify the products were produced in the United States. Manufacturers' Certification letters must be kept in the engineer's project file and on site during construction."

(9) (E-500, Exhibit A.1.05.A.20)
Add *subparagraph (c) to the end of A.1.05.A.20*: "(c) Review Change Proposals to ensure compliance with American and Iron Steel requirements mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference."

(10) (E-500, Exhibit A.1.05.A.25)
Add *item "a" as a deliverable under paragraph A.1.05.A.25*: "(a) Obtain the Contractors' Certification letter and copies of Manufacturers' Certification letters for all American Iron and Steel products used in the project. Upon Substantial Completion, provide copies of Engineer's, Contractors', and Manufacturers' Certification letters to the Owner and a copy of Contractor's Certification letter to the Agency. Provide a list of manufacturers of American Iron and Steel products used in the project and include manufacturer's name and location, and product(s) to the Agency."

(11) (E-500, Exhibit B.2.02)
Add *the following language to B.2.02:* "Owners are ultimately responsible for compliance with Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference and will be responsible for the following:

(a) ***Signing*** loan resolutions, grant agreements and letters of intent to meet conditions which include American Iron and Steel language, accepting American Iron and Steel requirements in those documents and in the letter of conditions.
(b) ***Signing*** change orders (i.e. C-941 of EJCDC) and partial payment estimates (i.e. C-620 of EJCDC) and thereby ***acknowledging*** responsibility for compliance with American Iron and Steel requirements.
(c) ***Obtaining*** the certification letters from the consulting engineer upon substantial completion of the project and ***maintaining*** this documentation for the life of the loan.
(d) Where the owner provides their own engineering and/or construction services, ***providing*** copies of engineers', contractors', and manufacturers' certification letters (*as applicable*) to the Agency. All certification letters must be kept in the engineer's project file and on site during construction. For Owner Construction (Force Account), all clauses from Section 17 of RUS Bulletin 1780-35 must be included in the Agreement for Engineering Services.
(e) Where the owner directly procures American Iron and Steel products, ***including*** American Iron and Steel clauses in the procurement

contracts and ***obtaining*** manufacturers' certification letters and ***providing*** copies to consulting engineers and contractors.

(12) (E-500, Exhibit D1.01.C.11.g)
Add *sub paragraph D.1.01.C.11.g:* "(g) Maintain all Manufacturers' Certification letters in the project file and on site during construction to ensure compliance with American and Iron Steel requirements mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference, as applicable."

b <u>Bidding and Construction Contract Documents (EJCDC C-Series, 2013)</u>

(1) Advertisement for Bids (C-111):
Add *at the end of C-111 prior to the Owner's name:* "Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. All listed iron and steel products used in this project must be produced in the United States. The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. The deminimis and minor components waiver *{add project specific waivers as applicable}* apply to this contract."

(2) Instructions to Bidders (C-200):

(a) (C-200, Article 5.01.C)
Delete the semicolon at the end of 5.01.C and ***insert*** *the following*:
…including but not limited to American Iron and Steel requirements as mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference which apply to the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) (C-200, Article 11.01)
Modify *paragraph 11.01, as previously amended by RUS 1780-26, by inserting the following sentence after* "Each such request shall comply with the requirements of Paragraphs 7.04 and 7.05 of the General Conditions.

Each such request shall include Manufacturer's Certification letter for compliance with Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference, if applicable. Refer to Manufacturer's Certification Letter provided in these Contract Documents."

(c) (C-200, Article 24.02)
***Add** paragraph to 24.02*: "Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. All iron and steel products used in this project must be produced in the United States. The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. The deminimis and minor components waiver *{add project specific waivers as applicable}* apply to this contract."

(3) Bid Form (C-410)

(a) (C-410, Article 3.01.C)
***Add** language at the end of the sentence of Article 3.01.C*: "…and including all American Iron and Steel requirements."

(b) (C-410, Article 7.01)
Add 7.01.K after 7.01.J (7.01.J added by RUS 1780-26): K. Manufacturers' Certification letter of compliance with Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference for all equals or substitutes approved by Addenda for American Iron and Steel products as provided in these Contract Documents.

(4) Supplementary General Conditions (C-800)

(a) (C-800, Article SC 1.01.A.51)
***Add** 1.01.A.51 after 1.01.A.50 (as amended by RUS 1780-26)*:
"*Manufacturer's Certification letter* is documentation provided by the manufacturer, supplier, distributor, vendor, fabricator, etc. to various entities stating that the American Iron and Steel products to be used in the project are produced in the United States in accordance with American Iron and Steel requirements. Refer to Manufacturer's Certification Letter provided in these Contract Documents."

(b) (C-800, Article SC 1.01.A.52)
Add *1.01.A.52 after 1.01.A.51*: "AIS - refers to requirements mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference. The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials."

(c) (C-800, Article SC 7.03)
Add *sentence 7.03.d*: "All iron and steel products must meet American Iron and Steel requirements."

(d) (C-800, Article SC 7.04.B.1)
Add *7.04.B.1*: "Contractor shall include a Manufacturer's Certification letter for compliance with American Iron and Steel requirements in support data, if applicable. Refer to Manufacturer's Certification Letter provided in these Contract Documents. In addition, for the Deminimis Waiver, Contractor shall maintain an itemized list of incidental components and ensure that the cost is less than 5% of total materials cost for project; for the Minor Components Waiver, the Contractor shall maintain a list of products to which the minor components waiver applies and the cost of the non-domestically produced component is less than 5% of total materials cost of that product."

(e) (C-800, Article SC 7.05.A.3.a.4)
Add *7.05.A.3.a.4*: "4) comply with American Iron and Steel by providing Manufacturer's Certification letter of American Iron and Steel compliance, if applicable. Refer to Manufacturer's Certification Letter provided in these Contract Documents."

(f) (C-800, Article SC 7.11.A)
Modify *7.11.A by inserting the following after "written interpretations and clarifications,"*: "Manufacturers' Certification letter is documentation provided by the manufacturer, supplier, distributor, vendor, fabricator, etc. to various entities stating that the iron and steel products to be used in the project are produced in the United States in accordance with American Iron and Steel Requirements. Refer to Manufacturer's Certification Letter provided in these Contract Documents."

(g) (C-800, Article SC 7.16.A.1.e)
Add *7.16.A.1.e*: "e. obtained Manufacturer's Certification letter for any item in the submittal subject to American Iron and Steel requirements and include

the Certificate in the submittal. Refer to Manufacturer's Certification Letter provided in these Contract Documents."

(h) (C-800, Article SC 7.16.D.9)
Add *7.16.D.9*: "Engineer's review and approval of Shop Drawing or Sample shall include review of compliance with American Iron and Steel requirements, as applicable."

(i) (C-800, Article SC 7.17.E)
Add *7.17.E*: "Contractor shall certify upon Substantial Completion that all Work and Materials has complied with American Iron and Steel requirements as mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference. Contractor shall provide said Certification to Owner. Refer to General Contractor's Certification Letter provided in these Contract Documents."

(j) (C-800, Article SC 10.10.A)
Add *10.10.A American Iron & Steel*: "A. "Services required to determine and certify that to the best of the Engineer's knowledge and belief all iron and steel products referenced in engineering analysis, the Plans, Specifications, Bidding Documents, and associated Bid Addenda requiring design revisions are either produced in the United States or are the subject of an approved waiver and services required to determine to the best of the engineer's knowledge and belief that approved substitutes, equals, and all iron and steel products proposed in the shop drawings, Change Orders and Partial Payment Estimates are either produced in the United States or are the subject of an approved waiver under Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017).

(k) (C-800, Article SC 11.06.A.1)
Modify *11.06.A.1 by inserting the following sentence after "within 15 days after the submittal of the Change Proposal."*: "Include supporting data (name of manufacturer, city and state where the product was manufactured, description of product, signature of authorized manufacturer's representative) in the Manufacturer's Certification Letter, as applicable."

(l) (C-800, Article SC 14.03.G)
Add *14.03.G*: "G. Installation of Materials that are non-compliant with American Iron and Steel requirements shall be considered defective work."

(m) (C-800, Article SC 15.01.B.4)
Add *15.01.B.4*: "4. By submitting Materials for payment, Contractor is certifying that the submitted Materials are compliant with American Iron and Steel requirements. Manufacturer's Certification letter for Materials satisfy this certification. Refer to Manufacturer's Certification Letter provided in these Contract Documents."

(n) (C-800, Article SC 15.01.C.2.d)
Add *15.01.C.2.d*: "d. the Materials presented for payment comply with American Iron and Steel."

(o) (C-800, Article SC 15.03.A)
Modify *15.03.A by adding the following after the last sentence*: "Services required to determine and certify that to the best of the Contractor's knowledge and belief all substitutes, equals, and all iron and steel products proposed in the shop drawings, Change Orders and Partial Payment Estimates, and those installed for the project are either produced in the United States or are the subject of an approved waiver under Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference."

(p) (C-800: Article 19, SC 19.14):
Add **"**Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. All iron and steel products used in this project must be produced in the United States. The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. The deminimis and minor components waiver *{add project specific waivers as applicable}* apply to this contract."

(q) (C-800: Article 19, SC 19.15):
Add *SC 19.15 Definitions:*
"Assistance recipient" is the entity that receives funding assistance from programs required to comply with Section 746 Division A Title VII of the Consolidated Appropriations Act of 2017 (Agriculture, Rural Development,

Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference. This term includes owner and/or applicant.

“Certifications” means the following:

- *Manufacturers’* certification is documentation provided by the manufacturer or fabricator to various entities stating that the iron and steel products to be used in the project are produced in the United States in accordance with American Iron and Steel (AIS) Requirements. If items are purchased via a supplier, distributor, vendor, etc. vs. from the manufacturer or fabricator directly, then the supplier, distributor, vendor, etc. will be responsible for obtaining and providing these certification letters to the parties purchasing the products.
- *Engineers*’ certification is documentation that plans, specifications, and bidding documents comply with AIS.
- *Contractors’* certification is documentation submitted upon substantial completion of the project that all iron and steel products installed were produced in the United States.

“Coating” means a covering that is applied to the surface of an object. If a coating is applied to the external surface of a domestic iron or steel component, and the application takes place outside of the United States, said product would be considered a compliant product under the AIS requirements. Any coating processes that are applied to the external surface of iron and steel components that would otherwise be AIS compliant would not disqualify the product from meeting the AIS requirements regardless of where the coating processes occur, provided that final assembly of the product occurs in the United States. This exemption only applies to coatings on the *external surface* of iron and steel components. It does not apply to coatings or linings on internal surfaces of iron and steel products, such as the lining of lined pipes. All manufacturing processes for lined pipes, including the application of pipe lining, must occur in the United States for the product to be compliant with AIS requirements.

“Construction materials” are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered “structural steel”.
Note: Mechanical and electrical components, equipment and systems are not considered construction materials. See definition of mechanical and electrical equipment.

“Consulting engineer” is an individual or entity with which the owner has contracted to perform engineering/architectural services for water and waste projects funded by the programs subject to AIS requirements).

"De minimis incidental components" are various miscellaneous low-cost components that are essential for, but incidental to, the construction and are incorporated into the physical structure of the project. Examples of incidental components could include small washers, screws, fasteners (such as "off the shelf" nuts and bolts), miscellaneous wire, corner bead, ancillary tube, signage, trash bins, door hardware etc.
Costs for such de minimis incidental components cumulatively may comprise no more than a total of five percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed one percent of the total cost of the materials used in and incorporated into a project.

"General contractor" is the individual or entity with which the applicant has contracted (*or is expected to*) to perform construction services (or for water and waste projects funded by the programs subject to AIS requirements). This includes bidders, contractors that have received an award from the applicant and any party having a direct contractual relationship with the owner/applicant. A general contractor is often referred to as the prime contractor.

"Iron and steel products" are defined as the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. Only items on the above list made primarily of iron or steel, permanently incorporated into the project must be produced in the United States. For example trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

"Manufacturers" meaning a supplier, fabricator, distributor, materialman, or vendor is an entity with which the applicant, general contractor or with any subcontractor has contracted to furnish materials or equipment to be incorporated in the project by the applicant, contractor or a subcontractor.

"Manufacturing processes" are processes such as melting, refining, forming, rolling, drawing, finishing, and fabricating. Further, if a domestic iron and steel product is taken out of the United States for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components do not have to be of domestic origin. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-U.S. sources.

“Mechanical equipment” is typically that which has motorized parts and/or is powered by a motor. “Electrical equipment” is typically any machine powered by electricity and includes components that are part of the electrical distribution system. AIS does apply to mechanical equipment.

“Minor components” are components *within* an iron and/or steel product otherwise compliant with the American Iron and Steel requirements. This is different from the de minimis definition where de minimis pertains to the entire project and the minor component definition pertains to a single product. This waiver, would allow non-domestically produced miscellaneous minor components comprising up to five percent of the total material cost of an otherwise domestically produced iron and steel product to be used. However, unless a separate waiver for a product has been approved, all other iron and steel components in said product must still meet the AIS requirements. This waiver does not exempt the whole product from the AIS requirements only minor components within said product and the iron or steel components of the product must be produced domestically. Valves and hydrants are also subject to the cost ceiling requirements described here. Examples of minor components could include items such pins and springs in valves/hydrants, bands/straps in couplings, and other low cost items such as small fasteners etc.

“Municipal castings” are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and solid waste infrastructure.

“National Office” refers to the office responsible for the oversight and administration of the program nationally. The National Office sets policy, develops program regulations, and provides training and technical assistance to help the state offices administer the program. The National Office is located in Washington, D.C.

“Owner” is the individual or entity with which the general contractor has contracted regarding the work, and which has agreed to pay the general contractor for the performance of the work, pursuant to the terms of the contract for water and waste projects funded by the programs subject to AIS requirements. For the purpose of this Bulletin, this term is synonymous with the term “applicant” as defined in 7 CFR 1780.7 (a) (1), (2) and (3) and is an entity receiving financial assistance from the programs subject to the AIS requirements.

"Pass through Entities" is an entity that provides a subaward to a loan and/or grant recipient to carry out part of a Federal program. Examples are grantees utilizing the Revolving Loan Program and Household Water Well Program and Alaska Native Tribal Health Consortium (ANTHC) or the State of Alaska from the RAVG Program.

"Primarily iron or steel" is defined as a product made of greater than 50 percent iron or steel, measured by cost. The cost should be based on the material costs. An exception to this definition is reinforced precast concrete (see Definitions). All technical specifications and applicable industry standards (e.g. NIST, NSF, AWWA) must be met. If a product is determined to be less than 50 percent iron and steel, the AIS requirements do not apply.

For example, the cost of a fire hydrant includes:
(1) The cost of materials used for the iron portion of a fire hydrant (e.g. bonnet, body and shoe); and
(2) The cost to pour and cast to create those components (e.g. labor and energy).

Not included in the cost are:
(1) The additional material costs for the non-iron and steel internal workings of the hydrant (e.g. stem, coupling, valve, seals, etc.); and
(2) The cost to assemble the internal workings into the hydrant body.

"Produced in the United States" means that the production in the United States of the iron or steel products used in the project requires that all manufacturing processes must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives.

"Project" is the total undertaking to be accomplished for the applicant by consulting engineers, general contractors, and others, including the planning, study, design, construction, testing, commissioning, and start-up, and of which the work to be performed under the contract is a part. A project includes all activity that an applicant is undertaking to be financed in whole or part by programs subject to AIS requirements. The intentional splitting of projects into separate and smaller contracts or obligations to avoid AIS requirements is prohibited.

"Reinforced Precast Concrete" may not consist of at least 50 percent iron or steel, but the reinforcing bar and wire must be produced in the United States and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the United States. The cement and other raw materials used in concrete production are not required to be of domestic origin. If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered to be a construction material and must be produced in the United States.

"Steel" means an alloy that includes at least 50 percent iron, between 0.02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel, and other specialty steels.

"Structural steel" is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees, and zees. Other shapes include but are not limited to, H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

"Ultimate recipient" is a loan or grant recipient receiving funds from a pass-through entity. Examples include: (1) a loan recipient from the Revolving Loan Fund; (2) a loan recipient from the Household Water Well Program; and (3) a grant recipient from ANTHC or the State of Alaska from the RAVG Program.

"United States" means each of the several states, the District of Columbia, and each Federally Recognized Indian Tribe.

c Purchase Agreements

Add award language from Section 17 a not including 17 a (1).

17 PROVISIONS OF LETTERS OF CONDITIONS, LOAN RESOLUTIONS, GRANT AGREEMENTS, AND CONDITIONAL COMMITMENTS

a Standard Award Language for WWD, ECWAG, Guaranteed Loan Program, 306C, RAVG Administered by USDA, and REAP

Add the following language:
"Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies a new American Iron and Steel (AIS) requirement to obligations made after May 5th, 2017:

(1) No Federal funds made available for this fiscal year for the rural water, waste water, waste disposal, and solid waste management programs authorized by the Consolidated Farm and Rural Development Act (7 U.S.C. 1926 et seq.) shall be used for a project for the construction, alteration, maintenance, or repair of a public water or wastewater system unless all of the iron and steel products used in the project are produced in the United States.

(2) The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(3) The requirement shall not apply in any case or category of cases in which the Secretary of Agriculture (in this section referred to as the "Secretary") or the designee of the Secretary finds that—
(a) applying the requirement would be inconsistent with the public interest;
(b) iron and steel products are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or
(c) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent."

(1) Additional Language (*not to be included in purchase agreements*)

Add: "Owners are ultimately responsible for compliance with AIS requirements and will be responsible for the following:

(a) ***Signing*** loan resolutions, grant agreements and letters of intent to meet conditions which include AIS language, accepting AIS requirements in those documents and in the letter of conditions.
(b) ***Signing*** change orders (i.e. C-941 of EJCDC) and partial payment estimates (i.e. C-620 of EJCDC) and thereby ***acknowledging*** responsibility for compliance with American and Iron Steel requirements.
(c) ***Obtaining*** the certification letters from the consulting engineer upon substantial completion of the project and ***maintaining*** this documentation for the life of the loan.
(d) Where the owner provides their own engineering and/or construction services, ***providing*** copies of engineers', contractors', and manufacturers' certification letters (*as applicable*) to the Agency to insert into the Agency file. All certification letters must be kept in the engineer's project file and on site during construction. For Owner Construction (Force Account), all clauses from Section 17 must be included in the Agreement for Engineering Services.
(e) Where the owner directly procures AIS products, ***including*** AIS clauses in the procurement contracts and ***obtaining*** manufacturers' certification letters and ***providing*** copies to consulting engineers and contractors.

b Standard Award Language for Revolving Loan Funds, RAVG Administered by ANTHC or the State of Alaska, Guaranteed Loan Program and Household Water Well Program

Add the following language to award agreements to ultimate recipients:
"Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies a new American Iron and Steel requirement to obligations made after May 5th, 2017:

(1) No Federal funds made available for this fiscal year for the rural water, waste water, waste disposal, and solid waste management programs authorized by the Consolidated Farm and Rural Development Act (7 U.S.C. 1926 et seq.) shall be used for a project for the construction, alteration, maintenance, or repair of a public water or wastewater system unless all of the iron and steel products used in the project are produced in the United States.

(2) The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(3) The requirement shall not apply in any case or category of cases in which the Secretary of Agriculture (in this section referred to as the "Secretary") or the designee of the Secretary finds that**—**
(a) applying the requirement would be inconsistent with the public interest;
(b)iron and steel products are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or
(c) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent."

18 PURCHASE OF EQUIPMENT AND MATERIALS

Irrespective of who purchases AIS products, owner, contractor or other parties must ensure that the products were produced in the United States as defined in this Bulletin. It is the manufacturers' responsibility to provide manufacturers' certification letters to ensure compliance with AIS requirements. The AIS requirements supersede any regulation on full and open competition stated in 7 CFR 1780.70(b) and (d) and 2 CFR Part 200.319. For example, if an iron and steel product that is compliant with AIS is made by only one manufacturer, sole source procurement of said product may be used.

19 WAIVER PROCESS

a General

Each entity that receives financial assistance for the construction, alteration, maintenance, or repair of water and waste infrastructure from programs mandated to comply with the statute, must use iron and steel products produced in the United States. A waiver is a legal document granting a project an exception to AIS requirements, to use iron and steel products of non-domestic origin specified in the waiver(s). More than one waiver could be applied to a project.

Any funding recipient including the ultimate recipients subject to AIS requirements are eligible to apply for waivers as outlined in the statute which states:

"A waiver may be granted by the Secretary of Agriculture or designee, if one or more of the following conditions are met:

1. Applying the American Iron and Steel requirements of the Act would be inconsistent with the public interest;
2. Iron and steel products are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or
3. Inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent."

Until a waiver is granted by USDA, the AIS requirement stands except with respect to municipalities covered by international agreements (see Section 22).

One public interest waiver has been granted by the Secretary of Agriculture or designee that addresses: (1) de minimis items and (2) minor components. This waiver is national in scope and applies to all projects. The term de minimis applies to products when they occur as de minimis incidental components and is intended for assistance recipients to use for their projects. The term minor components applies to minor components *within* an iron and/or steel product and is intended for manufacturers to certify that their products comply with the AIS requirements. For definitions of de minimis and minor components see Definitions.

b Application

To request a project specific waiver, proper and sufficient documentation must be provided by the assistance recipient (see Exhibit H).

To apply for a waiver under *condition one* (*public interest*), applicants and their consulting engineers must demonstrate definitive impacts on the community if a specified product is not utilized. Information must be submitted to the National

Office (via EESEngineering@wdc.usda.gov), copy the RD State Engineer and approved by the Administrator of RUS. Public interest waivers national in scope will be identified and approved by the Administrator of RUS.

To apply for a waiver under *condition two* (*quantity or quality*), applicants and their consulting engineers must submit the information outlined in Exhibit I to the National Office (via EESEngineering@wdc.usda.gov).

To apply for a waiver under *condition three* (*25 percent of project cost*), applicants and their consulting engineers must submit the information in Exhibit I and J to the National Office (via EESEngineering@wdc.usda.gov).

All waiver applications must be submitted to National Office. If a RD State Office receives any waiver requests, the request must be submitted to National Office for approval.

c Timing

Waivers should be submitted prior to and no later than with the submission of final plans, specifications, and bidding documents for any iron and steel products of known foreign origin. All waivers requests must be approved by the Agency prior to authorization to advertise for bids. In the event that a waiver is requested post award, it must be approved by the Agency prior to construction. In the event that a waiver is requested during construction such as via a change order, it must be approved by the Agency prior to installation.

d Evaluation by USDA

After receiving an application for a waiver of the AIS requirements, USDA National Office will publish the request on its website for 15 days and receive informal comment. National Office will evaluate whether the application adequately documents the statutory basis cited for the waiver. The Secretary or designee will determine whether or not to grant the waiver. Approved and disapproved waivers will be posted on the USDA AIS website.

For project specific waivers where EPA and USDA are co-funding and the applicant has already submitted a request to and received an approved waiver from EPA, USDA will review said waiver for the co-funded project. Applicants/owners or their representatives are required to submit the *approved* waiver to EESEngineering@wdc.usda.gov for USDA RD review and concurrence.

All approved waivers must be included in the bidding documents, any bid addenda, change orders, and partial estimates. All information presented in waiver requests are subject to verification. Waiver requests deliberately containing false information will be rejected.

20 MONITORING

In order to comply with the Executive Order 13788 “Buy American, Hire American”, dated April 18, 2017, and AIS requirements, monitoring activities will be completed by the State Office and/or the National Office.

21 NON-COMPLIANCE

No Federal funds made available for the rural water, waste water, waste disposal, and solid waste management programs authorized by sections 306, 306A, 306C, 306D, 306E, and 310B of the Consolidated Farm and Rural Development Act (7 U.S.C. 1926 et seq.) shall be used for a project for the construction, alteration, maintenance, or repair of a public utility system unless all of the iron and steel products used in the project are produced in the United States.

Noncompliance occurs when funds are used from these programs for construction, alteration, maintenance, or repair using non-domestic iron or steel products and the product is not covered by either a project-specific or a national waiver. Loan and grant recipients should avoid noncompliance at all times as it is a violation of a Federal statute.

<u>Process for Noncompliance</u>
(1) Identify the noncompliant product.
(2) The loan or grant recipient or pass through entity notifies appropriate USDA RD State or National Office contact.
(3) If USDA RD State Office is notified, the Program Director will notify the National Office, Director of EES.
(4) USDA will apply remedies for noncompliance as per 2 CFR 200 §§338 – 342.

22 INTERNATIONAL AGREEMENTS

The AIS requirements apply in a manner consistent with United States obligations under international agreements. In the few cases where such an agreement exists between a loan and/or grant recipient and an international entity, that recipient is under the obligation to determine the applicability of the AIS requirements and document the actions taken to comply with these requirements.

23 USE OF EXHIBITS

The following explains the purpose of each Exhibit to this Bulletin:

a AMERICAN IRON & STEEL COMPLIANCE STATEMENT: Exhibit A consists of a statement to be read by the Rural Development representative during the preconstruction conference. In addition, the RD representative should read Sections 5, 6, and 7 of this Bulletin to remind the owner, consulting engineer, and general contractor of their roles and responsibilities to comply with AIS.

b ENGINEER’S CERTIFICATION OF COMPLIANCE: Exhibit B consists of a letter to be completed and signed by the consulting engineer certifying that he/she will ensure that plans, specifications, and bidding documents and associated bid addenda, executed contracts and change orders for this project will comply with the AIS requirements. This certification letter is to be submitted to the Agency for approval prior to approval of the Advertisement for Bids and must be kept in the engineers project file and on-site during construction.

c GENERAL (PRIME) CONTRACTOR'S CERTIFICATION OF COMPLIANCE: Exhibit C consists of a letter to be completed and signed by the general contractor certifying that he/she will ensure that all iron and steel products installed for this project by their company and by any and all subcontractors and manufacturers their company has contracted with comply with the AIS requirements. This certification letter is to be submitted upon substantial completion of the project to the project engineer.

d EXAMPLE OF A MANUFACTURER'S CERTIFICATION LETTER OF COMPLIANCE: Exhibit D is an example of a letter to be completed and signed by the manufacturer certifying that he/she will ensure that all iron and steel products and/or materials shipped or provided for the subject project are in full compliance with the American Iron and Steel requirement. This includes listing each individual item/product/material provided to the project and providing the location of this/these item(s) being manufactured including assembly. All manufacturers' certification letters must be kept in the engineer's project file and on site during construction.

e EXAMPLES OF MUNICIPAL CASTINGS: Exhibit E provides a sample list of iron and steel products that are subject to the AIS requirements. This list is not exhaustive and is meant to provide examples.

f EXAMPLES OF CONSTRUCTION MATERIALS: Exhibit F provides a sample list of construction materials that are subject to the AIS requirements. This list is not exhaustive and is meant to provide examples.

g EXAMPLES OF NON-CONSTRUCTION MATERIALS: Exhibit G provides a sample list of items that are not subject to the AIS requirements. This list is not exhaustive and is meant to provide examples.

h INFORMATIONAL CHECKLIST FOR PROJECT SPECIFIC WAIVER REQUEST: Exhibit I is a checklist that is to be completed by the applicant and/or consulting engineer to help ensure that all appropriate and necessary information is submitted with the request to USDA. This checklist should not be used for a public interest waiver, is for informational purposes only and does not need to be included as part of a waiver application. Project specific waivers may be requested if one or more of the following conditions applies: (1) The iron and/or steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; (2) The inclusion of iron and/or steel products produced in the United States will increase the cost of the overall project by more than 25 percent. All approved waivers must be included in the bidding documents, any bid addenda, change orders, and partial estimates.

All information presented in waiver requests are subject to evaluation. Waiver requests deliberately containing false information will be rejected.

i EXAMPLE COST TABLE FOR A PROJECT COST WAIVER: This exhibit is an example of a table that must be included with any cost based project waiver request. Information included in the table: product reference in the specification, brief description of the product, quantity, unit, unit price and two costs of the item: (1) cost of an AIS compliant product and (2) cost of a non-domestic product. The total cost for all items will be part of the evaluation for the project cost waiver. Note: Information in this table is subject to evaluation. Waiver requests deliberately containing false information in order to receive a project cost waiver will be rejected.

j CHECKLIST FOR STATE ENGINEERS: This exhibit is a checklist that should be completed by the RD State Engineer for each project during active construction. It is important to note items being stored on-site for installation are compliant with AIS. Please ask the Resident Project Representative (RPR) if it is unclear whether or not the items in question are compliant with AIS (e.g. via manufacturer's certification letters). For checklists, RD field staff should take pictures of visible items subject to AIS. Pictures should include the manufacturer's label. If there is no label, please ask to be shown the manufacturer's certification for the item in question from the RPR or consulting engineer if on-site to verify that the items in question are compliant. These checklists and attached pictures are to be submitted to National Office upon final payment.

AMERICAN IRON & STEEL COMPLIANCE STATEMENT

“Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project.

All parties are required to comply with these requirements and to ensure that all iron and steel products used in this project must be produced in the United States. The term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.”

ENGINEER'S CERTIFICATION OF COMPLIANCE WITH PROVISIONS OF THE AMERICAN IRON AND STEEL REQUIREMENTS OF SECTION 746 OF TITLE VII OF THE CONSOLIDATED APPROPRIATIONS ACT OF 2017 (DIVISION A - AGRICULTURE, RURAL DEVELOPMENT, FOOD AND DRUG ADMINISTRATION, AND RELATED AGENCIES APPROPRIATIONS ACT, 2017) AND SUBSEQUENT STATUTES MANDATING DOMESTIC PREFERENCE

DATE:

RE: PROJECT NAME
APPLICANT
CONTRACT NUMBER

I hereby certify that to the best of my knowledge and belief all iron and steel products referenced in the Plans, Specifications, and Bidding Documents for this project comply with Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference or are the subject of a waiver approved by the Secretary of Agriculture or designee. This certification is not intended to be a warranty in any way, but rather the designer's professional opinion that to the best of their knowledge the documents comply.

I hereby commit that to the best of my ability all iron and steel products that will be referenced in the Bid Addenda, Executed Contracts, and Change Orders will comply with Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference or will be the subject of a waiver approved by the Secretary of Agriculture or designee.

____
Name of Engineering Firm (PRINT)

____
By Authorized Representative (SIGNATURE)

____
Title

This letter is to be submitted prior to Agency authorization of Advertisement for Bids.

GENERAL (PRIME) CONTRACTOR'S CERTIFICATION OF COMPLIANCE WITH PROVISIONS OF THE AMERICAN IRON AND STEEL REQUIREMENTS OF SECTION 746 OF TITLE VII OF THE CONSOLIDATED APPROPRIATIONS ACT OF 2017 (DIVISION A - AGRICULTURE, RURAL DEVELOPMENT, FOOD AND DRUG ADMINISTRATION, AND RELATED AGENCIES APPROPRIATIONS ACT, 2017) AND SUBSEQUENT STATUTES MANDATING DOMESTIC PREFERENCE

DATE:

RE: PROJECT NAME
APPLICANT
CONTRACT NUMBER

I hereby certify that to the best of my knowledge and belief all iron and steel products installed for this project by my company and by any and all subcontractors and manufacturers my company has contracted with for this project comply with Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference or are the subject of a waiver approved by the Secretary of Agriculture or designee.

This certification is to be submitted upon completion of the project to the project engineer.

____
Name of Construction Company (PRINT)

____
By Authorized Representative (SIGNATURE)

____
Title

EXAMPLE OF A MANUFACTURER'S CERTIFICATION LETTER OF COMPLIANCE WITH PROVISIONS OF THE AMERICAN IRON AND STEEL (AIS) REQUIREMENTS OF SECTION 746 OF TITLE VII OF THE CONSOLIDATED APPROPRIATIONS ACT OF 2017 (DIVISION A - AGRICULTURE, RURAL DEVELOPMENT, FOOD AND DRUG ADMINISTRATION, AND RELATED AGENCIES APPROPRIATIONS ACT, 2017) AND SUBSEQUENT STATUTES MANDATING DOMESTIC PREFERENCE

Date:

Company Name:

Company Address:

Subject: AIS Step Certification for Project (X), Owner's Name, and Contract Number

I, (company representative), certify that the (melting, bending, galvanizing, cutting, etc.) processes for (manufacturing or fabricating) the following products and/or material shipped or provided for the subject project is in full compliance with the AIS requirement as mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference.

Item, Products and/or Materials, and location of delivery (City, State):

1.
2.

Such processes for AIS took place at the following location:

____
(City, State)

This certification is to be submitted upon request to interested parties (e.g. municipalities, consulting engineers, general contractors, etc.)

If any of the above compliance statements change while providing materials to this project, please immediately notify the person(s) who is requesting to use your product(s).

____
Authorized Company Representative Signature
(Note: *Authorized signature shall be manufacturer's representative not the material distributor or supplier*)

EXAMPLES OF MUNICIPAL CASTINGS (*includes but not limited to*):

Access Hatches;
Ballast Screen;
Benches (Iron or Steel);
Bollards;
Cast Bases;
Cast Iron Hinged Hatches, Square and Rectangular;
Cast Iron Riser Rings;
Catch Basin Inlet;
Cleanout/Monument Boxes;
Construction Covers and Frames;
Curb and Corner Guards;
Curb Openings;
Detectable Warning Plates;
Downspout Shoes (Boot, Inlet);
Drainage Grates, Frames and Curb Inlets;
Inlets;
Junction Boxes;
Lampposts;
Manhole Covers, Rings and Frames, Risers;
Meter Boxes;
Service Boxes;
Steel Hinged Hatches, Square and Rectangular;
Steel Riser Rings;
Trash receptacles;
Tree Grates;
Tree Guards;
Trench Grates; and
Valve Boxes, Covers and Risers.

EXAMPLES OF CONSTRUCTION MATERIALS (*includes but not limited to*):

Wire rod, bar, angles
Concrete reinforcing bar, wire, wire cloth
Wire rope and cables
Tubing
Framing
Joists
Trusses
Fasteners (i.e., nuts and bolts)
Welding rods
Decking
Grating
Railings
Stairs
Access ramps
Fire escapes
Ladders
Wall panels
Dome structures
Roofing
Ductwork
Surface drains
Cable hanging systems
Manhole steps
Fencing and fence tubing
Guardrails
Doors
Stationary screens

EXAMPLES OF NON-CONSTRUCTION MATERIALS – (*includes but not limited to*):
(NOTE: *includes appurtenances necessary for their intended use and operation and are not subject to AIS*)

Pumps
Motors
Gear reducers
Drives (including variable frequency drives (VFDs)
Electric/pneumatic/manual accessories used to operate valves (such as electric valve actuators)
Mixers
Gates (e.g. sluice and slide gates)
Motorized screens (such as traveling screens)
Blowers/aeration equipment
Compressors
Meters (flow and water meters)
Sensors
Controls and switches
Supervisory control Data acquisition (SCADA)
Membrane bioreactor systems
Membrane filtration systems (includes RO package plants)
Filters
Clarifier arms and clarifier mechanisms
Rakes
Grinders
Disinfection systems
Presses (including belt presses)
Conveyors
Cranes
HVAC (excluding ductwork
Water heaters
Heat exchangers
Generators
Cabinetry and housings (such as electrical boxes/enclosures)
Lighting fixtures
Electrical conduit
Emergency life systems
Metal office furniture
Shelving
Laboratory equipment
Analytical instrumentation
Dewatering equipment.

INFORMATIONAL CHECKLIST FOR PROJECT SPECIFIC WAIVER REQUEST

Please reference the specifications of the product.

Information	☐	**Note**
General • Waiver request includes the following information: – Description of the foreign and domestic construction materials – Unit of measure – Quantity – Price – Date that product is needed (e.g. time of delivery or availability) – Location of the construction project – Name and address of the proposed supplier – A detailed justification for the use of foreign construction materials • Waiver request was submitted according to the instructions in the memorandum • Assistance recipient made a good faith effort to solicit bids for domestic iron and steel products, as demonstrated by language in requests for proposals, contracts, and communications with the prime		
Cost Waiver Requests • Waiver request includes the following information: – Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products (Exhibit J) – Relevant excerpts from the bid documents used by the contractors to complete the comparison – Supporting documentation indicating that the contractor made a reasonable survey of the market, such as a description of the process for identifying suppliers and a list of contacted suppliers		
Availability Waiver Requests • Waiver request includes the following supporting documentation necessary to demonstrate the availability, quantity, and/or quality of the materials for which the waiver is requested: – Supplier information or pricing information from a reasonable number of domestic suppliers indicating availability/delivery date for construction materials – Documentation of the assistance recipient's efforts to find available domestic sources, such as a description of the process for identifying suppliers and a list of contacted suppliers. – Date that product is needed (e.g. time of delivery or availability) to provide justification – Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of construction materials • Waiver request includes a statement from the prime contractor and/or supplier confirming the non-availability of the domestic construction materials for which the waiver is sought • Has the State received other waiver requests for the materials described in this waiver request, for comparable projects?		

EXAMPLE COST TABLE FOR A PROJECT COST WAIVER

AIS/Non-AIS Cost Comparison Table						
Specification	**Item or Description**	**Quantity**	**Unit**	**Unit Price**	**Cost if applying AIS**	**Cost if a waiver to AIS is applied**
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
TOTAL COST:					**$0.00**	**$0.00**

CHECKLIST FOR STATE ENGINEERS

Date____________________ Project Name____
Project Type:__Water__Wastewater__Stormwater__Solid Waste
Applicant/Owner Name:
Project % Completion (*estimated*):
Total Project Cost: Estimated Materials Cost:

Items	Stored	OR	Installed?	US Made (Y/N)/Manufacturer Name
Ductile Iron Pipe	☐		☐	__________
Reinforced Conc. Pipe	☐		☐	__________
Other Steel Pipe	☐		☐	__________
Fittings	☐		☐	__________
Valve Boxes	☐		☐	__________
Hydrants	☐		☐	__________
Valves	☐		☐	__________
Fittings/Bends/etc.	☐		☐	__________
Manholes	☐		☐	__________
Manhole Frames/Covers	☐		☐	__________
Other Municipal Castings	☐		☐	__________
Detection Plates	☐		☐	__________
Grates	☐		☐	__________
Manholes/Precast Conc.	☐		☐	__________
Steel Roofing Materials	☐		☐	__________
Steel Doors & Frames	☐		☐	__________
Steel Tanks/Pressure Vessels	☐		☐	__________
Reinforcing Bar/Wire	☐		☐	__________
Steel Stairs/Catwalks/Railings	☐		☐	__________
Unknown Iron/Steel Item	☐		☐	__________

Deminimis Waiver
General contractor maintains an itemized list of incidental components and the cost is less than 5% of total materials cost for project. YES ☐ NO ☐

Minor Components Waiver
General contractor maintains a list of products to which the minor components waiver applies and the cost of the non-domestically produced component is less than 5% of total materials cost of that product. YES ☐ NO ☐

Project Specific Waiver
Is there an approved waiver for this project? Is so, please list. YES ☐ NO ☐
Inconsistent with public interest YES ☐ NO ☐
Not produced in U.S. in sufficient and reasonable available quantities or of a satisfactory quality. YES ☐ NO ☐
Cost of the overall project increased by more than 25%. YES ☐ NO ☐

<u>Miscellaneous</u>

Is there a project file that includes all manufacturers' certifications on site? If yes, please review the project file for compliance. YES ☐ NO ☐

This inspection form was prepared by:

____

(Print and sign name)

Consulting Engineer/RPR present (If yes, print name):

General Contractor present (If yes, print name):

Owner/Applicant present (If yes, print name):

Others (If yes, print name):

CITY AND BOROUGH OF WRANGELL, ALASKA

WATER TREATMENT PLANT UPGRADES PROJECT

PRELIMINARY ENGINEERING REPORT

March 2017

USDA

Prepared for: USDA Rural Development
800 West Evergreen, Suite 201
Palmer, Alaska 99645-6539

CRW ENGINEERING GROUP, LLC

Prepared by: CRW Engineering Group, LLC
3940 Arctic Blvd. Suite 300 Anchorage, AK 99503

In cooperation with:
The City and Borough of Wrangell

City and Borough of Wrangell

Preliminary Engineering Report

Water Treatment Plant Upgrades

March 2017

The technical material and data contained in this report were prepared under the supervision and direction of the undersigned whose seal as a Professional Engineer is affixed below.

STATE OF ALASKA

49 TH

Jon H. Hermon

EV-14139

3/29/17

REGISTERED PROFESSIONAL ENGINEER

Table of Contents

List of Tables

List of Photos

List of Figures

List of Appendices

Acronyms and Abbreviations

%	percentage
˚F	degree Fahrenheit
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ADD	average daily demand
AOC	"assimilable" organic carbon
APDES	Alaska Pollutant Discharge Elimination System
ATV	all-terrain vehicle
BDOC	"biodegradable" DOC
$CaCO_3$	calcium carbonate
CBW	City and Borough of Wrangell
CRW	CRW Engineering Group, LLC
DAF	Dissolved Air Flotation
DBPs	disinfection byproducts
DOC	Dissolved Organic Carbon
EPA	Environmental Protection Agency
ft	feet
FY	fiscal year
GAC	granular activated carbon
gpcd	gallons per capita per day
gpm	gallons per minute
gpm/sf	gallons per minute per square foot
HAA_5	five Haloacetic Acids
HDPE	high density polyethylene
kW	kilowatt
MCL	maximum contaminant level
MDD	max daily demand
mgd	million gallons per day
mg/L	milligrams per liter
NPV	net present value
NTU	nephelometric turbidity units
O&M	operation and maintenance
PER	Preliminary Engineering Report
psig	pounds per square inch gauge
SUVA	Specific UVA
SWTR	Surface Water Treatment Rule
TOC	Total Organic Carbon
TTHM	Total Trihalomethanes
USACE	U.S. Army Corps of Engineers
USDA-RD	U.S. Department of Agriculture, Rural Development
USPW	uniform series present worth factor
UVA_{254}	Ultraviolet absorbance at 254 nm
WST	water storage tank
WTP	water treatment plant
WWTP	waste water treatment plant

1 Introduction

The City and Borough of Wrangell (CBW), in cooperation the U.S. Department of Agriculture, Rural Development (USDA-RD) has retained CRW Engineering Group, LLC (CRW) to provide engineering services related to improving the community's water treatment plant (WTP). The CBW currently operates a Community Public Water System (PWSID # AK2120143) using a surface water source under the requirements of the U.S. Environmental Protection Agency (EPA) surface water treatment rules.

This Preliminary Engineering Report (PER) has been written in accordance with the USDA-RD's Bulletin for water and sewer facilities and evaluates project need, existing conditions, and reasonable alternatives.

2 Project Planning

2.1 Location

Wrangell is located on the northwest side of Wrangell Island, south of Juneau and northwest of Ketchikan (Figure 1). The community is located near the mouth of the Stikine River, which historically was a trade route to the Canadian interior. Access to the community is by air or water. A state-owned, paved, lighted runway allows for jet service. There are three harbors for recreational and commercial vessels with a deep draft dock, state ferry terminal, and three boat launches.

2.2 Environmental Resources Present

2.2.1 History and Culture Summary

Wrangell is one of the oldest non-Native settlements in Alaska. In 1811, the Russians began fur trading with area Tlingits and built a stockade named Redoubt St. Dionysius in 1834. In the late 1800s, the community served as an outpost for gold prospectors. The City was incorporated in 1903. In the early 1900s, fishing and forest products were the primary industries. Recently, tourism and growth in the seafood processing and marine services industries have become important economic activities. On May 30, 2008, the City was dissolved and reincorporated as the CBW.[1]

2.2.2 Climate and Weather

The community is within the southeast maritime climate zone, which is characterized by cool summers, mild winters, and heavy rain throughout the year. Fog is common from September through December. The average annual temperature is 49 degrees Fahrenheit (^{o}F). Temperature, precipitation, and snowfall data is presented in Table 1.

Table 1 – Climate Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	33.9	37.7	42	49.1	56.3	61.7	64	63.5	57.7	49.4	41.1	36.4	49.4
Average Min. Temperature (F)	24.7	27.7	30.8	35.3	41.1	46.5	49.8	49.7	45.9	39.2	32.1	27.6	37.5
Average Total Precipitation (in.)	6.71	5.72	5.49	4.65	4.21	3.93	4.88	5.98	9.62	13.32	9.08	7.92	81.51
Average Total Snow Fall (in.)	18.4	12.4	7.9	0.8	0	0	0	0	0	0.1	5.8	12.6	58
Average Snow Depth (in.)	4	5	1	0	0	0	0	0	0	0	1	3	1

Source: Western Regional Climate Center, Period of Record: 11/01/1917 to 02/19/2013
Key: in. = inches

[1] Alaska Department of Commerce, Community, and Economic Development (DCCED). 2016. Community Database Online. Division of Community and Regional Affairs, State of Alaska.

2.2.3 Topography

Wrangell Island lies in the foothills of the Coastal Range. Topography is dominated by blocks of mountains separated by valleys and straits.

2.2.4 Geology and Soil Conditions

The bedrock on Wrangell Island is characterized by sedimentary (marine greywacke, mudstone, and limestone), andesitic to volcanic rocks, and intrusive rocks (plutons, batholiths of granodiorite, tonalite, and subordinate quartz diorite). Inland areas may be covered with surficial deposits up to 30 feet deep. The primary surficial materials are beach, alluvial, and glacial deposits.[2]

2.2.5 Flood, Erosion, and Seismic Hazards

The community does not have a history of waterfront flooding. A storm on October 26, 1978, caused some waterfront damage due to a combination of high winds and tide cycle. Riprapping of exposed land formations has provided flood protection along Zimovia Strait and the Eastern Passage.

Wrangell Island lies within the circum-Pacific seismic belt. The Chatham Strait Fault, Fairweather Fault, and numerous smaller faults traverse the area.

2.2.6 Vegetation and Wetlands

The predominant vegetation on Wrangell Island is coastal western hemlock-Sitka spruce forest. Sitka spruce, western hemlock, and Alaska yellow cedar characterize the overstory; blueberry, five-leaved bramble, single delight, skunk cabbage, and mosses comprise the understory. Sub-tidal wetlands exist throughout the island, comprised of silverweed, hair grass, yarrow, buttercup, and sedges. Above 2,000 feet, alpine vegetation consists of mountain hemlock, deer cabbage, heather, lichen, berries, and willow.

2.2.7 Surface Hydrology

Wrangell Island is characterized by small, steep, coastal watersheds. Two earthfill dams and reservoirs on Mill Creek provide the water supply for the CBW. The Stikine River delta is located north of Wrangell island. The drainage area for the Stikine River is approximately 20,000 square miles (mi^2) and the average flow during the summer is about 116,000 cubic feet per second (cfs).

2.2.8 Historic Sites

St. Philip's Episcopal Church (AHRS Site No. PET-315), built in 1903 and located at 446 Church Street, is on the National Registrar of Historical Sites.

2.3 Population Trends

According to the U.S. Census Bureau, the estimated population of CBW for year 2014 is 2,364. From 2000 to 2014, the population increased by a total of 2.6%, an average of 0.3% per year. To accommodate the possibility of future growth, an annual population increase of 0.8% is assumed for the next 20 years [3]. Using this growth rate, the future population of CBW would be 2772.

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[2] U.S. Geological Survey (USGS). 1995. Overview of Environmental and Hydrogeological Conditions of Wrangell, Alaska.

[3] This growth rate is the same forecasted as an average rate for the State of Alaska for the same timeframe. The 20-year period is assumed to begin in 2017, which, for the purposes of this report, is the assumed year that water treatment improvements would be ready for CBW use.

2.4 Community Engagement

The following community meetings were held by CBW regarding the WTP upgrades:

- *February 18, 2016* – Borough Assembly Meeting to review evaluation methods for improving the treatment process used at the CBW WTP. Described CRW's desktop assessment and the five alternates analyzed for pilot study, as well as each alternative's estimated capital and operating costs. Received the Assembly's concurrence with the recommended testing alternative, the Dissolved Air Flotation (DAF) system.
- *July 19, 2016* – Town Hall Meeting with the Borough Assembly to discuss the treated water shortage crisis, due to the WTP's inability to treat water fast enough to keep up with the water demand. Community members and business owners, including both seafood processors, were present. The Borough Assembly issued a declaration of local disaster and emergency, and water conservation measures were established, seafood processors discussed ways in which they could modify their potable water usage, and ideas for short-term WTP improvements were reviewed.
- *July 26, 2016* – Borough Assembly meeting in which the WTP's capacity was on the Borough Assembly's agenda. Public Work Director and Borough Manager provided an update regarding completing the pilot study and aggressively pursuing recommendations from the pilot testing project.

3 Existing Sanitation Facilities

3.1 History and Condition of Existing Facilities

Principal components of the existing facility and water treatment process are described in the following subsections and shown on Figure 2. A diagram of the existing water treatment process is shown on Figure 3.

3.1.1 Water Source

CBW's surface water source is comprised of two mountain lakes—an upper and a lower reservoir. These lakes are located east of and above the WTP, the lower reservoir being about a quarter mile away, via gravel road (Figure 2). The original wooden crib structures for the reservoir dams were constructed in 1900 for the lower dam and 1935 for the upper dam. The crib structures leaked badly and, as a result, earthen fill was placed over the crib structures in 1958. Additional improvements were later made to the dams in 1965. According to CBW, the upper reservoir has a storage volume of approximately 45,300,000 gallons. The lower reservoir has about 21,400,000 gallons of storage capacity.

Photo 1 Water Source

The upper reservoir is located about a half mile from the lower reservoir, and is fed by a forested watershed formed by an elevated valley between two mountain peaks. The upper reservoir is dammed and, through a submerged intake, flows into a small creek that feeds the lower reservoir. The spillway of the upper reservoir is elevated about 64 vertical feet above the lower reservoir spillway, which in turn is located about 34 feet above the control building floor elevation. The lower reservoir is also dammed, and features a submerged intake pipe that gravity-feeds raw water to the WTP via a 1,500 linear foot (LF), 12-inch diameter ductile iron and high density polyethylene (HDPE) pipeline. At the peak design flow of 900 gallons per minute (gpm), and accounting for friction losses in the pipeline, the pressure at the influent flow meter in the Control Building is calculated to be about 11 pounds per square inch gage (psig)[4]. The influent pipeline is valved so that the WTP could be entirely bypassed.

According to CBW staff, the reservoirs have thus far continuously supplied water to the community with no drought-related interruptions. Water levels fall during dry periods, which expose the reservoir's shoreline to increased erosion when rainfall resumes. This condition tends to increase turbidity levels in the raw water entering the WTP. Water levels tend to rise to spillway levels within a few days of when rainy weather returns. Two valves at the upper reservoir discharge pipe can increase the flow to the lower reservoir if the level of the lower reservoir falls below the spillway elevation during periods of high water usage.

The CBW reportedly has a watershed management plan. The CBW has not observed any algal growth in the reservoirs.

About 10 years ago, a piped bypass was planned for connecting the upper reservoir directly with the WTP for the purposes of improving water supply reliability, and for facilitating maintenance on the lower reservoir. This project was stopped due to wetlands permitting and funding concerns. The current

[4] *CBW WTP Operations and Maintenance Manual,* Wilson Engineering, Sept 1999.

process of filling the lower reservoir through the channel that connects the two reservoirs tends to increase turbidity as water flows to the lower reservoir. The piped connection of the two reservoirs would tend to increase water quality when the water is transferred from the upper reservoir to the lower. CBW currently has funding to complete the project and, pending completion of the design and permitting, anticipates construction to occur in 2018.

3.1.1.1 Raw Water Quality

CBW's raw water has elevated concentrations of organics, turbidity and color, which generally fall within the following ranges:

- Total organic carbon (TOC): 4 to 9 mg/L.
- Turbidity: 0.8 to 5 NTU.
- Color: 28 to 80 Platinum-Cobalt Color (Pt-Co) units.

The raw water also has a slightly elevated iron content, ranging between 0.4 and 1 mg/L. Raw water pH ranges between 5.4 in the colder seasons and 6.9 in the warmer seasons. Alkalinity is very low, generally ranging between 9 and 15 mg/L as $CaCO_3$.

Raw water samples were collected in July 2015 and tested for numerous contaminants. Laboratory testing results for principal contaminants and properties are summarized in Table 2.

Table 2 – July 2015 Raw Water Characteristics

Contaminant or Property	Units	Value	Limit
Turbidity	NTU	nm	1.49
Total Organic Carbon (TOC)	mg/L	5.3 – 6.4	n/a
Dissolved Organic Carbon (DOC)	mg/L	3.9 – 6.1	n/a
True Color	Pt-Co units	60	15
Iron	mg/L	1.0	0.3
Manganese	mg/L	0.1	0.05
pH	--	6.8	6.5 to 8.5
Alkalinity	mg/L as $CaCO_3$	9	n/a
Hardness	mg/L as $CaCO_3$	9	n/a
Total Dissolved Solids (TDS)	mg/L	34	500
Ultraviolet Absorbance (UVA_{254})	cm^{-1}	0.14 – 0.18	n/a
Specific UVA (SUVA)	L/mg-m	2.9 – 3.6	n/a

Key: NTU = nephelometric turbidity units.
Pt-Co = Platinum-Cobalt Color
nm = not measured in laboratory testing
n/a = not applicable
mg/L = milligrams per liter
$CaCO_3$ = calcium carbonate
cm^{-1} = reciprocal centimeters
mg/L-m = milligrams per liter - meter

In general, these water characteristics reflect the following implications:

- With the variants of the Surface Water Treatment Rule (SWTR), consistent turbidity removal and disinfection will be a principal focus of the water treatment process.
- With the Disinfectant/Disinfection Byproduct Rule, organics removal will also be an important emphasis of the treatment process.
- Color, iron, and manganese removal and pH adjustment will be needed to meet Secondary Contaminant objectives and provide acceptable palatability to customers.
- Low pH, hardness, and total dissolved solids indicate a corrosive tendency in the water, which is a concern addressed by the Lead and Copper Rule.
- Low alkalinity indicates a low capacity to accommodate the addition of strong acidic chemicals (like alum or ferric chloride as coagulants), which may significantly change the water chemistry.
- Relatively low ultraviolet absorbance (UVA_{254}),[5] and corresponding specific UVA_{254} (SUVA) values, suggest that the chemistry of organic matter is largely "hydrophilic" and not amenable to removal by typical coagulation/filtration methods.

These parameters are discussed in more detail in Appendix A.

Raw water turbidity, color, temperature, and pH are measured on a daily basis by CBW operating staff. Measurements taken from 2012 to 2015 were summarized into average values and graphed to discern general seasonal trends, which are summarized below. These graphs are provided in Appendix B.

- Turbidity tends to peak in August and September, with a smaller spike in May.
- Color tends to peak in August through November.
- Temperature tends to peak in June through September.
- pH tends to be highest in the summer months and lowest in the winter months.

3.1.2 Water Treatment Plant

The WTP was constructed in 1998 and is comprised of three buildings (Figure 2): the roughing filters building (44 feet (ft) by 44 ft), control building (44 ft by 44 ft), and slow sand filter building (165 ft by 77 ft). The buildings are rigid steel frame, bolted flange, pre-manufactured buildings, with galvanized cold-formed secondary structural members and pre-coated metal roofing. The roughing filter and slow sand filter beds are constructed of 4,000 pounds per square inch (psi) concrete. The process piping is primarily

Photo 2 Water Treatment Plant

[5] See Appendix C for a brief discussion of UVA_{254} and SUVA parameters.

flanged ductile iron, although the header piping for the slow sand filters is polyvinyl chloride (PVC). The building has a 600 amp, 480 volt, 3 phase electrical service.

3.1.2.1 Water Treatment Process

Gravity-fed raw water is received at the control building through a 12-inch influent pipeline comprised of HDPE and ductile iron pipe (Figure 3). CBW measures the flow rate of water as it enters the treatment process using a flow meter. An automated valve controls the influent flow by opening and closing proportionally to the level of treated water in the plant's storage tanks. The flow meter is also used to "flow-pace"[6] the injection of the following chemicals:

- Sodium hydroxide
- Ozone
- Sodium hypochlorite

The raw water is first injected with sodium hydroxide (caustic soda) to raise its pH to levels between 8 and 8.5. The purpose for this step is reportedly to improve the oxidation capabilities of ozone[7] and to reduce the corrosivity of the water. The dosage for this chemical generally ranges around 1 mg/L or less. Originally, the treatment design specified sodium carbonate (soda ash) to be used for this purpose, using a dosage of 8 mg/L, but CBW switched to using sodium hydroxide, probably as a cost savings measure. Sodium hydroxide is a corrosive chemical and, therefore, is hazardous to work with, whereas sodium carbonate is generally not hazardous. However, sodium hydroxide is a stronger basic chemical, and can cause pH changes with smaller dosages relative to sodium carbonate. At the dosages used by CBW, the use of sodium hydroxide does not significantly increase the water's alkalinity.

After the pH adjustment step, the raw water is treated with ozone (O_3) [8]. This is accomplished by flowing the raw water through a subsurface concrete tank having a volume of 9,000 gallons. At dosages of up to 10 mg/L (or 80 lbs/day), a 10% concentration of ozone is injected into the tank through an array of fine-bubble disk diffusers located on the tank floor and, being water-soluble, is taken up in the raw water. At the design peak flow rate of 900 gpm, the tank provides a nominal contact time of 10 minutes. Excess ozone that is off-gassed into the air chamber above the tank water is delivered to aboveground destructors that convert the ozone to oxygen, which is then discharged to the atmosphere.

After ozonation, the chemically-treated water is conveyed to two parallel roughing filters where it is up-flowed through a piped underdrain and coarse granular media to reduce its suspended solids content. At the peak flow rate of 900 gpm, the design loading rate on the roughing filters is 1.15 gpm per square foot area of media. The original design specified two layers of media: 1 millimeter (mm) sand particles overlying 4 mm "pea-gravel" particles. This media was reportedly used for a period of time before it was replaced by larger river gravel, because it reportedly clogged relatively fast and, as a result, could not meet water demands.

Filtered water exits the roughing filters above the media through a header-and-lateral piping system and into a splitter box, which distributes flow to downstream slow-sand filters. The roughing filter design also

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[6] "Flow-pace" means to speed up or slow down the chemical feed pump injection rates in proportion to the flow of the water passing through the pipeline. This is accomplished by electrical signals sent from the flow meter, through a controller to each connected feed pump.

[7] Higher pH levels tend to improve oxidation capabilities of ozone through the generation of hydroxyl ions, while lower dosages tend to improve its disinfection capabilities through the generation of longer lasting ozone molecules. CBW uses ozone primarily as an oxidant in its water treatment process.

[8] Ozone is generated using oxygen that is also generated on-site.

includes a “backwashing” feature. For this purpose, a pipeline connects the water storage tanks (WSTs) to the roughing filter. This connection is configured to allow potable water to be flowed <u>downward</u> through the filters and to a drainage sump that discharges to an exterior ditch.

Rough-filtered water is then conveyed to four 3,040 sf slow sand filters and flowed downward through 3.5 feet of sand media. As the water is flowed through the media, particulates are removed and dissolved solids are biologically treated. Over time after a filter cleaning, a sludge of microbes grows on the media surface (called *“schmutzdecke”*) where most of the biological treatment occurs. As treatment progresses, the filter gradually becomes clogged and the energy needed to drive the water through the media becomes greater. This energy need is exhibited by a growing depth of water that forms over the media surface. When the water depth (called “freeboard depth”) approaches a maximum of 6 feet, the water in that particular filter is drained-to-waste to a level of about 1 foot above the media surface. Using an all-terrain vehicle (ATV) fitted with a disk harrow, CBW staff ploughs the *schmutzdecke* layer, which re-suspends the biomatter in the remaining freeboard water, and which is thereafter flushed out of the system as wastewater.

Water passing through the slow sand filters is collected in a central clearwell. The clearwell functions like a “storage tank” that supplies two booster pumps which lift treated water to two WSTs located above the WTP (Figure 2). The booster pumps are controlled by a sensor that measures the water level in the clearwell and operate in “lead-lag” fashion. When the water level in the clearwell is low, just the lead booster pump will operate. When the clearwell level is high, both pumps will operate in parallel.

Prior to reaching the WSTs, the filtered water is disinfected with sodium hypochlorite (i.e. “chlorine”). Sodium hypochlorite is generated at the WTP using water and salt in an electrolysis process. Using a saturator, CBW consumes an average of 50 lbs of salt per day for generating the sodium hypochlorite solution. Upon injection, the sodium hypochlorite readily inactivates bacteria and viruses, as well as reacts with any remaining “oxidizable” compounds in the filtered water. The disinfection process happens relatively quickly (in a matter of minutes to hours, depending on a number of variables in the water like pH, temperature, and microbial characteristics), but the oxidation process can continue indefinitely, as discussed in Section 3.1.3.

3.1.3 Water Storage and Distribution System

The distribution system is typically considered to include the WSTs and the piping network that extends to points of use for consumers and fire protection. Current water storage volume is approximately 0.85 million gallons, as provided by two aboveground tanks. To accommodate the design maximum daily demand (MDD) of 1.8 million gallons per day (mgd) (see Section 5.1.1.2) the system would need an additional 0.95 million gallons of storage.

The system is pressurized by virtue of the WSTs being located 328 feet above sea level. The available pressure at a particular location depends on the difference in elevation between the tank and the point of use (called “elevation head”), and how much energy loss is caused by pipe friction. CBW intentionally uses pressure-reducing valves to lower the pressure to usable levels in two zones. One (“high”) pressure zone serves the upper elevations encompassing the downtown Wrangell area and allows up to 100 psig pressure. The other (“low”) pressure zone serves the downtown area located next to the harbors with up to 70 psig pressure.

Hydrant testing reports from CBW in 2000 indicate that all but one hydrant in the system produced flow results that would exceed 1,000 gpm at 20 psig residual pressure, with the majority of the hydrants testing above 1,500 gpm at 20 psig. Residentially zoned one and two-family dwellings (Group R-3 and R-4) are typically required to have a minimum flow of 1,000 gpm at 20 psig residual pressure (per Appendix B of the 2015 International Fire Code). A copy of the testing results is provided in Appendix B.

The majority of the water distribution system is comprised of ductile iron pipe. The system has experienced widespread breaks and leaks over the past several years resulting in disruption of service, potential contamination of the water system, and road and property damage. CBW is currently pursuing funding for replacement of the water mains deemed to be in the worst condition.

This PER is focused on the water quality within the distribution system. The quality of this water is primarily affected by the water chemistry leaving the treatment process, the interior conditions of the WSTs and piping network, and the "residence time" of the water in the system. These aspects are discussed in the following section.

3.1.3.1 Distribution System Water Quality

The time that a particular quantity of water stays in the distribution system is called "residence" time, and significantly affects the quality of water used by consumers. The residence time spent in WSTs can be less than a day (when stored water volume is relatively small) to many months (as is the case for "fill and draw" systems [9]). Typically, the longer the residence time, the lower the water quality can become, because the water within the system has a longer time to be affected by on-going chemical reactions that occur in the distribution system.

One major type of chemical reaction that is common to distribution systems is the oxidation process involving chlorine. This oxidation process continues as long as there are two ingredients available in the water: chlorine and oxidizable compounds. This process can last many days and weeks in the distribution system, and causes two conditions of primary concern to water treatment professionals:

- <u>First,</u> oxidation consumes chlorine. As long as chlorine is measurable in the water, it is present to protect public health by being available to inactivate pathogens. When it is not present, chlorine needs to be added so that it can continue providing disinfection—otherwise the desired protection is not available. This concern is addressed by the Total Coliform Rule and the disinfection requirements of the Surface Water Treatment Rule [10].
- <u>Second,</u> the oxidation process can create disinfection byproducts (DBPs), many of which are identified as potentially carcinogenic (cancer-causing) substances. The generation of DBPs will generally occur as long as the disinfectant and organic precursors are present. The more precursors that can be removed from the water by the treatment process, the less the potential will be for generating DBPs. This concern is addressed by the Disinfectant/Disinfection By-Product Rule [8].

A second type of chemical reaction of particular importance is the corrosive action of low pH or otherwise aggressive water on interior piping materials. When in contact with lead or copper-containing materials, corrosive water can leach these substances into suspension and increase their concentrations in the drinking water used by consumers. This concern is addressed by the Lead and Copper Rule [8]. CBW

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[9] "Fill and draw" systems are those that treat a sufficient quantity of drinking water in the summer season so that it can be stored and used over the course of winter. Relatively large volumes of stored water are needed for this purpose.

[10] See Appendix C for a brief summary of various water treatment regulations that are relevant to this project.

operators report that they generally target a pH range of 7.25 to 7.5 in the distribution system to reduce corrosion.

CBW monitors the water quality in its distribution system according to the schedule summarized in Table 3. This monitoring regimen is imposed by ADEC.

Table 3 – Monitoring Summary for CBW

<table>
<tr><th>Requirement</th><th>Sampling Frequency[1]</th></tr>
<tr><td>Total Coliform</td><td>2 samples every month</td></tr>
<tr><td>Total Trihalomethanes (TTHM)[1]</td><td>1 sample every quarter</td></tr>
<tr><td>Five Haloacetic Acids (HAA_5)[1]</td><td>1 sample every quarter</td></tr>
<tr><td>Lead and Copper</td><td>10 samples every 3 years</td></tr>
<tr><td>Synthetic Organic Chemicals</td><td rowspan="2">1 sample every quarter</td></tr>
<tr><td>Bromate</td></tr>
<tr><td>Nitrate</td><td rowspan="2">1 sample every year</td></tr>
<tr><td>Volatile Organic Chemicals</td></tr>
<tr><td>Arsenic</td><td rowspan="4">1 sample every 9 years</td></tr>
<tr><td>Inorganics</td></tr>
<tr><td>Radium 226 & 228</td></tr>
<tr><td>Total Gross Alpha</td></tr>
</table>

Key: 1 – Sampling dates are: February, May, August, and November.

Generally, CBW's water has complied with its monitoring and drinking water quality requirements, having no violations recorded since 2009. Color is substantially reduced by the ozonation process when a sufficient dosage is applied to the raw water [11]. Turbidity is readily removed in the filtration process, according to CBW's daily measurements, averaging around 0.35 NTU in the finished water according to CBW staff. In 2014 regulatory sampling for lead and copper, CBW had no lead samples exceeding the action level of 0.015 mg/L [12]. Further, no samples exceeded the copper action level of 1.4 mg/L [13].

For DBP sampling over the course of the last two years, three HAA_5 samples exceeded the maximum contaminant level (MCL) of 0.060 mg/L and the locational running average appears to have been exceeded once [14]. All TTHM samples tested below the MCL for this contaminant [15]. In general, HAA_5 levels measure closer to its MCL and in higher concentrations than do TTHMs, despite that the low SUVA measurements of CBW's water indicate a largely "hydrophilic" organic character (which would tend to yield more TTHMs

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[11] Per CBW's operating staff, color removal has not been as effective with one of its two aging ozone generators unable to produce its maximum dosage.

[12] Reference *ADEC Drinking Water Watch* website. One lead sample measured at 0.012 mg/L.

[13] *Ibid.* Three copper samples exceeded 1.0 mg/L.

[14] *Ibid.* These HAA_5 samples measured 79, 116 and 94 µg/L. Two others measured above 50 µg/L.

[15] *Ibid.* Three TTHM samples measured between 40 and 60 µg/L.

[16]). CBW staff has reported that its program for flushing lines in the distribution system has helped meet DBP Rule requirements.

Total organic carbon levels in the distribution system water have been elevated, ranging between 3 and 4 mg/L. Although no MCLs exist for this parameter, elevated organic content is problematic in CBW's system for three primary reasons:

- Increased demand on chlorine.
- Potential for increased DBP concentrations.
- Increased potential for accelerating internal corrosion.

Therefore, in addition to meeting drinking water regulations, a primary treatment objective is reducing the organic content in its treated water, to address the concerns listed above. Another important objective is reducing the corrosivity of the treated water. Both are included in the evaluation of water treatment options.

3.1.4 Operator Certifications

CBW's water treatment facility is operated by three certified operators, as summarized below.

Wayne McHolland, the primary WTP operator since 2009, currently holds the following certifications:

- Water Treatment: Level II.
- Water Distribution: Level I.
- Wastewater Treatment: Level II.
- Wastewater Collection: Level I.

Brian Christian currently holds the following certifications:

- Water Treatment: Level II.
- Wastewater Treatment: Level II.

Jeffry Davidson currently holds the following certifications:

- Water Treatment: Level I.
- Wastewater Treatment: Level I.

The certifications for all three operators expire in 2017.

3.2 Financial Status

CBW tracks the expenditures and revenue for the water system. For the 2016-2017 Fiscal Year (FY), the approved revenue was $1,007,827 (Table 4), the approved expenditures was $1,017,694 (Table 5), with an estimated reserves of $420,641 expected to cover the balance of $9,867 between the expenditures and revenue.

For FY 2015-2016, CBW had an expenditure of $89,987 on repayment of a 1999 DEC loan for the WTP. The CBW also had an expenditure of $14,270 on a 1997 USDA-RD water bond.

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[16] Liang and Singer, *Factors Influencing the Formation and Relative Distribution of HAAs and THMs under Controlled Chlorination Conditions,* 2001, AWWA.

The utility rates for the CBW water system are presented in Table 6. Monthly rates for metered charge types are listed at the base rate. The following applies to Table 6:

- For the small commercial metered, the base rate covers the first 4,000 gallons, after which the rate is an additional $2.52 per 1,000 gallons.
- For the large commercial metered, the base covers the first 500,000 gallons, after which the rate is an additional $0.84 per 1,000 gallons.

3.1 Water/Energy/Waste Audits

No known energy audits of the WTP have been conducted.

Table 4 – FY 2016-2017 Water Fund Revenue

DESCRIPTION	AMOUNT
PERS Refund	$9,340
Water Sales	$620,000
Water Connections	$2,500
Material Sales	$500
WTP Pilot Study Grant Revenue	$85,000
Upper Reservoir Connection Grant	$150,000
Interest Income	$8,000
Hydrant Rental	$42,500
Redemption Fund WTP DEC	$89,987
Total Revenue	$1,007,827

Table 5 – FY 2016-2017 Water Fund Expenditures

DESCRIPTION	
Wages and Salaries	$75,420
Overtime	$7,500
Benefits	$67,170
Travel and Training	$3,500
Telephone Expense	$3,000
Electricity Expense	$85,000
Materials and Supplies	$15,000
Chemical Expense	$24,000
Facility Repair and Maintenance	$50,000
Equipment Repair and Maintenance	$2,500
System Repair and Maintenance	$25,000
Garage Vehicle Expense	$35,830
Water Plant Pilot Study Grant	$85,000
Upper Reservoir Connection Grant	$150,000
Capital Additions / Improvements	$151,000
Compliance Testing	$15,000
Charges from Other Departments	$80,000
Audit Expense	$3,600
Credit Card Expense	$3,510
General Insurance Expense	$7,250
1999 DEC WTP Loan Interest	$6,456
1999 DEC WTP Loan Principal	$84,784
1997 Bond Interest	$9,108
1997 Bond Principal	$5,162
Bad Debt Expense	-
Charges from Finance and Admin	$22,904
Total Expenditures	$1,017,694

Table 6 – CBW Water Utility Rates

Charge Type	Revenue Source	Monthly Rate	No. of Customers
Residential	Apartment	$ 122.25	2
	Residential Apartment	$ 40.75	1
	Single Family	$ 40.75	844
Commercial Residential	Apartment	$ 122.25	1
	B&B	$ 73.35	3
	Flat Rate	$ 40.75	2
Small Commercial	Apartment	$ 262.61	10
	Bar	$ 154.27	3
	Beauty Shop - 2 basin	$ 69.40	2
	Church/Misc Stores	$ 38.54	11
	Clubs w/ Restaurant	$ 77.08	3
	Dental Clinic	$ 131.09	1
	Everything Else	$ 38.54	25
	Fountain	$ 38.54	1
	Garage	$ 76.96	4
	Hotel - up to 10 rooms	$ 115.68	1
	RV Park	$ 32.60	1
	Fire Hydrants	$ 24.44	2
	Small Com'l Hotel - over 10	$ 244.38	2
	Multi-Family Units	$ 749.28	1
	Offices	$ 42.82	27
	Office/Per Employee	$ 10.08	1
	Office Unplumbed	$ 8.98	2
	Medical Office	$ 131.09	1
	Ranger District	$ 395.16	1
	School per classroom	$ 203.76	1
	School per classroom	$ 203.76	1
	Restaurant - over 30 seats	$ 154.28	2
	Restaurant - Up to 30 seats	$ 115.68	3
	Small Commercial - Flat Rate	$ 40.75	25
Large Commercial	Grocery w/ meat	$ 119.38	2
	School per classroom	$ 331.11	1
	Multi-family - per unit	$ 218.54	1
	Office	$ 77.08	1
	Office - per employee	$ 10.08	1
	Office	$ 115.62	2
	Hospital	$ 306.56	1
Metered - Small Commercial	Small Commercial - Metered	$ 26.76	4
Metered - Large Commercial	Large Commercial - Metered	$ 401.47	3

4 Need for Project

4.1 Health, Sanitation, and Security

In July 2016, the CBW passed a Disaster Declaration with Request for State Assistance (see Appendix D) due to inadequacy of the filtration system to provide sufficient flow to meet community water consumption. The CBW requested that the public ration water use by 30% to 50% in an effort to decrease overall water use. The inability to provide sufficient water to meet local needs directly impacts local residents, medical facilities, seafood processing plants, and the ability to respond to local fires.

Furthermore, the CBW has received notifications that it has exceeded the levels permitted in the Stage 2 Disinfection and Disinfection Byproducts rule. The violations of allowable HAA_5 levels occurred in 2015 and 2016 and are indicative of the inadequacies of the current treatment system. Copies of the exceedance reports are included in Appendix D.

4.2 Significant WTP Process Concerns

The concerns expressed by CBW as significantly impacting the water treatment process are summarized below.

<u>Roughing Filter Performance:</u> CBW operators report that occasionally the turbidity leaving the roughing filters is greater than that entering the filters. This condition appears to be a symptom of poor cleaning performance by the backwashing system, which would result in the accumulation of contaminants within the media that would occasionally be discharged in relatively high concentrations. These issues may be aggravated by the use of media particles that are larger than specified.

<u>Ozone Residual:</u> CBW operators have also reported a strong ozone smell that lingers in the roughing filter building and in the slow sand filter buildings during water treatment. This condition may indicate that a significant ozone residual continues to be present in the treated water downstream of the contactor. If present in the slow sand filters, the ozone would tend to inhibit biological formation. The ozone residual will tend to be more persistent when the pH of the water is between 6 and 8, and when the water is colder (35^{o}F to 55^{o}F).

<u>Slow Sand Filter Cleaning:</u> Although the slow sand filtration system design anticipated a cleaning frequency of about four times per year, the actual need to clean filters arises about every 10 to 14 days on average (more frequently with higher summer flows and less frequently with lower winter flows). This condition appears to be due to the slow sand filters being subjected to a higher-than-anticipated solids loading rate, since the roughing filters are not performing effectively. ADEC has also expressed concern that the ATV used in cleaning the filters could contaminate the water.

<u>Filtration Capacity:</u> During summer months, when fish processors and other commercial users are consuming potable water, the water demand increases to the point where it is difficult to take filters off-line for cleaning. All filters are needed in these conditions to meet the water demand. Further, in a 2012 Sanitary Survey performed by ADEC, concern was expressed that the slow sand filters were not allowed to properly “ripen” (i.e., redevelop a sufficient biomat for effective treatment) prior to being placed back on-line. This requirement does not appear to be possible with the frequency currently needed for cleaning, and for the WTP to function in peak demand conditions.

4.3 Reasonable Growth

The current water treatment process does not provide sufficient treatment capacity to meet distribution system demands, as was evident by the Disaster Declaration by CBW in July 2016. Future population growth and increased industry water usage, which is discussed further in Section 5.1, will exacerbate this situation. Furthermore, CBW is in the planning stages for development of a 134-acre parcel for single family lots, medium density housing, and an Alaska Native Science & Engineering Program (ANSEP) campus. This development will tend to increase water demand by CBW.

5 Alternatives Considered

5.1 Design Criteria

5.1.1 Design Flow Rates

CBW's design flow rates are estimated in this evaluation for the purpose of scaling the economic comparison between options, as well as for scaling the pilot testing. These rates are based on existing water usage that is increased according to anticipated growth rates of population and water consumption by significant users, both of which are assumed to be 0.8%. These design flow rates are considered conceptual at this stage of the project, and should be confirmed or adjusted, as needed, during the design phase. Existing water usage and design flow rate calculations are summarized in Appendix E.

5.1.1.1 Average Daily Demand

Average daily demand (ADD) is based on the CBW'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. The ADD was further divided into two general categories and is summarized in Table 7:

- Residential usage plus system water losses (unmetered).
- Commercial usage by fish processors, passenger ships, boat harbors, dock facilities, etc. (metered).

Table 7 – Average Daily Water Demand

System	2014 ADD (gpd)[1]	2037 ADD (gpd)
Residential & System Losses	641,000	788,000
Commercial Users	177,000	212,000
TOTAL	856,000	1,000,000

Key: 1 - Data from 2014 water production meter records is used in this report. However, water production data from November 2015 to October 2016 was evaluated to verify that the 2014 usage records were still consistent with current system use. For the November 2015 to October 2016 time period, the total ADD for the system was 831,000 gpd, which is consistent with the 2014 data.

The water volume for the Residential and System Losses category was determined by subtracting the total metered volume of commercial users from the total volume of water that was measured in the WTP. This volume is also estimated as a simplified, "per capita" daily rate by dividing it by the 2014 population and 365 days, which amounts to about 251 gallons per capita-day (gpcd). As residential service lines are not metered, it is not known how much of this volume is attributable to system water losses (pipeline leaks, water wasting at plant and hydrants, and others).

For the purposes of this evaluation, the per-capita daily rate is assumed to decrease by about 5%, to 240 gpcd, in 2037. This decrease is assumed to be due to replacement of some leaking CBW water lines during the 20-year span, eventual re-use of backwash water at the WTP, and a continuing national trend of lower water consumption from conservation efforts.

5.1.1.2 Maximum Daily Demand (MDD)

MDD is estimated by multiplying the ADD by a peaking factor, which is commonly 150% for municipalities. However, a peaking factor of 175% is used for CBW, based on a review of the daily plant flow variation recorded between 2012 and June of 2015 (Appendix B). Year 2014 and 2037 MDD rates are summarized in Table 8.

Table 8 – Maximum Daily Water Demand

System	2014 MDD (gpd)	2037 MDD (gpd)
Residential & System Losses	1,189,000	1,375,000
Commercial Users	309,000	371,000
TOTAL	1,498,000	1,746,000

It is noteworthy that the peaking factor is a simplified planning number that reflects the variability of the total water demand on CBW's distribution system. The water flow data reflects peaking factors for the commercial users alone that are much higher (as much as 350%), but this flow volume accounts for only 20% to 40% of the estimated MDD. Nevertheless, the water storage system should be sized such that CBW can accommodate the occasional peaks in demand which exceed the 175% factor.

5.1.1.3 Peak Hourly Demand

The peak hourly demand (PHD) is estimated by applying another peaking factor to the ADD, and is used for specific hydraulic sizing of distribution piping and pumping equipment. These peaking factors generally vary from 2.0 to 4.5 depending on population, and the factored flow rate for PHD is typically expressed in gallons per minute (gpm). Since sufficient water storage should be provided as a volumetric buffer between the WTP and the hourly demand variations in the water distribution system, the MDD is typically used for sizing the treatment process. Therefore, the PHD rate is not used in this PER.

5.2 Regulations

ADEC is responsible for interpreting and enforcing the regulations regarding water and sewer systems.

CBW's water system is identified by the State of Alaska as PWSID# AK 2120143, serving 2,000 year-round residents and 300 transient people. As required by the Safe Drinking Water Act (SDWA) and State and Federal regulations, the water treated by CBW must meet certain water quality standards established by the EPA and adopted and enforced by environmental regulators at the state government level.

Principal treatment objectives for CBW are briefly summarized below:

- 99% (2-log) removal of *Cryptosporidium*.
- 99.9% (3-log) removal of *Giardia lamblia*.
- 99.99% (4-log) removal/inactivation of viruses.
- Continuous combined filter effluent (CFE) monitoring of turbidity.
- Maximum CFE turbidity value of 1.49 NTU in 95% of samples measured every month.
- Primary and secondary contaminants provisions met.
- Total coliform provisions met in distribution system.
- Lead and copper levels met in distribution system.

- Disinfection by-product (DBP) provisions met in distribution system for TTHM and HAA_5.
- Minimum disinfectant residual of 0.2 mg/L entering the distribution system.
- Detectable disinfectant residual within distribution system.
- Sanitary survey required every 3 years.
- Meet APDES general permit stipulations for wastewater discharges.

CBW must comply with all applicable drinking water regulations and most particularly the following:

- Primary Contaminants.
- Secondary Contaminants.
- Total Coliform Rule (TCR) and Revised TCR.
- Surface Water Treatment Rule (SWTR).
- Long Term 1 Enhanced SWTR (LT1ESWTR).
- Long Term 2 Enhanced SWTR (LT2ESWTR).
- Stage 1 and Stage 2 Disinfectant/Disinfection Byproducts Rule (D/DBPR).
- Lead and Copper Rule (LCR).
- Alaska Pollutant Discharge Elimination System (APDES).

These and other standards are summarized in more detail in Appendix C, and form the basis of CBW's minimum treatment requirements.

5.3 Permitting

5.3.1 Federal Permits

United States Army Corps of Engineers (USACE) Section 404 Permit: The USACE issues a permit that combines its authorities under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. The project will require a Section 404 permit if any wetlands will be filled or excavated.

National Historic Preservation Act Section 106 Consultation: If historical resources are likely to be affected, a cultural resources assessment may be required.

5.3.2 State Permits

ADEC Permits: All construction plans for water and sewer projects must be submitted to ADEC for review and approval prior to construction. A Construction General Permit will also be required for storm water discharge activities related to construction.

5.3.3 Local Permits

There are currently no local permitting requirements in CBW.

5.4 Water Treatment Alternatives

The alternatives formulated for this PER were developed by considering the relative feasibilities of various WTP options for CBW. These considerations were largely qualitative, being based on the inputs and experience of water treatment professionals, and on engineering judgment. This evaluation does not intend to scrutinize alternatives for all possible options and permutations that may come to mind. It instead considers a limited number of options that appear to be reasonably promising for use in Wrangell.

The following water treatment alternatives were evaluated for this PER:

1. Alternative 1 – Improve Existing Water Treatment Process
2. Alternative 2 – MIEX Process with Multimedia (Conventional) Filtration
3. Alternative 3 – Ozonation with MIEX and Biological Filtration
4. Alternative 4 – Dissolved Air Flotation (DAF) with Multimedia Filtration
5. Alternative 5 – Nanofiltration with Multimedia (Two-Stage) Filtration
6. Alternative 6 – No Action Alternative

Each alternative is evaluated relative to various criteria, including: capital costs, operation and maintenance (O&M) costs, life-cycle costs, treatment performance and capacity, complexity, reliability, sustainability, operator certification, and operator safety.

5.5 Alternative 1 – Improve Existing Water Treatment Process

5.5.1 Description

Alternative 1 primarily features the following water treatment steps (Figures 4 and 5):

- pH adjustment
- Ozonation
- Roughing Filtration
- Slow Sand Filtration
- Disinfection

The existing water treatment process is described in Section 3.1. Improvements are considered below for all aspects of the treatment process.

5.5.1.1 pH Adjustment

The pH level in CBW's raw water is generally low, ranging between 5.4 and 6.9, and its alkalinity is also low, ranging around plus or minus 10 mg/L as $CaCO_3$. Originally, CBW added soda ash (sodium carbonate) to elevate the water's pH and increase its alkalinity. Due to the high cost of adding large of amounts of soda ash, CBW now uses caustic soda (sodium hydroxide), a much stronger base that can increase the pH with a smaller dosage. However, at the dosages used by CBW, caustic soda does not add much alkalinity, and, therefore, the alkalinity level remains low in CBW's water, leaving it prone to significant pH changes in downstream processes.

Due to the cost of using soda ash and other pH adjustment chemicals like sodium bicarbonate, CBW would likely continue using caustic soda for this alternative. However, CBW's chemical feed system should be modified with a ventilated hopper system that reduces or eliminates the tendency for operators to contact airborne dust containing this chemical as it is poured into a solution tank.

5.5.1.2 Ozonation

CBW recently purchased new, more-efficient ozone generators to replace the worn-out existing units. It is expected that the WTP's oxidation performance will be improved with the new system after it is installed. The new system offers a larger maximum output of ozone (nearly four times that of the existing system), with lower power requirements and features that enhance maintenance and replacement of critical components. Per CBW operating staff, it is expected that the new generators will be readily piped into the existing layout of the plant, to receive oxygen (O_2) from the existing O_2 generators, and discharge ozone into downstream piping that feeds the ozone contactor.

5.5.1.3 Roughing Filters

It appears that a capable cleaning system is needed for the roughing filters, in addition to the replacement of the existing media. Typically, roughing filters are intended to be cleaned on a frequent basis, with rapid, downward flowing water using only gravity as the energy source. However, with a perforated collection system below the media, the existing facility does not appear to be configured to promote rapid draining.

One way to improve a rapid drawdown of water is providing large valved openings in the roughing filter basin that would allow water to readily flow in the adjacent waste sump. Further, the construction of an underdrain space below the media would also promote rapid downflow. With this configuration, the discharge-to-waste piping would likely be the flow-limiting element.

Another way would be to provide a more positive means of cleaning. If the backwash flow direction were reversed and allowed to flow upward, then an air scour could be applied simultaneously, which would more effectively clean the media relative to the rapid drain-down approach. With relatively large media particles used in these filters, an air scour is needed to sufficiently agitate and scrub solids that are trapped within the media. This objective is not readily accomplished with backwashing only. Before initiating the backwash process, the WTP flow can be directed to the waste line.

To backwash the filters in this fashion, a pump would be activated to increase the upflow through the filter media. Air scouring would then occur by pumping air though a piped grid placed below the media. After media agitation and scouring, the backflow upflow would continue until a targeted clarity was achieved in the water. Then the backwash pump would be deactivated, and the WTP flow redirected to the slow sand filters. By cleaning solids upstream beforehand, the loading rate on the slow sand filters could be reduced, thereby allowing them to run longer.

Along with replacing the existing media with that of the proper size, a granular activated carbon (GAC) cap might be considered for converting any residual ozone into oxygen. Doing so would better facilitate the biological growth needed for optimizing the performance of the slow sand filters downstream, and may improve the system's ability to remove turbidity. However, because it will likely absorb dissolved organics and other substances over time, replacement of the GAC would be needed on a periodic basis, which would increase the cost of WTP operation.

5.5.1.4 Slow Sand Filters

An improved system for removing the *schmutzdecke* layer and recovering spent sand and backwash water should also be considered for reducing operational costs. Relative to scraping, CBW's use of an ATV offers a quicker method for cleaning the filters, which would be even less of a burden on time and money if cleaning frequencies could be greatly lengthened—from once every two weeks to once every 2 or 3 months. However, in the process of draining up to 6 feet of treated water to allow filter cleaning, CBW wastes a significant amount of water (as much as 135,000 gallons per filter—about 17 million gallons total in 2014) that might otherwise be pumped directly to a standby slow sand filter, or captured in a tank and recycled to a reentry point upstream of either the ozonation process or the roughing filters. An on-site sand cleaning unit is recommended to facilitate cleaning the sand.

5.5.1.5 On-Site Chlorine Generation

Sodium hypochlorite is produced at the WTP with the use of a chlorine generator and salt brine. The salt brine is made by soaking high-purity salt in water. The brine is fed through an electrolytic cell within the generator, which, through the process of electrolysis, converts sodium chloride (salt) into sodium hypochlorite and hydrogen. The sodium hypochlorite is stored in a tank for subsequent injection in the process stream as disinfectant, while the hydrogen is exhausted to the atmosphere outside of the WTP building. A water softener is commonly needed with an on-site chlorine generation system to reduce mineral build-up on the electrodes in the generator, as well as a heater/chiller to maintain water temperature within a range that will best sustain the electrolytic cells. Due to the age and condition of the existing facilities, the on-site chlorine generation facilities would be replaced as part of the WTP upgrades.

5.5.1.6 Hydraulic and Treatment Capacity

Hydraulic and treatment capacity would be improved with longer slow sand filter runs resulting from the aforementioned pre-treatment improvements, but an increase in treatment flow is not likely without increasing the size of the ozonation, rough filtering, and slow sand filtering processes. Raising the plant flow rate from 900 gpm (1.3 mgd) to 1,250 gpm (1.8 mgd) represents a 40% increase, and to 1,390 gpm (2.0 mgd) represents over a 50% change. Based on inputs from CBW, it appears that the new ozone generators could accommodate these increases. However, the oxygen generators and ozone contactor would need proportionate upsizing. The footprints of the roughing filters and slow sand filters would also need to be made larger proportional to the increased flow rate, and doing so would require additional site area. At a minimum, the number of roughing filters would need to increase from two cells to three cells, and two slow sand filters would be added to the existing four filters - for a total of six.

Further, with cold water temperatures, the unit process flow rate may need to be decreased (i.e., "de-rated") to improve biological treatment. Doing so may require additional upsizing of the unit processes previously described. A second additional roughing filter cell and a seventh slow sand filter as standby would facilitate the off-line cleaning of the other filters and allow newly-cleaned filters to properly ripen prior to being returned into service.

Increased water storage would better buffer the water treatment process from peak water demands in the distribution system. By providing another 1 million gallons in water storage, the increased stored volume (1.8 million gallons) would nearly equal the peak daily demand (which would occur only a few times per year), and provide nearly 2 days of average daily demand. Further, this larger storage capacity would:

- Allow CBW to operate the WTP at a lower flow rate, as needed to maintain sufficient volumes of stored water for particular seasonal usages by customers.
- Allow CBW to better address any system failures that would diminish or shut down WTP flow.
- Better accommodate system maintenance, such as taking filters off-line for cleaning.

However, increased storage volumes would create longer residence times in the distribution system. CBW staff has expressed concern that, with the current water treatment process, the chlorine concentration in the finished water needs to be boosted to counter losses that occur in the WST. As much as 0.8 mg/L is provided in the water leaving the WTP so that water entering the piped system would have at least a 0.2 mg/L chlorine residual, in accordance with ADEC regulations [17]. With relatively high organic concentrations leaving the WTP, the longer residence time in the WST would create increased potential for DBP generation. The more that the treatment process can remove organic material, the less DBP generation would occur.

For comparing this option, the following improvements are considered for meeting the future peak daily demand:

- Increased ozonation capacity in added oxygen generator and ozone destructor, plus a 50% increase in ozone contactor volume.
- Addition of two roughing filters and media replacement in existing two filters.
- Use of a one-foot deep GAC cap in the roughing filter.
- Revising the backwashing configuration to provide upflow through the roughing filters with new backwashing pumps.
- Addition of an air scour feature for the roughing filters.
- Addition of three slow sand filters.
- Larger booster pumps.
- A freeboard recapture tank and associated transfer pumps.
- Sand cleaning equipment.

5.5.2 Advantages/Disadvantages

One of the main objectives of the original WTP design was to simplify its operations with a relatively cost effective process. The original design strived to meet this objective primarily in the following steps:

- Use of sodium hydroxide (caustic soda) to raise the pH for oxidation and reduce corrosivity of the water.
- Use of ozone as an oxidant to remove iron, manganese, color, tastes, and odor.
- Use of a roughing filter to remove suspended solids.
- Use of a slow sand filter to reduce dissolved and biodegradable substances.
- Use of on-site generation of chlorine for disinfection.

The pros and cons of each of these steps are generally discussed below.

5.5.2.1 pH Adjustment

Primary advantages of pH adjustment include:

- Water chemistry can be made more suitable for oxidation and coagulation processes.
- In association with added calcium, pH levels can be made more neutral to reduce the corrosivity of the treated water.

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[17] Chlorine residual establishment in the WST is complicated by the disconnection between plant flow rate and the flow rate leaving the tank. Pumping rate to the WST varies according to the difference between low water level and the level at which the pumps are automatically deactivated. If flow rates leaving the WSTs are relatively low, chlorine tends to accumulate in the tank and its concentrations tend to be higher. When flow rates leaving the WST are relatively low, the converse tends to be true for chlorine concentration.

- With the use of soda ash, sodium bicarbonate, or a lime contactor, alkalinity can be added to the treated water, which stabilizes it from significant pH changes and replaces any alkalinity lost in the water treatment process.

The primary disadvantages of pH adjustment include:

- Added chemical treatment costs. CBW being located in a relatively remote community, these costs can be substantial.
- Added complexity to the water treatment process. Although the chemical feed systems are not difficult to operate, adding pH adjustment to the overall water treatment scheme increases the number of unit processes that need to be monitored. Water systems can often circumvent the need for pH adjustment by using different oxidants and coagulants that are not as pH-sensitive.
- In the case of using caustic soda, which is a corrosive chemical, extra safety measures are needed to protect the health of operators working with it.

Generally, the decision to use pH adjustment boils down to determining whether or not the added cost and complexity of this step is justified by its benefits to the water treatment process. With the use of alkalinity-consuming processes like coagulation and nanofiltration, pH adjustment is ordinarily needed in the treatment of low-alkalinity water.

5.5.2.2 Ozone

Ozonation is an older but relatively sophisticated water treatment technology, and consequently is not common in small Alaskan communities. The systems that generate ozone on site are relatively complex and need skilled personnel to operate and maintain them. However, ozone is a very strong, multi-dimensional oxidant that can provide a number of benefits in the treatment of water. Primary benefits for CBW's water treatment process include:

- Reduces larger weight organic molecules into compounds that are smaller and more biodegradable in the downstream filtration processes.
- Inactivates microbial and viral contaminants.
- Reduces color.
- Removes disagreeable tastes and odors associated with organic materials in the water.
- Reduces the amount of chlorine needed after treatment to maintain a disinfectant residual in the distribution system water.

Because ozone is fairly reactive with the types of organic molecular structures that are also associated with the formation of certain types of DBPs, its use by CBW probably reduces the concentration of DBP precursors in the raw water, which would lead to lower DBP levels in the distribution system [18]. Ozone may also benefit downstream coagulation processes.

In short, CBW gets "a lot of bang for the buck" because, in one step, its use of ozone provides many benefits that otherwise might be achieved by multiple processes and additional chemicals.

The primary disadvantages of ozone usage are:

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[18] In some water conditions, the use of ozone reportedly can increase the concentration of DBP precursors (Reckhow, AWWA *Formation and Control of Disinfection By-Products in Drinking Water*, 1999, edited by Singer).

- Complexity: the ozone system used by CBW is comprised of four sub-systems: oxygen generation, ozone generation, ozone contact, and ozone destruction. Three of these subsystems feature sophisticated electro/mechanical equipment that requires specialized knowledge for operating, maintaining, and repairing them.
- Power consumption: these subsystems require a significant amount electrical power to perform the required chemical conversions for the process to function.
- Short residual times: Being highly reactive, ozone will not produce a long-lasting residual. Another disinfectant is required for meeting the drinking water requirement of having a detectible residual in the distribution system.
- Safety concerns: being a very strong oxidant, ozone can also be harmful to human health if not properly contained. Typically, ozone dosages range between 1 and 5 mg/L, but waters with color often require dosages greater than 5 mg/L. CBW uses a dosage as high as 10 mg/L.

These concerns constitute some of the reasons for discouraging its usage in smaller Alaskan communities.

As long as the ozone system functions as intended, it can be a very advantageous component of CBW's water treatment process. However, if the system is not functioning correctly, it can present significant challenges and, possibly, unsafe conditions to operating personnel.

5.5.2.3 Roughing Filters

The roughing filters (also called "up-flow clarifiers") provide an environment in which two processes can occur: flocculation and filtration. Flocculation is a process wherein particles that have previously been coagulated can clump together into larger solids that are more readily removed by filtration. In the existing process, ozone performs the coagulation that is intended to neutralize the electrostatic charges of particles which would otherwise prevent them from clumping together. The turbulent water flowing in between the media particles promotes the collisions and "agglomeration" of solids that is intended to facilitate their removal during filtration.

The filtration process occurs in three ways: first by solids adhering to media particles; second, by adsorption of solids to the solids mass already adhered to media particles; and third, by physically straining out particles that become trapped in confined pore spaces. As these removal processes continue, the filters become clogged, which increases the hydraulic energy needed to drive water through them. Backwashing is then needed to dislodge solids from the media and flush them out of the system to waste.

The primary advantage of this method of removing solids is that it is a relatively simple alternative to sedimentation processes featured in conventional filtration. Roughing filters are intended to provide sedimentation within the filter media with the use of relatively large particles. Roughing filters are commonly used with ozonation and slow sand filtration when the turbidity of raw water is higher than that which can be readily treated by the latter process. Roughing filters might also be advantageously used for some biological filtration if amenable conditions can be maintained.

The primary disadvantage of roughing filters is they can become a liability to downstream filtration if not properly cleaned. In this situation, they can become prematurely clogged and cause the effluent to have worse water quality than the influent, as contaminants accumulate in the media. With an effective cleaning system, this disadvantage would not likely become apparent.

5.5.2.4 Slow Sand Filters

Slow sand filtration is an old but proven technology for treating water having moderately low quality. It primarily uses a biological process to remove biodegradable and assimilable substances, which are not readily removed by ordinary granular filtration methods. As water slowly flows through fine-grained sand media, a biological mat (*schmutzdecke*) develops on its surface, which provides a medium for microbes to encounter, break down, and assimilate dissolved compounds. As this process continues, the *schmutzdecke* thickens to the point where it needs to be physically scraped away.

Primary advantages of this technology are:

- No chemicals are needed to facilitate the removal of dissolved substances. The *schmutzdecke* effectively performs this task.
- It is a largely self-governing process when operating properly, and self-indicating when filter cleaning is needed.
- The cleaning of *schmutzdecke* is relatively "low-tech"—it is a physical task that requires no special skill set. The vast bulk of the treatment performance occurs on the upper surface of the media and within the *schmutzdecke*. A relatively thin scraping of the media surface (about 1/2 inches) is all that's needed for media cleaning.
- From a regulatory standpoint, a significant advantage of using slow sand filtration is the relatively high MCL for turbidity (1 NTU—or 1.49 NTU rounded down). The turbidity limit for other filtration methods is 0.3 NTU. The recent updates to the SWTR require regulatory action (comprehensive performance evaluations) if the turbidity MCL is exceeded at an established frequency. The higher turbidity MCL of 1.49 NTU is a readily achievable and sustainable goal when slow sand filtration is operating properly, thereby making the triggering of regulatory action readily avoidable as well.

However, a number of disadvantages are associated with slow sand filtration, such as the following:

- Slow sand filtration is vulnerable to poor upstream water quality. Having fine-grained media, slow sand filters are not capable of handling large solids loading without prematurely clogging. Therefore, these types of filters are more appropriate for treating raw water with relatively decent clarity (i.e., having less than 1.0 NTU of turbidity).
- Relatively large areas of land are needed for constructing these types of filters. Slow sand filters are so-called because the loading rate used (0.04 to 0.10 gpm/sf) is very small relative to conventional filters (1.0 to 5.0 gpm/sf). Therefore, to handle large flow rates, large surface areas of sand are required, making the cost of expansion relatively expensive.
- Long ripening periods are needed to generate a biomat that will produce the desired water quality. As much as 4 to 6 weeks can be required to ripen sand before the filter can be placed on-line [19]. This ripening time is currently not practical for CBW when summer-time water demands are peaking.
- Another disadvantage is the physical nature of removing the *schmutzdecke:* while the approach is simple, it is also a laborious task when large filters are being cleaned. Cleaning one filter takes

[19] As much as 12 weeks could be required for ripening new, clean sand.

CBW staff about 5 hours of draining water and ploughing with the ATV before bringing it back on line. In CBW's case, this condition is made more challenging in the summer time when peaking water demands require that all filters stay in operation.

5.5.2.5 On-Site Chlorine Generation

The primary advantage of on-site chlorine generation is avoiding the handling of stronger concentrations of chlorine. Only the inert ingredients of salt and water are needed to generate chlorine. A maximum of 0.8% solution (8,000 mg/L) of hypochlorite can be produced, which is a low concentration relative to liquid sodium hypochlorite (12% to 15%) or calcium hypochlorite (60% to 70%). Further, for moderate and large sizes of WTPs, on-site generation is a more cost effective approach relative to importing these other two forms of chlorine, and when salt can be economically supplied in bulk. In general, CBW staff is pleased with their on-site chlorine generator and expects to continue using this technology in any future water treatment process.

The primary disadvantage of this approach is the complexity of the equipment. The equipment used to perform the electrolysis is sophisticated and takes special skills to repair and maintain. Maintenance typically involves the cleaning of electrodes with an acid solution. Repairing and replacing components usually requires a trained specialist. Another disadvantage is that large chemical feed pumps are needed with the low concentration if a large chlorine dosage is required to meet a sizeable disinfectant demand. This is not the case at CBW's WTP.

5.5.3 Treatment Performance

In general, slow sand filtration alone is capable of the following treatment performance or contaminant reduction capacities [20]:

- Less than 1.0 NTU turbidity.
- Between 1 to 3 log units of coliform bacteria.
- Between 2 and 4 log units of viruses and *Giardia* cysts.
- Greater than 4 log units of *Cryptosporidium* oocysts.
- Between 15% and 25% of TOC and dissolved organic carbon (DOC).
- Up to 50% removal of biodegradable DOC [21].
- Between 20% and 30% removal of TTHM precursors.

Currently, CBW's WTP produces water of good quality, with turbidity levels ranging between 0.1 and 0.5 NTU in the finished water, and color generally ranging between 0.10 and 0.25 units using the full capacity of the ozone generators. The extent of color removal strongly varies with raw water color and the ozone dosage.

The capability of slow sand filtration to remove organics ranges from average to considerably less relative to other technologies. Yet, this approach has evidently been sufficient to avoid high DBP concentrations in CBW's distribution system. Based on available testing data, CBW's organics removal performance generally ranges between 25% and 50%, leaving a relatively high concentration of organics (3 to 4 mg/L)

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[20] Table 9-3, *AWWA Water Treatment Plant Design*, 3rd Edition,1998, McGraw-Hill, and Table 1, *Tech Brief - Slow Sand Filtration,* National Drinking Water Clearinghouse, June 2000.
[21] Biodegradable DOC typically represents 10 to 20% of raw water DOC, per Techneau, *Ozonation and Biofiltration in Water Treatment—Operational Status and Optimization Issues,* Dec. 2006.

in the finished water after treatment. These remaining concentrations can impose a continual chlorine demand throughout the distribution system and promote interior pipe corrosion.

5.5.4 Operational Considerations: Complexity, Reliability, Safety & Sustainability

The unit processes within the existing water treatment process have varying levels of complexity, reliability, safety, and sustainability. These considerations are generally described as:

- Complexity – relates to the training and skill levels needed to properly operate and maintain the unit process as intended. A high degree of complexity usually requires a high skill set of the operator and vice versa. Complexity could be apparent in the sophisticated technology of a particular component, or in the number of steps and degree of system balance needed to operate a process.
- Reliability – relates to how readily a process is prone to function as intended over its useful life. High levels of reliability indicate systems that inherently or readily perform well. Low levels of reliability indicate systems that are prone to upsets or a frequent need for adjustments and close supervision to perform well.
- Safety – relates to the possibility of hazards to human health during operation. A high degree of safety indicates a relatively innocuous process. A low degree of safety indicates that hazards are apparent and extra precautions are necessary.
- Sustainability – relates to the combination of technical and financial resources needed by the public water system to operate the process beneficially for the life of the facility. High need for technical expertise and/or high operating costs indicate low sustainability, and vice versa. With low sustainability, a community will tend to be at risk of being unable to sustain operations of a particular process with the loss of a particular operator, or with deficient operating revenues. With high sustainability, the risk of being unable to sustain operations of a process is reduced, because relatively little expertise or operating revenues are needed.

Assuming an improved process as described in this section, the levels of these operational considerations are anticipated as noted in Table 9.

Table 9 – Operational Considerations for Alternative 1

Process	Complexity	Reliability	Safety	Sustainability
pH Adjustment, Raw Water[1]	Moderate	High	Low	Moderate
Ozonation	High	High	Low	Low
Roughing Filtration	Moderate	Moderate	High	Moderate
Slow Sand Filtration	Low	High	High	Moderate
On-Site Chlorination	High	High	Moderate	Moderate

Key: 1 – assuming use of sodium hydroxide (caustic soda).

These considerations are further discussed in Section 6 in comparison to the other alternatives.

5.5.5 Certification Requirements

Operator certification requirements for Alternative 1 are summarized in Section 6.2. For Alternative 1, it is estimated that a Level III operator certification will be required.

5.5.6 Environmental Impacts

Expansion of the slow sand filters would require clearing of the land on the north end of the WTP site. Expansion of the roughing filter building would require drilling and blasting on the south end of the site.

5.5.7 Land Requirements

The construction of additional sand filters will require expansion of the WTP site to the north. The expansion will occur on land owned by CBW.

5.5.8 Potential Construction Problems

No significant construction problems are anticipated. Drilling and blasting of bedrock will be required for construction of the new sand filter beds.

5.6 Alternative 2 – MIEX Process with Multimedia Filtration

5.6.1 Description

Alternative 2 primarily features the following water treatment steps (Figures 6 and 7):

- pH adjustment using soda ash
- MIEX
- Multimedia filtration
- Disinfection

This alternative assumes that a MIEX system would be installed downstream of the pH adjustment system, which would feature the use of soda ash to increase the raw water's alkalinity (instead of caustic soda). The ozonation system would not be used in this alternative. Alum is assumed to be used as the coagulant, and rapid-mixed with the raw water. The use of MIEX is assumed to allow a lower dosage of alum that would be optimized more for turbidity removal, and less for organics removal. The roughing filter building would be modified to house a conventional filtration system comprised of three parallel flocculation/sedimentation/filtration trains, with a redundant fourth filter for backwashing purposes (Appendix F). The existing disinfection system would be re-used and the existing slow sand filters would be converted to a serpentine clearwell for storing disinfected water after filtration.

The pH adjustment and disinfection steps are described in Section 5.5.1. The MIEX and Multimedia Filtration processes are described in Section 5.6.1.1.

5.6.1.1 MIEX

MIEX is a proprietary ion exchange process marketed by Ixom Watercare, Inc. (Ixom, formerly Orica Watercare) that is effective in removing DOC and color in drinking water applications. This process features a "magnetic" ion exchange resin that exhibits a strong affinity for adsorbing low weight molecular organic substances that are not effectively removed by coagulation and multimedia filtration processes. When combined with multimedia filtration, MIEX can help remove a wide spectrum of both small and large organic compounds that produce DBPs. This technology is currently being used in Saxman, Alaska (south of Ketchikan) and Gulkana, Alaska. It is also being implemented in Buckland, Alaska.

The MIEX process (Photo 3) differs from typical "fixed bed" ion exchange systems in that it provides continuous regeneration of its resin[22] using automated controls. The system features a "high rate" contactor module, a resin regeneration vessel, a brine tank, a salt saturator, and multiple pumps. The regeneration, brine, and reactor tanks are packaged together on a single skid frame. The MIEX process continuously regenerates its resin using brine made from salt, which is a process already employed by CBW for on-site generation of sodium hypochlorite.

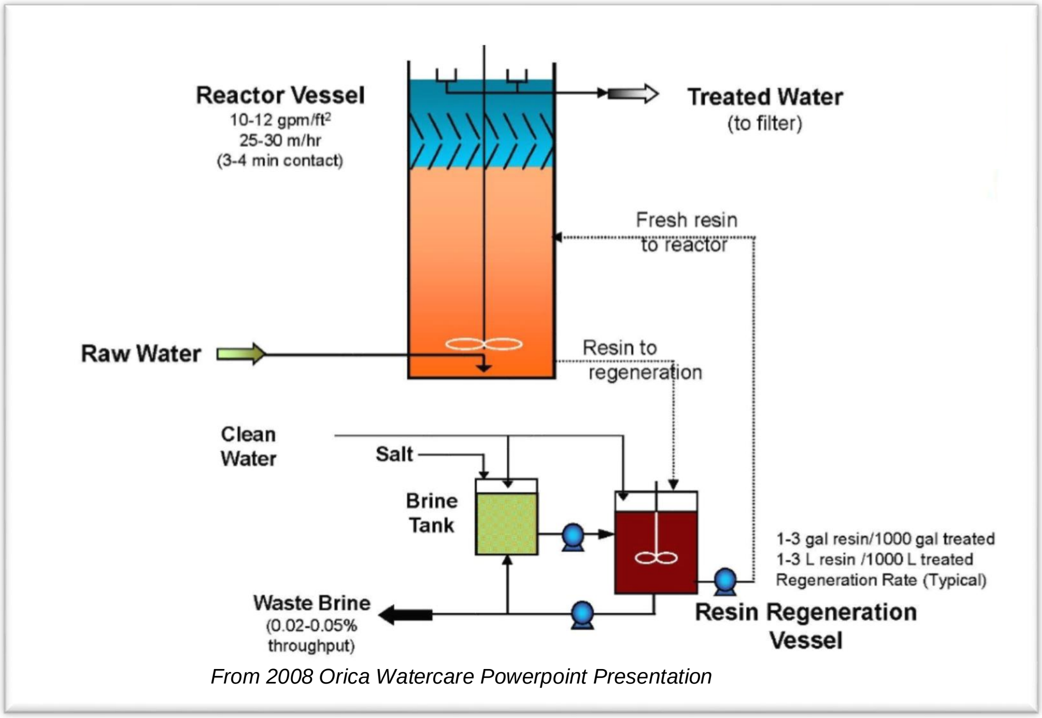

Photo 3 MIEX Process Diagram

In the operation of this system, water is conveyed through the bottom of the contactor and flows upward through the magnetic resin. Treated water flows out of the top of the contactor to downstream processes. A relatively high up-flow rate (10 to 12 gpm/sf) and an agitator keeps the resin in suspension. However, the weak magnetic properties of the resin allow beads to agglomerate into larger clumps that sink by gravity to the bottom of the contactor. Settling tubes are provided near the top of the contactor to facilitate separation of the resin from the water prior to its exit from the contactor. A small proportion (1 gallon of resin slurry per 1,000 gallons of water treated) of the settled resin is continuously directed out of the contactor and into the regeneration tank and is replaced by regenerated resin. A secondary cycle of salt brine is circulated from the brine tank to the regeneration tank. The salt saturator continuously feeds the brine tank. Despite the use of magnetic resin and tube settlers, a fractional amount of resin (1 to 2 gallons per 1,000,000 gallons of water treated) is lost due to physical attrition and overflow. This condition requires that the lost resin be replaced with new resin and also be captured by a downstream filtration process.

5.6.1.2 Multimedia Filtration

As MIEX does not remove suspended solids, a filtration process would follow downstream to meet SWTR drinking water regulations and receive the treatment credits required for a surface water source.

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[22] "Resin" is a synthetic media made of organic compounds.

Filtration would also remove turbidity, color, additional organics, and other contaminants. The multimedia filtration process, which would also be a component of Alternatives 2 through 5, is discussed here.

For the purpose of this assessment, “multimedia” filtration will refer to the use of more than one type of granular media to filter water. Usually, the different media types are installed in layers and specific thicknesses, depending on the filtration approach. Materials commonly used as filter media include silica sand, garnet, greensand, and anthracite coal. A commonly used media profile is a layer of fine sand that is overlain by a layer of larger anthracite coal particles.

Multimedia filtration also refers to “rapid” sand filtration (as opposed to “slow” sand filtration). Relative to the slow sand method, much higher filtration rates (1 to 5 gpm per square foot of media surface) can be used with multimedia filtration, which allows much smaller area requirements for water treatment. As an example, for the same treatment capacity provided by slow sand filtration, rapid sand filtration can provide the same capacity with 10% or less surface area. With less sand to clean during the backwash process, smaller pumps are used and less water is wasted or recycled.

For the purpose of this PER, two types of multimedia filtration are considered for meeting the microbial removal requirements imposed by the SWTR:

1. Conventional Filtration
2. Two-stage Filtration

Conventional filtration is an older technology that is commonly used for water treatment. In industry terminology, “conventional” filtration refers to a process involving coagulation, flocculation, and sedimentation upstream of granular media filtration. This type of process intends to remove a considerable amount of suspended solids from water before it is passed through the filters. Removing a large percentage of solids upstream of the filters improves the filtration process by allowing longer filter runs between backwashing. The longer that filters can run, the more efficient is the process, because a lower percentage of water is used in the backwashing step that is either wasted afterward or recycled.

To accomplish the solids removal objective, a “coagulant [23]” is first injected and mixed with raw water (Photo 4) to neutralize the natural electrical charge of particles that would otherwise cause them to repel each other. Next, in the flocculation step, the treated water is gently agitated so that the neutralized particles will collide and clump into larger particles that they can either be settled out or removed by the filters. After flocculation, the treated water is conveyed through a quiescent basin to encourage particles to settle out by gravity. Settling tubes are commonly used in this step to produce a calm, laminar flow that facilitates the sedimentation process. With colder water temperatures, such as that experienced by CBW during the winter, floc sizes and/or settling times need to be increased to account for slower settling rates. This adjustment is usually accomplished by increasing the size of the settling basin, which lowers the flow rate of the water (also called “de-rating” the flow rate).

Filter cleaning is accomplished with the use of backwashing and an air-scour feature. Depending on the manufacturer’s preference, this process more commonly occurs either by first air-scouring and then backwashing, or by simultaneously doing both. After the water above the media is lowered to within several inches of the media surface, air scouring is accomplished by pumping air upward through the media using a piped grid. This step agitates media particles to dislodge captured solids. After a few

[23] Most common types of coagulants are metal salts (such as aluminum sulfide—“alum”, polyaluminum chloride, and ferric chloride), polymers, and blends of both.

minutes, the air scouring process is stopped and the media is then backwashed by flowing water upward through the media bed. Typically, potable water is used for this cleaning process. Backwashing flow is established such that the media bed will be expanded by 40%. The backwashing process re-suspends and conveys the solids to waste. When the backwash water reaches a prescribed clarity, the process is terminated.

Relative to conventional filtration, Two-stage filtration is a newer filtration technology that accomplishes the solids removal objective with similar steps, but without the use of sedimentation. A two-stage filter plant (also called "adsorption-clarifier") first up-flows coagulant-treated water through a course media filter to promote flocculation within. The course media (called an "up-flow clarifier") removes larger flocculated solids. In this manner, the water is "rough-filtered" before being conveyed downward through a multimedia filter as a polishing step (similar to the roughing filter technology used by CBW in the existing water treatment process).

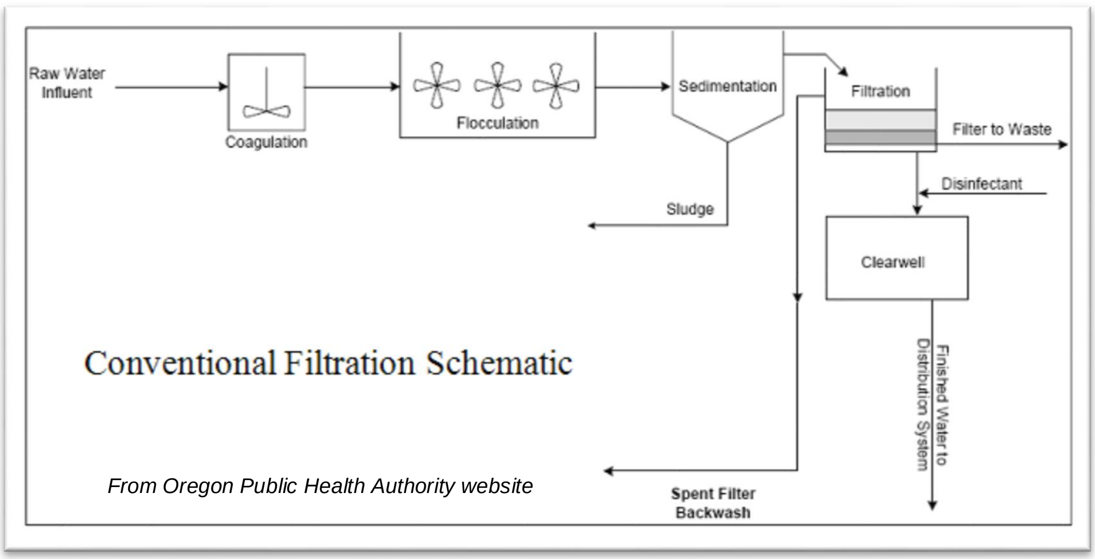

Photo 4 Typical Conventional Filtration Process Diagram

Both the up-flow clarifier and multimedia filter are backwashed with an air-scour feature. The multi-media filter is cleaned with potable water as described above for conventional filtration. The up-flow clarifier is typically cleaned using unfiltered, chemically-treated water for backwashing. Air-scouring is commonly employed simultaneously with backwashing in order to clean the course media used in this filtration step. The direction of backwash and air scour flow is the same as used for up-flow clarification, except that out-flowing water is directed to waste instead of to the multimedia filter. This configuration facilitates automated backwashing and air scouring for cleaning the filters.

5.6.2 Advantages/Disadvantages

5.6.2.1 pH Adjustment

While pH adjustment will not significantly impact the MIEX process, it is needed for replacing alkalinity consumed in the coagulation process associated with multimedia filtration. Soda ash is assumed for this purpose. General advantages and disadvantages of pH adjustment are described in Section 5.5.2.1.

5.6.2.2 MIEX

Primary advantages of using the MIEX process are:

- Ability to remove low weight molecular organic compounds, and its usage complements the ability of multimedia filtration to remove larger weight molecular organics. This arrangement can substantially reduce the generation of DBPs and the chlorine demand in the distribution system.
- When used upstream of multimedia filtration, MIEX will tend to reduce the need for coagulants and facilitate longer filter runs.
- Relative to “fixed bed” ion exchange processes, a smaller equipment footprint is needed. Further, less salt and less brine is needed to regenerate the media.
- Relatively low energy usage.
- Less brine disposal is required, relative to “fixed bed” ion exchange.
- Salt used for brine generation is similar to that used for on-site chlorine generation. The CBW is accustomed to importing salt, and may realize some economies of scale in the procurement of salt for both of these processes.

Disadvantages of using MIEX are:

- The contaminant selectivity of MIEX process is limited to certain kinds and sizes of organic compounds. It adds significant expense to the overall treatment process while targeting only one specific function.
- Relative to other technologies reviewed, MIEX does not readily accommodate changes in raw water quality or finished water demand.
- The system is relatively complicated. Relatively high operator attention is needed to monitor system performance, particularly the resin regeneration process, to avoid organics fouling.
- Resin is continually lost through attrition and carry-over to downstream processes, and is expensive to replace.
- Some brine disposal is required.

5.6.2.3 Multimedia Filtration

Primary advantages of using multimedia filtration are:

- Multimedia filtration is an older, proven process, with a lot of expertise available within the water treatment profession, including: studies, operator experience, regulations, and manufacturers. By using multimedia filtration, CBW would have access to a substantial amount of experience and knowledge to draw from.
- The performance and troubleshooting capabilities of multimedia filtration are well-known.
- Multimedia filtration is effective in handling a wide range of solids and contaminant loadings.
- The multimedia filtration process offers a “regenerate-able” media cleaning process through air-scouring and backwashing. The useful life of granular media can exceed 10 to 15 years, if well-maintained.
- Relative to slow sand filtration, multimedia filter cleaning is relatively easy and quickly accomplished.

Primary disadvantages are:

- Optimizing coagulation to maximize the reduction of organics (i.e., "enhanced" coagulation) may cause finished water turbidity levels to increase.
- With the use of "enhanced" coagulation, multimedia filtration can require large quantities of chemicals and generate large amounts of waste sludge, the disposal of which adds operational costs.
- When using "enhanced" coagulation, pH adjustment is often required to produce the optimum pH at which best organics removal is achieved. Although CBW already employs this step, it complicates the overall water treatment process, especially if a pH re-adjustment is needed prior to conveying the treated water into the distribution system.
- With variable raw water quality, these technologies constantly need coagulant dosage adjustments. This need can be addressed through the use of a streaming current detector.
- The capabilities of conventional and two-stage filtration are limited in removing dissolved substances.

Comparing conventional and two-stage filtration technologies:

- Conventional filtration can treat water with higher contamination levels, and offers better dissolved solids removal. However, to achieve this better performance, conventional filtration tends to use more coagulant and generate more waste sludge.
- Conventional filtration tends to provide better control of the treatment process, but involves more process variables to do so.
- Two-stage filtration is a relatively simpler technology and tends to require less floor space than conventional filtration.
- The construction and O&M costs of two-stage filtration tend to be less relative to conventional filtration.
- Both technologies are commonly manufactured as package plants.

The turbidity levels in CBW's raw water (up to 5 NTU) are well within the treatment capability of two-stage filtration (up to 50 NTU). However, it is less effective in removing color and DOC. Therefore, it will be assumed that two-stage filtration will be used in alternatives that feature other unit processes for removing color and dissolved organic carbon. Therefore, the use of multimedia filtration will be assumed as follows:

- Alternative 1 – not applicable.
- Alternative 2 – conventional filtration.
- Alternative 3 – conventional filtration (as a biological filter).
- Alternative 4 – multimedia filtration integral to the DAF process.
- Alternative 5 –two-stage filtration.

5.6.3 Treatment Performance

5.6.3.1 MIEX

Tests have shown that MIEX alone is generally capable of removing 60% to 80% of DOC and of 40% to 90% of UVA_{254} depending on the character of organic material and "dosage" of resin. Higher removals of these constituents are generally achievable when MIEX is used in association with multimedia filtration.

MIEX performs better in removing "hydrophilic" organic matter. This type of organic matter is generally characterized by low weight molecular organics having SUVA values less than 3.0 L/mg-m. CBW's raw water exhibits SUVA values ranging between 2.9 to 3.6 L/mg-m, indicating that MIEX is very suitable for removing dissolved organic carbon in the water.

In the testing performed by Ixom on CBW's raw water (Appendix G), the use of MIEX alone provided the following removals:

- 78% of DOC.
- 69% of UVA_{254}.
- 58% of color.

When MIEX was used in association with coagulation and filtration, the following removals were achieved:

- 90% of DOC.
- 83% of UVA_{254}.
- 94% of color.

While the addition of coagulation and filtration improved removals of these constituents by 15% for DOC to over 60% for color, the coagulant dosage was in excess of 100 mg/L (using ferrous sulfate). It is further noted that the MIEX process significantly reduced the coagulant dosage while producing better DOC, UVA_{254} and color, relative to using coagulation alone. However, with the MIEX + coagulation/filtration testing, pre-filtration turbidity still increased from less than 2 NTU (raw water) to about 50 NTU. This turbidity level would be at the maximum practical loading for two-stage filtration, and at an elevated loading for conventional filtration. With conventional filtration, this turbidity would need to be substantially removed in the sedimentation step to avoid overly-frequent backwashing.

5.6.4 Multimedia Filtration

While multimedia filtration is effective in removing large amounts of suspended particulate matter, the collective experience of WTPs nationwide has shown a limited effectiveness in removing dissolved substances that cause color and form DBPs when disinfected. For alkalinities similar to CBW's, this testing showed that "enhanced" coagulation and conventional filtration generally removes between 30% and 60% of TOC, depending on coagulant dosage and characteristics of the water [24]. With CBW's low alkalinity, and raw water TOC ranging between 4 and 9 mg/L, the Disinfectant/Disinfection Byproducts Rule would require that a minimum 45% to 50% TOC be removed if "enhanced" coagulation were used.

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[24] Archer and Singer, *Evaluating the Relationship between SUVA and the Susceptibility of Water to Enhanced Coagulation using the Information Collection Rule Database,* Table 3. "Enhanced" coagulation refers to increased dosages of coagulant used to optimize removal of organics.

Two-stage filtration can generally reduce raw water turbidities ranging between 3 and 30 NTU to less than 0.1 NTU in the finished water [25]. Convention filtration can produce the same quality, but with much higher raw water turbidity (as high as 1,000 NTU). Both filtration technologies can provide greater than 99.9% removal of *Giardia* cysts [26]. Relative to technologies like ozone, dissolved air flotation, or nanofiltration, neither is effective in removing color without large coagulant dosages.

Bench testing performed individually by CRW, Ixom, and AWC Water Solutions on CBW raw water indicates that use of coagulants with multimedia filtration will not likely be amenable to achieving adequate color and organics removal of CBW water. This testing showed a need for large dosages of different types of coagulants to achieve significant color removal. Using various polymers in jar testing, CRW needed dosages of 9 to 32 mg/L to optimize coagulation, but was only able to produce modest organic and color removals in the filtered water. As noted above, in its testing for MIEX, Ixom needed in excess of 100 mg/L of the metal salt ferrous sulfate to achieve decent removal of DOC and color. Finally, testing performed by Corix (now AWC Water Solutions) indicated that well over 100 mg/L of a proprietary polyaluminum chloride and over 150 mg/L of soda ash may be needed to produce a settleable size of floc.

These results indicate a high degree of difficulty in treating highly-colored, low-turbidity water with commonly-used coagulants and granular filtration. This high coagulation effort appears to be consistent with the relatively low SUVA values noted in the raw water quality testing summary of Section 3.1.1.1. This testing also confirms the need for supplementing multimedia filtration with other unit processes in order to effectively remove the dissolved substances comprising color and organic content. For Alternative 2, the MIEX technology would provide this function.

5.6.5 Operational Complexity, Reliability, Safety and Sustainability

Assuming the unit processes of Alternative 2, as described in this section, the levels of operational considerations are anticipated as noted in Table 10.

Table 10 – Operational Considerations for Alternative 2

Process	Complexity	Reliability	Safety	Sustainability
pH Adjustment [1]	Moderate	High	High	Low
MIEX	High	Moderate	High	Low
Conventional Filtration	Moderate	Moderate	High	Moderate
On-Site Chlorination	High	High	Moderate	Moderate

Key: 1 – Assuming use of soda ash (sodium carbonate).

Descriptions of these considerations are provided in Section 5.5.4. They are further discussed in Section 6.4 in comparison to the other alternatives.

5.6.6 Certification Requirements

Operator certification requirements for Alternative 2 are summarized in Section 6.2. For Alternative 2, it is estimated that a <u>Level III</u> operator certification will be required.

[25] Kim, *Performance of a Two-Stage Water Treatment System Employing Contact Clarification and Filtration.*
[26] *Ibid.*

5.6.7 Environmental Impacts

Construction of the new treatment building would require drilling and blasting to the south of the project site.

5.6.8 Land Requirements

The required expansion of the water treatment facilities will occur within the existing site; however, some blasting of the bedrock face to the south of the site will be required. No additional land acquisition will be required.

5.6.9 Potential Construction Problems

No significant construction problems are anticipated. Some drilling and blasting of bedrock will likely be required for foundation work of the new treatment building.

5.7 Alternative 3 – Ozonation with MIEX and Biological Filtration

5.7.1 Description

Alternative 3 primarily features the following water treatment steps (Figures 8 and 9):

- pH adjustment using soda ash
- MIEX
- Ozonation
- Biological filtration
- Disinfection

This alternative is considered as a variation of Alternate 2, in light of CBW's forthcoming upgrade of its ozone generators. It assumes that a MIEX would be installed in between the pH adjustment and the ozone systems. Alum is assumed to be used as the coagulant, and rapid-mixed with the raw water. The use of MIEX and ozonation is assumed to allow a lower dosage of alum that would be optimized more for turbidity removal, and less for organics removal. The roughing filter building would be modified to house four biological filters in a similar configuration as for Alternative 2 (Appendix F). The existing disinfection system would be re-used and the existing slow sand filters would be converted to a serpentine clearwell for storing disinfected water after filtration.

The pH adjustment, MIEX, and disinfection steps are further described in Sections 5.5.1 and 5.6.1. The ozone and biological filtration processes are described below.

5.7.1.1 Ozonation

The ozonation process has largely been described in Section 3 and Section 5.5.1. In this section, ozonation is discussed in terms of its need to be followed by a process that removes biodegradable organics caused by the use of ozone.

Ozone is one of the most powerful oxidants used in water treatment. When dissolved in water, it strongly reacts with "oxidizable" compounds as molecular ozone (0_3) or as hydroxyl (OH-) ions that form when ozone reacts with water. The relative amounts of ozone and hydroxyl ions depend largely on the pH of the water, but both of these constituents can readily break down high molecular weight organic compounds into smaller, lower weight compounds. Portions of these compounds become characterized as "biodegradable" dissolved organic carbon (BDOC) and "assimilable" organic carbon (AOC), both of which can be metabolized by bacteria present in the treated water. If BDOC and AOC are conveyed into the distribution system, biological growth problems can develop in storage tanks and pipelines, because this carbon is food for bacteria that can persist in zones that are not well-disinfected.

To address this potential wherever ozone is used, a downstream barrier is needed to capture and substantially remove the BDOC and AOC from the water prior to it being delivered to the distribution system. Because the organic structures of BDOC and AOC are very small, processes that readily remove these forms of carbon are needed. In CBW's existing system, slow sand filtration provides this capability biologically with the *schmutzdecke,* and hence is considered to be a form of biological filtration. Newer forms of biological filtration are being increasingly used currently to enhance DOC removal performance by targeting BDOC and AOC. The conversion of multimedia filters to biological filters is a common way to achieve this objective.

5.7.1.2 Biological Filtration

Biological filtration is a variation of multimedia filtration and is operated to enhance and sustain colonies of microorganisms within the media. The high surface area provided by media particles allows bacteria to attach, grow, and biologically treat drinking water contaminants. "Biofiltration" (as this process is often called) is suitable for removing low molecular weight organics, and biodegradable contaminants such as BDOC and AOC.

Generally, the primary difference between a biofilter and a standard multimedia filter is that bacteria are permitted and encouraged to grow in a biofilter as "biofilm" on the surface of filter media particles. This technology removes dissolved substances primarily through two processes:

- <u>Adsorption</u> of contaminants onto the surface of media particles.
- <u>Biodegradation</u> of contaminants by microorganisms inhabiting sites on the media particles.

By capturing and reducing these organics through biofiltration, the water conveyed to the distribution system can be more "biologically stabilized". This means that water in the distribution system would have a lower tendency to promote biological activity that would otherwise lead to biofilm growth, accelerated corrosion, and taste and odor problems in WSTs and pipelines. Further, enhancing the removal of dissolved organics through biofiltration will tend to reduce the DBP formation potential of the water.

Factors that affect the biodegradability of organics material include:

- <u>Character of organics:</u> smaller, "hydrophilic" organics tend to be more readily biodegraded than "hydrophobic" organics. CBW's raw water tends to be more hydrophilic than hydrophobic; therefore, appears to be amenable to biofiltration in this regard.
- <u>Ozone dosage</u>: Ozone increases the biodegradability of larger, hydrophobic organics, and would tend to reduce the time needed to biologically-treat this portion of the TOC in the water.
- <u>Contact time and temperature:</u> Larger organic molecules require more time to be biologically-treated. Lower temperatures also tend to slow the rate of biological activity. Therefore, providing longer contact times will be more favorable for treating CBW's water. For the purpose of this PER, an "empty-bed contact time" (EBCT) of 20 minutes is assumed.
- <u>Backwashing flow rate:</u> Backwashing is a critical function with all forms of filtration, to clean accumulated contaminants from the surface of media particles and pores. With biofiltration, backwashing needs to be performed at flow rates higher than normal for conventional multimedia filters. Therefore, filters will likely need to be sized with extra volume to accommodate larger media expansion.

Various studies have shown that the use of GAC as media outperforms sand and anthracite media in colder water temperatures, intermittent operation, and periodic exposure to chlorine. For the purpose of this evaluation, it is assumed that GAC will be used as biofilter media. However, as the contaminant removal capabilities of GAC will depend in part on adsorption, it will need to be periodically replaced—generally every 5 to 6 years. It is, therefore, assumed for this PER that the GAC will require replacement every 5 years.

Biofilters can be operated as "rapid" media filters, with loading rates ranging from less than 2 gpm/sf up to 10 gpm/sf. For this PER, the loading rate is assumed to be 2 gpm/sf, the same as used for conventional filtration in this PER.

Alternative 3 essentially adds ozone to the overall process of Alternative 2, and the addition of ozone requires that biological filtration be included as well. Biological filtration may add some redundancy to the MIEX process in the enhanced removal of DOC, but for the purpose of this evaluation, it is considered only for removing the biodegradable and assimilable fractions of DOC generated by the use of ozone. As a variation to Alternative 3, biofiltration might be considered in conjunction with ozone usage, but without the use of MIEX. However, whether biofiltration alone can perform as well as MIEX in the enhanced removal of DOC is uncertain.

5.7.2 Advantages/Disadvantages

Advantages and disadvantages for pH adjustment, ozone, and MIEX are provided in Sections 5.5.2 and 5.6.2. This section describes the advantages and disadvantages of using ozone in combination with MIEX and biological filtration.

5.7.2.1 Ozone and MIEX

The primary advantage of the ozone and MIEX combination is:

- Enhanced water quality: ozone and MIEX provide different but complementary benefits. Ozone effectively removes color and breaks down larger organic molecules into smaller organic molecules. MIEX alone does not remove color as well as ozone, but does effectively remove smaller-weight dissolved organics. Using MIEX upstream of ozone tends to lower the ozone demand. Using ozone in front of MIEX tends to improve the amount of dissolved organics targeted by MIEX.

The primary disadvantage of the ozone and MIEX combination is:

- Increased operational costs and complexity: both technologies feature components and systems that require significant degree of proprietary manufacturer support during breakdowns and malfunctions. Therefore, providing on-the-floor redundancy would be beneficial to keep the WTP in service during any repairs of these facilities.

5.7.2.2 Biological Filtration

Primary advantages of biological filtration are:

- Biological filtration is a natural process that can enhance the treatment of water when it is working as intended. Biofiltration is effective in removing dissolved organics, pesticides, and taste-and-color compounds.

- Biofiltration removes biodegradable organics to decrease and control biofilm-related problems in the distribution system.
- Biofilters are operated very much like standard multimedia filters and are relatively easy and inexpensive to operate and implement by retrofitting existing multimedia filters.
- Operated like multimedia filters, biofilters can be “ripened” much quicker (several hours) after backwashing, relative to slow sand filtration after removal of the *schmutzdecke* (up to 16 weeks).

Primary disadvantages of biological filtration are:

- Increased headloss accumulation or reduced filter run times over the course of using biofiltration, if the backwashing process is not able to substantially clean the media.
- With higher backwashing rate for cleaning filter media, backwash pumping costs will be higher.
- Potential for conveying increased concentrations of bacteria into the filter effluent if filters are not operating correctly. This issue increases the disinfectant demand.
- Potential for undesirable biofilm or algal growth in various locations within the treatment works, which may require periodic applications of disinfectant.
- Need to replace GAC media on a periodic basis, which significantly increases operational costs.

5.7.3 Treatment Performance

The treatment performance of ozone and MIEX are described in Sections 5.5.3 and 5.6.3, respectively. When used together, they can improve the water quality by enhancing the removal of organics at “dosage” rates that are reduced relative to each technology being used alone. Both technologies were jar tested together by Ixom in two different sequences, with the results provided in Table 11.

Table 11 – Ozone-MIEX Sequence Comparisons

Parameter	Ozone before MIEX	MIEX before Ozone
Relative to Raw Water		
DOC	Reduced by 66%	Reduced by 49%
UVA_{254}	Reduced by 62%	Reduced by 52%
Color	Reduced by 71%	Reduced by 100%
Relative to MIEX Alone		
DOC	Reduced by 29%	Increased by 6%
UVA_{254}	Reduced by 26%	Reduced by 10%
Color	Reduced by 10%	Reduced by 100%

The ozone preceding MIEX sequence provided better removals of DOC and UVA_{254} relative to the MIEX preceding ozone sequence (Table 11). Conversely, the latter sequence provided better removals of color. Color was better removed with MIEX preceding ozone, because the ozone demand was partially alleviated by MIEX removing some of the color beforehand.

Relative to using MIEX alone (see Section 5.6.3), these results show that using ozone with MIEX improved the removal of DOC, UVA_{254}, and color for all categories except for when MIEX preceded ozonation. In that exception, using MIEX alone provided better DOC removals. This converse result could be due to changes in organic structures caused by ozone that are not readily removed by the MIEX process.

For the purpose of this evaluation, the sequence of ozone preceding MIEX was assumed, due to better removals of DOC and UVA_{254}. In this sequence, color removal could still be enhanced with an increased dosage of ozone. The ozone dosage in the testing was well within CBW's maximum dosage range.

5.7.4 Operational Complexity, Reliability, Safety and Sustainability

Assuming the unit processes of Alternative 3, as described in this section, the levels of operational considerations are anticipated as noted in Table 12.

Table 12 – Operational Considerations for Alternative 3

Process	Complexity	Reliability	Safety	Sustainability
pH Adjustment [1]	Moderate	High	High	Low
MIEX	High	High	High	Low
Ozonation	High	High	Low	Low
Biological Filtration	Moderate	Moderate	High	Moderate
On-Site Chlorination	High	High	Moderate	Moderate

Key: 1 – Assuming use of soda ash (sodium carbonate).

Descriptions of these considerations are provided in Section 5.5.4. They are further discussed in Section 6.4 in comparison to the other alternatives.

5.7.5 Certification Requirements

Operator certification requirements for Alternative 3 are summarized in Section 6.2. For Alternative 3, it is estimated that a Level III operator certification will be required without on-site treatment of backwashing wastes. If on-site wastewater treatment is pursued, then a Level IV operator certification would be needed.

5.7.6 Environmental Impacts

Construction of the new treatment building would require drilling and blasting to the south of the project site.

5.7.7 Land Requirements

The required expansion of the water treatment facilities will occur within the existing site; however, some blasting of the bedrock face to the south of the site will be required. No additional land acquisition will be required.

5.7.8 Potential Construction Problems

No significant construction problems are anticipated. Some drilling and blasting of bedrock will likely be required for foundation work of the new treatment building.

5.8 Alternative 4 – Dissolved Air Flotation (DAF) with Multimedia Filtration

5.8.1 Description

Alternative 4 primarily features the following water treatment steps (Figures 10 and 11):

- pH adjustment using soda ash
- DAF
- Multimedia filtration
- Disinfection

This alternative assumes that two parallel DAF plants would be installed downstream of the pH adjustment system in the roughing filter building, which would be modified to suit the DAF process. The two package plants would integrate both DAF and multimedia filtration on the same skid (Photo 5). Alum is assumed as the coagulant, and rapid-mixed with the raw water. The use of DAF is assumed to allow a lower dosage of alum due to the efficiencies of flotation. The existing disinfection system would be re-used and the existing slow sand filters would be converted to a serpentine clearwell for storing disinfected water after filtration.

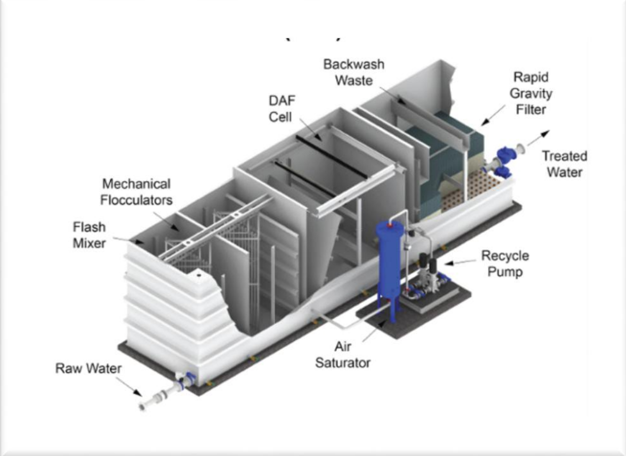

Photo 5 DAF Package Plant

The pH adjustment and disinfection steps are described in Section 5.5.1, the multimedia filtration process is described in Section 5.6.1. DAF is described below.

5.8.2 Dissolved Air Flotation with Multimedia Filtration

DAF is a pre-filtration process that uses the introduction of minute air bubbles to suspend low-density solids like algae and organic compounds, which facilitate the removal of these contaminants from the water treatment stream. These compounds are typically difficult to remove by sedimentation processes, because they settle very slowly, especially when water temperatures are colder. With sedimentation, coagulants are used to increase the mass of these compounds and increase their ability to settle out of the treatment flow and be disposed of. Further, the sedimentation process needs to operate with slower flow rates when water temperatures are relatively cold.

DAF is an effective alternative to sedimentation, as the targeted compounds are floated instead of settled, and are subsequently skimmed from the water surface. With the use of flotation, smaller coagulant dosages can be used to remove contaminants, because it is generally easier to float suspended particles out of the process flow rather than sinking them. With DAF providing a more efficient removal process, the required treatment time can be made considerably shorter than for the sedimentation process. Consequently, DAF flow rates are typically higher, and the equipment can be made smaller relative to conventional filtration.

The upstream end of the DAF process (Photo 6) resembles that of conventional filtration, with rapid mixing and coagulant injection, followed by flocculation basins. These steps are followed by a flotation tank into which tiny air bubbles are released. The air bubbles collide and attach to flocculated particles, carrying them to the water surface where they accumulate and are mechanically skimmed into a collection channel and then conveyed to a hopper or dewatering bin. Within the hopper or bin, the water content is reduced, thereby thickening the solids into smaller volumes of sludge to facilitate disposal. The DAF process is then followed by a multimedia filtration step to receive the filtration credits required for CBW's surface water source. Since DAF is a *pre-treatment* process, it is considered integrally with multimedia filtration for the purposes of evaluating this alternative.

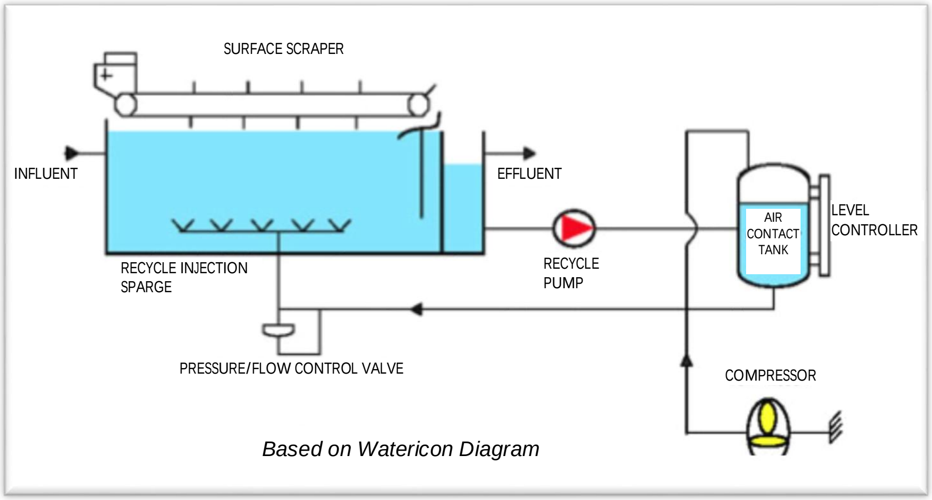

Photo 6 DAF Process Diagram

The floating sludge layer is periodically removed by a mechanical surface skimmer. The DAF sludge would be dewatered with a centrifuge or screw press system. The dewatered sludge would be placed in bins and allowed to further dewater over the period of two months, after which a solids content of 40% to 50% is typically achieved. After the two-month dewatering stage, the sludge would be transported to the landfill for final disposal.

5.8.3 Advantages/Disadvantages

Advantages and disadvantages for pH adjustment and multimedia filtration are provided in Sections 5.5.2 and 5.6.2, respectively. This section describes the advantages and disadvantages of using DAF in combination with multimedia filtration.

5.8.3.1 Dissolved Air Flotation with Multimedia Filtration

Primary advantages of DAF are:

- DAF provides better removals of low-density particles (i.e., flocculated solids) and algae that can otherwise cause short filter runs in conventional filtration. Consequently, lower dosages of coagulants and shorter flocculation times can be used to provide and equal or better treatment performance.
- DAF is a resilient process that can produce consistently good water quality, given considerable variability in TOC, turbidity, and temperature.
- When integrated with multimedia design, higher filtration rates or longer filter runs can be obtained with DAF compared to those obtained after clarification by sedimentation.

- DAF typically requires a smaller equipment footprint relative to conventional filtration and generally has lower capital costs.

Primary disadvantages of DAF are:

- Relatively higher power costs from pumping recycle water and discharging air into the flotation tank.
- DAF produces a greater amount of sludge solids to dispose of relative to conventional filtration. However, this is a result of more effective solids removal.
- The use of additional subsystems, such as air injection and skimming sludge removal, increases the complexity of DAF relative to conventional filtration.

5.8.4 Treatment Performance

5.8.4.1 Dissolved Air Flotation with Multimedia Filtration

DAF is more efficient in removing low-density floc than sedimentation processes like conventional filtration. Effluent turbidities ranging between 0.2 and 0.5 NTU are commonly achieved with DAF prior to multimedia filtration [27]. This technology is particularly effective in removing algae and pathogens like *Giardia* and *Cryptosporidium*, and can also strip some taste and odor compounds from the water.

DAF works well for treating raw water having average turbidities between 0 and 10 NTU, with occasional spikes as high as 50 NTU, and TOC levels ranging between 0 and 14 mg/L [28]. Depending on the coagulation dosage used and flotation time, DAF can also remove high levels of color to below ADEC's secondary MCL of 15 units. In 2011, DAF was recommended as the primary treatment process for a water utility in Lake McNeil, British Colombia, with surface water having the following parameters (similar to CBW's raw water): 7 to 10 mg/L of alkalinity as $CaCO_3$; pH = 6.5 to 6.7; 11 to 38 units of true color; 1 to 8.5 NTU turbidity; and 55% to 68% of ultraviolet transmissivity (0.26 to 0.17 cm^{-1} UVA_{254}). In this pilot testing, over 90% removals of true color and UVA_{254} were achieved [29].

5.8.5 Operational Complexity, Reliability, Safety and Sustainability

Assuming the unit processes of Alternative 4 as described in this section, the levels of operational considerations are anticipated as noted in Table 13.

Table 13 – Operational Considerations for Alternative 4

Process	Complexity	Reliability	Safety	Sustainability
pH Adjustment[1]	Moderate	High	High	Low
DAF w/ Multimedia Filtration	High	Moderate	High	Moderate
On-Site Chlorination	High	High	Moderate	Moderate

Key: 1 – Assuming use of soda ash (sodium carbonate).

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[27] Edzwald and Haarhoff, *Dissolved Air Flotation for Water Clarification,* 2012, AWWA.
[28] *Ibid*.
[29] HDR Engineering, Inc., *Selecting an Advanced Pretreatment Process for Removal of Color and TOC at Lake McNeil, British Columbia,* 2011 AWWA Conference Proceedings.

Descriptions of these considerations are provided in Section 5.5.4.

5.8.6 Certification Requirements

Operator certification requirements for Alternative 4 are summarized in Section 6.2. For Alternative 4, it is estimated that a Level III operator certification will be required without on-site treatment of backwash water. Much of the scoring that leads to this level rating is due to the DAF process alone, as ADEC evidently views this technology as being particularly complicated. If on-site wastewater treatment is pursued, then a Level IV operator certification would be needed.

5.8.7 Environmental Impacts

Construction of the new treatment building would require drilling and blasting to the south of the project site.

5.8.8 Land Requirements

The required expansion of the water treatment facilities will occur within the existing site; however, some blasting of the bedrock face to the south of the site will be required. No additional land will be required.

5.8.9 Potential Construction Problems

No significant construction problems are anticipated. Some drilling and blasting of bedrock will likely be required for foundation work of the new treatment building.

5.9 Alternative 5 – Nanofiltration with Multimedia Filtration

5.9.1 Description

Alternative 5 primarily features the following water treatment steps (Figures 12 and 13):

- pH Adjustment (Raw Water)
- Oxidation by Potassium Permanganate
- Multimedia Filtration (Two-Stage)
- Nanofiltration
- pH adjustment (Finished Water)
- Disinfection

This alternative assumes that a nanofiltration system would be installed downstream of two-stage filtration, all of which would be located in a modified version of the roughing filter building. A pH adjustment system using soda ash and potassium permanganate oxidations step would precede the filtration process. The soda ash would provide sufficient alkalinity for the coagulation process. Alum is assumed as the coagulant. The existing disinfection system would be re-used and the existing slow sand filters would be converted to a serpentine clearwell for storing disinfected water after filtration. A second pH adjustment step featuring soda ash would downstream of the clearwell for increasing alkalinity in the water of the distribution system.

The pH adjustment and disinfection steps are described in Section 5.5.1. The multimedia filtration process is described in Section 5.6.1. Nanofiltration is described below.

Nanofiltration is a membrane filtration technology that is continuing to experience growing usage in the water treatment industry. As a physical separation process, this technology effectively removes dissolved contaminants from water, including colloidal substances like DOC and color, and microbes as small as viruses. As a result, excellent water quality is produced and disinfectant dosages are significantly decreased because pathogens and organics are substantially removed as water passes through the membranes.

Relatively high system pressures (70 to 150 psig) are needed to force water through nanofilter membranes, and, as a result, a significant amount of "reject" water can be generated that will require disposal (10% to 25% of the treatment flow). Since nanofilter membranes have pores that are molecular in size, they are prone to becoming fouled by suspended solids, such as iron and manganese. Hence, pre-treatment processes, like multimedia filtration and anti-scalant injection, are frequently needed upstream of the nanofiltration process to remove substances that can otherwise cause pre-mature clogging of the membranes. Further, as nanofiltration will also remove alkalinity from the water, a post-treatment pH adjustment process using soda ash will be needed after nanofiltration to add it back into the water upstream of the distribution system.

Photo 7 300 gpm Corix Nanofiltration & Filter Plant

The process envisioned for CBW would feature a two-stage ("adsorption-clarifier") filtration unit, followed by two parallel nanofiltration package systems (Photo 7). The two-stage filter would provide removal of suspended solids, including iron and manganese. In addition to a coagulant for turbidity removal, potassium permanganate would be injected upstream of the filter to oxidize iron and be used as a regenerant for the filter media. Anthracite and greensand would be used as the media in this filter to capture the suspended solids, oxidized iron and dissolved manganese. Filter effluent would then be conveyed to the nanofiltration plants.

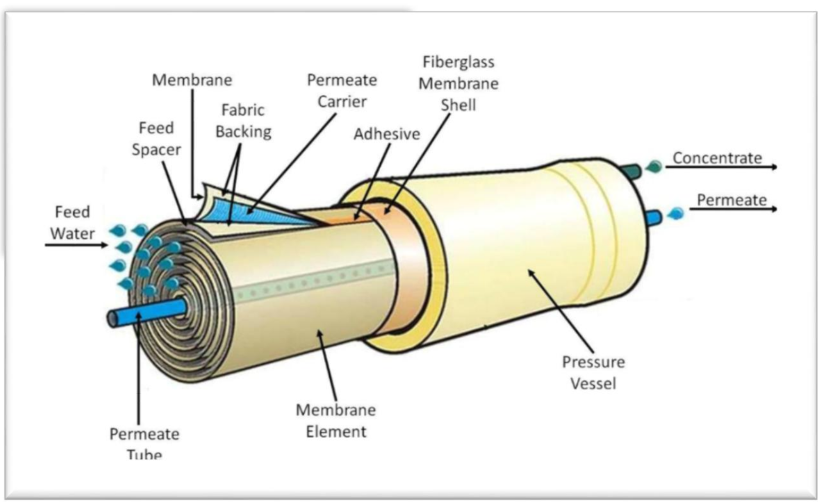

Photo 8 Membrane Element

Nanofiltration plants are typically comprised of modularized racks of membrane elements, the number of which increases proportionally to WTP flow rate and inversely proportional to the "flux" rate that will pass through each membrane element. Membrane elements (Photo 8) are commonly configured as plates or tubes, depending on the manufacturer. Spiral-wound or hollow-fiber tubular elements are most commonly used in treatment applications. Water that passes through the membranes is collected into a central conduit within each element and then conveyed downstream to the next process as "permeate". Rejected contaminant-laden water is conveyed out of each element through a separate conduit as "concentrate" and sent to waste or is recycled.

The pH adjustment will need to be monitored throughout the process upstream of nanofiltration, and acid added if needed to lower the pH to within the range targeted for operation. Alkalinity will need to be added after nanofiltration, because it will be consumed during the filtration process.

5.9.2 Advantages/Disadvantages

Advantages and disadvantages for pH adjustment and multimedia filtration are provided in Sections 5.5.2 and 5.6.2, respectively. This section describes the advantages and disadvantages of using nanofiltration.

5.9.2.1 Nanofiltration

Primary advantages of nanofiltration are:

- By virtue of its ability to block out nearly all the contaminants targeted by CBW, including organics, bacteria, and viruses, nanofiltration will likely provide the highest quality of all the technologies reviewed in this evaluation.
- When working as intended, nanofiltration can be a very reliable process in providing superior water quality, as little operator intervention is needed to provide excellent contaminant removals.

Primary disadvantages of nanofiltration are:

- High pressures are needed to convey water through the membranes, which tends to increase capital and operational costs.
- A substantial, upstream pre-treatment process is typically needed, especially with surface water sources. This pre-treatment process will impose additional operation costs on CBW, especially with the use of chemicals.
- Alkalinity addition will be needed after nanofiltration, which would add considerable chemical costs.
- Significant quantities of wastewater will be generated that need to be disposed of. Wastewater generation represents an inefficiency of the water treatment process. The efficiency that CBW can expect with the use of nanofiltration is recovering 75% to 90% of the water it treats.
- Membrane replacement can manifest into very high replacement costs that typically requires water utilities to conduct long-term financial planning in preparation for their purchase and installation.
- Membranes are vulnerable to constituents that might be present in the raw water, such as calcium, silica, iron, manganese, and organics, which may shorten membrane life. Application of acid washing or an anti-scalant may be needed to control the adsorption or precipitation of these constituents onto the membrane material.
- Nanofiltration is a relatively complex technology to operate due to its level of sophistication, and requires a great deal of operational knowledge of its various systems. For example, daily

membrane integrity testing is typically needed to protect against contaminant breakthrough. Acid washing and the application of an anti-scalant also increases operational complexity.

5.9.3 Treatment Performance

5.9.3.1 Nanofiltration

Nanofiltration can provide in excess of 5 log removals of both *Giardia* and *Cryptosporidium* and between 70% to 95% removals of TOC and corresponding DBP formation potential [30]. Upstream of nanofiltration, turbidity, iron, and manganese would be removed by two-stage filtration, which is capable of reducing these contaminants to well below the MCLs.

5.9.4 Operational Complexity, Reliability, Safety and Sustainability

Assuming the unit processes of Alternative 5 as described in this section, the levels of operational considerations are anticipated as noted in Table 14.

Table 14 – Operational Considerations for Alternative 5

Process	Complexity	Reliability	Safety	Sustainability
pH Adjustment, Raw Water[1]	Moderate	High	Low	Moderate
Multimedia Filtration	Moderate	Moderate	High	Moderate
Nanofiltration	High	High	Moderate	Low
pH Adjustment, Finished Water[1]	Moderate	High	High	Low
On-Site Chlorination	High	High	Moderate	Moderate

Key: 1 – Assuming use of soda ash.

Descriptions of these considerations are provided in Section 5.5.4. They are further discussed in Section 6.4 in comparison to the other alternatives.

5.9.5 Certification Requirements

Operator certification requirements for Alternative 4 are summarized in Table 18, Section 6.2. For Alternative 5, it is estimated that a Level III operator certification would be required without on-site treatment of plant-generated wastes. If on-site wastewater treatment is pursued, then a Level IV operator certification would be needed.

5.9.6 Environmental Impacts

Construction of the new treatment building would require drilling and blasting to the south of the project site.

[30] Environmental Protection Agency, *Technologies and Costs Document for the Final LT2ESWTR and Final Stage 2 D/DBPR*, EPA 815-R-05-013, Dec 2005.

5.9.7 Land Requirements

The required expansion of the water treatment facilities will occur within the existing site. No additional land acquisition will be required.

5.9.8 Potential Construction Problems

No significant construction problems are anticipated. Some drilling and blasting of bedrock will likely be required for foundation work of the new treatment building.

5.10 Alternative 6 – No Action

The No Action alternative does not meet the CBW's need for long term, reliable, and safe water treatment facilities.

5.11 Backwash Waste Disposal

The backwash waste from each of the Alternatives 1 through 5 is required to be disposed of in accordance with ADEC wastewater regulations. Several alternatives (A1, A2, B, C and D) are presented below for disposal of backwash waste.

Under all of the backwash waste disposal alternatives backwash waste water from the WTP would be piped to an insulated above-ground bolted steel storage tank. Polymer would be injected into the backwash waste water to improve settling of solids in the clarifier tank. Various disposal alternatives are presented for the clarified backwash water.

Under all of the alternatives backwash sludge would undergo primary dewatering with a centrifuge system and secondary dewatering over the course of one to two months through evaporation and gravity drain in outside covered containers. The dewatered sludge would be transported by ocean freight to a landfill facility in eastern Washington (used by CBW for all municipal refuse disposal).

5.12 Backwash Waste Disposal Alternative A1 – Sewer Extension to WWTP (Buried)

5.12.1 Description

Under this alternative, sewer service would be extended uphill from the wastewater treatment plant (WWTP) to the WTP (Figure 14). This would require construction of approximately 1,300 linear feet of buried gravity sewer main. Construction of the sewer main would require clearing and blasting along the proposed alignment. The gravity sewer main would connect to the WWTP where backwash wastewater would be treated.

5.12.2 Advantages/Disadvantages

The primary advantages of this alternative are:

- Most direct route for extension of sewer service to the WTP.
- Treatment of backwash water would occur at the existing WWTP.

The primary disadvantages of this alternative are:

- Would require clearing forest and some drilling and blasting along the proposed pipeline alignment

5.12.3 Environmental Impacts

Clearing would be required along the pipeline alignment. Some drilling and blasting may be required to accommodate the buried pipeline.

5.12.4 Land Requirements

The proposed pipeline alignment would be routed to the WWTP through property owned by CBW, so no additional land acquisition would be required.

5.12.5 Potential Construction Problems

The gravity sewer alignment will be routed along steep terrain from the WTP to the WWTP, so some degree of difficulty is anticipated during construction.

5.13 Backwash Waste Disposal Alternative A2 – Sewer Extension to WWTP (Above Grade)

5.13.1 Description

Under this alternative, sewer service would be extended uphill from the WWTP to the WTP (Figure 14). This would require construction of approximately 1,300 linear feet of gravity sewer main. The pipeline would be above ground, supported by timber sleepers and secured with duckbill or drilled epoxy anchors (depending on depth of bedrock). The pipeline would be insulated and would have electric heat trace to provide freeze protection during the coldest times of the year. The gravity sewer main would connect to the WWTP where clarified backwash wastewater would be treated.

5.13.2 Advantages/Disadvantages

The primary advantages of this alternative are:

- Most direct route for extension of sewer service to the WTP.
- Treatment of backwash water would occur at the existing WWTP.

The primary disadvantages of this alternative are:

- Heat trace and insulation required for aboveground pipeline.
- Would require clearing forest along the proposed pipeline alignment.

5.13.3 Environmental Impacts

Clearing would be required along the pipeline alignment.

5.13.4 Land Requirements

The proposed pipeline alignment would be routed to the WWTP through property owned by CBW, so no additional land acquisition would be required.

5.13.5 Potential Construction Problems

The gravity sewer alignment will be routed along steep terrain from the WTP to the WWTP, so some degree of difficulty is anticipated during construction.

5.14 Backwash Waste Disposal Alternative B – Extend Sewer Service from Zimovia Highway

5.14.1 Description

Under this alternative, sewer service would be extended from the Zimovia Highway, along Wood Street to the WTP (Figure 14). This would require construction of approximately 3,100 linear feet of gravity sewer main. The pipeline alignment would be routed inside the existing road corridor.

5.14.2 Advantages/Disadvantages

The primary advantages of this alternative are:

- Construction would occur within the road corridor, which would not require additional clearing.
- Treatment of backwash water would occur at the existing WWTP.

The primary disadvantages of this alternative are:

- Less direct route than Alternative A1 and A2.

5.14.3 Environmental Impacts

The pipeline alignment would be routed through the existing road corridor, so environmental impacts would be minimal.

5.14.4 Land Requirements

The proposed pipeline alignment would be routed through the existing Wood Street road corridor, so no additional land acquisition would be required.

5.14.5 Potential Construction Problems

No significant construction problems are anticipated.

5.15 Backwash Waste Disposal Alternative C – Marine Outfall

5.15.1 Description

Similar to the other alternatives, the backwash waste water from the WTP would be piped to an insulated, above-ground, bolted steel storage tank (Figure 15). The clarifier would allow solids to settle between backwash cycles. Supernatant from the clarifier would then be routed through a pipeline to a marine outfall for discharge. This would require construction of approximately 2,000 LF of gravity sewer main.

Accumulated backwash sludge would be periodically removed from the clarifier tank, dewatered, and disposed of.

5.15.2 Advantages/Disadvantages

The primary advantages of this alternative are:

- Would not require extension of sewer service to the WTP site.

The primary disadvantages of this alternative are:

- Would require clearing forest along the proposed pipeline alignment.

- Would require an additional discharge permit from ADEC and additional monthly effluent sampling.
- Treatment of backwash water would occur onsite and CBW would be responsible for removal and disposal of sludge from the clarifier chambers, which would involve work in a confined space environment.

5.15.3 Environmental Impacts

Clearing would be required along the pipeline alignment.

5.15.4 Land Requirements

The backwash clarifier tank would be constructed on the existing site. The sewer outfall line would be routed through land owned by CBW.

5.15.5 Potential Construction Problems

The alignment of the sewer line would be through steep terrain, so some degree of difficulty is anticipated during construction.

5.16 Backwash Waste Disposal Alternative D – Recycle of Backwash Water

5.16.1 Description

Similar to the other alternatives, the backwash waste water from the WTP would be piped to an insulated, above-ground, bolted steel storage tank. Polymer would be injected into the backwash waste water to improve settling of solids in the clarifier tank. Supernatant from the clarifier would be routed to the water treatment process, upstream of the treatment process and raw water chemical injection. The recycled backwash water would be blended with influent raw water and undergo treatment through the selected filter system (Figure 16).

5.16.2 Advantages/Disadvantages

The primary advantages of this alternative are:

- Backwash water would be recycled, increasing the overall treatment efficiency.

The primary disadvantages of this alternative are:

- Treatment of backwash water would occur onsite and CBW would be responsible for removal and disposal of sludge from the clarifier chambers, which would involve work in a confined space environment.

5.16.3 Environmental Impacts

Minimal environmental impact is anticipated with this alternative.

5.16.4 Land Requirements

The backwash clarifier would be constructed on the existing site.

5.16.5 Potential Construction Problems

No construction problems are anticipated.

6 Selection of an Alternative

The various alternatives are compared in this section in the following terms:

- Capital, O&M, and Life Cycle Costs
- Operator Certifications
- Use of a Selection Matrix

The selection matrix numerically ranks all the major considerations made in this assessment and, from this exercise, determines a "preferred" alternative. A discussion of this selection process follows the matrix.

6.1 Capital, O&M, and Net Present Value

Capital, O&M and life cycle costs were estimated to compare the relative expense of each alternative. *Capital* costs refer to the estimated costs needed to design and construct the proposed facilities. *O&M* costs are those estimated for operation the facility, including: labor; repairing and replacing malfunctioning or worn-out components; and procurement of consumables, such as power and chemicals. *Net Present Value (NPV)* costs combine capital and O&M costs to compare the theoretical sum of the capital cost, plus the present worth of a uniform series of annual O&M costs.

For comparative purposes, capital costs include only construction costs, including 15% for contractor overhead and profit, as well as a 3% bonding and insurance fee. Total costs assume a 15% contingency to generally account for details that are not ordinarily identified in this level of conceptual evaluation. Design, project management, and administration costs are included in these estimates.

The O&M costs are based on providing the future peak flow of 1.8 mgd. CBW's existing O&M costs are based on providing the current peak flow rate of 1.3 mgd. The only conclusion that can be generally made in comparing existing O&M costs with those of each alternative is that operating costs will, over the life of the improvements increase significantly, especially those alternatives in which large dosages of chemicals are featured.

Table 15 summarizes the capital, O&M, and NPV costs. A net present worth, or life cycle cost analysis, is a technique used to compare alternatives. Also known as a NPV, the analysis identifies the cost of owning and operating an asset for the entirety of its lifespan. The NPV equation and variables are defined as:

$$NPV = C + USPW(O\&M) - SPPW(S)$$

Where *C* is the estimated capital cost of the alternative, *USPW* is the uniform series present worth factor applied to the annual *O&M* costs of the alternative and *SPPW(S)* is the single payment present worth of the salvage value, which, for this project, is assumed to be zero.

The USPW is a function of the OMB "real" discount rate (i) and the lifespan of the asset (n). For a 20-year life (n=20), the discount rate is 1.2%.

Detailed breakdowns of capital and O&M costs are provided in Appendix H.

Table 15 – Comparison of Costs

Cost	Alt 1 – Improve Existing	Alt 2 – MIEX + CF	Alt 3 – MIEX + Ozone + BF	Alt 4 – DAF + Filtration	Alt 5 – Nano + TS Filtration
Capital Cost	$12,543,000	$12,216,000	$13,712,000	$8,191,000	$8,185,000
Annual O&M Cost	$260,646	$351,711	$403,007	$289,614	$417,079
NPV	$17,153,130	$18,436,813	$20,840,101	$13,313,496	$15,561,998

Key: CF - Conventional Filtration
BF - Biological Filtration
TS - "Two-Stage" Filtration

This analysis indicates that Alternative 4 (DAF with Multimedia Filtration) has the lowest life cycle cost of the five alternatives, with relatively low capital and O&M costs. Alternative 1 (Improve Existing Process) offers the second lowest O&M costs, but has one of the highest capital costs, which include the construction of additional concrete basins for slow sand filtration and roughing filtration and the upsizing of various equipment items. As shown in Appendix H, the capital cost of Alternative 1 would be considerably greater with a water recapture tank, associated pumps and piping, and a slow sand filter cleaning system included.

In the consideration of O&M costs, water wasting was reviewed in terms of revenue loss. Treated water lost in the course of cleaning filters (all alternatives) and in the rejection of contaminants (Alternative 5) is assumed to be wasted and not available for re-treatment and subsequent usage in the community. Although this loss of revenue does not strictly represent an O&M cost, it is nevertheless viewed as a cost to account for the influence that water treatment inefficiency has on establishing water rates. Without this revenue, the community would need higher water rates to cover the overall cost of operating the WTP. This revenue loss is assumed to be computed as gallons of non-salable water multiplied by the average per-gallon treatment cost of water. Table 16 summarizes this review.

Table 16 – Comparison of O&M Costs Including Water Wasting

Cost	Alt 1 – Improve Existing	Alt 2 – MIEX + CF [1]	Alt 3 – MIEX + Ozone + BF [2]	Alt 4 – DAF + Filtration	Alt 5 – Nano + TS [3] Filtration
O&M	$260,646	$351,711	$403,007	$289,614	$417,079
Non-salable Water	$40,438	$35,740	$45,584	$26,989	$101,573
Total	$301,084	$387,450	$448,591	$316,603	$518,652

Key: Non-salable Water includes process waste and non-potable water.
CF - Conventional Filtration
BF - Biological Filtration
TS - "Two-Stage" Filtration

Alternative 4 has the lowest O&M cost, and would also provide the smallest loss of revenue associated with non-salable water. This benefit is due to the efficiency of the DAF process, which tends to result in less volume backwashing relative to conventional filtration. Alternative 5 would present the largest impact to water utility revenues. For this alternative, backwashing and nanofiltration reject water streams represent the largest loss of water.

A NPV analysis for the backwash water disposal alternatives is presented in Table 17. The alternative with the lowest NPV is Alternative A2– Sewer Extension to WWTP (Above Grade).

Table 17 – Comparison of Costs for Backwash Water Disposal

Cost	Alt A1 – Sewer Extension to WWTP (Buried)	Alt A2 – Sewer Extension to WWTP (Above Grade)	Alt B – Sewer Extension to Zimovia Hwy	Alt C – Marine Outfall	Alt D – Backwash Recycle
Capital Cost	$1,659,000	$1,574,000	$2,411,000	$1,934,000	$860,000
Annual O&M Cost	$3,500	$5,805	$4,600	$3,600	$2,761
NPV	$1,720,906	$1,676,683	$2,492,362	$1,997,674	$908,839

6.2 Operator Certification

Operator certification requirements are imposed on community water systems by ADEC to ensure that operators have a minimum level of technical understanding for drinking water treatment. Currently, the classification system is rated by the following scoring ranges:

- Class I: 1 to 30 points.
- Class II: 31 to 55 points.
- Class III: 56 to 75 points.
- Class IV: 76 points and above.

Table 18 estimates certification requirements for various treatment scenarios. As made evident in the table, adding treatment process components tends to increase the classification score. It is important to note that the scoring estimates shown in Table 18 do not necessarily reflect the score that would be determined by ADEC.

Table 18 – Comparison of Operator Certification Levels

Component Category [1]	Existing System	Alt 1 - Improve Existing	Alt 2 – MIEX + CF	Alt 3 – MIEX + Ozone + BF	Alt 4 – DAF + Filtration	Alt 5 – Nano + TS Filtration
System Size (1.3 mgd)	16	--	--	--	--	--
System Size (2.0 mgd)	--	16	16	16	16	16
Surface Water Source	6	6	6	6	6	6
Pretreatment - Roughing Filter, Gravel or Rock	4	--	--	--	--	--
Pretreatment - Roughing Filter, Backwashable Granular Media	--	8	--	--	--	--
pH Adjustment	3	3	3	3	3	3

Component Category [1]	Existing System	Alt 1 - Improve Existing	Alt 2 – MIEX + CF	Alt 3 – MIEX + Ozone + BF	Alt 4 – DAF + Filtration	Alt 5 – Nano + TS Filtration
Potassium Permanganate Oxidation	--	--	--	--	--	4
Ion Exchange	--	--	4	4	--	--
Ozonation	10	10	--	10	--	--
Coagulation - Primary	--	--	5	5	5	5
Rapid Mix - In-Line Static	1	1	1	1	1	1
Mechanical Flocculator	--	--	8	8	8	8
Clarification Process - Tube or Inclined Plate Settlers	--	--	2	2	--	2
Clarification Process - DAF	--	--	--	--	16	--
Filtration - Slow Sand	4	4	--	--	--	--
Filtration - Granular Media	--	--	8	8	8	8
Filtration - Membrane Nanofiltration	--	--	--	--	--	10
Disinfection - Sodium Hypochlorite, Generated On-site	5	5	5	5	5	5
Clearwell	3	3	3	3	3	3
SUBTOTAL SCORE	52	56	61	71	71	71
SYSTEM CLASS	II	III	III	III	III	III
On-site Treatment of Sludge or Backwash	0	6	6	6	6	6
TOTAL SCORE	52	62	67	77	77	77
SYSTEM CLASS	II	III	III	IV	IV	IV

Key: 1 – 18 AAC 74, *Water and Wastewater Operator Certification and Testing*, Section 120.
CF - Conventional Filtration
BF - Biological Filtration
TS - “Two-Stage” Filtration

The scoring estimates a Level II certification requirement for the existing CBW treatment system. If the existing system were to be upgraded as described in this evaluation, a Level III certification would be required. The new processes featured in Alternatives 2, 3, 4, and 5 would require Level III certifications and, if on-site backwash and wastewater treatment is pursued by CBW, then Level IV certifications would be required for Alternatives 3, 4, and 5.

If additional coagulants are needed for any of the future scenarios, such as a filter-aid, a score of 3 would be added for each coagulant used, up to a maximum of 12 points for the category. The conventional filtration scenario assumes that a filter aid is not used; however, its usage would not appear to increase the certification requirements for any of the alternatives as envisioned in this evaluation.

To achieve the required certification level, both education and experience are required. Per ADEC's certification regulations for water treatment [31]:

- Level II operators are required to have 12 years of education and 3 years of operation experience.
- Level III operators are required to have 14 years of education and 4 years of operation experience.
- Level IV operators are required to have 16 years of education and 4 years of operation experience.

However, the following equivalencies may be considered by ADEC:

- A year of post-secondary education needed by Level III and IV operators can be counted as a year of trade school, or if the operator receives 45 ADEC-approved continuing education credits (CEUs).
- Two years of accrued excess water treatment experience at a Class II or higher water treatment facility may be used to satisfy up to one year of the post-secondary education requirement for Level III water treatment certification.
- Four years of accrued excess water treatment experience at a Class III or higher water treatment facility may be used to satisfy up to two years of the post-secondary education requirement for Level IV water treatment certification.

Further details on certification requirements and equivalence are found in 18 AAC 74, *Water and Wastewater Operator Certification and Testing.*

6.3 Selection Matrix

The relative advantages and disadvantages of the alternatives are compared in this section using a numerical scoring approach. This scoring process is summarized in a selection matrix, presented in Table 19.

The left column of the matrix contains important criteria that are considered for comparing the alternatives. Next to each criterion is a weighting factor that assigns a relative importance (1 low to 4 high) to each of the criterion. Each alternative was given a score (1 poor to 5 excellent) for each of the criterion. The weighting factor and score were multiplied to give a "Weighted Score" for each criterion, and then summed for each alternative to give the total score.

[31] 18 AAC 74, *Water and Wastewater Operator Certification and Testing*, Table A.

Table 19 – Alternatives Selection Matrix

		Alt 1 – Improved Existing		Alt 2 – MIEX + CF		Alt 3 – MIEX + Ozone + BF		Alt 4 – DAF + Filtration		Alt 5 – Nano + AC Filtration	
Criteria	Weight Factor	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
Treatment Performance	4	3	12	4	16	5	20	4	16	5	20
Treatment Efficiency	2	2	4	3	6	3	6	4	8	1	4
Complexity	3	3	9	2	6	1	3	2	6	1	3
Reliability	3	3	9	2	6	2	6	2	6	3	9
Safety	4	2	8	4	16	2	8	4	16	3	12
Sustainability	4	3	12	2	8	1	4	3	12	1	4
Operator Certification	2	4	8	4	8	2	4	2	4	2	4
Capital Costs	3	1	3	1	3	1	3	3	9	3	9
O&M Costs	4	3	12	2	8	1	4	3	12	1	4
Owner Preference	4	4	16	2	8	3	12	3	12	1	4
Total Score			93		85		70		101		73

Key: CF - Conventional Filtration
BF - Biological Filtration
TS - "Two-Stage" Filtration

Alternative 4 has the highest total score of the five alternatives considered and, consequently, becomes the "preferred" alternative. Alternative 5 scores the lowest. The comparative scoring of the criteria is discussed below.

6.3.1 Treatment Performance

Treatment performance is given the highest weighting factor of 4, because high water quality translates into a higher degree of public health. Further, high water quality indicates that the WTP is operating well. Alternatives 3 and 5 are scored highest, with the ability to produce excellent water by virtue of having more robust barriers against the passage of contaminants into the water distribution system. However, this water quality excellence comes at the expense of higher complexity and higher capital and operational costs. Alternative 1 is given the lowest score based on the limitations of slow sand filtration to remove dissolved organics. Alternatives 2 and 4 are given moderate scores, both being somewhat limited by multimedia filtration in the ability to remove organics and color. In Alterative 2, the MIEX process is expected to excel in the removal of low molecular weight organics and less so for color removal. In Alternative 4, DAF is expected to excel in the removal of color, but possibly less so in the removal of organics.

6.3.2 Treatment Efficiency

Treatment efficiency is given a weighting factor of 2, because efficiency is considered an enhancement of treatment performance, and because small to moderate inefficiencies can be readily overcome by making slight water rate adjustments. Alternative 4 is given the highest score based on its higher treatment rate, lower operational cost, and lower water wastage. Alternative 5 is scored the lowest for this criterion due to the loss of water through backwashing and rejection of contaminates.

6.3.3 Complexity

Plant complexity is given a moderate weighting factor of 3. It is an important criterion with respect to an operator's ability to understand and make adjustments to the process (see Section 5.5.4 for a description of this consideration). However, with training and experience, operators can become accustomed to a system's complexity and it becomes less of a challenge over time. Despite the complexities of the existing ozone system, Alternative 1 is given the highest score, due to the familiarity of operators in working with this unit process. However, only a score of 3 is given, due to the fact that ozonation is complex and would require a significant amount of time for a new operator to arrive at the experience and knowledge needed to be proficient with this technology. Lowest scores are given to Alternatives 3 and 5, both of which feature multiple and relatively sophisticated unit processes.

6.3.4 Reliability

This criterion is given a moderate weighting factor of 3. Reliability is an important consideration for selecting a process or a treatment system as it relates to the ability to consistently produce good water quality (see Section 5.5.4 for description). But a lack of reliability can be substantially offset by the expertise of the operator. Alternatives 1 and 5 are scored the highest in terms of producing good water quality. As long as the process is operating well, good water quality will be produced without a substantial degree of operator intervention. However, these alternatives are scored only 3, because their complexities (via ozonation or nanofiltration) can cause challenges if processes or equipment are not working correctly. All other alternatives are given a score of 2, because each features multimedia filtration, which relies more on operator expertise and execution to produce excellent water quality.

6.3.5 Safety

Safety is given the highest weighting factor of 4 (see Section 5.5.4 for description). By virtue of working with chemicals, no alternative is given the highest score—all feature the use of caustic soda for pH adjustment and chlorine for disinfection, which are corrosive substances and require breathing apparatuses during handling. Beyond the use of these chemicals, Alternatives 2 and 4 are given the highest scores as coagulants are featured, which are relatively innocuous (with some exceptions). Alternatives 1 and 3 are given lowest scores because ozonation is used and can be harmful if significant concentrations become airborne. Alternative 5 is given a moderate score of 3, presuming that the anti-scalant chemical is not very hazardous and that an acid application is not needed.

6.3.6 Sustainability

This criterion is given the highest weighting factor of 4. It combines the need for sound financial and technical capacity of those running the water system (see description in Section 5.5.4), and has high importance: if a community cannot sustain its water system either through the inability to fund its operation, or the inability of its employees to operate the plant, it will fail in meeting its drinking water objectives. Alternatives 1 and 4 are scored highest with a moderate 3. Both of these alternatives offer the lowest O&M costs, and both have moderate complexity scores. But neither is simple to operate. That CBW has proven over the last 15 years that it can sustain an ozone system gives some credence to giving Alternative 1 this higher score. But it has done so because its operators have gained the expertise to operate and repair the ozone system, as needed. With new operators, this scoring would be difficult to justify for Alterative 1. Alternatives 3 and 5 are given the lowest scores due to high O&M costs and complexity in multiple unit processes.

6.3.7 Operator Certification, Capital Costs, and O&M Costs

These criteria are scored for each alternative based on the analyses detailed in this section.

Operation certification is given a weighting factor of 2. It is an important criterion, but one that can be met over time. Relative to most Alaskan communities, CBW has a good financial ability to hire and retain capable operators. A Level IV certification is given half the score of Level III due to the additional requirements needed to achieve this higher level.

The capital cost criterion is given a weighting factor of 3. Capital funding can be difficult to obtain and, for moderately sized Alaskan communities, usually requires loans as well as grants, which are discrete obligations that can be met over time. Higher scores are given to the alternatives presenting the lowest capital costs.

The O&M cost criterion is given the highest weighting factor 4, as it directly relates to the sustainability criterion and represents annual costs that extend into perpetuity. Higher scores are given to the alternatives offering lowest O&M costs.

6.3.8 Owner Preference

This criterion is given the highest weighting factor 4 and scored the alternatives based on CBW's sense of which option it would prefer to pursue in pilot testing. Alternatives were scored based on CBW's familiarity with the use of ozonation and its recent decision to invest in the replacement of its existing ozone generators. This scoring presumes that CBW would prefer to keep using its ozone system in some capacity. If not, it is presumed CBW would next prefer to pursue the alternative that would provide the most cost effectiveness, which would be Alternative 4, based on its life cycle cost.

6.4 Discussion of Alternatives

6.4.1 Alternative 1 – Improve Existing Process

Alternative 1 scored second highest out of the five considered in the selection matrix process. This alternative is attractive primarily for the following reasons:

- CBW is familiar with this water treatment process.
- O&M costs would remain relatively low, primarily because a lesser need for chemicals relative to other alternatives.
- CBW would continue the use of ozone, having recently invested significant funds to replace its aging ozone generators.
- Improved process would require the lowest operator certification level (III).

Conversely, Alternative 1 presents the following primary challenges:

- High capital costs, which will be more difficult to fund relative to other alternatives.
- Unlike the other alternatives, which could make use of the slow sand filter basins as additional water storage, Alternative 1 will experience a continued lack of water storage during the summer, which tends to expose the water treatment process to the fluctuations of community water demands.

- Potential for continued difficulties in post-treatment high chlorine demands and in reducing disinfection by-products, as slow sand filtration has limited organic removal capabilities.

Alternative 1 remains a very strong candidate for pursuit in future improvements

6.4.2 Alternative 2 – MIEX Process with Multimedia Filtration

Alternative 2 scored third highest out of the five considered in the selection matrix process. This alternative is attractive primarily for the following reasons:

- The MIEX process is very effective in removing low weight molecular organics that can produce certain kinds of DBPs.
- When combined with conventional filtration, this alternative will provide effective removal of both small and large molecular organics, which will substantially reduce the tendency for generating a wide spectrum of disinfection by-products, and turbidity.

Conversely, Alternative 2 presents the following primary challenges:

- The MIEX and conventional filtration processes will combine to impose higher O&M costs on CBW, in the need for significant amounts of chemicals and replacement of MIEX resin.
- Without substantial amounts of coagulant, this alternative may not remove color as substantially as ozone.

With Alternative 2, exceptional water quality can be achieved, but at higher O&M costs relative to Alternatives 1 and 4.

6.4.3 Alternative 3 – Ozonation with MIEX and Biological Filtration

Alternative 3 scored the lowest out of the five considered in the selection matrix process. This alternative, which is a variation of Alternative 2, is attractive primarily for the following reasons:

- Same reasons as noted for Alternative 2 above.
- The use of ozone will provide excellent removals of color, taste, and odors, in addition to a probable reduction of coagulant dosage.

Conversely, Alternative 3 presents the following primary challenges:

- The MIEX, ozone, and biological filtration processes will combine to impose very high O&M costs on CBW, in the need for significant amounts of power for ozone and chemicals, and replacement of MIEX resin; therefore, Alternative 3 offers the lowest level of sustainability.
- The multiple processes in this alternative will combine to greatly increase the operational complexity of the WTP. The use of ozone imposes a need for biological filtration, which will be more complex relative to conventional filtration.
- The MIEX process may not readily accommodate significant variability in raw water characteristics, which may result in variable finished water quality.
- This alternative will likely require a Level IV operator certification.

With Alternative 3, superior water quality can be achieved, but at higher O&M costs and complexity relative to Alternatives 1, 2, and 4.

6.4.4 Alternative 4 – DAF with Multimedia Filtration

Alternative 4 scored the highest out of the five considered in the selection matrix process. This alternative is attractive primarily for the following reasons:

- DAF is the most cost effective treatment process based on having the lowest life cycle costs and highest treatment efficiency.
- The use of DAF is expected to provide good organics removal and excellent color removal, in addition to a probable reduction of coagulant dosage relative to Alternatives 2, 3, and 5.
- DAF is a robust process that can accommodate significant variability in raw water quality without substantial adjustments in the treatment process.

Conversely, Alternative 4 presents the following primary challenges:

- This process will probably require a Level IV certification.
- This alternative will probably not remove organics as well as Alternatives 2, 3, and 5 and, therefore, may result in a moderate chlorine demand in the distribution system and some DBP generation, although not as high as Alternative 1.

With Alternative 4, very good water quality can be achieved with high treatment efficiency and lower O&M costs.

6.4.5 Alternative 5 – Nanofiltration with Multimedia Filtration

Alternative 5 scored the fourth highest out of the five considered in the selection matrix process. This alternative is attractive primarily for the following reasons:

- Nanofiltration will provide superior water quality relative to the other alternatives and will remove substantial amounts of organics, color, and microbial contaminants.
- With the use of nanofiltration, the two-stage filtration process can be optimized to remove turbidity, iron, and manganese, which will tend to decrease the coagulant dosage.

Conversely, this alternative presents the following primary challenges:

- This alternative offers the highest O&M costs in terms of chemicals needed and eventual replacement of filter membranes, and hence the lowest level of sustainability.
- This alternative is the most complex of the alternatives considered.
- This process will likely require a Level IV certification.

6.5 Summary

Based on this evaluation, the top two candidates for future action in the water treatment process are:

- Alternative 1 – Improve Existing Process.
- Alternative 4 – Dissolved Air Flotation (DAF) with Multimedia Filtration.

The pursuit of either alternative for future action would be reasonable. In Alternative 1, CBW would be improving a system it is very familiar with, and one that would be the most economical to operate. The high capital costs would be more challenging to fund, but, in phased construction, this objective would be more achievable. In pursuing Alternative 4, CBW would be substantially stepping away from slow sand filtration for a treatment process that would provide better water quality, but would also be able to make considerable re-use of the existing facilities and possibly remodel the slow sand filter basins to cost-effectively provide extra water storage. However, CBW's water treatment challenges involve both water quality and hydraulic capacity concerns, and Alternative 4 would more effectively address both relative to Alternative 1, which is more limited in terms of treatment performance and future plant expansion. Alternative 4 – DAF with Multimedia Filtration is, therefore, affirmed as the "preferred" alternative for CBW.

6.6 DAF Pilot Testing Results

Pilot testing for the DAF process was performed at the WTP from July 27 to September 29, 2016. Skid-mounted pilot testing modules were supplied by AWC Water Solutions, Ltd, Surrey, BC, Canada, and connected to the WTP's influent piping. Raw water was side-streamed into the pilot apparatus, which was comprised of a dissolved air flotation module and a filter module. A third module housed the chemical feed systems. The process was tested with two types of coagulant, alum and aluminum chlorohydrate (ACH), and soda ash for pH adjustment. The process was also tested with ozonated water using intake piping supplied from a basin located downstream of the ozone contact tank (and upstream of the roughing filters).

The best performing chemical scheme featured ACH with no pH adjustment, and produced water with ultraviolet transmissivities (UVTs) approaching 95%, true colors of 5 Pt-Co units, and turbidities less than 0.15 NTU. DOC levels were also reduced by an average of 75%, to less than 2 mg/L as $CaCO_3$. Standard DBP formation testing, with exceptionally-elevated chlorine levels, produced DBP levels 17% to 18% above the MCLs for TTHM and HAA_5. A final round of DBP formation potential testing with a lower-but-still-conservative chlorine dosage indicated that results were below the MCLs for both TTHM and HAA_5.

6.7 Backwash Waste Disposal Alternatives

The waste disposal alternative with the lowest NPV is Alternative D – Recycle of Backwash Water. Under this alternative, the backwash waste water would be directed to an above-ground clarifier tank. A polymer would be injected into the backwash waste water to improve settling of solids in the clarifier tank. Supernatant from the clarifier tank would be directed back into the process stream, upstream of the filter. Recycled backwash water would be blended with raw water and treated.

Sludge from the clarifier tank would be dewatered and transported to a landfill for final disposal.

7 Proposed Project (Recommended Alternatives)

7.1 Preliminary Project Design

A new treatment building would be constructed to house two parallel DAF plants, which would integrate both DAF and multimedia filtration on the same skid. The treatment process would involve dissolved air flotation accompanied with chemical coagulation and gravity filtration, and would have a design flowrate of 1.8 mgd. Chemical feed tanks and associated pumps and control systems would also be located in the new treatment building. The existing slow sand filters would be converted into clearwells to provide CBW with an additional 0.9 million gallons of water storage. With the existing WSTs, the total storage capacity would be 1.75 million gallons, which nearly reaches the design flowrate of 1.8 mgd. A portion of the existing control building will be used for chemical storage. A gravity sewer line would be constructed to transport backwash waste from the new treatment building to the WWTP. A standby generator and bulk fuel tank would also be installed at the site. Estimated capital and O&M costs for all the recommended alternatives are provided in Appendix H. The proposed improvements are shown on Figures 7, 11, 15 and 17.

7.2 Project Schedule

The project schedule will be driven by the availability of design and construction funding. The proposed improvements are expected to be completed over the course of one year.

7.3 Permit Requirements

The following permits will be required for construction of the project:

- ADEC: Drinking water plan review and approval to construct for the improvements to the WTP. Discharge permit for disposal of backwash waste.

7.4 Sustainability Considerations

Like many rural Alaskan communities, CBW faces high energy costs and is concerned with minimizing operational costs. To help minimize energy costs, all new pumps will be equipped with high efficiency motors and all new lighting will feature LED bulbs. Furthermore, the new DAF treatment system has filter efficiencies of 97% to 98%, which results in less water lost to filter backwashing and process waste. This efficiency would be further improved by recycling backwash waste to the front of the treatment process.

7.5 Total Project Cost Estimate

The total estimate cost for the project is presented in Table 20. Detailed capital cost estimates are provided in Appendix H.

Table 20 – Estimated Project Cost

Description	WTP Upgrades	Backwash Disposal
Construction	$6,824,000	$715,000
Design	$615,000	$65,000
Construction Administration	$615,000	$65,000
Project Administration	$137,000	$15,000
Total	$8,191,000	$860,000
	Combined Total	$9,051,000

7.6 Annual Operating Budget

7.6.1 Annual Treatment O&M Costs

The annual O&M cost for the proposed improvements, combined with the cost of water wasting, is anticipated to increase the annual treatment costs of the system by approximately $133,000 (Table 21). For FY 2016-2017, water sales accounted for $620,000 in revenue. To accommodate the increased cost, it is anticipated that user fees will need to be increase by approximately 21%, for a projected water sale revenue of $753,000. Since this increase in rates is based upon estimated annual O&M costs, CBW is encouraged to monitor O&M costs and conduct a rate study after completion of the WTP upgrades. The actual increase in O&M costs will dictate the required increase in rates.

Table 21 – Estimated Annual Treatment O&M Costs

	Existing (Current Flow)	Alt 4 – DAF + Filtration & Alt D - Backwash Recycle
O&M - DAF	$124,312	$289,614
O&M - Backwash Recycle	-	$2,761
Non-salable Water	$61,760	$26,989
Total	$186,071	$319,364

Without this revenue, the community would need higher water rates to cover the overall cost of operating the WTP. This revenue loss is assumed to be computed as gallons of non-salable water multiplied by the average per-gallon treatment cost of water.

7.6.2 Debt Repayment

Where funds can be borrowed from commercial sources at a reasonable interest rate, on an interim basis for the total amount of loan funds needed during construction, such interim financing will be obtained so as to preclude the necessity for multiple advances of Rural Utility Service (RUS) loan funds. The loan amount will be identified once the USDA-RD underwriting effort is complete. The City and Borough of Wrangell would then seek financing quotes from a commercial financial lender. Once a lender is identified and the loan is approved, the City and Borough of Wrangell would notify USDA-RD of the interim lender

The CBW has existing loan repayment obligations for an ADEC loans as follows:

- The CBW has accepted a DEC loan in the amount of $322,650 for the replacement of an ozone generator
- The CBW has accepted a DEC loan in the amount of $542,249 for the design and replacement of water mains.

Copies of the loan resolutions are provided in Appendix I.

7.6.3 Reserves

The CBW had a Water Fund reserve of $410,774 for FY 2016-2017.

7.6.4 Short-Lived Asset Reserve

Replacement costs for short-lived assets for both the water and sewer utility are provided in Appendix J.

8 Conclusion and Recommendations

Based on this evaluation, Alternative 4 – Dissolved Air Flotation (DAF) with Multimedia Filtration is designated the "preferred" alternative for water treatment. For disposal of backwash water, Alternative D – Recycle of Backwash Water is the "preferred" alternative. The improvements associated with these alternatives will allow CBW to continue to provide safe drinking water to the community.

Figures

FILE NAME: J:\JobsData\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\02 Figures\05 PER\20901.00 Vicinity Map.dwg

CRW ENGINEERING GROUP, LLC	CITY AND BOROUGH OF WRANGELL PRELIMINARY ENGINEERING REPORT	Project No: 20901.00
		Drawn By: WMK
		Scale: NTS
Project:	VICINITY MAP	Date: 3/22/2017
STATUS: FINAL		Figure: 1

PROJECT: 20901.00
STATUS: FINAL

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

WRANGELL WTP PER

EXISTING AREA MAP

DATE 3/29/17
SCALE GRAPHIC
FIGURE 2

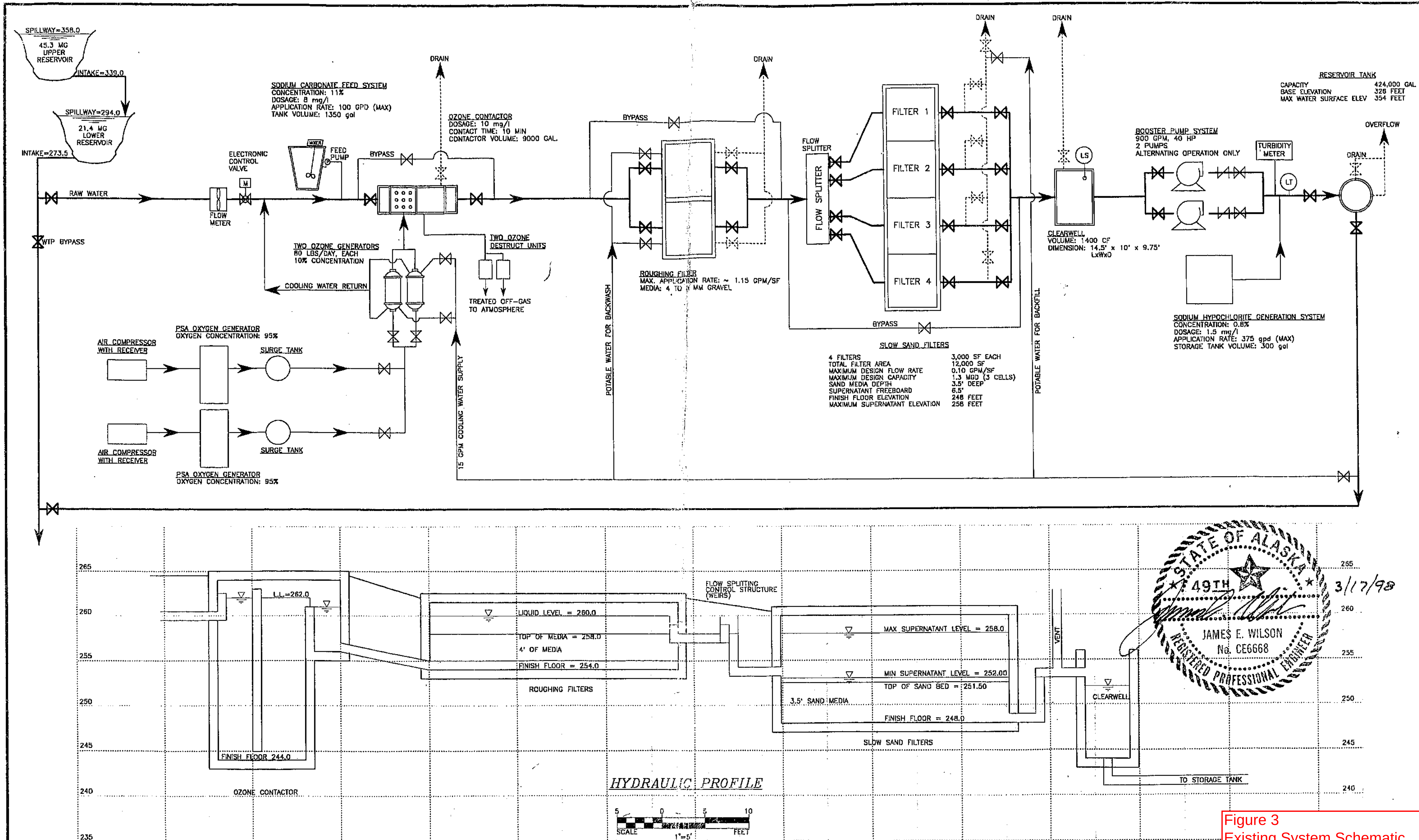

Figure 3
Existing System Schematic

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY:	MAC
DRAWN BY:	WAH
CHECKED BY:	MAC

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
HYDRAULIC PROFILE & PROCESS SCHEMATIC

DATE	SHEET
3/12/98	C02
SCALE AS SHOWN	OF
JOB NUMBER 97070	C09

CT\97070\DWG\97070C02 Thu Mar 12 16:59:31 1998 WAH

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PROJECT: 20901.00
STATUS: FINAL

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PHONE: (907) 562-3252
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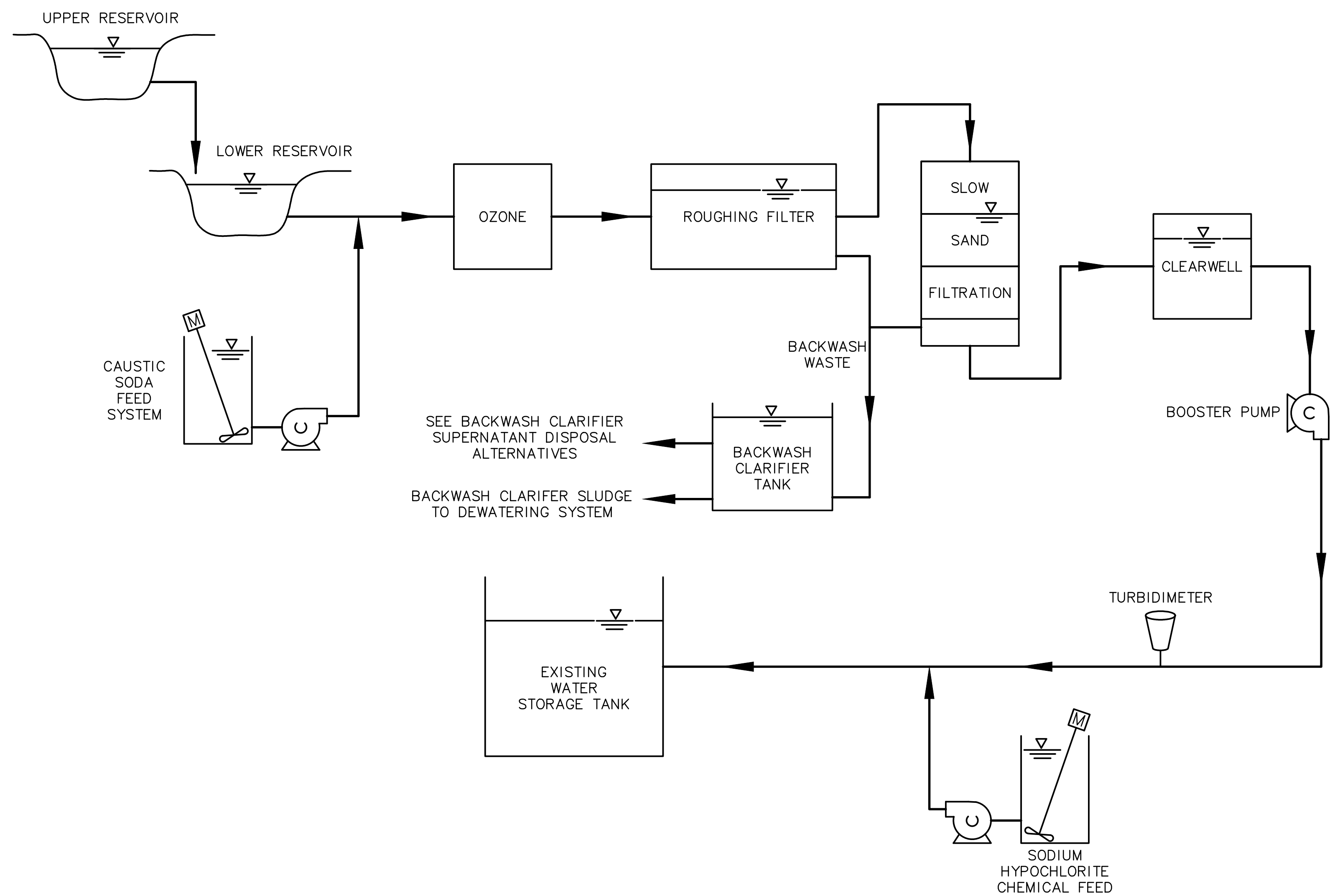
WRANGELL WTP PER

SITE PLAN – ALTERNATIVE 1
IMPROVE EXISTING WATER TREATMENT PROCESS

DATE 3/29/17
SCALE GRAPHIC
FIGURE 4



PROJECT: 20901.00
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PHONE: (907) 562-3252
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WRANGELL WTP PER

PROCESS SCHEMATIC – ALTERNATIVE 1
IMPROVE EXISTING WATER TREATMENT PROCESS

DATE 3/29/17
SCALE GRAPHIC
FIGURE 5

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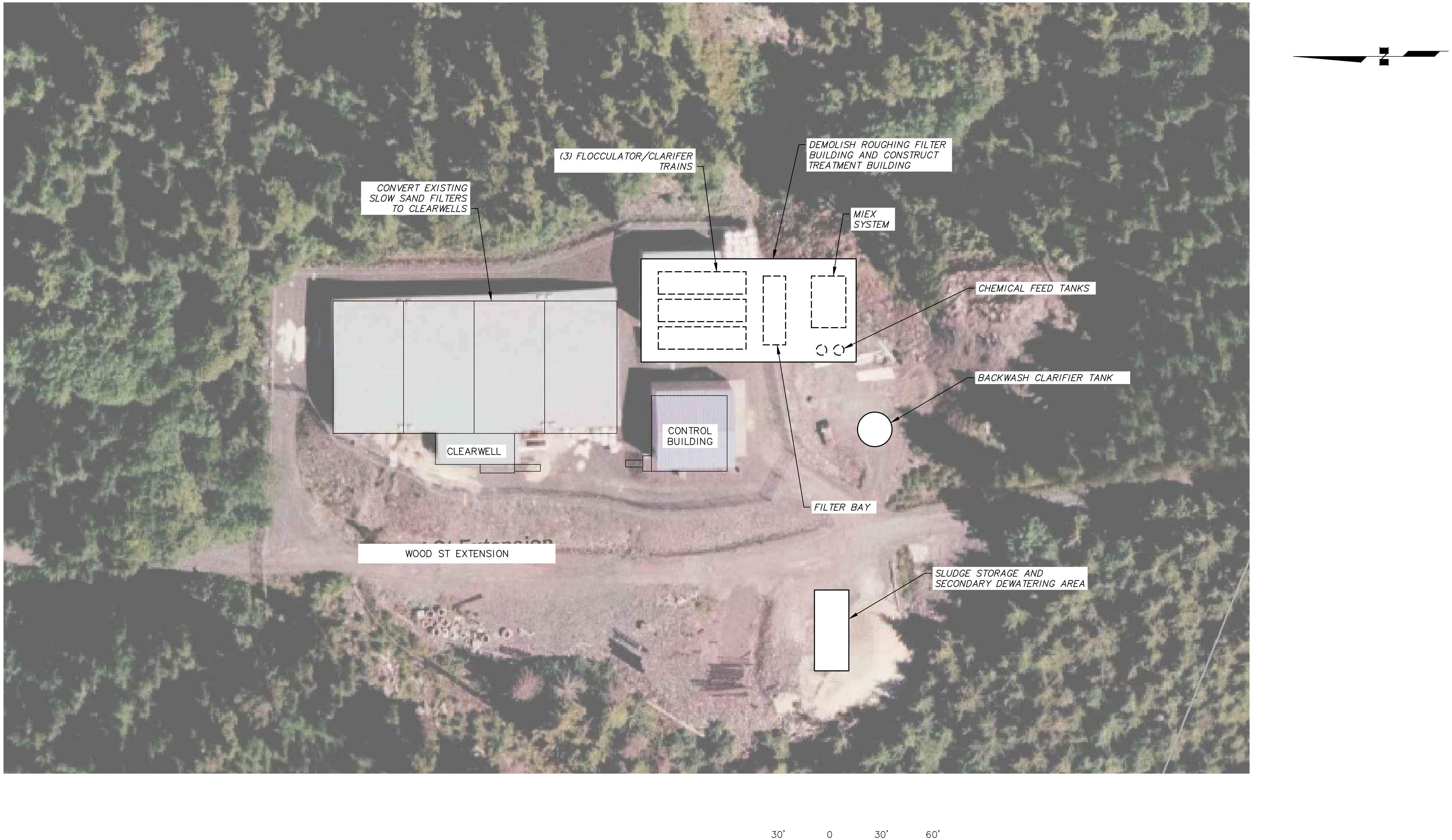

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PHONE: (907) 562-3252
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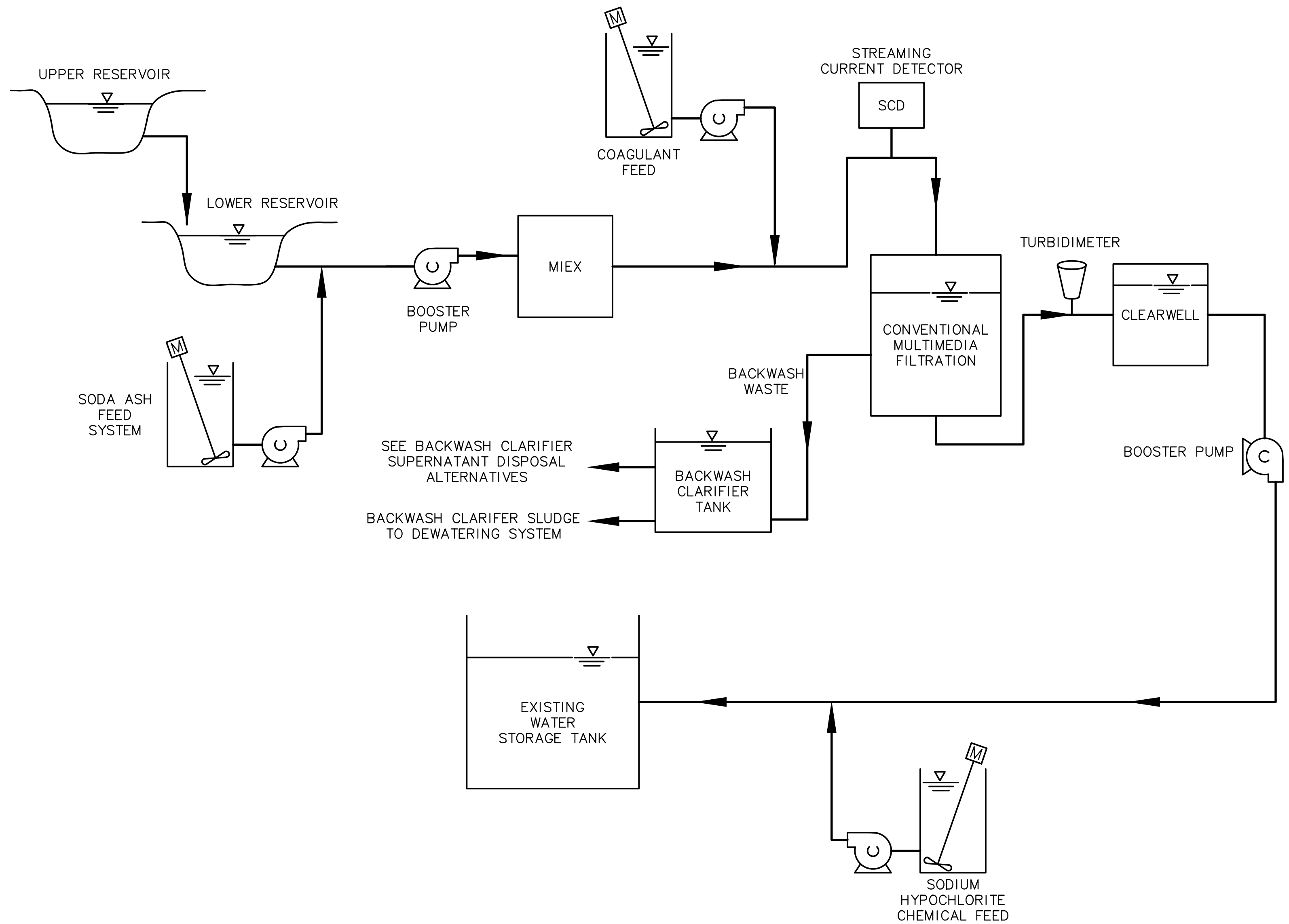
WRANGELL WTP PER

SITE PLAN – ALTERNATIVE 2
MIEX PROCESS AND
MULTIMEDIA FILTRATION

DATE 3/29/17
SCALE GRAPHIC
FIGURE 6



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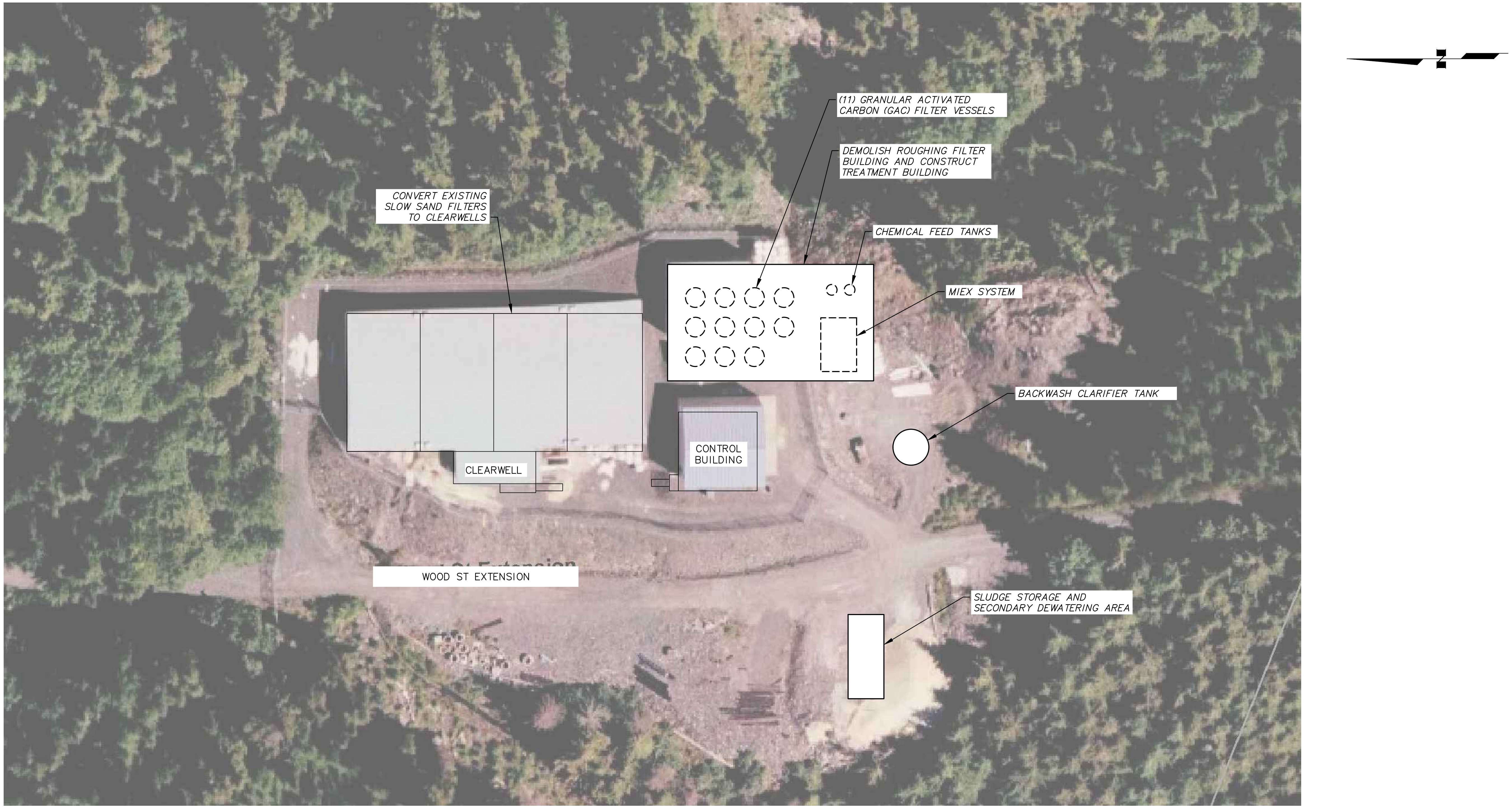
PROJECT: 20901.00 STATUS: FINAL	CRW ENGINEERING GROUP, LLC 3940 ARCTIC BLVD. SUITE 300 ANCHORAGE, ALASKA 99503 PHONE: (907) 562-3252 #AECL882-AK	WRANGELL WTP PER PROCESS SCHEMATIC – ALTERNATIVE 2 MIEX PROCESS AND MULTIMEDIA FILTRATION	DATE 3/29/17 SCALE GRAPHIC FIGURE 7



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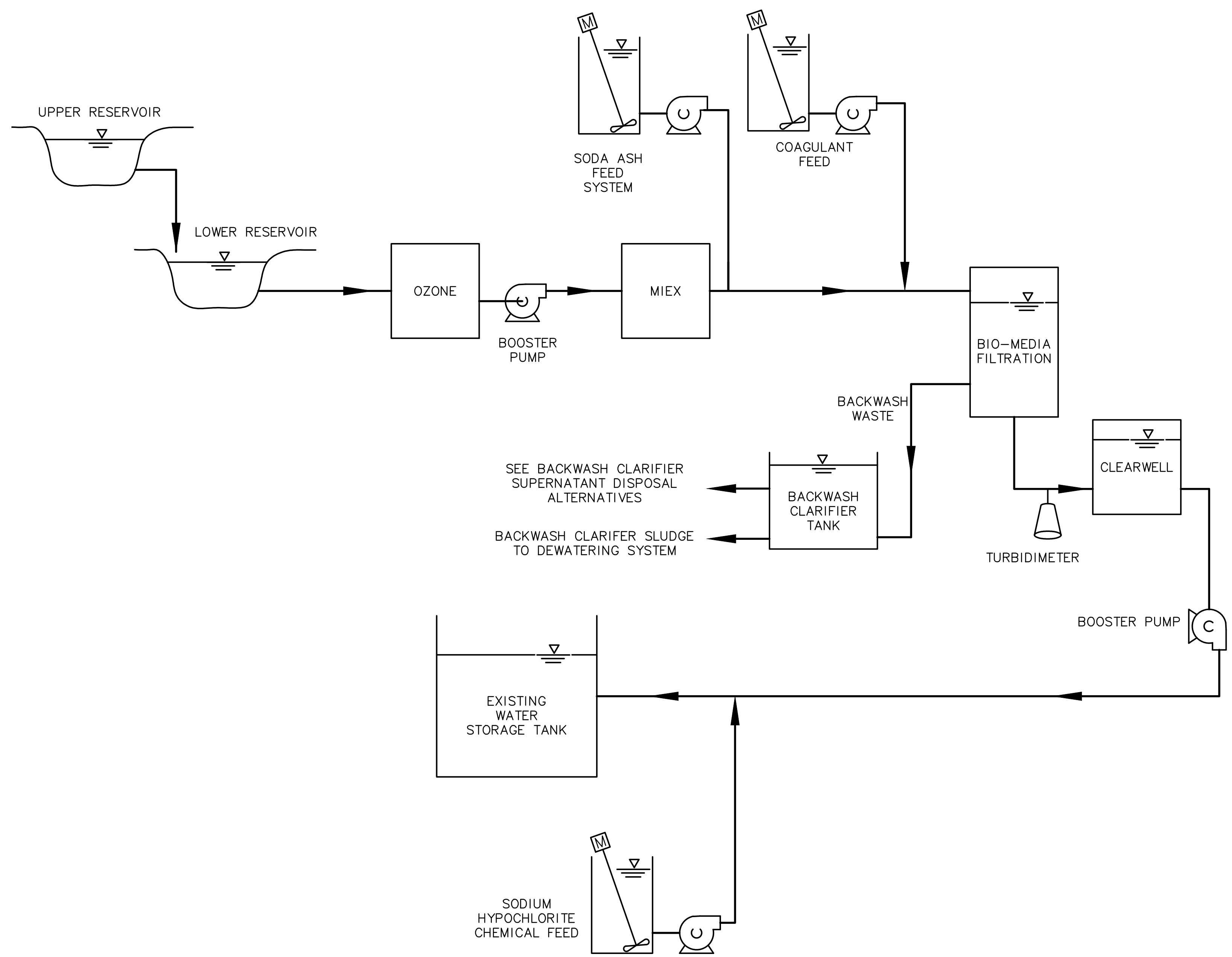
WRANGELL WTP PER

SITE PLAN – ALTERNATIVE 3
OZONATION WITH MIEX AND
BIOLOGICAL FILTRATION

DATE	3/29/17
SCALE	GRAPHIC
FIGURE	8

File: J:\JobsData\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\02 Figures\05 PER\20901.00 ALT 3 – MIEX And BIO.dwg



PROJECT: 20901.00

STATUS: FINAL

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3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

WRANGELL WTP PER

PROCESS SCHEMATIC – ALTERNATIVE 3
OZONATION WITH MIEX AND BIOLOGICAL FILTRATION

DATE 3/29/17

SCALE GRAPHIC

FIGURE 9

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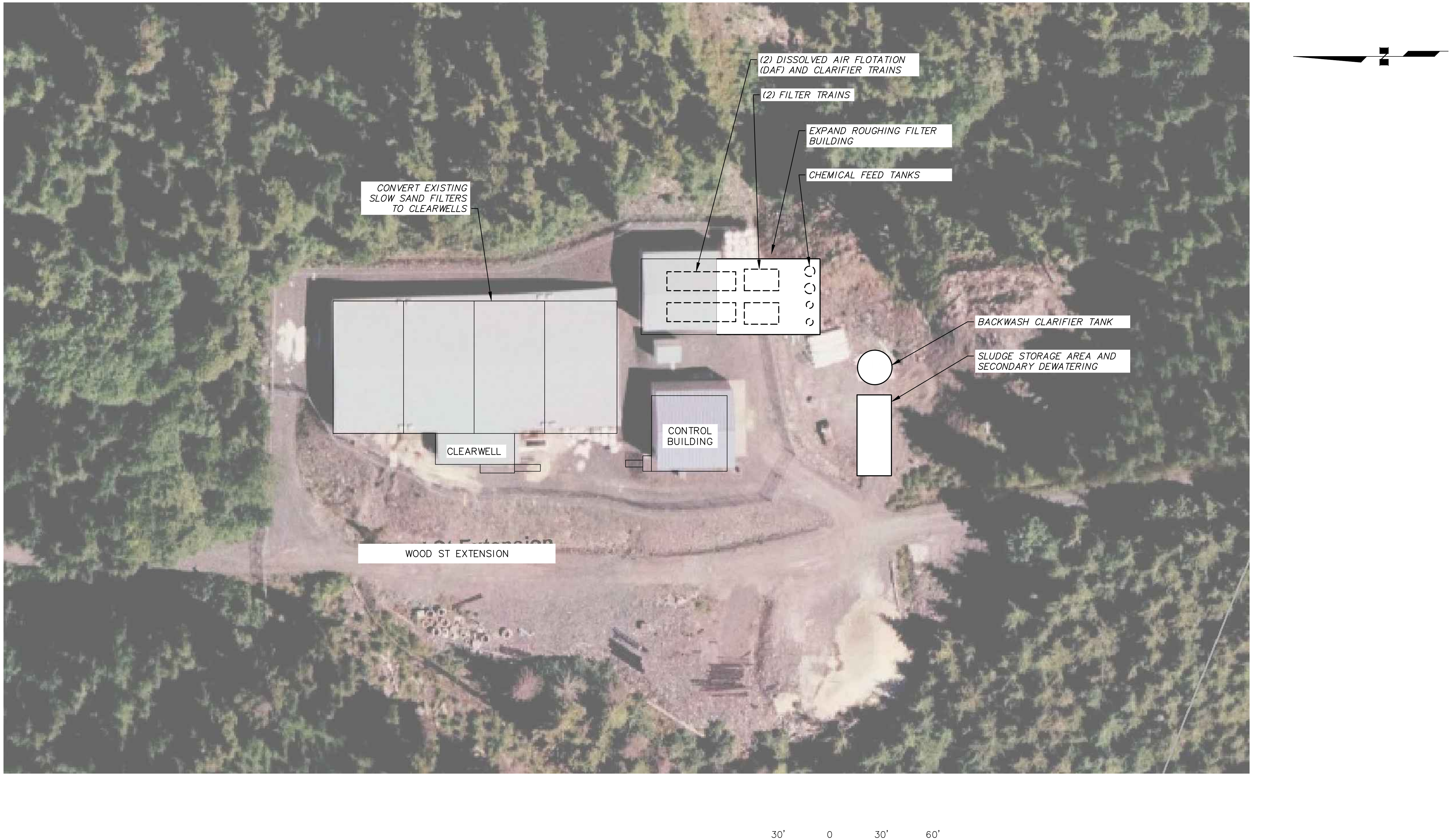

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PROJECT: 20901.00
STATUS: FINAL

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3940 ARCTIC BLVD, SUITE 300
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PHONE: (907) 562-3252
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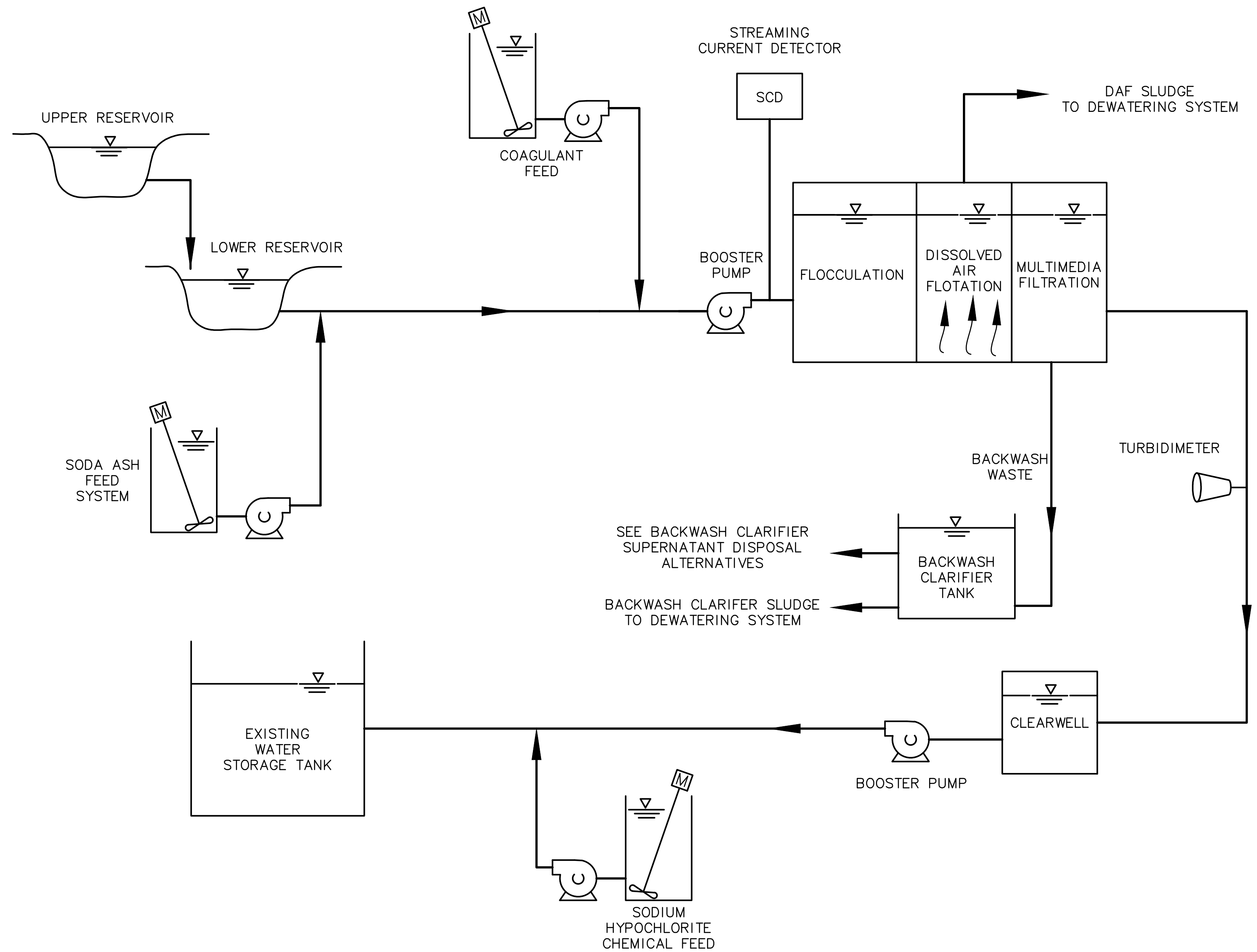
WRANGELL WTP PER

SITE PLAN – ALTERNATIVE 4
DISSOLVED AIR FILTRATION WITH
MULTIMEDIA FILTRATION

DATE 3/29/17
SCALE GRAPHIC
FIGURE 10



File: J:\JobsData\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\02 Figures\05 PER\20901.00 Wrangell Process Schematics.dwg

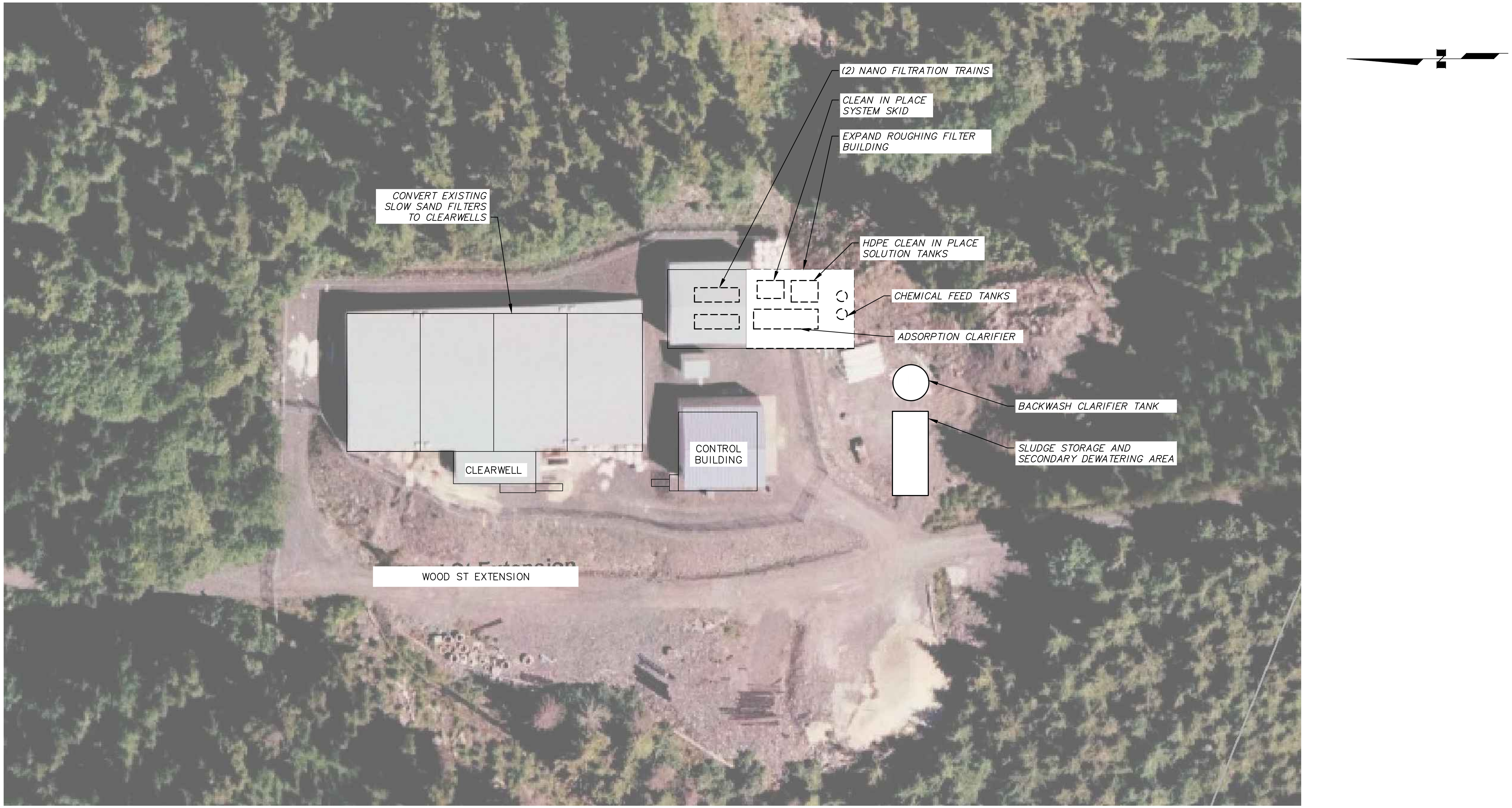
PROJECT: 20901.00
STATUS: FINAL

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD, SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

WRANGELL WTP PER

PROCESS SCHEMATIC – ALTERNATIVE 4
DISSOLVED AIR FLOTATION AND
MULTIMEDIA FILTRATION

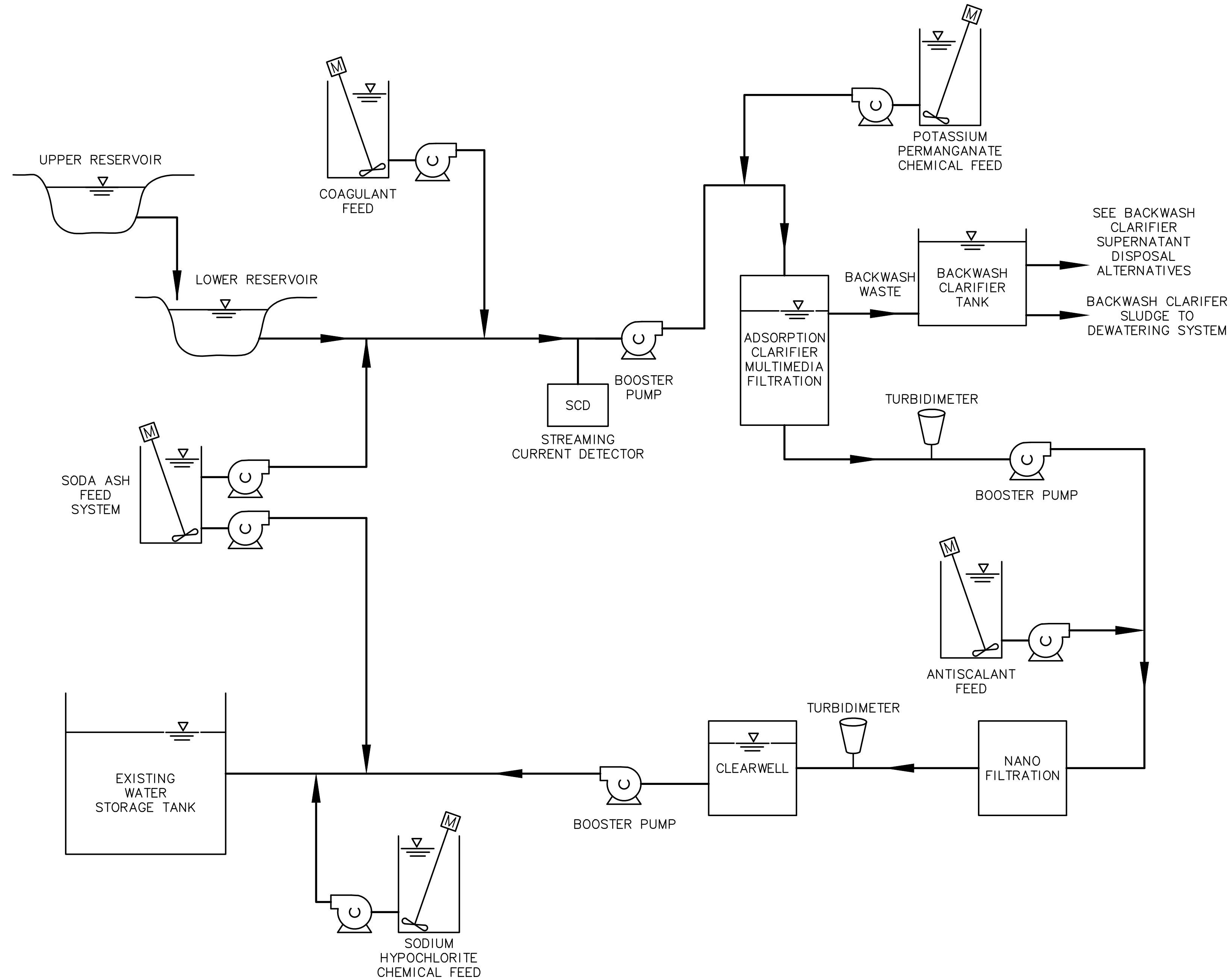
DATE 3/29/17
SCALE GRAPHIC
FIGURE 11



30' 0 30' 60'

File: J:\JobsData\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\02 Figures\05 PER\20901.00 ALT 5 AC + NANO.dwg

PROJECT: 20901.00 STATUS: FINAL	CRW ENGINEERING GROUP, LLC 3940 ARCTIC BLVD. SUITE 300 ANCHORAGE, ALASKA 99503 PHONE: (907) 562-3252 #AECL882-AK	WRANGELL WTP PER SITE PLAN – ALTERNATIVE 5 NANOFILTRATION WITH MULTIMEDIA FILTRATION	DATE 3/29/17 SCALE GRAPHIC FIGURE 12



PROJECT: 20901.00

STATUS: FINAL

CRW ENGINEERING GROUP, LLC

3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

WRANGELL WTP PER

PROCESS SCHEMATIC – ALTERNATIVE 5
NANOFILTRATION WITH MULTIMEDIA
FILTRATION

DATE
3/29/17

SCALE
GRAPHIC

FIGURE
13

File: J:\JobsData\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\02 Figures\05 PER\20901.00 Wrangell Process Schematics.dwg

200' 0 200' 400'

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD, SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

PROJECT:

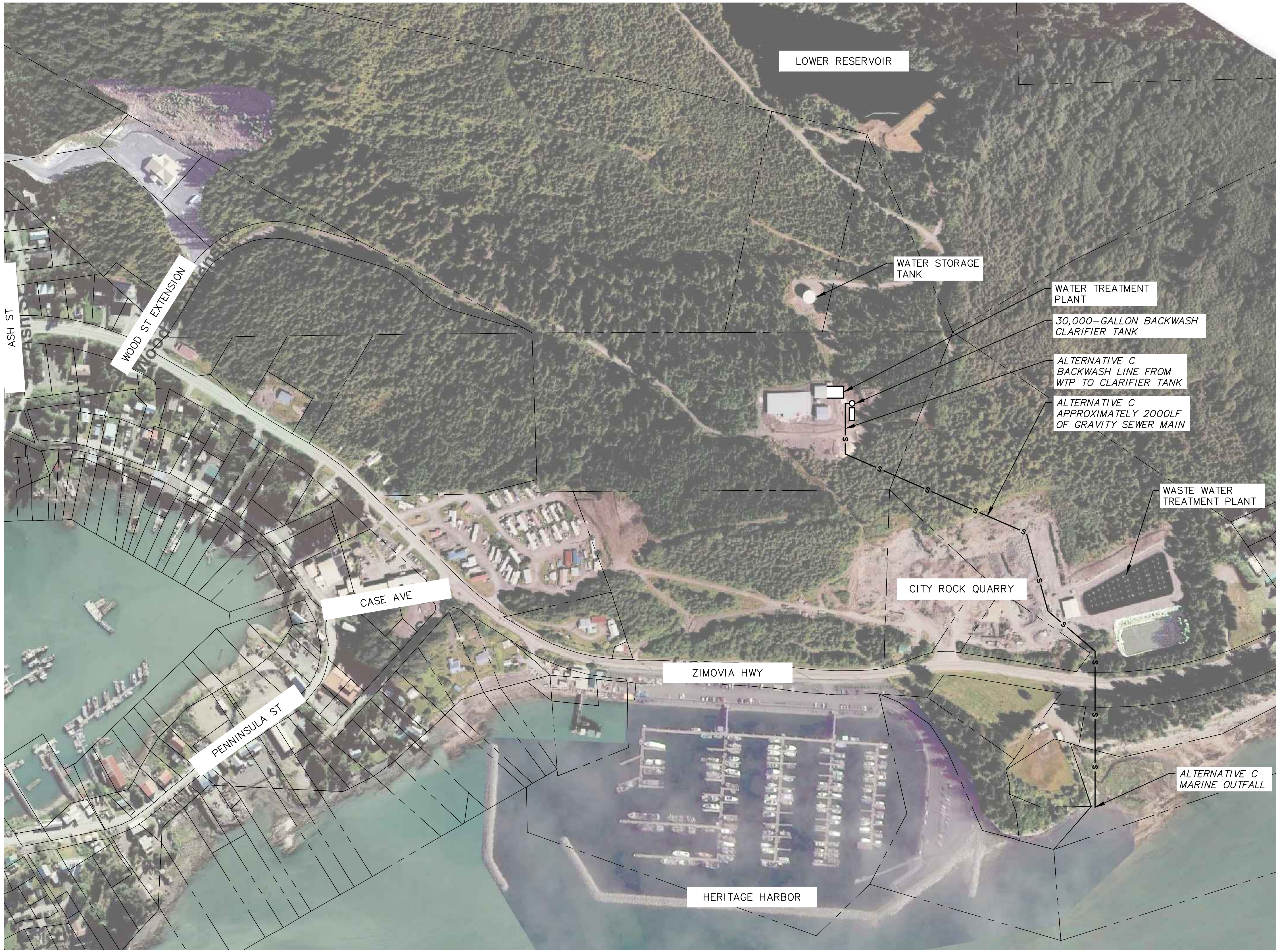
STATUS: FINAL

WRANGELL WTP PER

BACKWASH WASTE DISPOSAL
ALTERNATIVES A & B

DATE	3/29/17
SCALE	GRAPHIC
FIGURE	14

File: J:\JobsData\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\02 Figures\05 PER\20901.00 Sewer Disposal Alternatives.dwg



200' 0 200' 400'

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

PROJECT:

STATUS: FINAL

WRANGELL WTP PER

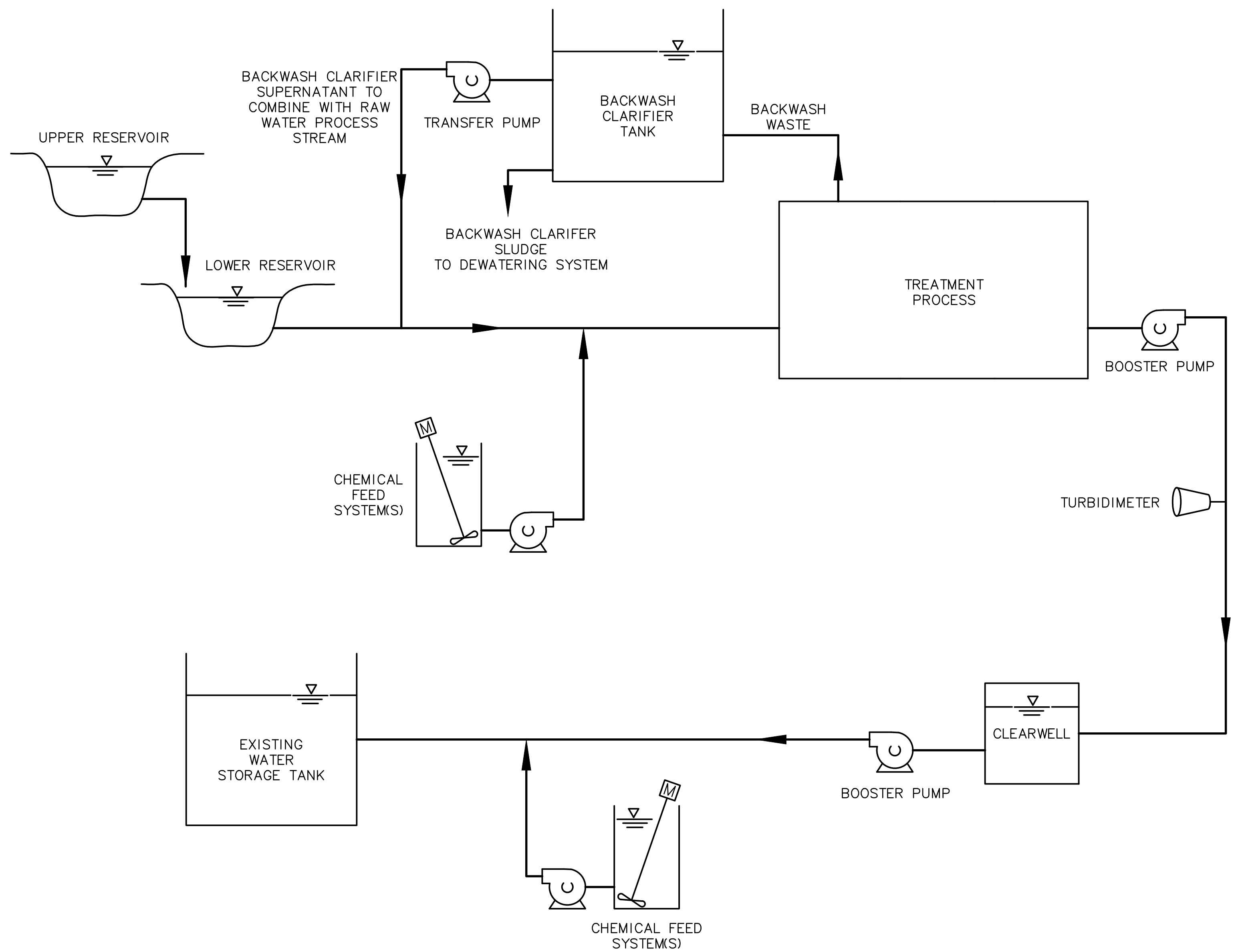
BACKWASH WASTE DISPOSAL
ALTERNATIVE C

DATE 3/29/17

SCALE GRAPHIC

FIGURE 15

File: J:\JobsData\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\02 Figures\05 PER\20901.00 Sewer Disposal Alternatives.dwg



File: J:\JobsData\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\02 Figures\05 PER\20901.00 Wrangell Process Schematics.dwg

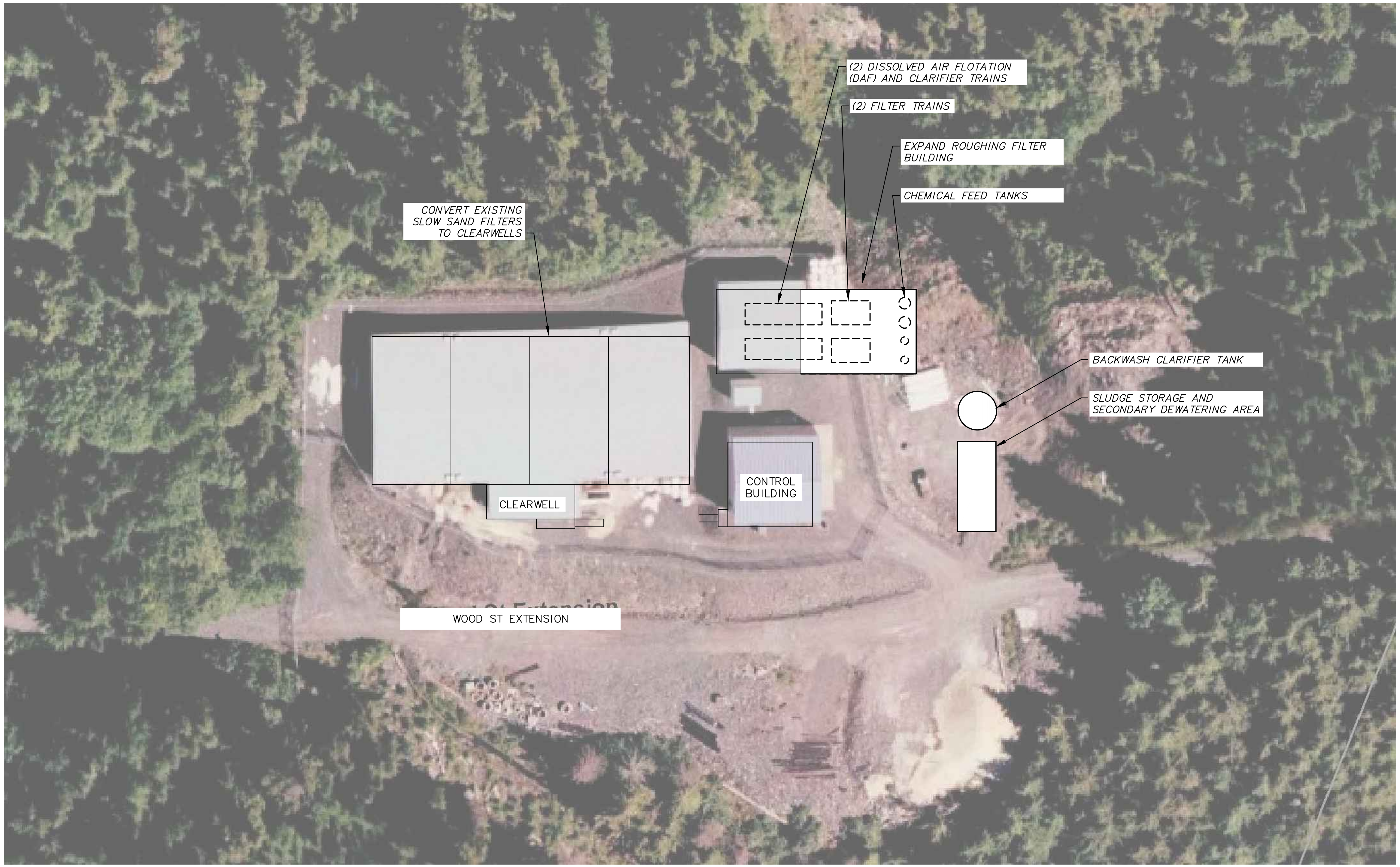
PROJECT: 20901.00
STATUS: FINAL

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

WRANGELL WTP PER

PROCESS SCHEMATIC – ALTERNATIVE D
BACKWASH CLARIFIER AND BACKWASH RECYCLE

DATE 3/29/17
SCALE GRAPHIC
FIGURE 16



30' 0 30' 60'

File: J:\JobsData\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\02 Figures\05 PER\20901.00 ALT 4 DAF.dwg

PROJECT: 20901.00
STATUS: FINAL

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

WRANGELL WTP PER

SITE PLAN – PREFERRED ALTERNATIVES
ALT 4 – DAF
ALT D – CLARIFIER/ BACKWASH RECYCLE

DATE 3/29/17
SCALE GRAPHIC
FIGURE 17

Appendix A – Raw Water Parameters

1. RAW WATER PARAMETERS

1.1. Turbidity

Turbidity refers to the cloudiness of a fluid caused by suspended particles or air bubbles. For drinking water, turbidity is used as a general surrogate for measuring the amount of suspended particles that may contain harmful substances or microbial contaminants. Studies conducted over many years in the water treatment industry have established strong relationships between the presence of turbidity and the presence of these harmful contaminants. High turbidity levels indicate a higher probability of these contaminants, and low turbidity levels indicate a lower probability. Using turbidity as a surrogate avoids the need for a substantial amount of water testing for specific contaminants.

Based on decades of water treatment experience and related testing throughout the world, EPA has established maximum turbidity limits that, when qualified types of filtration are employed and operated properly, substantial percentages of the targeted microbial contaminants *Giardia* and *Cryptosporidium* can be removed to high degree of certainty (called "log removals"). For example, when slow sand filtration is practiced and operated properly, EPA will credit this process with a 99% (2.0 log) removal of *Giardia*. This type of compliance is called "treatment technology," which means that, with proper operation of the filtration system, and within the regulated turbidity limits, the removal and inactivation of targeted contaminants is considered to be achieved, without the need for water testing.

For drinking water applications, turbidity is determined by measuring scattered light using the nephelometric method as a standard procedure. Turbidity is therefore measured in nephelometric turbidity units (NTU). For direct and conventional filtration systems, the allowable turbidity level is defined in two ways:

- 0.3 NTU above which at least 95% of measurements cannot exceed in a one month period.
- 1 NTU maximum level for any one turbidity measurement.

For slow sand filtration, the allowable turbidity level is:

- 1 NTU above which at least 95% of measurements cannot exceed in a one month period.
- 5 NTU maximum level for any one turbidity measurement.

Using the nephelometric method, turbidity can be readily measured on a regular basis by side-streaming process water through a turbidimeter. CBW is required to measure turbidity from its combined filter effluent every 4 hours using this method, and reported to ADEC every month.

1.2. Organic Parameters: TOC, DOC, UVA and SUVA

Total organic carbon (TOC), dissolved organic carbon (DOC), ultraviolet absorbance at 254-nanometer wavelength (UVA_{254}), and specific UVA (SUVA) are parameters used to characterize the organic content of water. As organic chemistry is extremely complex and very expensive to characterize in the laboratory, these parameters are used as approximate surrogates. The water industry has developed general relationships and an extensive body of experience using these parameters to help predict and assess the removal of targeted organic substances that can create health and palatability concerns with drinking water. TOC measures the total concentration of organic matter that can be oxidized, which is of primary interest in water treatment. DOC is the dissolved fraction of TOC. Because dissolved organics are difficult to remove and because these compounds produce the largest concentrations of disinfection by-products (DBPs), DOC is an important parameter to evaluate when helping a water system comply with the D/DBP Rules.

The study of DBPs over the last 40 years has established a strong relationship between UVA_{254} and organic compounds that contain precursors which create DBPs when combined with chlorine. Generally, the higher the UVA_{254} value, the higher the tendency to produce DBPs in the disinfection process. SUVA is a more refined parameter that is calculated from dividing the UVA_{254} value by the DOC value. SUVA generally indicates the average "amount" of UVA_{254} found in a unit of DOC. Higher SUVA values reflect a largely "hydrophobic" characteristic of the natural organic matter, but also reflect a higher likelihood the DOC can be removed by coagulation and granular filtration methods (depending on the water alkalinity). Hydrophobic organics tend to be less soluble in water, and have larger molecular weights that can be more readily removed by coagulation and filtration. Conversely, lower SUVA values reflect a largely "hydrophilic" character of organics, featuring low molecular weights which are more soluble in water, and therefore more difficult to remove via coagulation and filtration. Wrangell's surface water has relatively low SUVA values, or a largely hydrophilic character, meaning that the coagulation and filtration processes is expected to be only partially effective in removing organics.

1.3. Color

Color is measured using two parameters: apparent color and true color. Apparent color characterizes water that contains solid matter, which imposes a particular color to it. Two common examples of solid matter that cause apparent color are iron and turbidity. When these contaminants are filtered out, the water color improves considerably. True color characterizes water containing only dissolved matter (i.e. that which passes a 0.45 µm filter). A common example of a dissolved substance that causes true color in water is natural organic matter. True color is often used as a rough surrogate for assessing the organics content in water. In Wrangell's case, true color would generally reflect the presence of organics in treated water after color-causing solids have been removed.

1.4. Iron

Iron is a prominent secondary contaminant found in many water sources. It is found in both groundwater and surface water sources throughout the State in various concentrations. In all potential sources, the raw water iron levels are well above the secondary MCL of 0.3 mg/L and cause the water to develop an objectionable yellow color that greatly diminishes its palatability and stains clothing and plumbing fixtures. Generally, iron is readily removed using filtration, ion exchange and other technologies. However, the co-existence of high organics and iron may indicate that the iron is organically-bound. This condition makes difficult the efficient removal of iron without the use of polymers.

1.5. Manganese

Manganese is almost always encountered with the presence of iron, and thus is a secondary contaminant that's commonly found in water sources. Like iron, manganese is a nuisance contaminant that can cause staining. It can also result in the presence of black particles in the potable water, reducing its palatability. The secondary MCL of manganese is 0.05 mg/L and is low because even with a slight excess above this limit, the contaminant can be problematic in large water distribution systems. With a low MCL, manganese concentrations can be difficult to reduce and maintain below acceptable limits. One reason is that manganese can be added to water in two common treatment processes: use of ferric chloride as a coagulant and the use of manganese-coated greensand. A third reason relates to the oxidation process employed in a water treatment process. Oxidation of manganese can result in the creation of solids that are too small to remove with filtration, and which can pass into the filtrate, increasing the manganese concentration. Leaving manganese in soluble form allows it to be more effectively removed by adsorption to greensand media. When potassium permanganate is used as the primary oxidant, manganese is readily oxidized, and as a result, the manganese levels in the filtrate tend to increase.

1.6. pH

The pH of water is a measurement of the hydrogen ion concentration in water. Due to the asymmetrical structure of the water molecule, a certain degree of ionization naturally occurs. Ionization refers to the degree that molecules break down when dissolved in water. Water will ionize by itself into hydrogen (H+) and hydroxide (OH-) ions, and the pH value measures this degree of ionization. The greater the number of hydrogen ions in the water, the lower the pH value, and the more acidic is the water classified. Conversely, the greater the number of hydroxide ions present, the higher the pH value, and the more basic is the water classification.

When the concentration of hydrogen ions equals the concentration of hydroxide ions, the water is considered neutral. The pH of water significantly affects how chemicals react due to the relative degree that hydrogen and hydroxide ions are available to combine with such chemicals.

Secondary drinking water regulations target a pH range of 6.5 to 8.5 to encourage the supply of water that is generally neutral and less reactive. Wrangell's surface water tends to exhibit a pH range between 5.9 and 6.4, with high pHs measured in the warmer seasons. As the water warms, the solubility of carbon dioxide increases, causing it to off-gas. When this occurs, the pH increases. The application of chlorine in the disinfection process tends to lower the pH slightly.

The pH level is an important parameter when metal salts like ferric chloride and alum are used as coagulants. Ferric chloride typically requires a pH level of about 5.5 for optimum organics removal. Alum typically needs pH levels ranging between 5.5 and 6.0 for optimum performance. The pH can be lowered by increasing the dosages of these coagulants or by adding a strong acid, like sulfuric acid. The pH can be increased with the addition of a basic chemical like soda ash or caustic soda (as currently used by the City).

1.7. Total Dissolved Solids (TDS)

The total dissolved solids parameter generally characterizes the degree that various natural minerals are dissolved in water. Such dissolved compounds are most commonly various types of salts comprised of sodium, calcium, magnesium, chloride, sulfate and carbonate. TDS imparts various tastes to water, which primarily affects its palatability and can create health and maintenance concerns. Water with TDS levels between 1000 and 10,000 mg/L is considered brackish and unfit for use. The secondary MCL for TDS is held at 500 mg/L to encourage the use of a "fresh" source water for treatment and subsequent consumption. Being comprised of dissolved substances, TDS is difficult to remove from water, usually requiring sophisticated treatment processes like reverse osmosis, electrodialysis and distillation.

1.8. Alkalinity

Alkalinity is used to quantify buffering capacity in water. This parameter measures the combined concentration of carbonates, bicarbonates, hydroxides and other minor constituents that are ionized in water, all of which help neutralize acids. These constituents act like a "buffer" that combine with acids to maintain ionic equilibrium in water, and thereby inhibits the tendency for the pH level to drop. As the alkalinity content is consumed, the buffering effect diminishes, and the tendency for lowering the pH increases. As the pH level drops, the water takes on a more acidic chemistry and reacts differently. Some alkalinity is desirable, because it stabilizes the reactivity of potable water. If alkalinity is too low, it can lead to issues like increased corrosion, red water problems and nitrification in the distribution system. However, if alkalinity is too high, chemical addition can be undesirably ineffective. A common problem with high alkalinity is its significant inhibition of the ability of coagulants to remove contaminants like turbidity and organic matter. When it is lacking in water, alkalinity can be added using basic chemicals such as sodium carbonate (soda ash), sodium bicarbonate and sodium hydroxide (caustic soda).

1.9. Calcium, Hardness and LSI

Calcium is commonly found in water and can influence its chemistry in many ways. Of particular interest to the water supply industry is its relationship to the corrosivity and hardness of water. Generally, the more calcium present in water, the less corrosive the water. Also, higher concentrations of calcium usually translate into higher levels of hardness. Hardness is a measure of the combined concentrations of calcium and magnesium, which can cause scaling problems in hydraulic vessels and piping, and reduce the effectiveness of soap products. Wrangell's surface water is very low in hardness (i.e. very "soft"). The Langelier Saturation Index (LSI) measures the tendency of water to dissolve or deposit calcium. The lower the LSI, the greater the tendency for water to dissolve calcium. This relationship is used as a rough, qualitative value to determine corrosivity of water.

1.10. Arsenic

Arsenic is also a common contaminant in waters that also contain iron and manganese, although it doesn't not appear to be a significant concern for CBW. Unlike iron and manganese, arsenic is a primary contaminant that creates health concerns. When the arsenic MCL was reduced from 0.50 mg/L to 0.10 mg/L in 2006, many water systems were faced with treating for this contaminant. Fortunately, many of these same communities also treat for high iron, which facilitates the removal of arsenic. When sufficient concentrations of soluble iron are oxidized into ferric hydroxide, arsenic becomes enmeshed in the gelatinous iron matrix by way of adsorption and co-precipitation processes. When the iron is removed by filtration, the arsenic is removed as well. Therefore, while arsenic is a concern by virtue of its danger to human health, it is considered a readily treatable contaminant.

1.11. Lead and Copper

Lead and copper are metallic elements that can be harmful to human health when ingested in high concentrations. As contaminants, these elements are commonly found in drinking water systems featuring lead, brass, bronze and copper in fittings and piping. These contaminants can become present in high concentrations when drinking water is relatively corrosive and causes these elements to be leached out of the parent materials that are in contact with the water. The Lead and Copper Rule has been established to address this problem (Appendix A). Low-lead solder and brass/bronze fittings are also mandated by building codes to minimize the possibility of leaching lead into drinking water.

Copper levels in water can often be reduced by elevating the pH of the water. Lead levels can be reduced to some extent by this method, but more commonly requires other methods for preventing lead from leaching into the drinking water. One such method is called "passivation," whereby orthophosphates are injected into the water distribution system to coat the interior surfaces of piping and valves. This chemical binds lead compounds, thereby making them less reactive with the water (i.e. passivating the lead), and less likely to be leached into the water.

END

Appendix B – Existing Data Summaries

HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #001 Airport (State Office) N-1 DATE 10-17-00

TEST MADE BY Rob & Gary TIME 10:00 A.M.

REPRESENTATIVE OF City of Wrangell

WITNESS Tom Gillen

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING Stikine / Evergreen Pump (not running)

FLOW HYDRANTS #001 A1 #002 A2 A3 A4

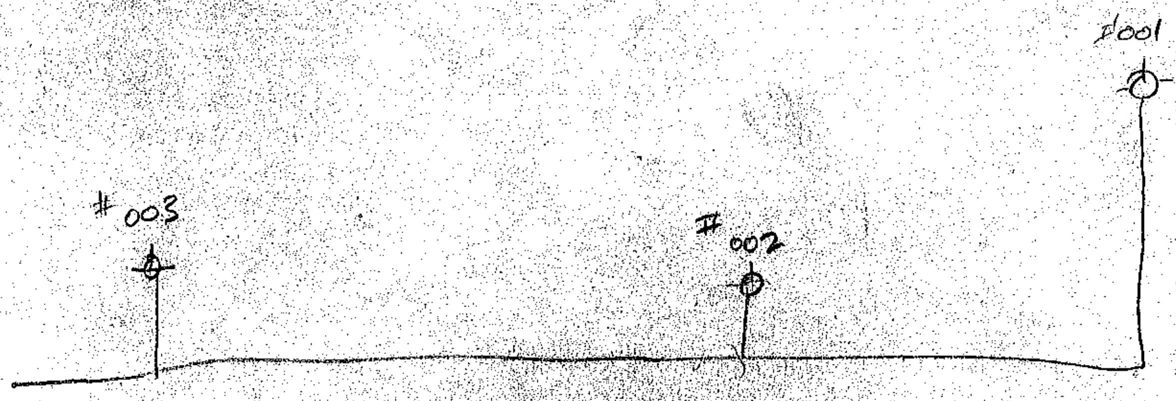
SIZE NOZZLE 2"

PITOT READING 68 psi TOTAL GPM 980

STATIC B 96 psi RESIDUAL B 86 psi

PROJECTED RESULTS @ 20 psi 2928 gpm, or @ 0 psi RESIDUAL 3321 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Airport #N2 DATE 5-2-07

TEST MADE BY Wayne McHolland Derek Meissner TIME 12 P.M.

REPRESENTATIVE OF City of Wrangell

WITNESS Jeff Rooney Sr.

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ~~0~~

FLOW HYDRANTS N2 A1 A2 A3 A4

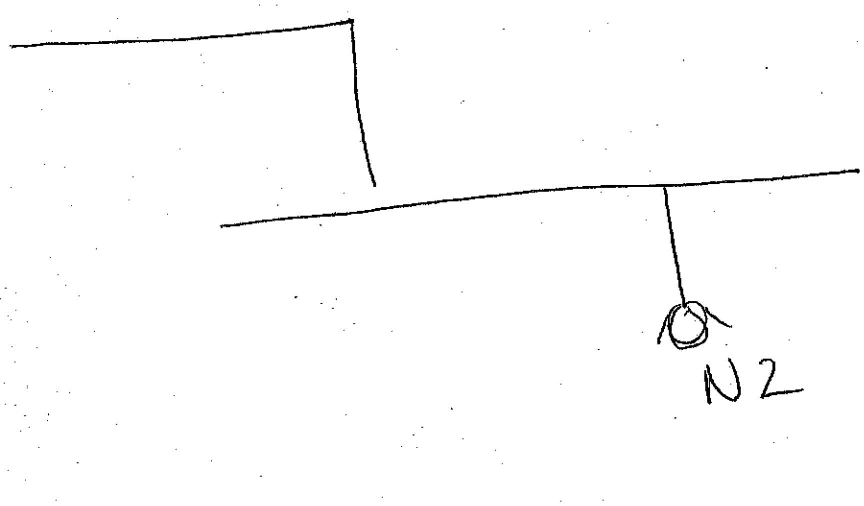
SIZE NOZZLE $2\frac{1}{4}$

PITOT READING 49 (48) psi TOTAL GPM 1043

STATIC B 91 psi RESIDUAL B 76 psi

PROJECTED RESULTS @ 20 psi 2412 gpm, or @ ~~0~~ psi RESIDUAL 2760 gpm

REMARKS Total GPM (1043) was taken from flow test data table for 48 psi because no 49 psi exhists in table



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

N-3

LOCATION # 002 Airport Between State Bld. & Temposco DATE 10-17-00

TEST MADE BY Rob & Gary TIME 10:00 A.M.

REPRESENTATIVE OF City

WITNESS Tom Gillen

STATE PURPOSE OF TEST Flow Testing

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING Stikine / Evergreen (NOT Running)

FLOW HYDRANTS #002 A1 #003 A2 A3 A4

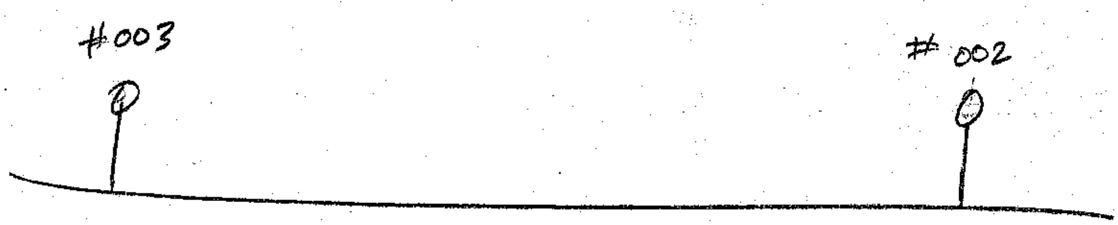
SIZE NOZZLE 2"

PITOT READING 68 psi TOTAL GPM 980

STATIC B 94 psi RESIDUAL B 88 psi

PROJECTED RESULTS @ 20 psi 3808 gpm, or @ psi RESIDUAL 4333 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

N-4

LOCATION #003 Airport Temsco End DATE 10-17-00

TEST MADE BY Rob & Gary → Joe & Rob (10-19) TIME 10:00 A.M.

REPRESENTATIVE OF City Public Works

WITNESS Tom Gillen

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING Stikine / Evergreen (NOT RUNNING)

FLOW HYDRANTS #003 A1 #004 A2 A3 A4

SIZE NOZZLE 2"

PITOT READING 76 TOTAL GPM 1036

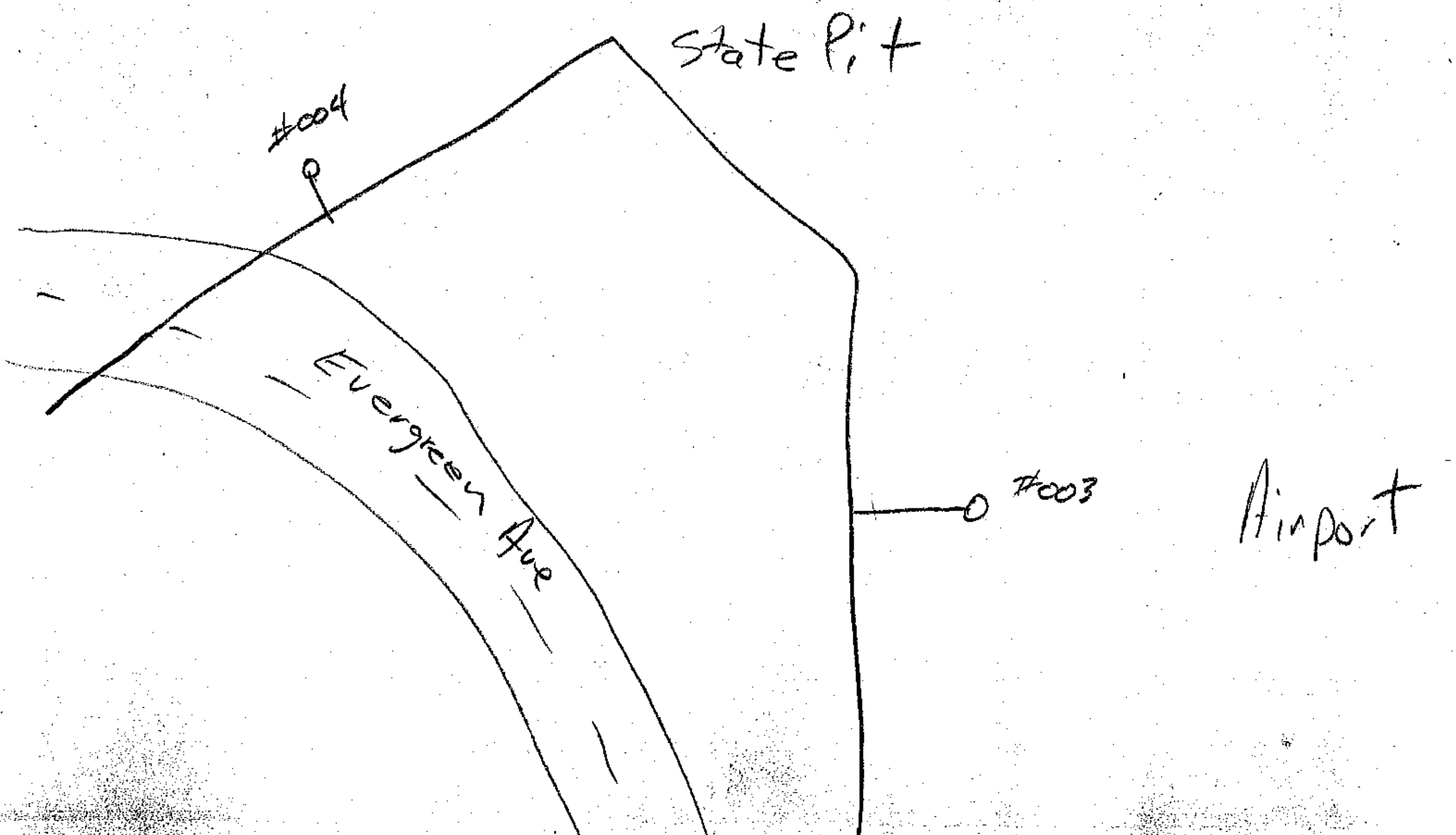
STATIC B 88 psi RESIDUAL B 84 psi

PROJECTED RESULTS @ 20 psi 4792 gpm, or @ 0 psi RESIDUAL 5509 gpm

REMARKS ~~No Test~~ - Hydrant Valve NOT ON

Hydrant needs Ballards

"turned Hydrant on - completed test 10-19"



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

#004 N-5

LOCATION State Rock Pit on Evergreen Ave DATE 10-17-00

TEST MADE BY Rob & Gary TIME 11:10 A .M.

REPRESENTATIVE OF Public Works

WITNESS Jeff & Tom

STATE PURPOSE OF TEST Flow testing

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING Evergreen Pump (NOT RUNNING)

FLOW HYDRANTS State Pit A1 Gerard Hall A2 A3 A4

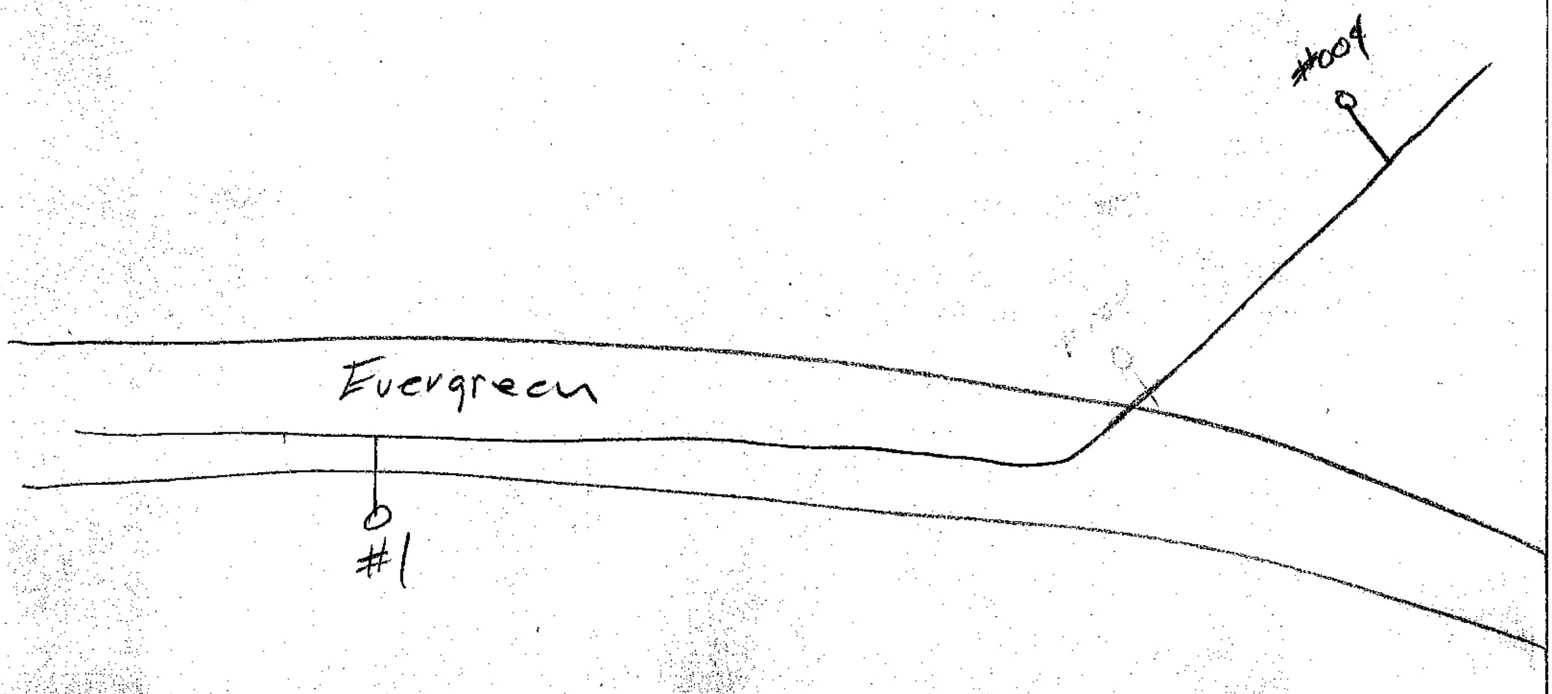
SIZE NOZZLE 2"

PITOT READING 60 psi TOTAL GPM 920

STATIC B 70 psi RESIDUAL B 68 psi

PROJECTED RESULTS @ 20 psi 5247 gpm, or @ 0 psi RESIDUAL 6294 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #1 Evergreen Ave N-6 DATE 10-17-00

TEST MADE BY Rob & Gary TIME 11:00 A.M.

REPRESENTATIVE OF City Public Works

WITNESS Tom Gillen

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ____

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING Stikine / Evergreen (NOT RUNNING)

FLOW HYDRANTS #1 A1 #2 A2 ____ A3 ____ A4 ____

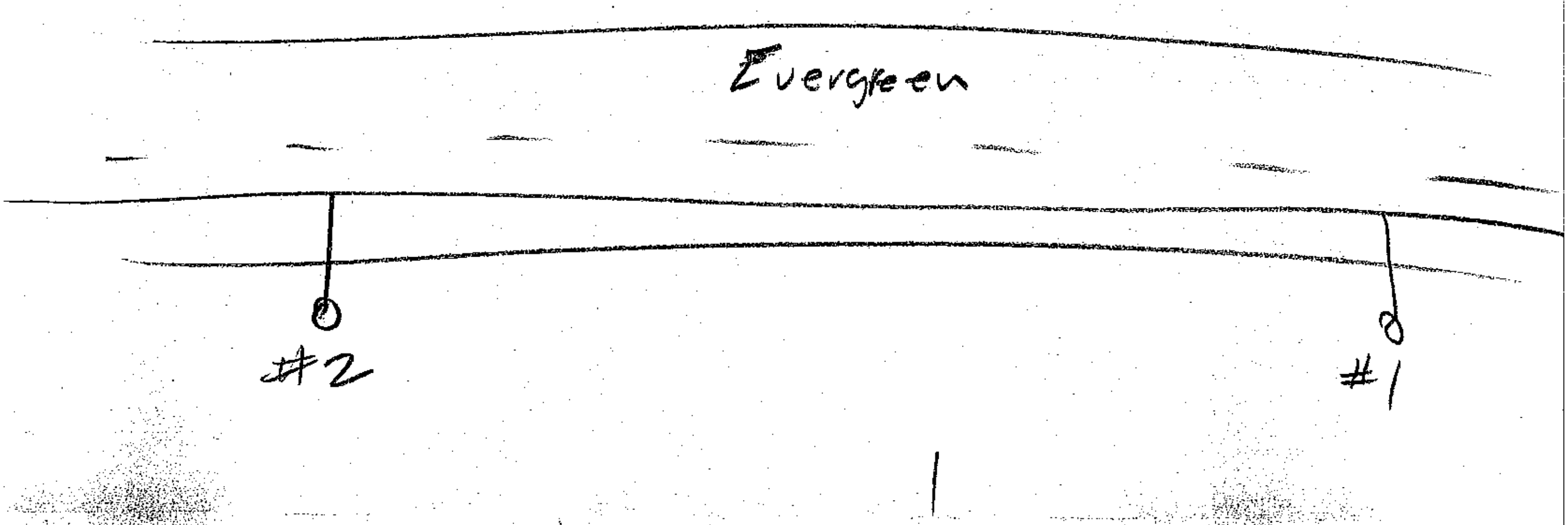
SIZE NOZZLE 2"

PITOT READING 50 psi TOTAL GPM 841

STATIC B 66 psi ____ RESIDUAL B 62 psi

PROJECTED RESULTS @ 20 psi 3152 gpm, or @ 0 psi RESIDUAL 3830 gpm

REMARKS ____



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #2 Evergreen Ave N-7 DATE 10-17-00

TEST MADE BY Rob & Gary TIME 11:00 A.M.

REPRESENTATIVE OF City Public Works

WITNESS Tom Gillen

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING Stikine / Evergreen (not running)

FLOW HYDRANTS #2 A1 #3 A2 A3 A4

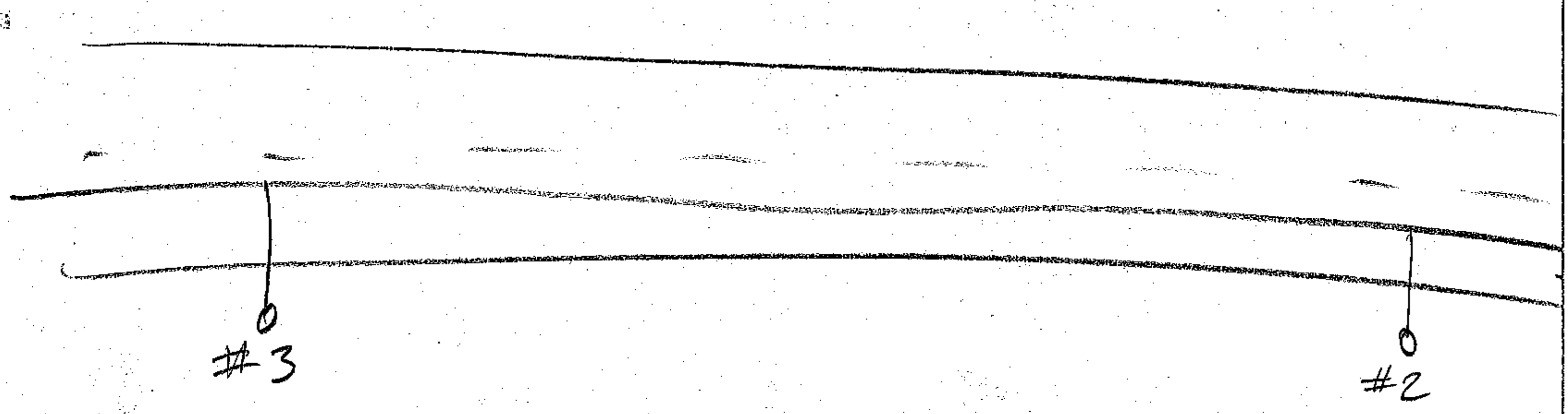
SIZE NOZZLE 2"

PITOT READING 44 psi TOTAL GPM 788

STATIC B 72 psi RESIDUAL B 66 psi

PROJECTED RESULTS @ 20 psi 2528 gpm, or @ 0 psi RESIDUAL 3017 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #3 Evergreen Ave N-10 DATE 10-17-00

TEST MADE BY Rob & Gary TIME 2:00 p.M.

REPRESENTATIVE OF Public Works

WITNESS Tom Gillen

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING Stikine / Evergreen (not running)

FLOW HYDRANTS #3 A1 A2 A3 A4

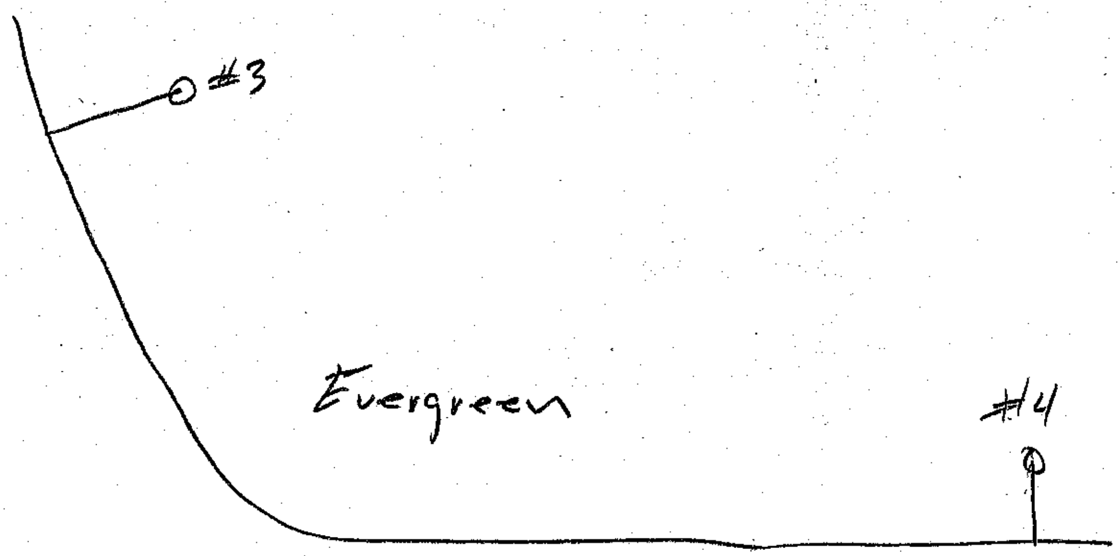
SIZE NOZZLE 2"

PITOT READING 50 psi TOTAL GPM 841

STATIC B 66 psi RESIDUAL B 60 psi

PROJECTED RESULTS @ 20 psi 7529 gpm, or @ 0 psi RESIDUAL 3073 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Landfill #1 N-8 DATE 12-27-00

TEST MADE BY Gary and Rob TIME 2:27 P.M.

REPRESENTATIVE OF PUBLIC Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS Landfill #1 A1 Doug Smith A2 A3 A4

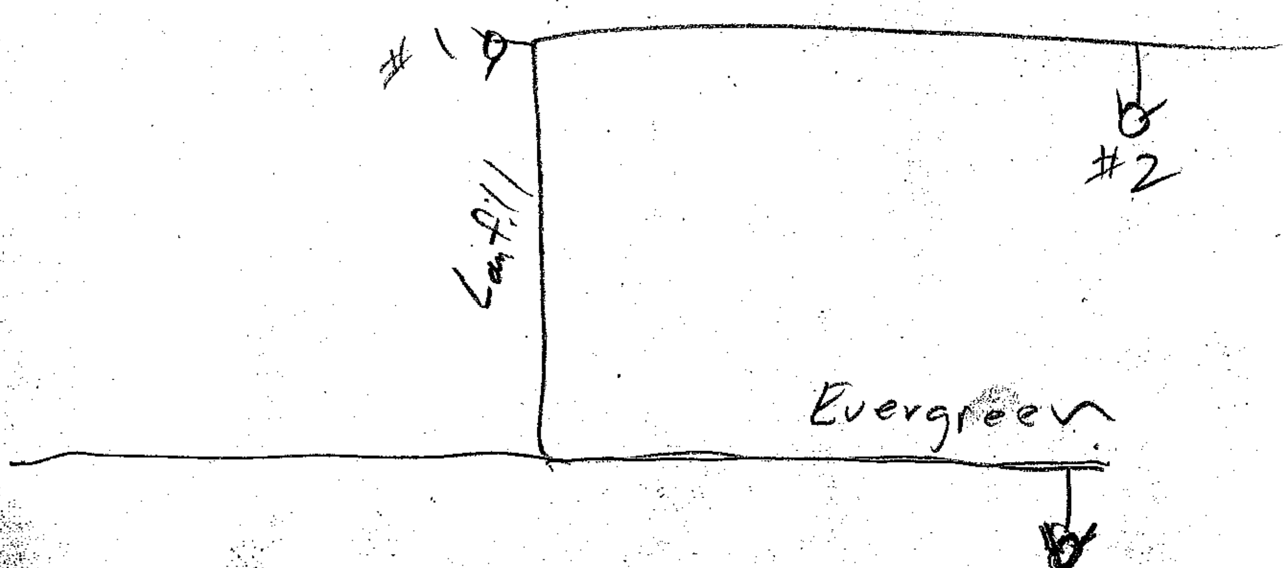
SIZE NOZZLE 1 1/2

PITOT READING 48 TOTAL GPM 394

STATIC B 64 psi RESIDUAL B 62 psi

PROJECTED RESULTS @ 20 psi 2098 gpm, or @ 0 psi RESIDUAL 2567 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION LANDFILL #2 N-9 DATE 12-27-00

TEST MADE BY ROB DAVIDSON & GARY PULLMAN TIME 2-2:30 P.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING Stikine / Evergreen (NOT Running)

FLOW HYDRANTS Landfill #2 A1 Landfill #1 A2 A3 A4

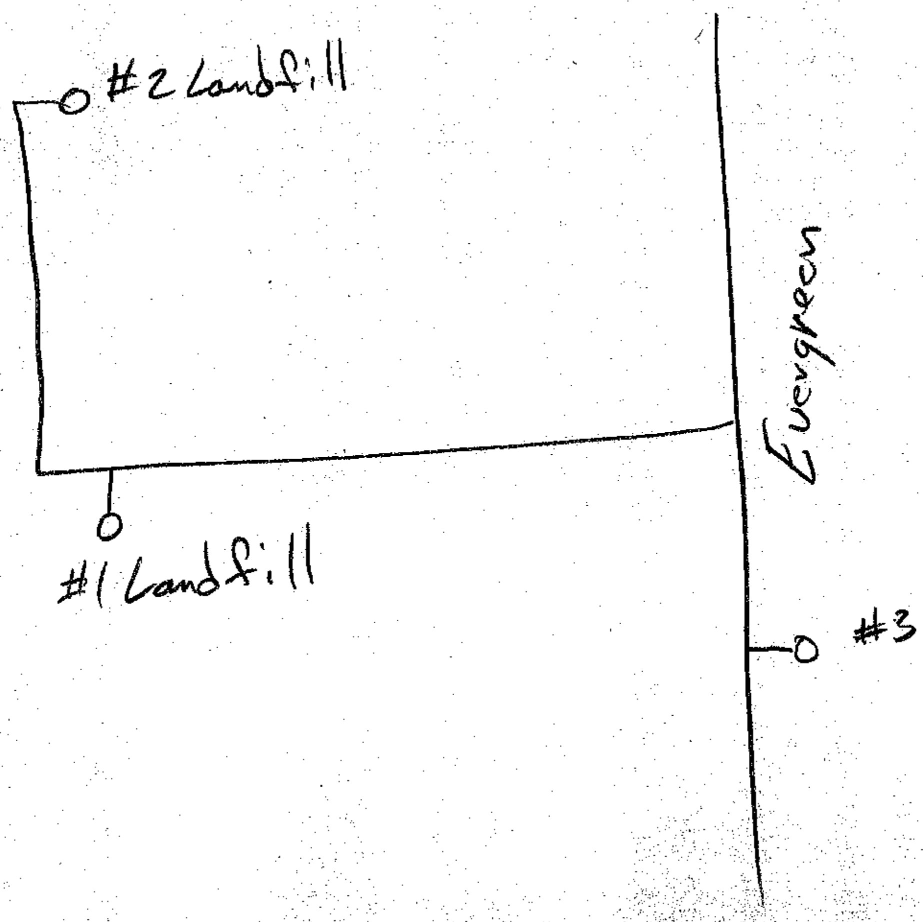
SIZE NOZZLE ~~2"~~ 1 1/2"

PITOT READING 42 ~~[illegible]~~ psi TOTAL GPM 369

STATIC B 52 ~~[illegible]~~ psi RESIDUAL B 50 psi

PROJECTED RESULTS @ 20 psi 1654 gpm, or @ ~~0~~ psi RESIDUAL 2148 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

N-12

LOCATION #4 Evergreen Ave N-11 ? DATE 10-17-00

TEST MADE BY Rob Davidson & Gary Pullman TIME 2:30-3 p.M.

REPRESENTATIVE OF Public Works

WITNESS ______

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ______

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING Stikine/Evergreen (NOT Running)

FLOW HYDRANTS #4 A1 #5 A2 ______ A3 ______ A4 ______

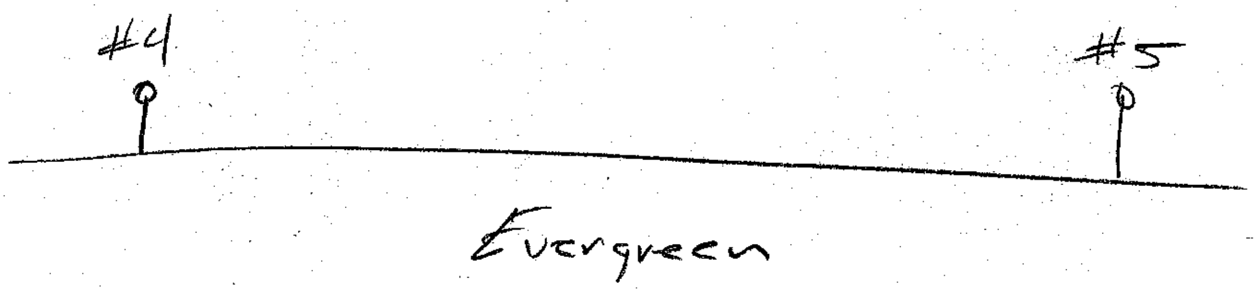
SIZE NOZZLE 2"

PITOT READING 54 psi TOTAL GPM 873

STATIC B 72 psi RESIDUAL B 64 psi

PROJECTED RESULTS @ 20 psi 2400 gpm, or @ 0 psi RESIDUAL 2864 gpm

REMARKS ______



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

N-13

LOCATION #5 Evergreen Ave (Stuoghs trlcrt) DATE 10-17-00

TEST MADE BY Rob Davidson & Gary Pullman TIME 2:30-3 p.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING Stikine / Evergreen (not running)

FLOW HYDRANTS #5 A1 #6 A2 A3 A4

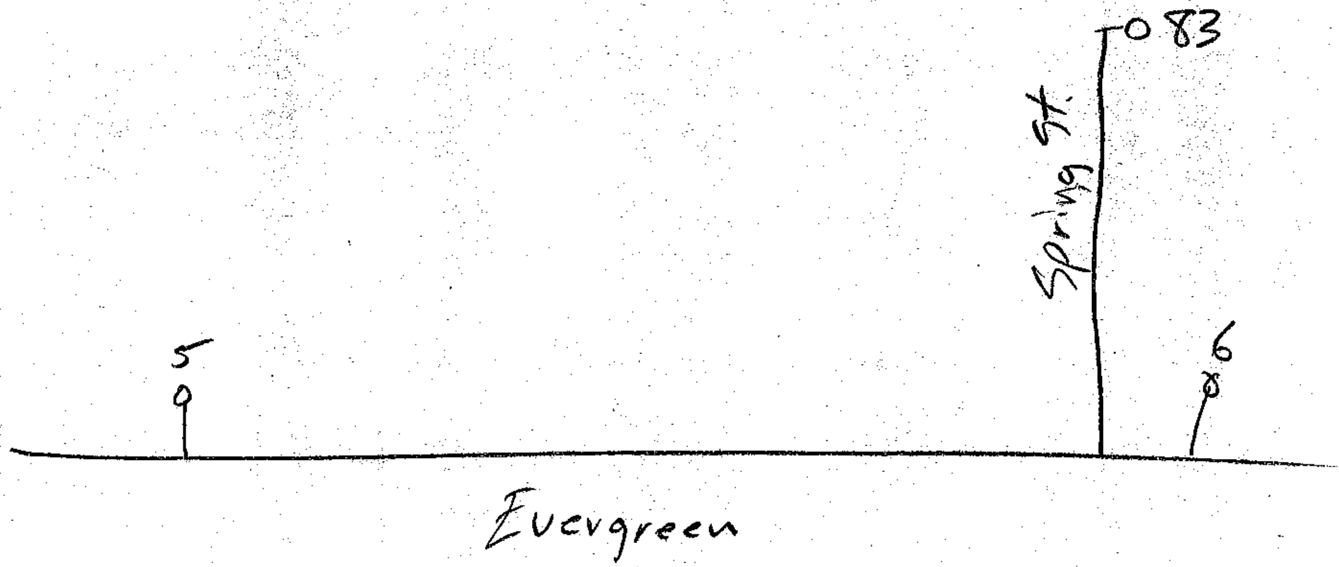
SIZE NOZZLE 2"

PITOT READING 58 psi TOTAL GPM 905

STATIC B 80 psi RESIDUAL B 70 psi

PROJECTED RESULTS @ 20 psi 2378 gpm, or @ 0 psi RESIDUAL 2754 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

N-15

LOCATION #6 Evergreen Ave & Spring St. DATE 10-17-00

TEST MADE BY Rob & Gary TIME 2:30 - 3 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING Stikin/Evergreen (Not running)

FLOW HYDRANTS #6 A1 #7 A2 A3 A4

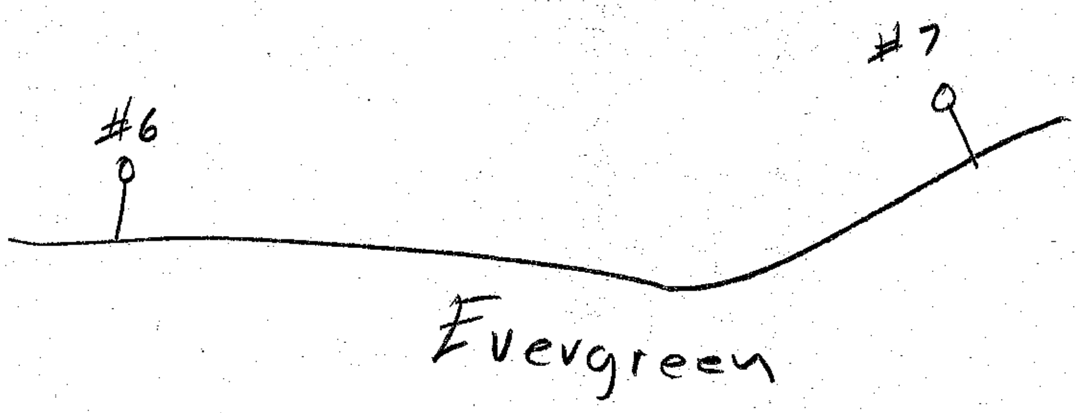
SIZE NOZZLE 2"

PITOT READING 54 psi TOTAL GPM 873

STATIC B 78 psi RESIDUAL B 70 psi

PROJECTED RESULTS @ 20 psi 2548 gpm, or @ 0 psi RESIDUAL 2989 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #7 Evergreen Ave N-16 DATE 10-17-00

TEST MADE BY Rob & Gary TIME 3-3:30 p.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING Stikine/Evergreen (NOT Running)

FLOW HYDRANTS #7 A1 #8 A2 A3 A4

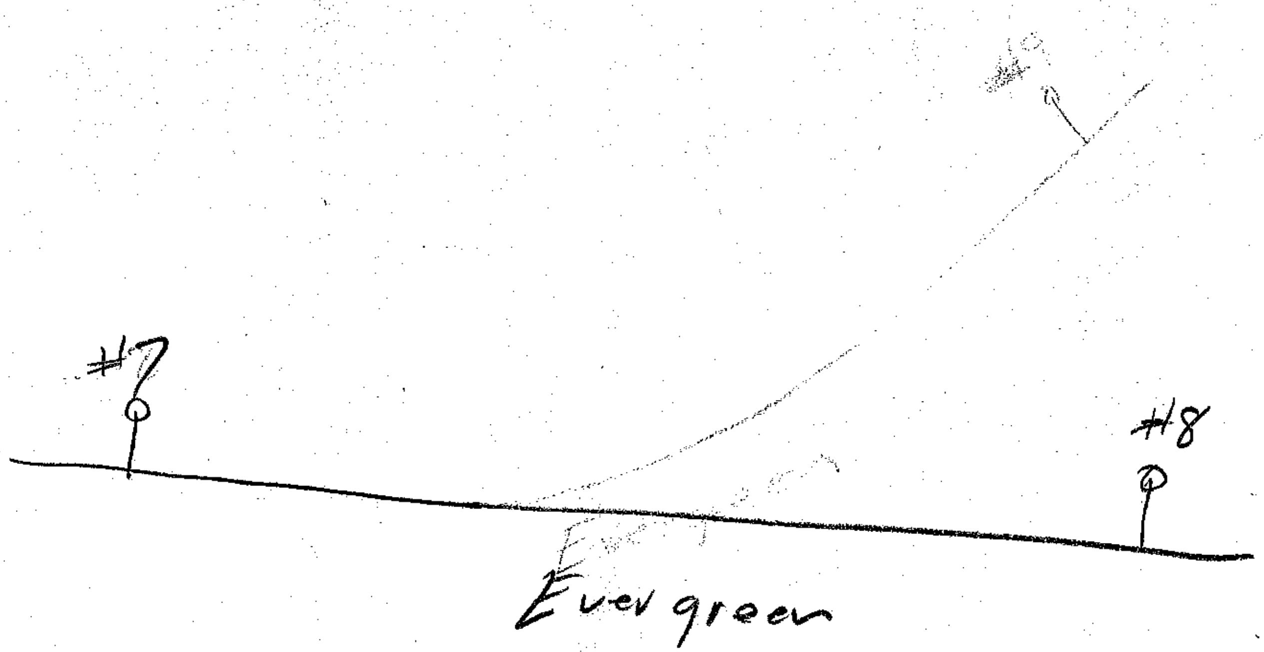
SIZE NOZZLE 2"

PITOT READING 56 psi TOTAL GPM 889

STATIC B 80 psi RESIDUAL B 70 psi

PROJECTED RESULTS @ 20 psi 2337 gpm, or @ 0 psi RESIDUAL 2731 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #8 Evergreen Ave N-17 DATE 10-17-00

TEST MADE BY Rob & Gary TIME 3-3:30 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING Stikin / Evergreen (not running)

FLOW HYDRANTS #8 A1 #9 A2 A3 A4

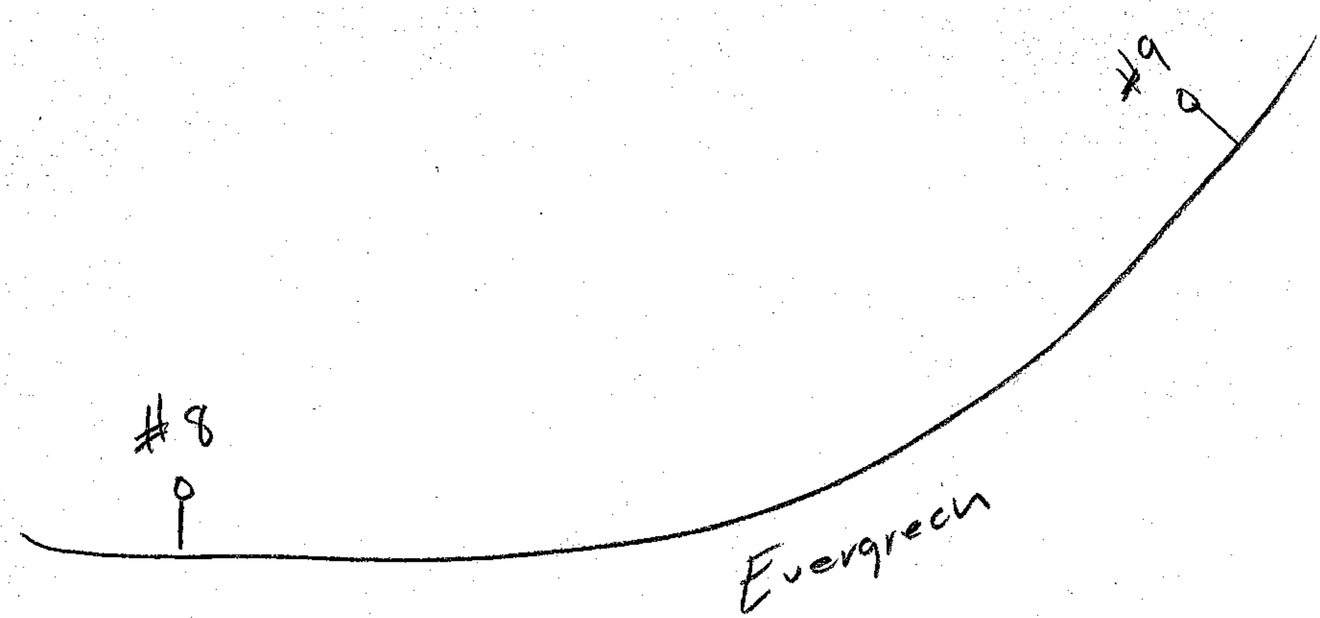
SIZE NOZZLE 2"

PITOT READING 56 psi TOTAL GPM 889

STATIC B 80 psi RESIDUAL B 72 psi

PROJECTED RESULTS @ 20 psi 2641 gpm, or @ 0 psi RESIDUAL 3087 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

L-18

LOCATION #9 Evergreen Ave DATE 10-17-00

TEST MADE BY Rob & Gary TIME 3:30-4 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #9 A1 #10 A2 A3 A4

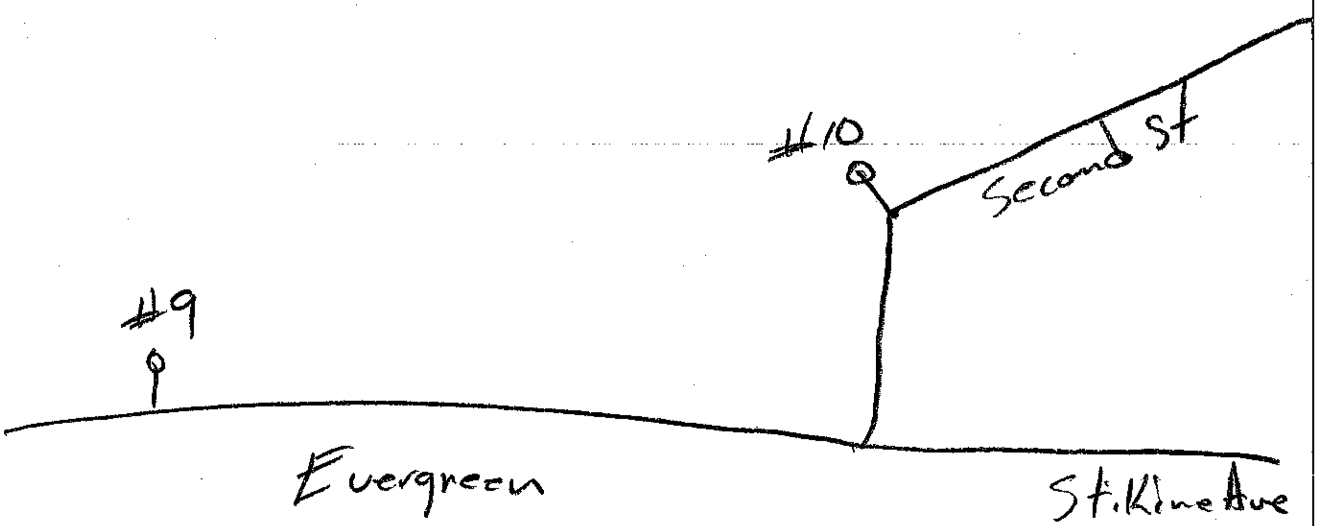
SIZE NOZZLE 2"

PITOT READING 50 psi TOTAL GPM 841

STATIC B 74 psi RESIDUAL B 62 psi

PROJECTED RESULTS @ 20 psi 1893 gpm, or @ 0 psi RESIDUAL 2244 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

L-19

LOCATION # 10 Second St & McCormick St DATE 10-17-00

TEST MADE BY Rob & Gary TIME 3:30-4 p.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #10 A1 #11 A2 A3 A4

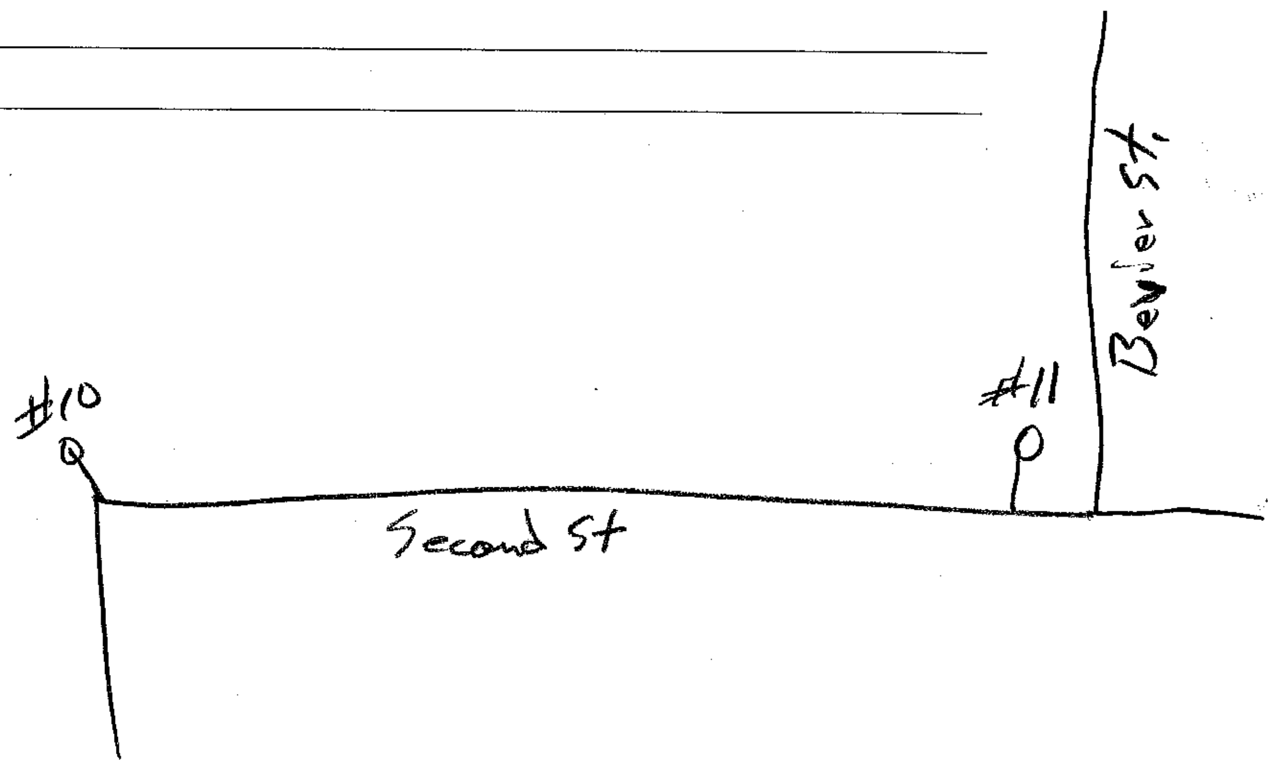
SIZE NOZZLE 2"

PITOT READING 50 psi TOTAL GPM 841

STATIC B 68 psi RESIDUAL B 60 psi

PROJECTED RESULTS @ 20 psi 2216 gpm, or @ 0 psi RESIDUAL 2674 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL L-20

LOCATION #11 Bevier St & Second St. DATE 10-17-00

TEST MADE BY ROB Davidson & Gary Pullman TIME 3-4 P.M.

REPRESENTATIVE OF PUBLIC Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #11 A1 #12 A2 A3 A4

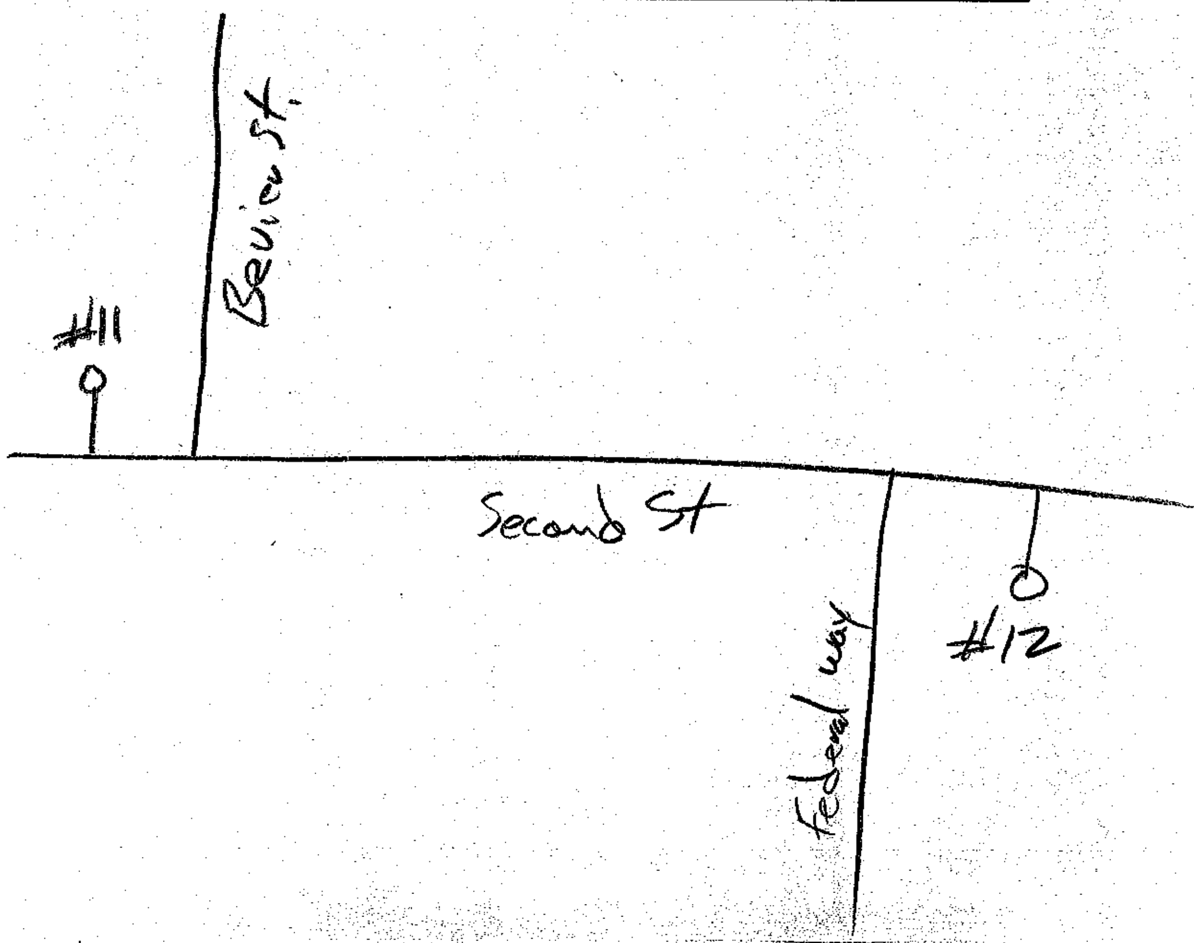
SIZE NOZZLE 2"

PITOT READING 48 psi TOTAL GPM 824

STATIC B 72 psi RESIDUAL B 108 psi

PROJECTED RESULTS @ 20 psi 3296 gpm, or @ 0 psi RESIDUAL 3932 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

L-21

LOCATION #12 Second St & Federal Way DATE 10-17-00

TEST MADE BY Rob & Gary TIME 4:-4:30 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #12 A1 #13 A2 A3 A4

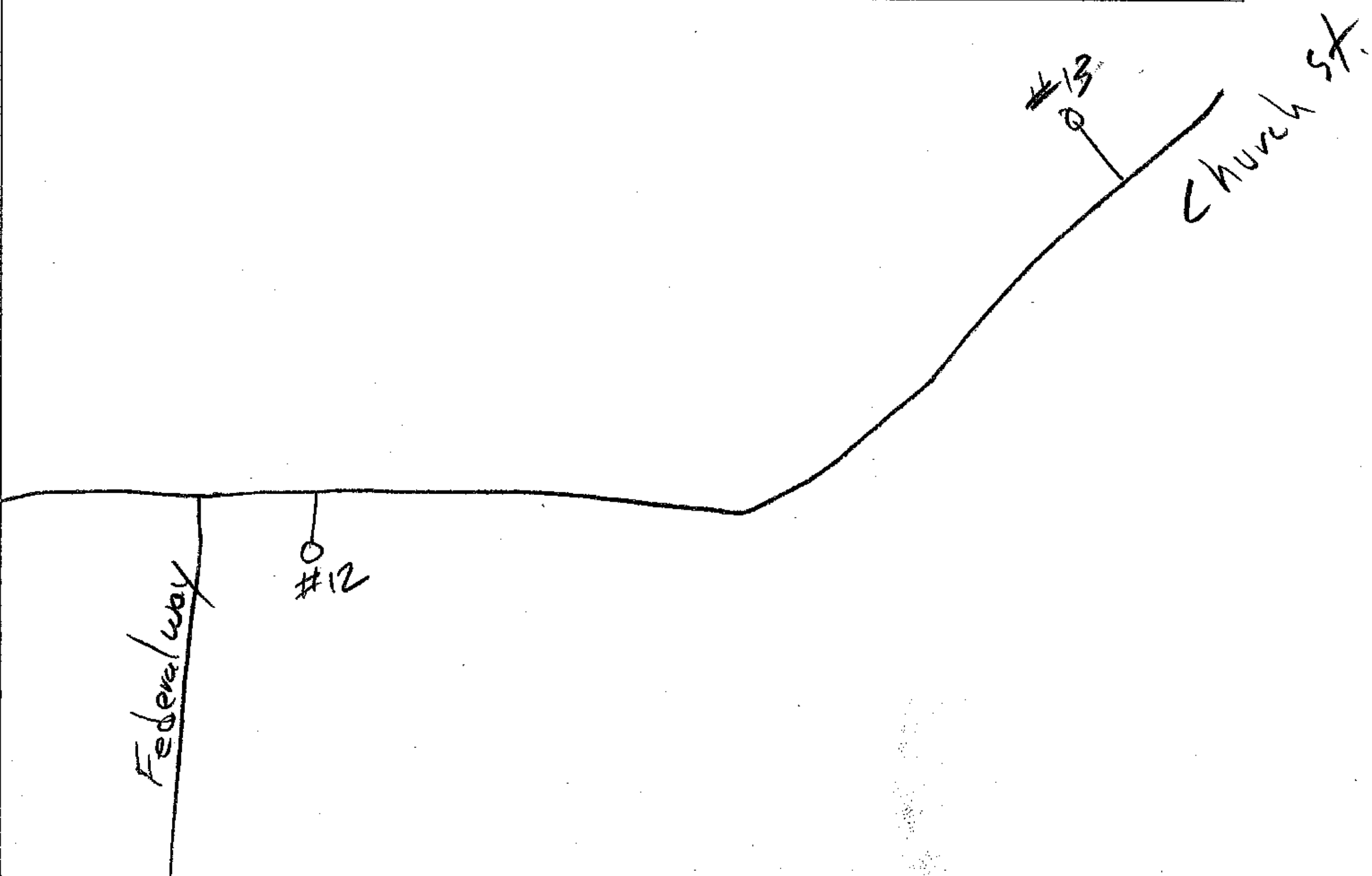
SIZE NOZZLE 2"

PITOT READING 50 psi TOTAL GPM 841

STATIC B 72 psi RESIDUAL B 66 psi

PROJECTED RESULTS @ 20 psi 2699 gpm, or @ 0 psi RESIDUAL 3220 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

L-22

LOCATION #13 Church St & McKinnon St DATE 10-17-00

TEST MADE BY Rob & Gary TIME 4-4:30 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #13 A1 #14 A2 A3 A4

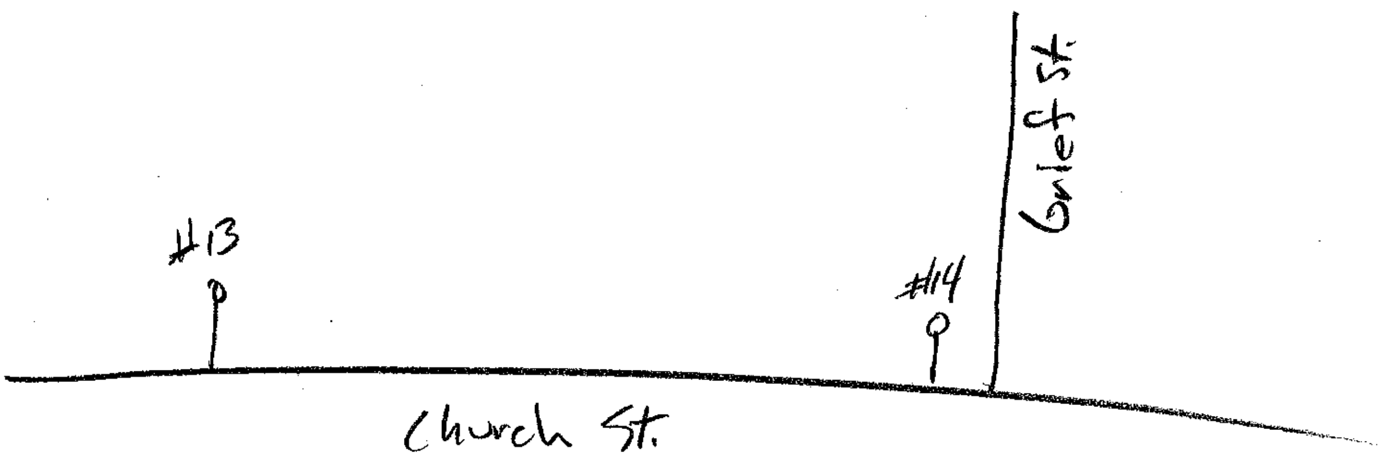
SIZE NOZZLE 2"

PITOT READING 52 psi TOTAL GPM 857

STATIC B 72 psi RESIDUAL B 66 psi

PROJECTED RESULTS @ 20 psi 2750 gpm, or @ 0 psi RESIDUAL 3281 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

L - 23

LOCATION #14 Church St & Grief St. DATE 10-18-00

TEST MADE BY Rob & Gary TIME 8:30 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #14 A1 #15 A2 A3 A4

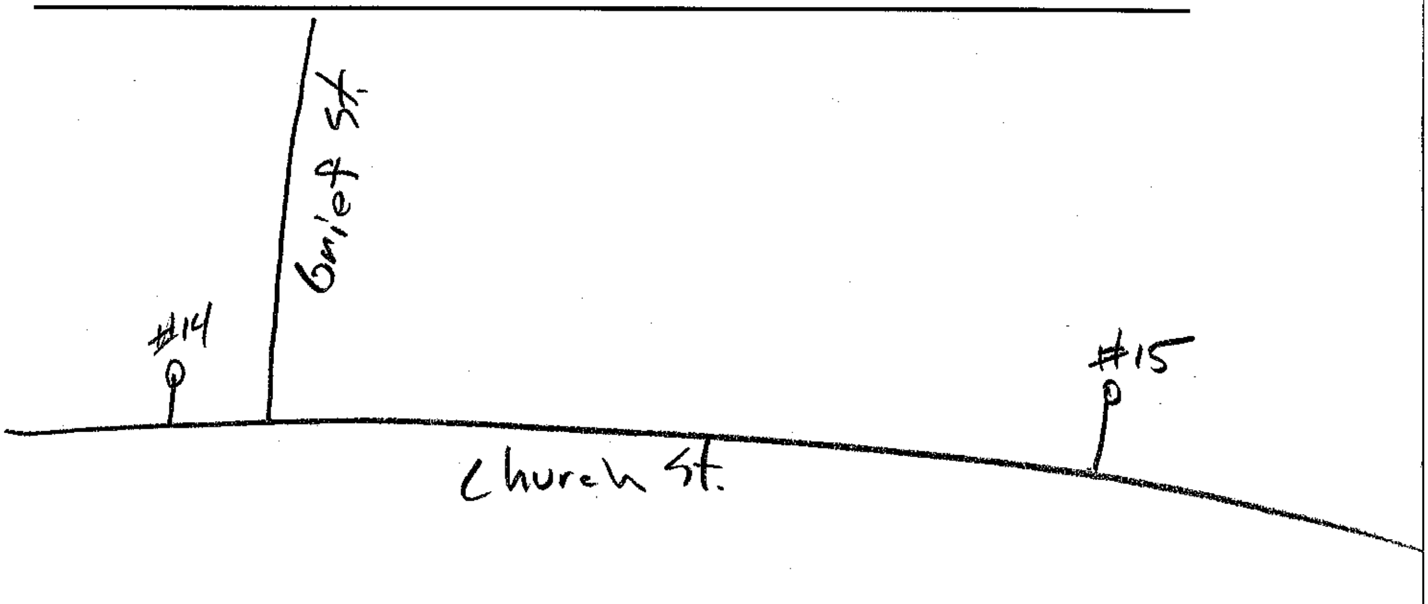
SIZE NOZZLE 2"

PITOT READING 50 psi TOTAL GPM 841

STATIC B 54 psi RESIDUAL B 50 psi

PROJECTED RESULTS @ 20 psi 2674 gpm, or @ 0 psi RESIDUAL 3436 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL L-24

LOCATION #15 Church St (Pool) DATE 10-18-00

TEST MADE BY Rob & Gary TIME 8:30-9 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #15 A1 #16 A2 A3 A4

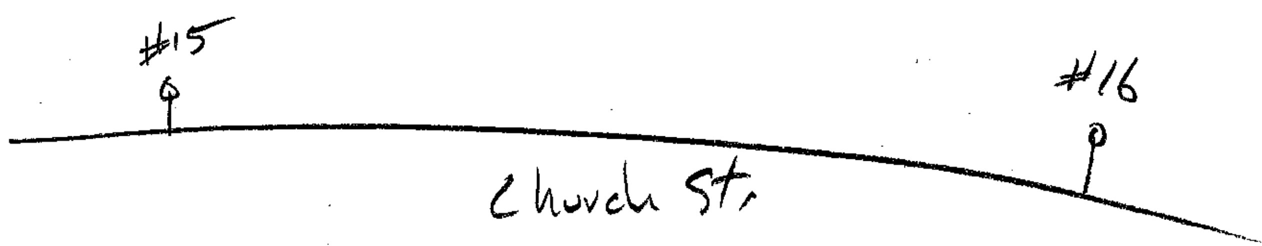
SIZE NOZZLE 2"

PITOT READING 40 psi TOTAL GPM 752

STATIC B 64 psi RESIDUAL B 58 psi

PROJECTED RESULTS @ 20 psi 2207 gpm, or @ 0 psi RESIDUAL 2702 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #16 Church & St. Michaels St. DATE 10-18-00

TEST MADE BY Rob & Gary TIME 11:00 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #16 A1 #39 A2 A3 A4

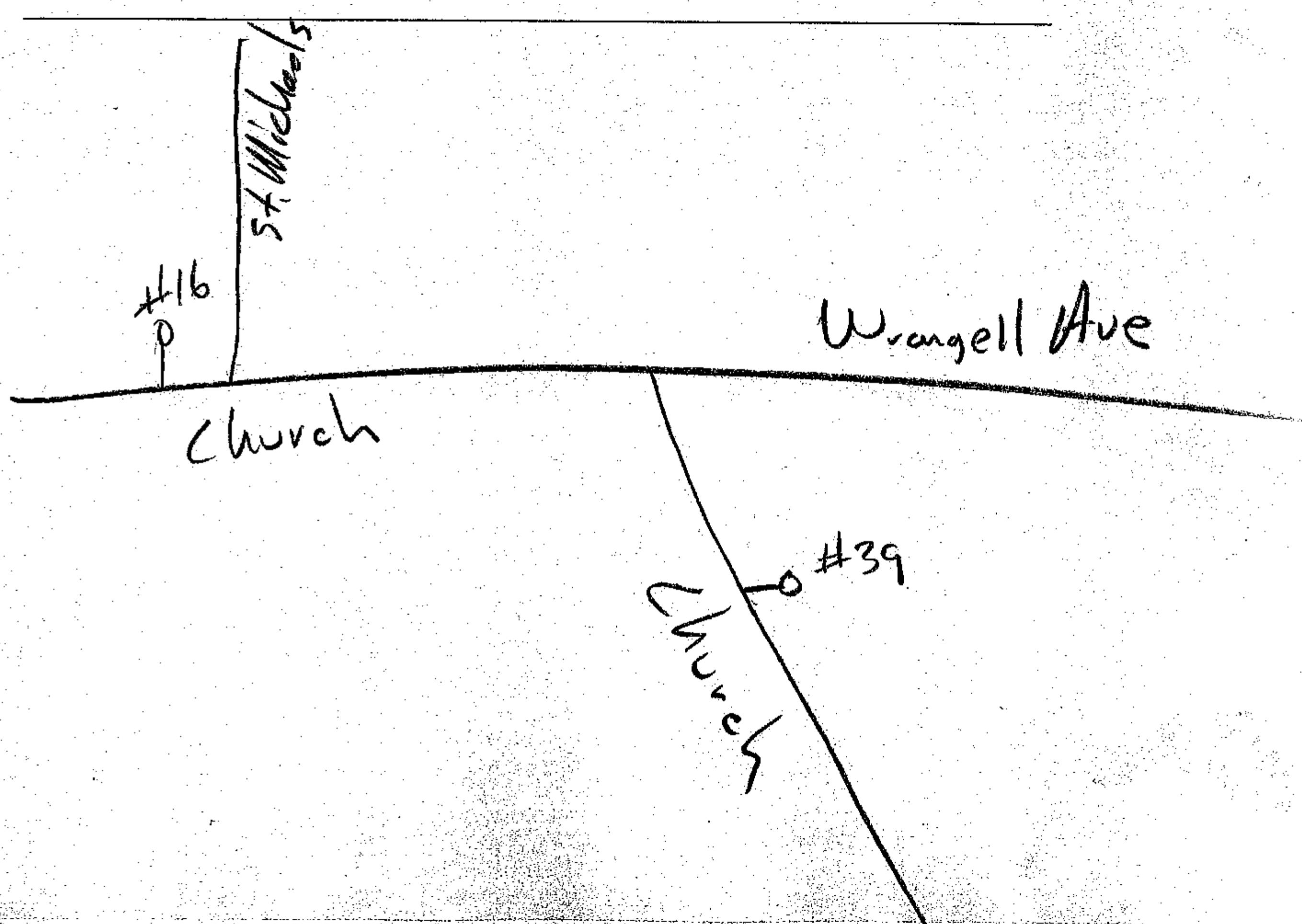
SIZE NOZZLE 2"

PITOT READING 44 psi TOTAL GPM 788

STATIC B 68 psi RESIDUAL B 64 psi

PROJECTED RESULTS @ 20 psi 3021 gpm, or @ 0 psi RESIDUAL 3645 gpm

REMARKS



HYDRANT FLOW TEST REPORT #17
CITY OF WRANGELL

LOCATION Wrangell Ave. + Bennet DATE 12-27-00

TEST MADE BY Gory and Bob TIME 3:00 P.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS Wrangell Ave Bennett A1 Church St Michaels A2 A3 A4

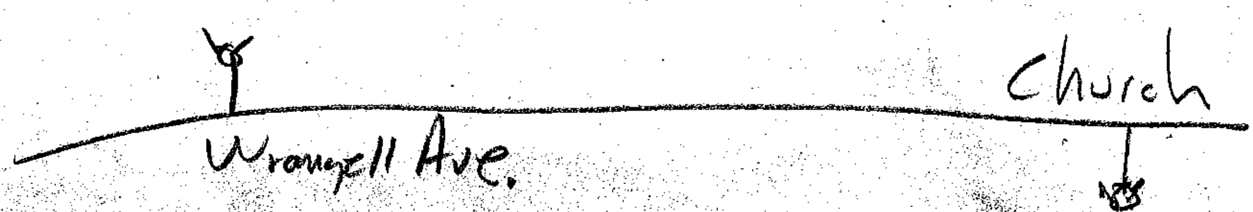
SIZE NOZZLE 3/4

PITOT READING 48 TOTAL GPM

STATIC B 58 psi RESIDUAL B 56 psi

PROJECTED RESULTS @ 20 psi gpm, or @ psi RESIDUAL gpm

REMARKS



HYDRANT FLOW TEST REPORT #18
CITY OF WRANGELL

LOCATION Salvation Army DATE 10-20-00

TEST MADE BY Gary and Rob TIME 11:00 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J18 A1 J19 A2 A3 A4

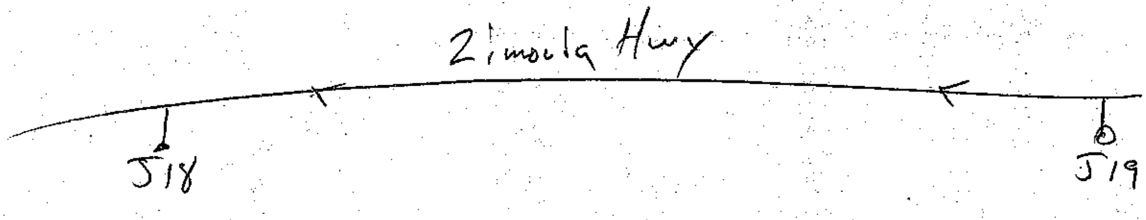
SIZE NOZZLE 2"

PITOT READING 86 TOTAL GPM 1102

STATIC B 1[illegible]0 psi RESIDUAL B 108 psi

PROJECTED RESULTS @ 20 psi 2720 gpm, or @ 0 psi RESIDUAL 2975 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

#19

LOCATION Zimovia and Ash DATE 10-24-00

TEST MADE BY Gary and Rob TIME 8:54 .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #19 A1 High pressure valt A2 A3 A4

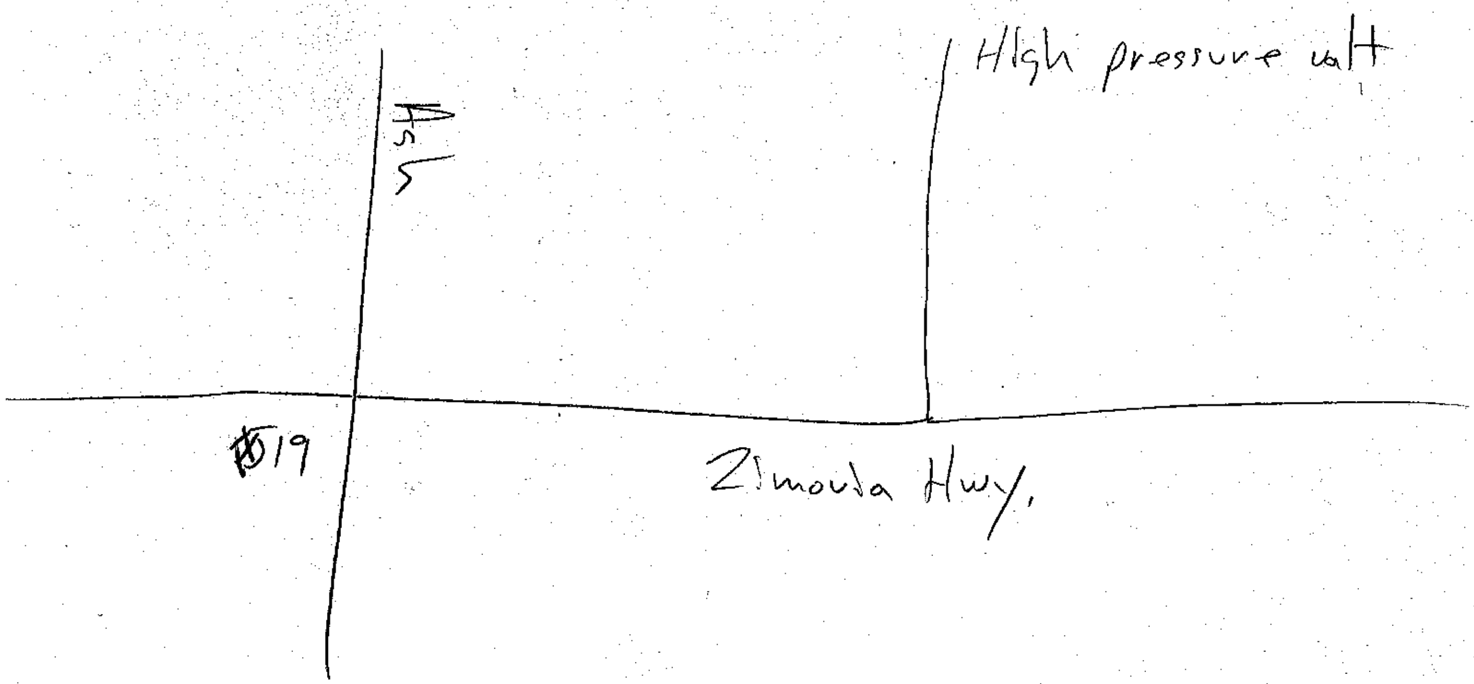
SIZE NOZZLE 2"

PITOT READING 86 psi TOTAL GPM 1102

STATIC B 110 psi RESIDUAL B 92 psi

PROJECTED RESULTS @ 20 psi 2630 gpm, or @ 0 psi RESIDUAL 2931 gpm

REMARKS



#20

HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Anne Armstrong DATE 10-24-00

TEST MADE BY Gary and Rob TIME 9:04 .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J20 A1 Low pressure valt A2 A3 A4

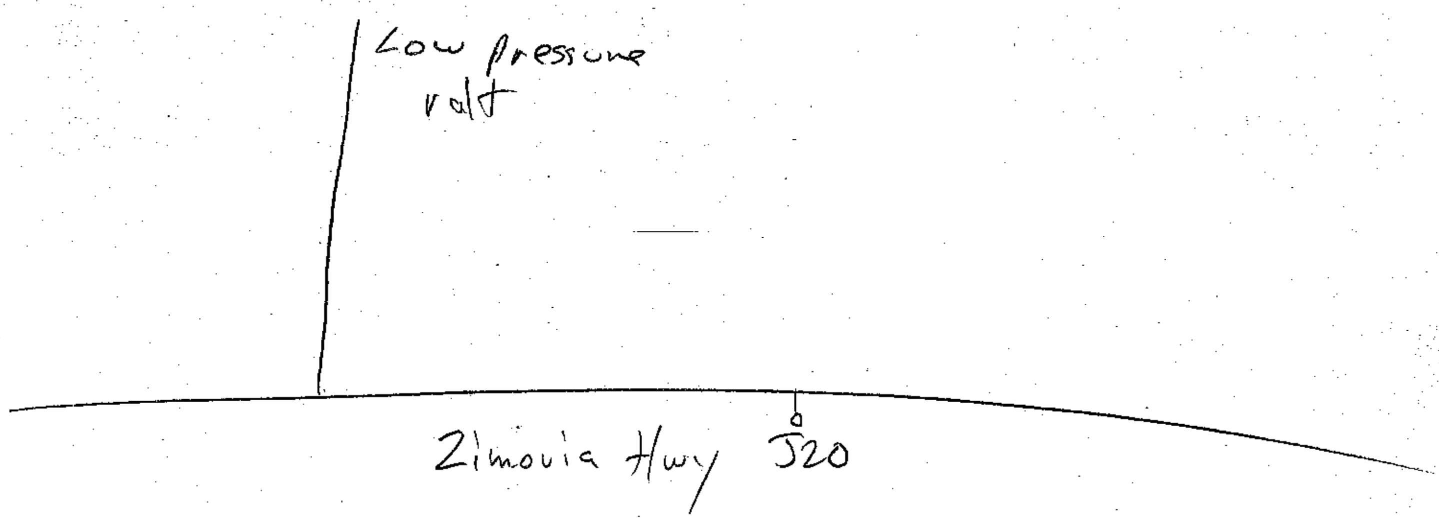
SIZE NOZZLE 2"

PITOT READING 46 psi TOTAL GPM 806

STATIC B 42 psi RESIDUAL B 38 psi

PROJECTED RESULTS @ 20 psi 1960 gpm, or @ 0 psi RESIDUAL 2876 gpm

REMARKS



#24

HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION: Sue ~~[illegible]~~ Nikodym DATE: 10-24-00

TEST MADE BY: Cory and Rob TIME: 9:11 .M.

REPRESENTATIVE OF: PUBLIC WORKS

WITNESS:

STATE PURPOSE OF TEST: Flow

CONSUMPTION RATE DURING TEST:

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING:

FLOW HYDRANTS: J21 A1 J-20 A2 A3 A4

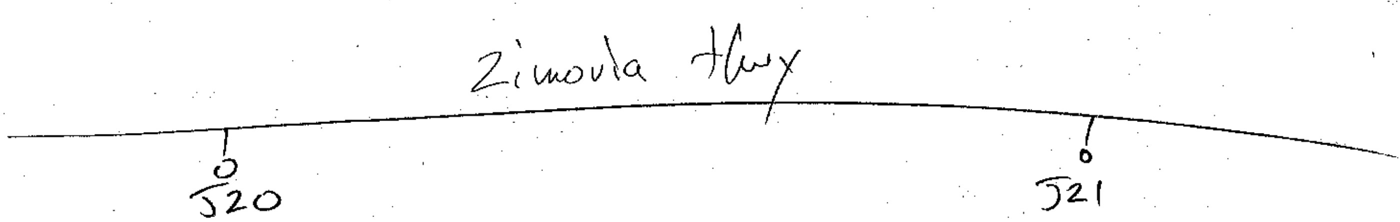
SIZE NOZZLE: 2"

PITOT READING: 48 psi TOTAL GPM: 824

STATIC B: 62 psi RESIDUAL B: 60 psi

PROJECTED RESULTS @ 20 psi 4279 gpm, or @ 0 psi RESIDUAL 5279 gpm

REMARKS:



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #22 Case Ave and Bergerst DATE 10-24-00

TEST MADE BY Gary and Rob TIME 9:30 .M.

REPRESENTATIVE OF Public Works

WITNESS ______

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ______

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ______

FLOW HYDRANTS J22 A1 J21 A2 ______ A3 ______ A4 ______

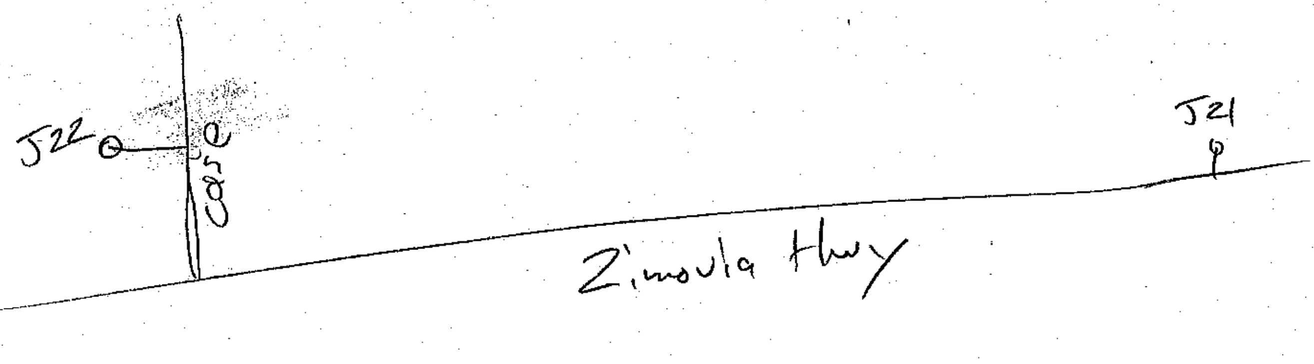
SIZE NOZZLE 2"

PITOT READING 52 psi TOTAL GPM 857

STATIC B 66 psi RESIDUAL B 64 psi

PROJECTED RESULTS @ 20 psi 4675 gpm, or @ 0 psi RESIDUAL 5679 gpm

REMARKS ______



#23

HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Cemetary DATE 10-24-00

TEST MADE BY Gary and Rob TIME 10:04 .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J23 A1 J81 A2 A3 A4

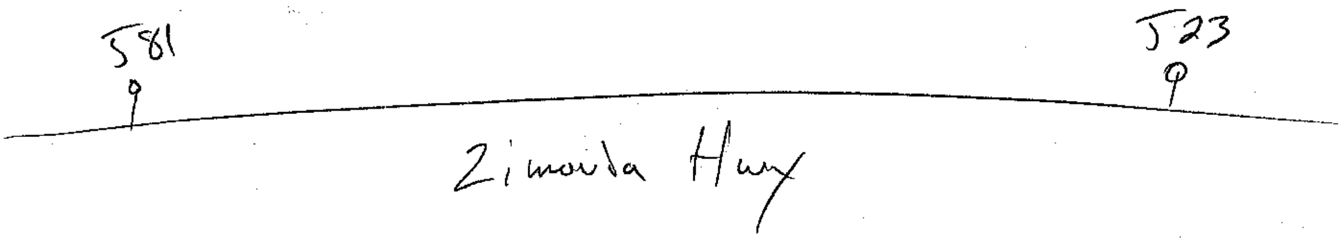
SIZE NOZZLE 2"

PITOT READING 90 psi TOTAL GPM 1128

STATIC B 146 psi RESIDUAL B 108 psi

PROJECTED RESULTS @ 20 psi 2155 gpm, or @ 0 psi RESIDUAL 2334 gpm

REMARKS



#24

HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Blooms Trailer Court DATE 10-24-00

TEST MADE BY Gary and Rob TIME 10:11 .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J24 A1 J23 A2 A3 A4

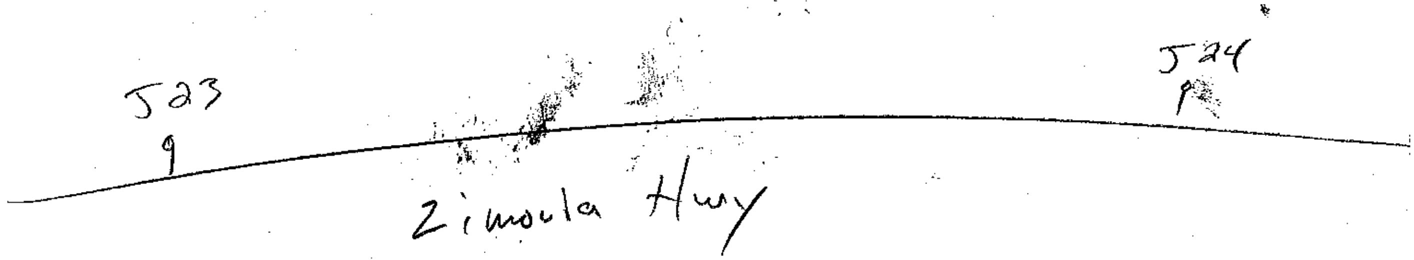
SIZE NOZZLE 2"

PITOT READING 92 psi TOTAL GPM 1040

STATIC B 136 psi RESIDUAL B 112 psi

PROJECTED RESULTS @ 20 psi 2672 gpm, or @ 0 psi RESIDUAL 2910 gpm

REMARKS



#25

HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Bakke Apt. DATE 10-24-00

TEST MADE BY Gary and Rob TIME 10:20 .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J-25 A1 J24 A2 A3 A4

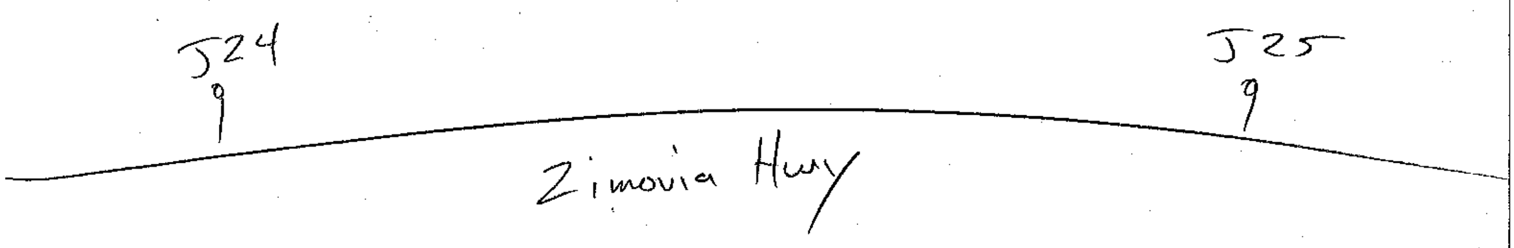
SIZE NOZZLE 2"

PITOT READING 88 psi TOTAL GPM 1115

STATIC B 140 psi RESIDUAL B 104 psi

PROJECTED RESULTS @ 20 psi 2135 gpm, or @ 0 psi RESIDUAL 2320 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #26 Penninsula St. Shustak St. DATE 10-18-00

TEST MADE BY Rob & Gary TIME 3:00 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #26 A1 #27 A2 A3 A4

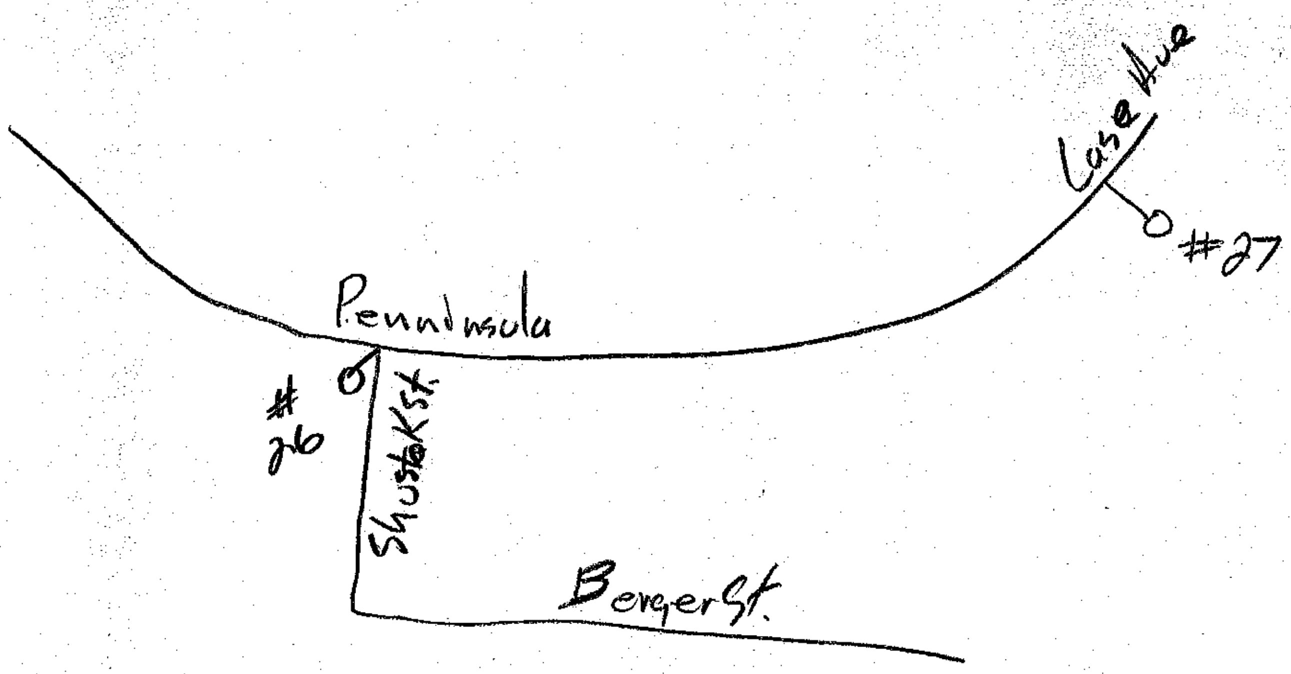
SIZE NOZZLE 2"

PITOT READING 56 psi TOTAL GPM 889

STATIC B 76 psi RESIDUAL B 70 psi

PROJECTED RESULTS @ 20 psi 2971 gpm, or @ 0 psi RESIDUAL 3505 gpm

REMARKS Low Hydrant - needs to be raised



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #27 Case Ave (Power Plant) DATE 10-18-00

TEST MADE BY Rob & Gary TIME 2-2:30 P.M.

REPRESENTATIVE OF Public Works

WITNESS ______

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ______

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ______

FLOW HYDRANTS #27 A1 22 A2 ______ A3 ______ A4 ______

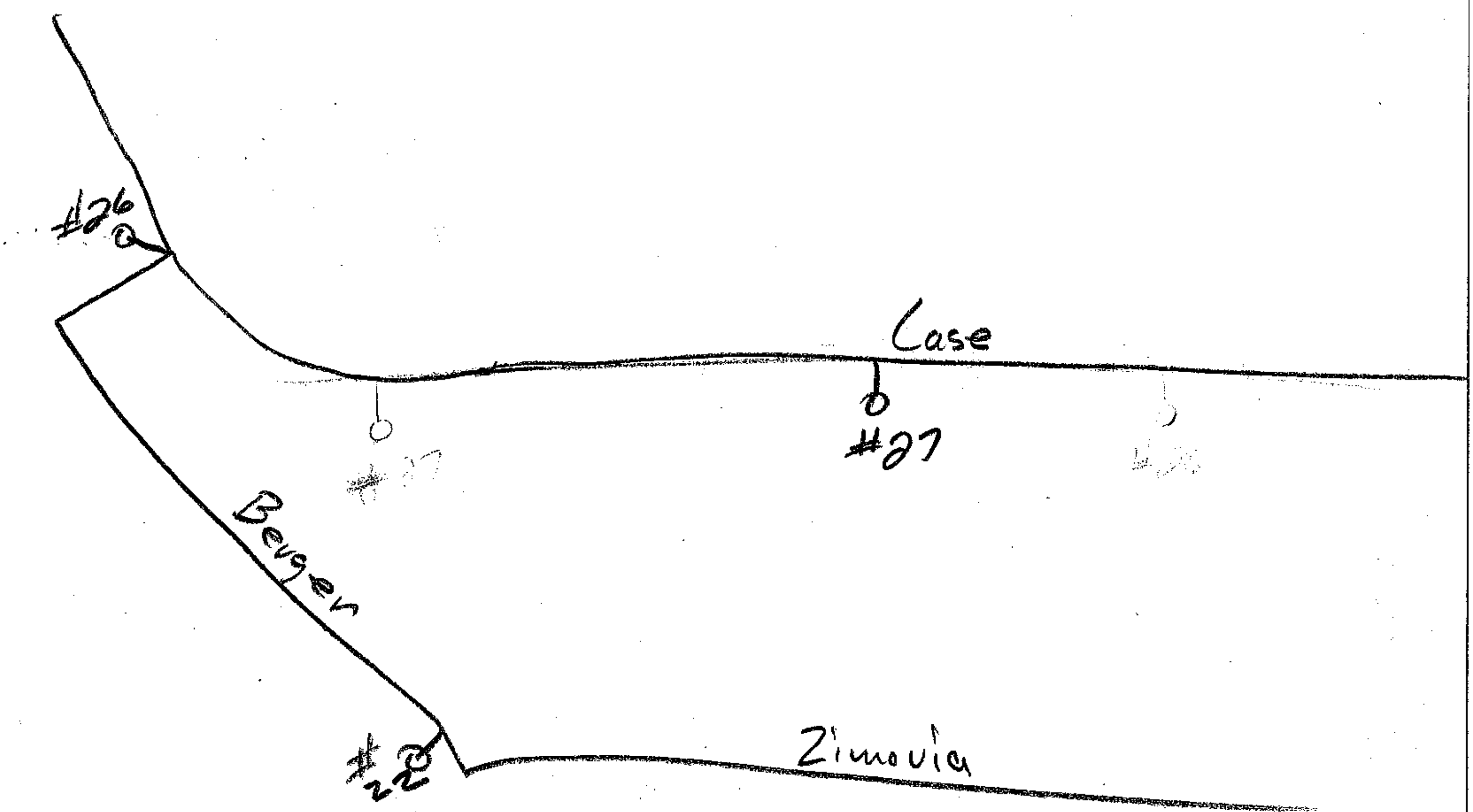
SIZE NOZZLE 2"

PITOT READING 60 psi TOTAL GPM 920

STATIC B 76 psi RESIDUAL B 72 psi

PROJECTED RESULTS @ 20 psi 3833 gpm, or @ 0 psi RESIDUAL 4522 gpm

REMARKS Hydrant needs to be raised



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #28 Case Ave DATE 10-18-00

TEST MADE BY Rob & Gary TIME 2-2:30 p.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #28 A1 #27 A2 A3 A4

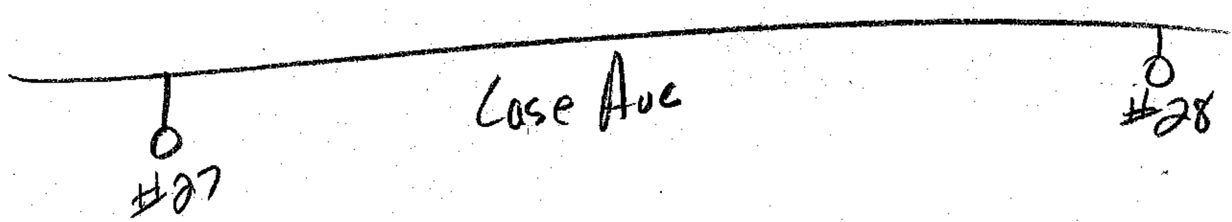
SIZE NOZZLE 2"

PITOT READING 56 psi TOTAL GPM 889

STATIC B 82 9.29 psi RESIDUAL B 80 1.45 psi

PROJECTED RESULTS @ 20 psi 5696 gpm, or @ 0 psi RESIDUAL 6622 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION # 29 Case Ave & Ash st DATE 10-18-00

TEST MADE BY Rob & Gary TIME 2:00 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #29 A1 #28 A2 A3 A4

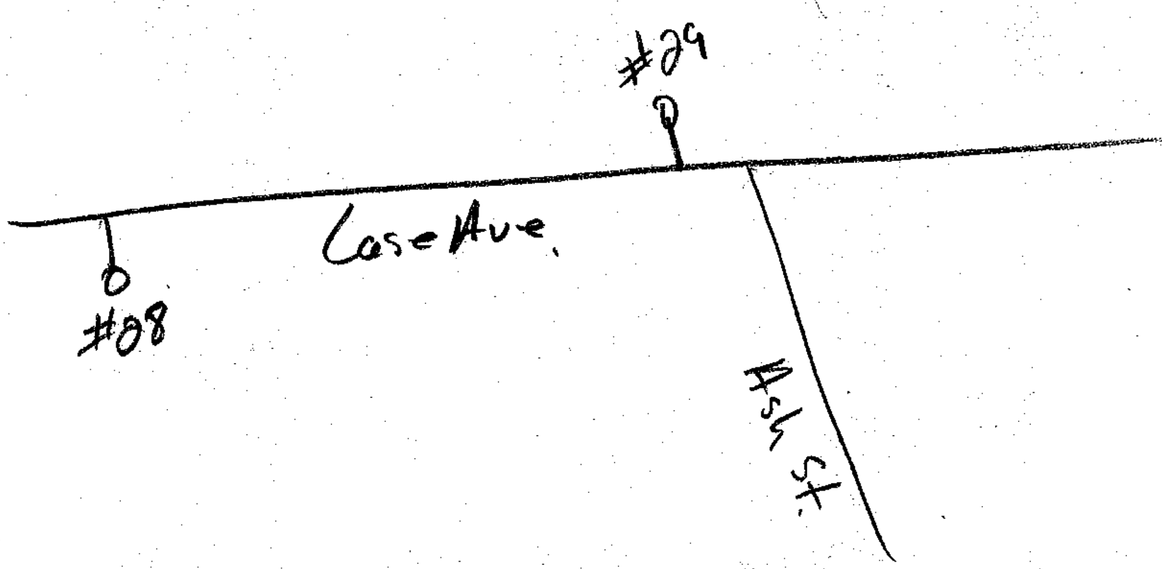
SIZE NOZZLE 2"

PITOT READING 54 psi TOTAL GPM 873

STATIC B 82 psi RESIDUAL B 80 psi

PROJECTED RESULTS @ 20 psi 5593 gpm, or @ 0 psi RESIDUAL 6502 gpm

REMARKS Hydrant needs to be raised



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #30 Case Ave (Hansen Boat) DATE 10-18-00

TEST MADE BY Rob & Gary TIME 1-1:30 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #30 A1 #29 A2 A3 A4

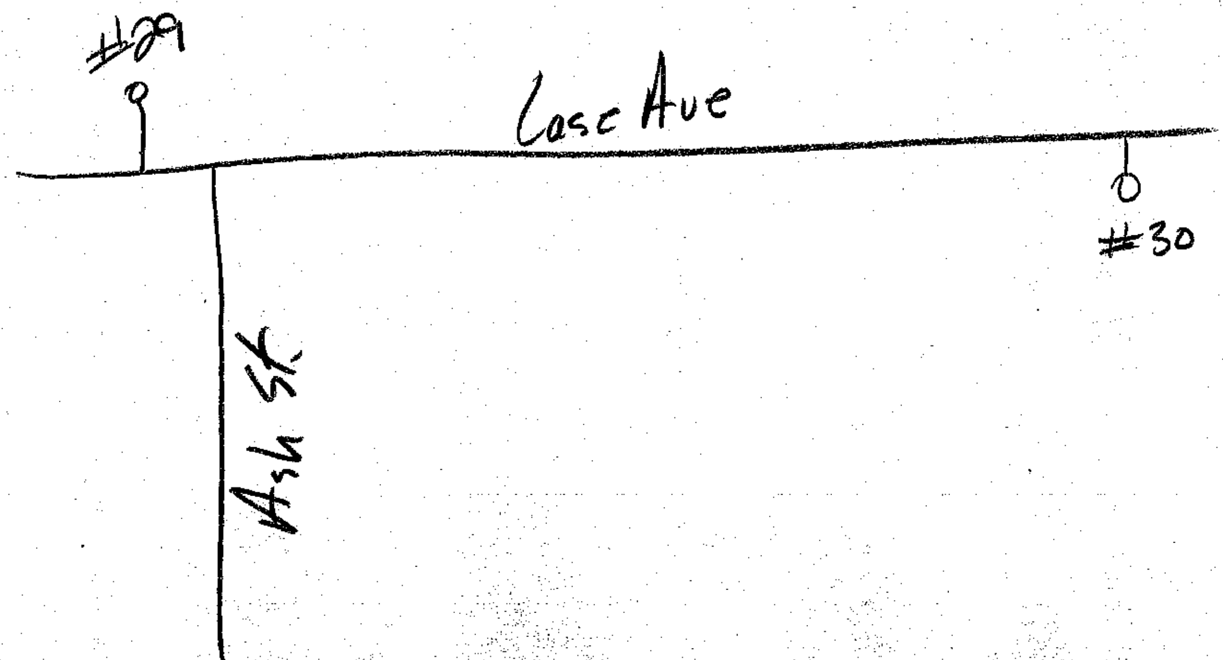
SIZE NOZZLE 2"

PITOT READING 60 psi TOTAL GPM 920

STATIC B 76 psi RESIDUAL B 74 psi

PROJECTED RESULTS @ 20 psi 5577 gpm, or @ 0 psi RESIDUAL 6580 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #31 Case Ave & Church St. DATE 10-18-00

TEST MADE BY Rob & Gary TIME 1:00 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #31 A1 #30 A2 A3 A4

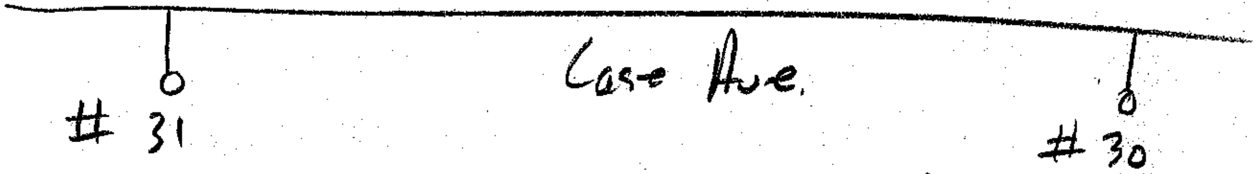
SIZE NOZZLE 2"

PITOT READING 60 psi TOTAL GPM 920

STATIC B 82 psi RESIDUAL B 80 psi

PROJECTED RESULTS @ 20 psi 5894 gpm, or @ 0 psi RESIDUAL 6852 gpm

REMARKS Turns Head



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #32 Case Ave & Front St. DATE 10-18-00

TEST MADE BY Rob & Gary TIME 11:30-12 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #32 A1 #31 A2 A3 A4

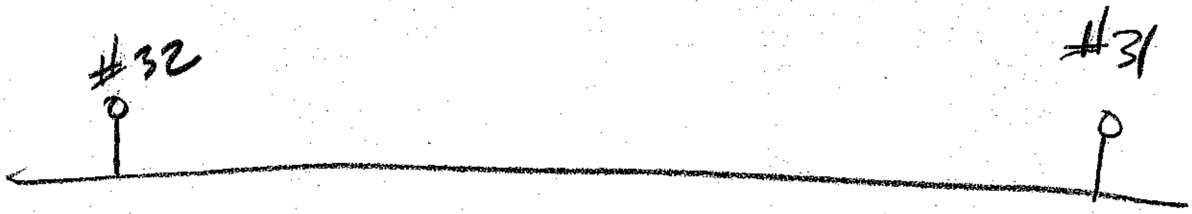
SIZE NOZZLE 2"

PITOT READING 60 psi TOTAL GPM 920

STATIC B 80 psi RESIDUAL B 78 psi

PROJECTED RESULTS @ 20 psi 5786 gpm, or @ 0 psi RESIDUAL 6764 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #33 Front St. DATE 10-25-00

TEST MADE BY Gary and Rod TIME 6:15 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 33 A1 32 A2 A3 A4

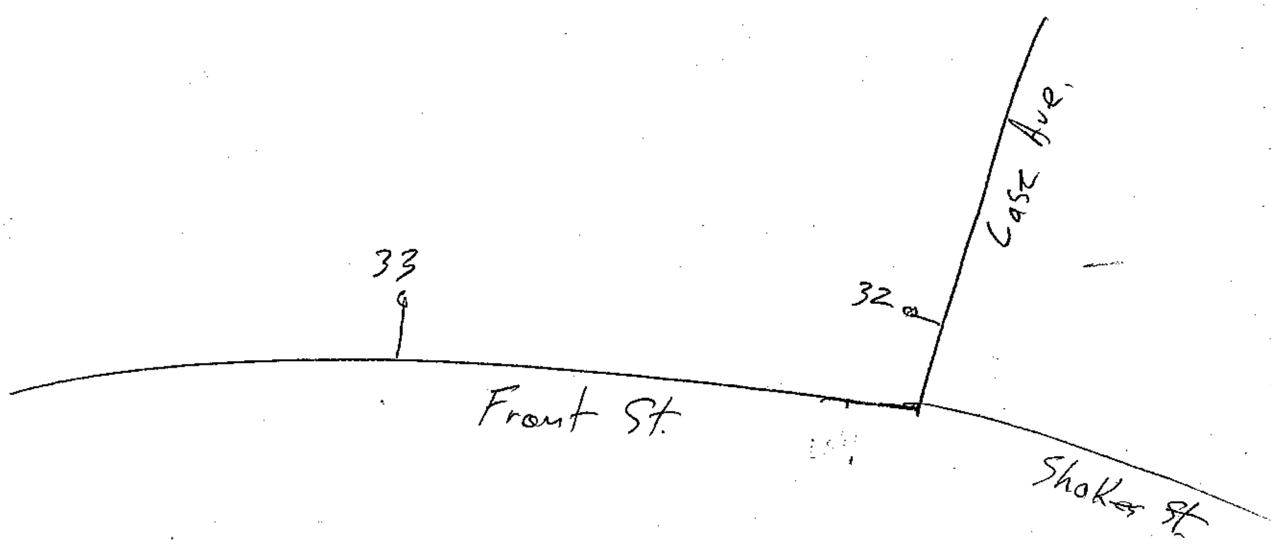
SIZE NOZZLE 2"

PITOT READING 60 psi TOTAL GPM 921

STATIC B 72 psi RESIDUAL B 68 psi

PROJECTED RESULTS @ 20 psi 3,080 gpm, or @ 0 psi RESIDUAL 4386 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #34 Front St and Episcopal St. DATE 10-25-00

TEST MADE BY Larry and Rob TIME 6:25 .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 34 A1 33 A2 A3 A4

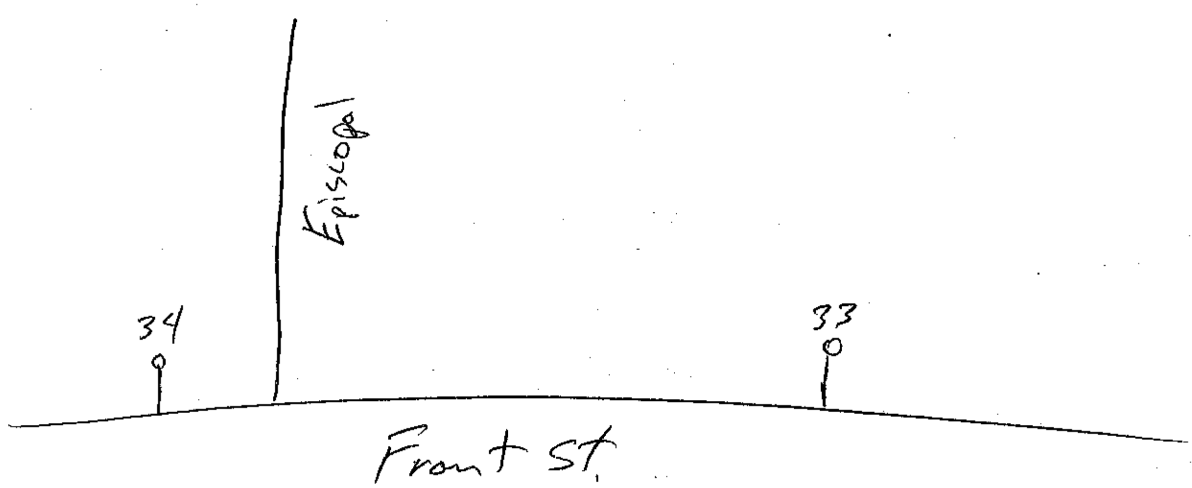
SIZE NOZZLE 2"

PITOT READING 60 psi TOTAL GPM 920

STATIC B 70 psi RESIDUAL B 68 psi

PROJECTED RESULTS @ 20 psi 5247 gpm, or @ 0 psi RESIDUAL 6294 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #35 Front St and St Michaels DATE 10-25-00

TEST MADE BY Gary and Rob TIME 6:34 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS - 35 A1 33 A2 A3 A4

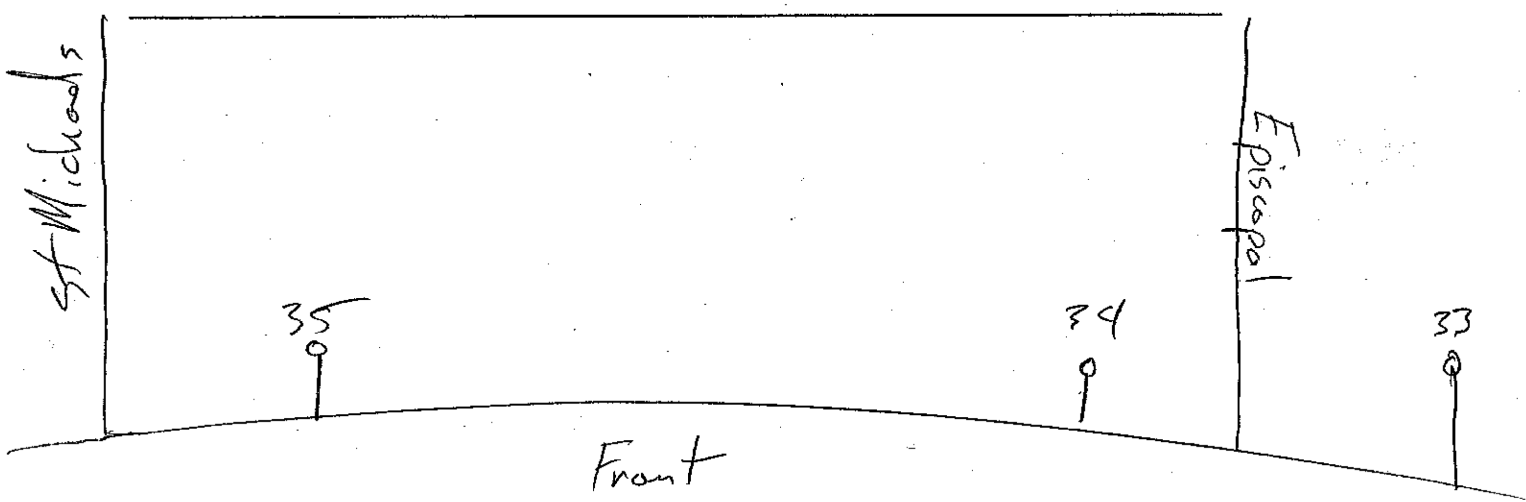
SIZE NOZZLE 2"

PITOT READING 56 psi TOTAL GPM 889

STATIC B 72 psi RESIDUAL B 68 psi

PROJECTED RESULTS @ 20 psi 3556 gpm, or @ 0 psi RESIDUAL 4243 gpm

REMARKS The (open arrow) on the operating nut is backwards.



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #36 Front St, and Lynch DATE 10-25-00

TEST MADE BY Gary and Rob TIME 6:45 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS ____

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ____

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ____

FLOW HYDRANTS 36 A1 35 A2 ____ A3 ____ A4 ____

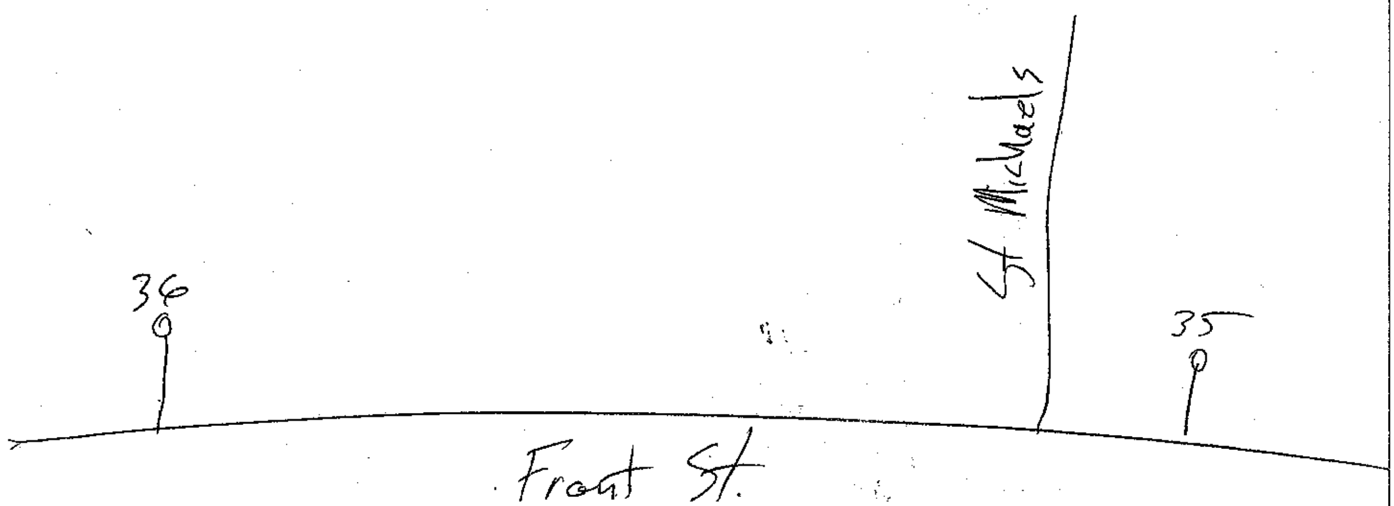
SIZE NOZZLE 2"

PITOT READING 56 psi TOTAL GPM 889

STATIC B 72 psi RESIDUAL B 68 psi

PROJECTED RESULTS @ 20 psi 3556 gpm, or @ 0 psi RESIDUAL 4243 gpm

REMARKS ____



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #37 Front St and Lynch St DATE 10-25-00

TEST MADE BY Gary and Rob TIME 7:00 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS ______

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ______

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ______

FLOW HYDRANTS – 37 A1 36 A2 ______ A3 ______ A4 ______

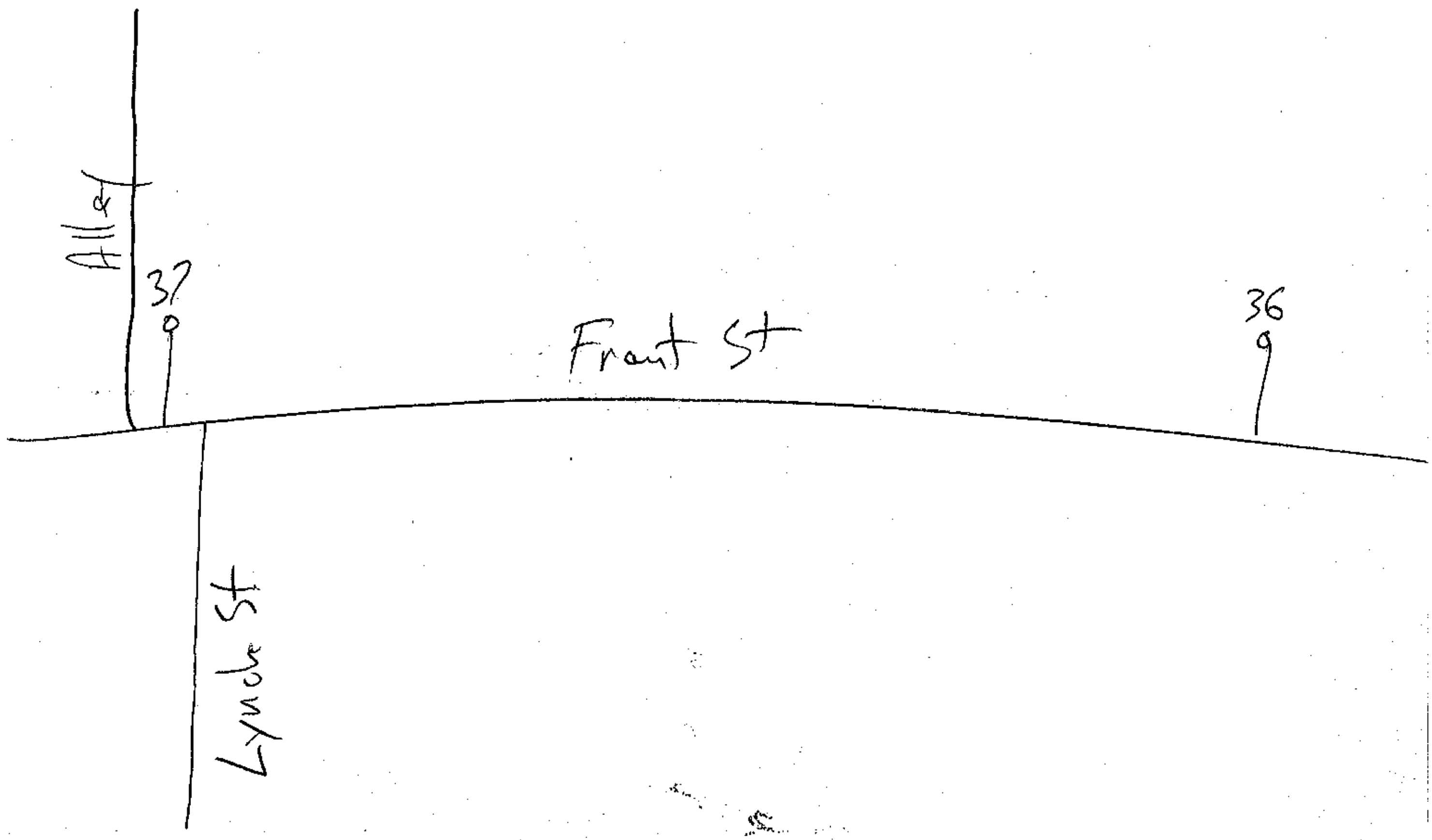
SIZE NOZZLE 2"

PITOT READING 58 psi TOTAL GPM 905

STATIC B 72 psi RESIDUAL B 68 psi

PROJECTED RESULTS @ 20 psi 3620 gpm, or @ 0 psi RESIDUAL 4319 gpm

REMARKS ______



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #38 Front st. (Elks) DATE 10-25-00

TEST MADE BY Gary and Rob TIME 7:05 A.M.

REPRESENTATIVE OF PUBLIL Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS -- 38 A1 37 A2 A3 A4

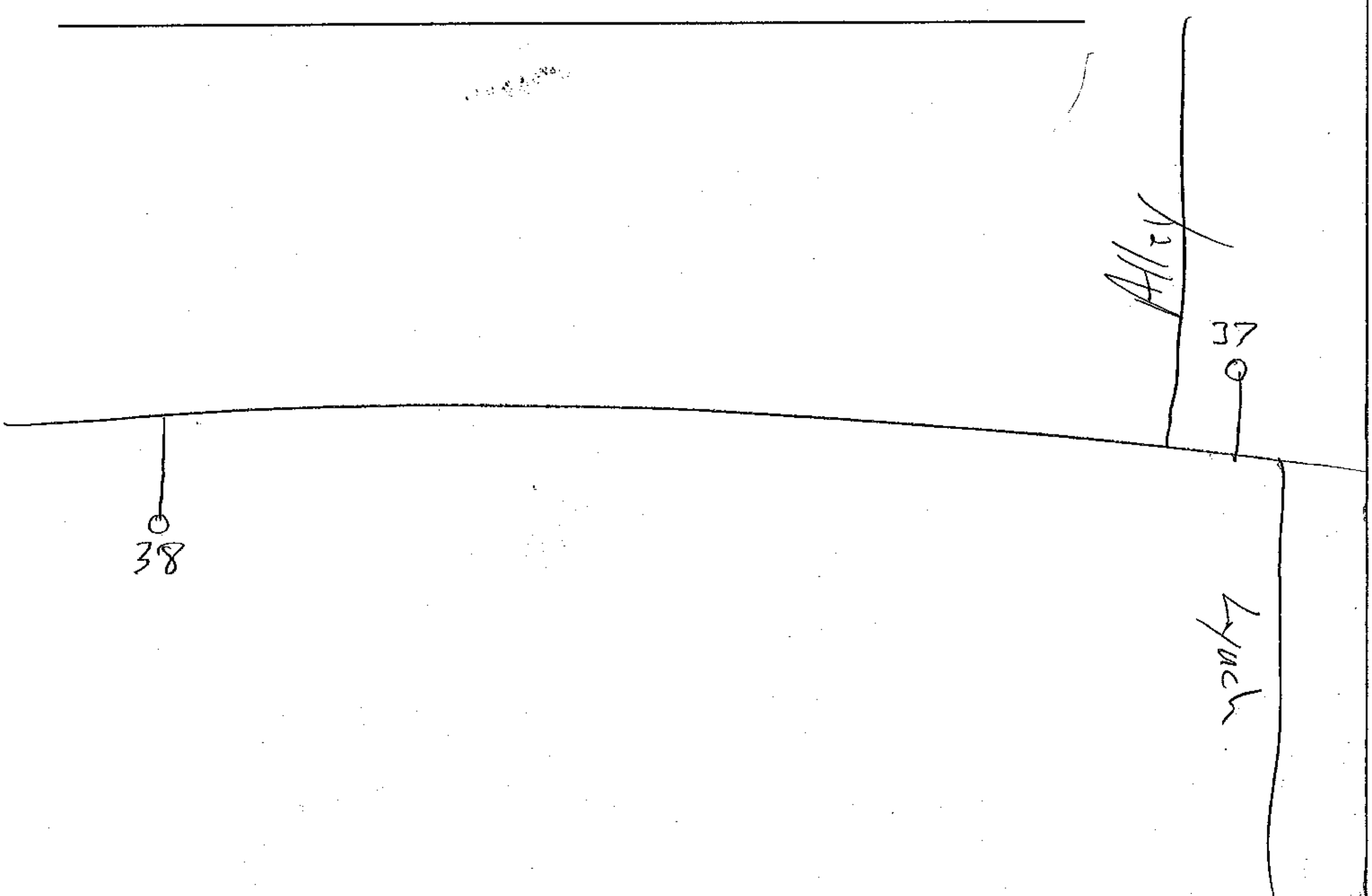
SIZE NOZZLE 2"

PITOT READING 56 psi TOTAL GPM 886

STATIC B 72 psi RESIDUAL B 66 psi

PROJECTED RESULTS @ 20 psi 2843 gpm, or @ 0 psi RESIDUAL 3392 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL
(Harry Churchill)

LOCATION #39 Church St & Wrangell Ave DATE 10-18-00

TEST MADE BY Rob & Gary TIME 11:-11:30 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #39 A1 #40 A2 A3 A4

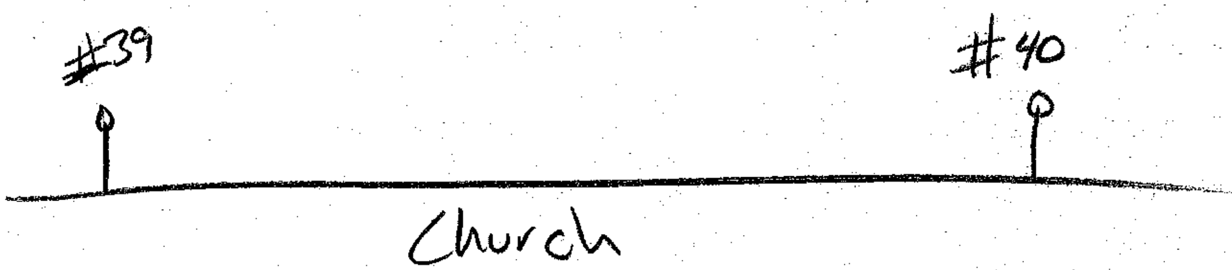
SIZE NOZZLE 2"

PITOT READING 46 psi TOTAL GPM 806

STATIC B 70 psi RESIDUAL B 66 psi

PROJECTED RESULTS @ 20 psi 3159 gpm, or @ 0 psi RESIDUAL 3789 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #40 Church St & Episcopal DATE 10-18-00

TEST MADE BY Rob & Gary TIME 11-11:30 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #40 A1 #41 A2 A3 A4

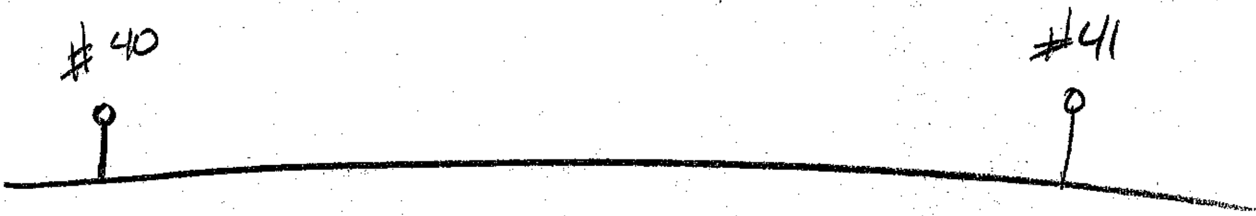
SIZE NOZZLE 2"

PITOT READING 50 psi TOTAL GPM 841

STATIC B 72 psi RESIDUAL B 70 psi

PROJECTED RESULTS @ 20 psi 4895 gpm, or @ 0 psi RESIDUAL 5840 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #41 Church St. Between Case & Episcopal DATE 10-18-00

TEST MADE BY Rob & Gary TIME 11:30 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #41 A1 #31 A2 A3 A4

SIZE NOZZLE 2"

PITOT READING 56 psi TOTAL GPM 889

STATIC B 80 psi RESIDUAL B 80 psi

PROJECTED RESULTS @ 20 psi gpm, or @ psi RESIDUAL gpm

REMARKS wrong residual reading

HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #42 City Dock DATE 10-25-00

TEST MADE BY Gary and Rob TIME 7:25 A.M.

REPRESENTATIVE OF PUBLIC Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS -- 42 A1 82 A2 A3 A4

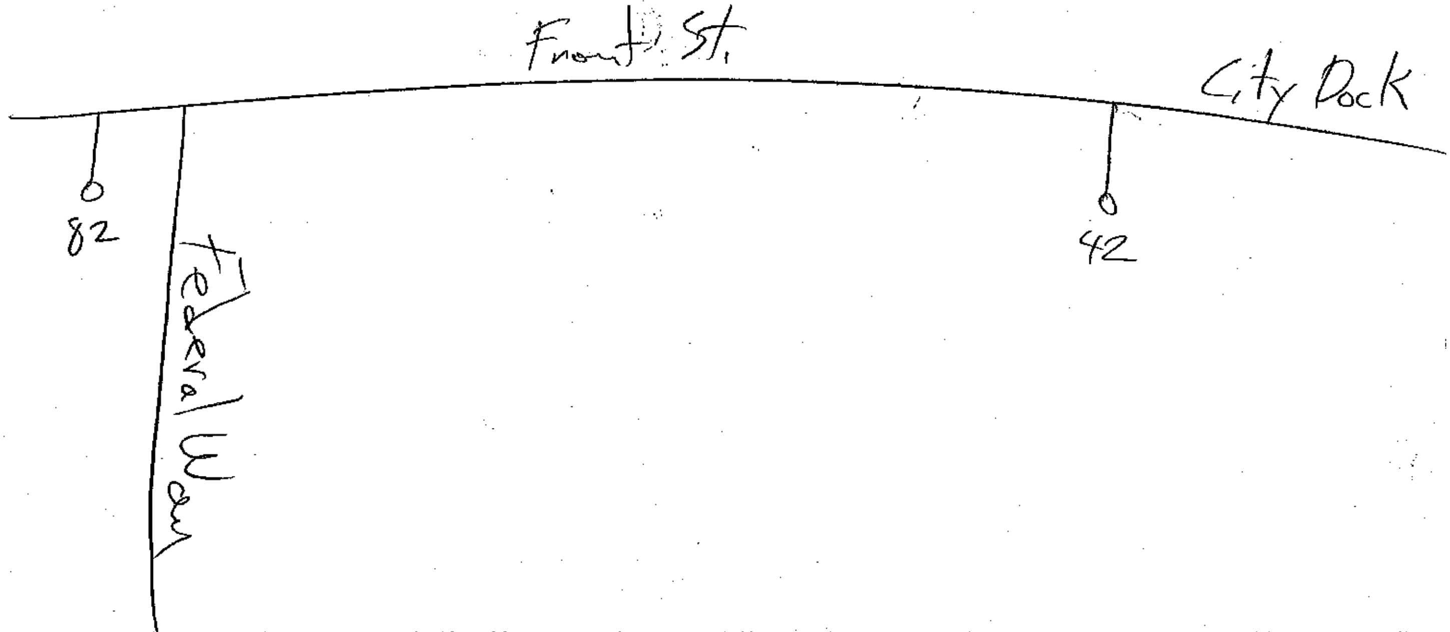
SIZE NOZZLE 2"

PITOT READING 52 psi TOTAL GPM 857

STATIC B 72 psi RESIDUAL B 66 psi

PROJECTED RESULTS @ 20 psi 2750 gpm, or @ 0 psi RESIDUAL 3281 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Boyer Lot #42A DATE 12-27-00

TEST MADE BY Gary Pullman & Rob Davidson TIME 2:57 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 42A A1 82 A2 A3 A4

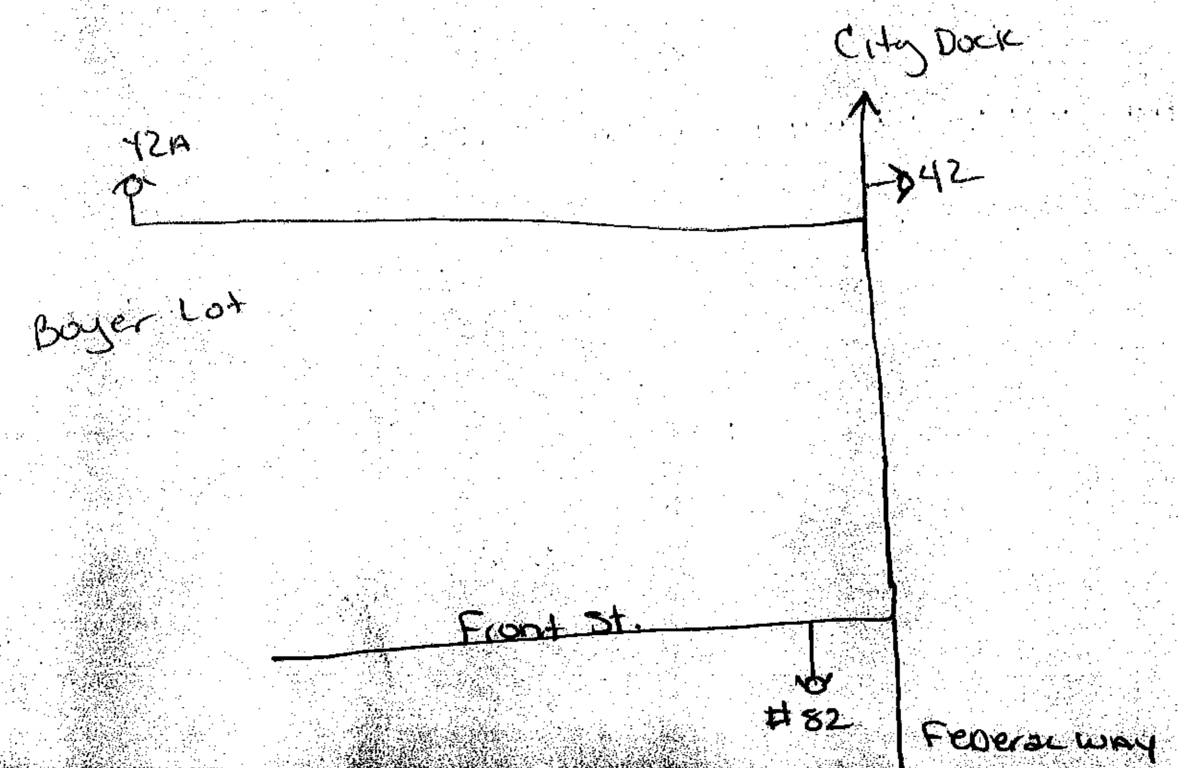
SIZE NOZZLE 1½"

PITOT READING 60 TOTAL GPM 441

STATIC B 74 psi RESIDUAL B 70 psi

PROJECTED RESULTS @ 20 psi 1802 gpm, or @ 0 psi RESIDUAL 2136 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #43 Federal Way DATE 10-25-00

TEST MADE BY Cody and Rob TIME 7:33 A.M.

REPRESENTATIVE OF PUBLIC Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 43 A1 82 A2 A3 A4

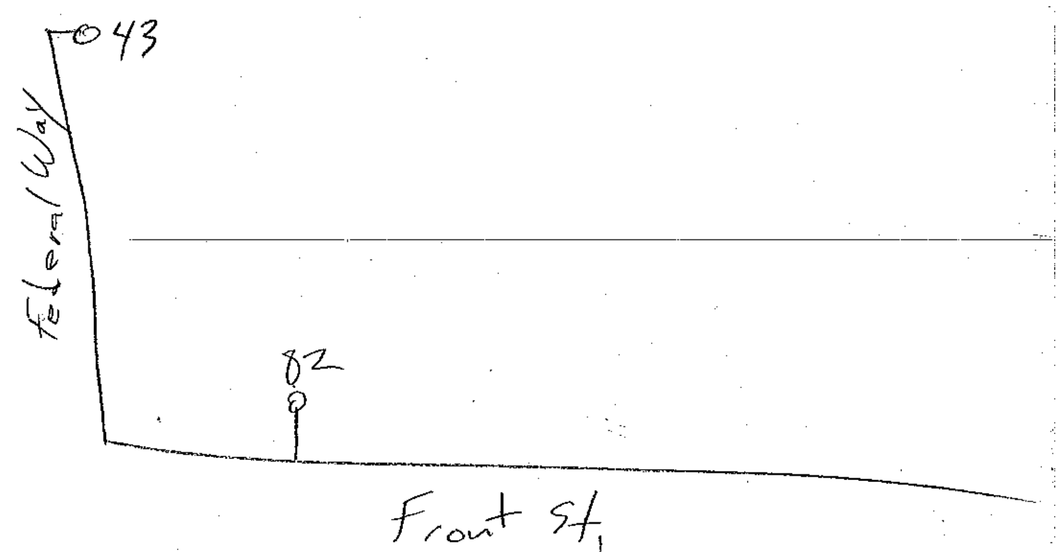
SIZE NOZZLE 2"

PITOT READING 50 psi TOTAL GPM 841

STATIC B 72 psi RESIDUAL B 66 psi

PROJECTED RESULTS @ 20 psi 2699 gpm, or @ 0 psi RESIDUAL 3220 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #44 Stikine Ave DATE 10-25-00

TEST MADE BY Gerry and Rob TIME 7:55 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 44 A1 43 A2 A3 A4

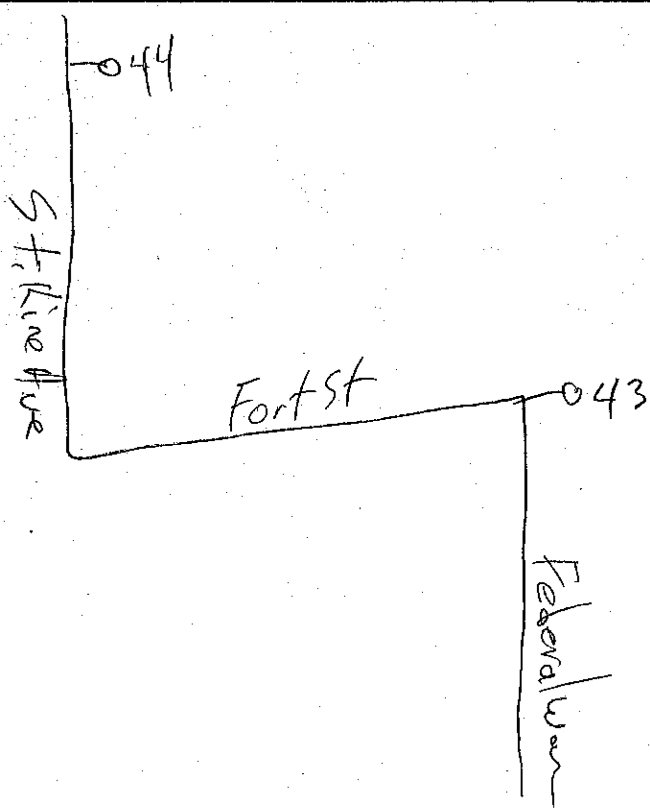
SIZE NOZZLE 2"

PITOT READING 50 psi TOTAL GPM 841

STATIC B 62 psi RESIDUAL B 58 psi

PROJECTED RESULTS @ 20 psi 3001 gpm, or @ 0 psi RESIDUAL 3703 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #45 Pine St. & Zimovia Ave. DATE 10-18-00

TEST MADE BY Rob & Gary TIME ________ .M.

REPRESENTATIVE OF Public Works

WITNESS ____________

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ____________

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ____________

FLOW HYDRANTS ______ A1 ______ A2 ______ A3 ______ A4 ______

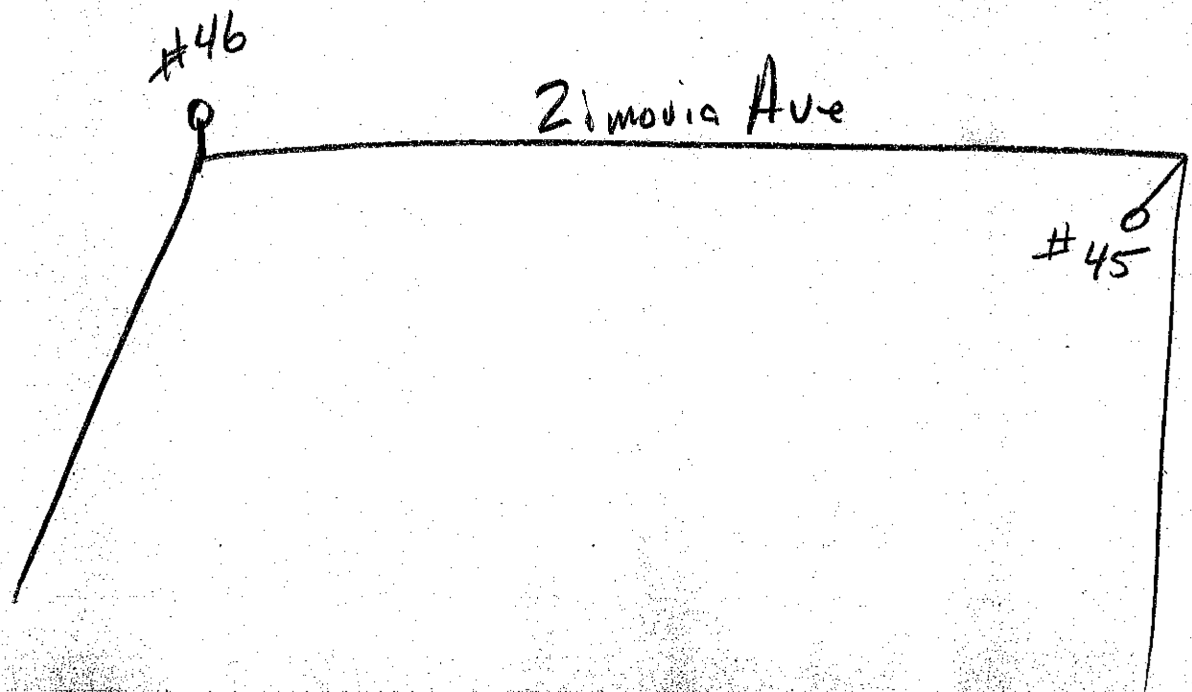
SIZE NOZZLE ____________

PITOT READING ________ psi TOTAL GPM ________

STATIC B ________ psi RESIDUAL B ________ psi

PROJECTED RESULTS @ 20 psi ________ gpm, or @ ______ psi RESIDUAL ________ gpm

REMARKS ____________



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #46 Wrangell Ave & Zimovia Ave DATE 10-18-00

TEST MADE BY Rob & Gary TIME ______ .M.

REPRESENTATIVE OF Public Works

WITNESS ______

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ______

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ______

FLOW HYDRANTS #46 A1 ______ A2 ______ A3 ______ A4 ______

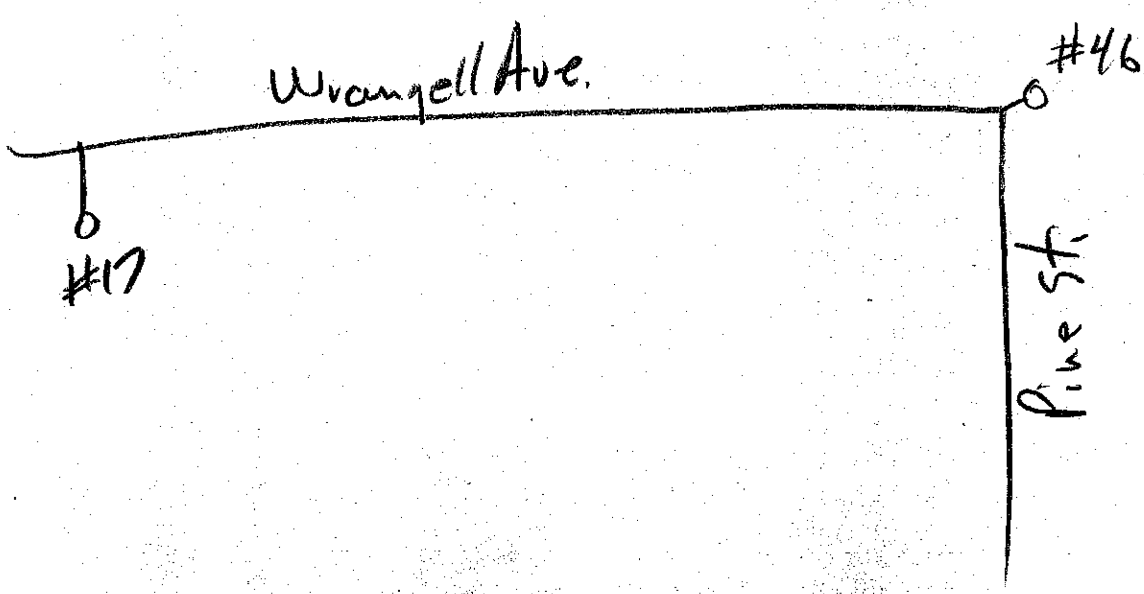
SIZE NOZZLE ______

PITOT READING ______ psi TOTAL GPM ______

STATIC B ______ psi RESIDUAL B ______ psi

PROJECTED RESULTS @ 20 psi ______ gpm, or @ ______ psi RESIDUAL ______ gpm

REMARKS ______



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

#47

LOCATION Reid St. and Bennet St. DATE 10-20-00

TEST MADE BY Gary and Rob TIME 11:15 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J47 A1 J69 A2 A3 A4

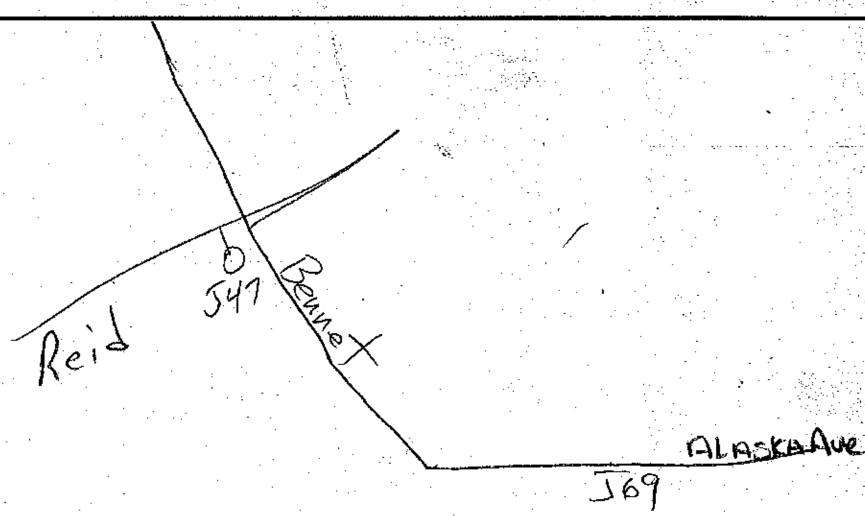
SIZE NOZZLE 2"

PITOT READING 66 TOTAL GPM 965

STATIC B 130 psi RESIDUAL B 106 psi

PROJECTED RESULTS @ 20 psi 2197 gpm, or @ 0 psi RESIDUAL 2404 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL #48

LOCATION Reid St and St Michaels St DATE 10-20-00

TEST MADE BY Gary and Rob TIME 1:25 P.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J48 A1 J39 A2 A3 A4

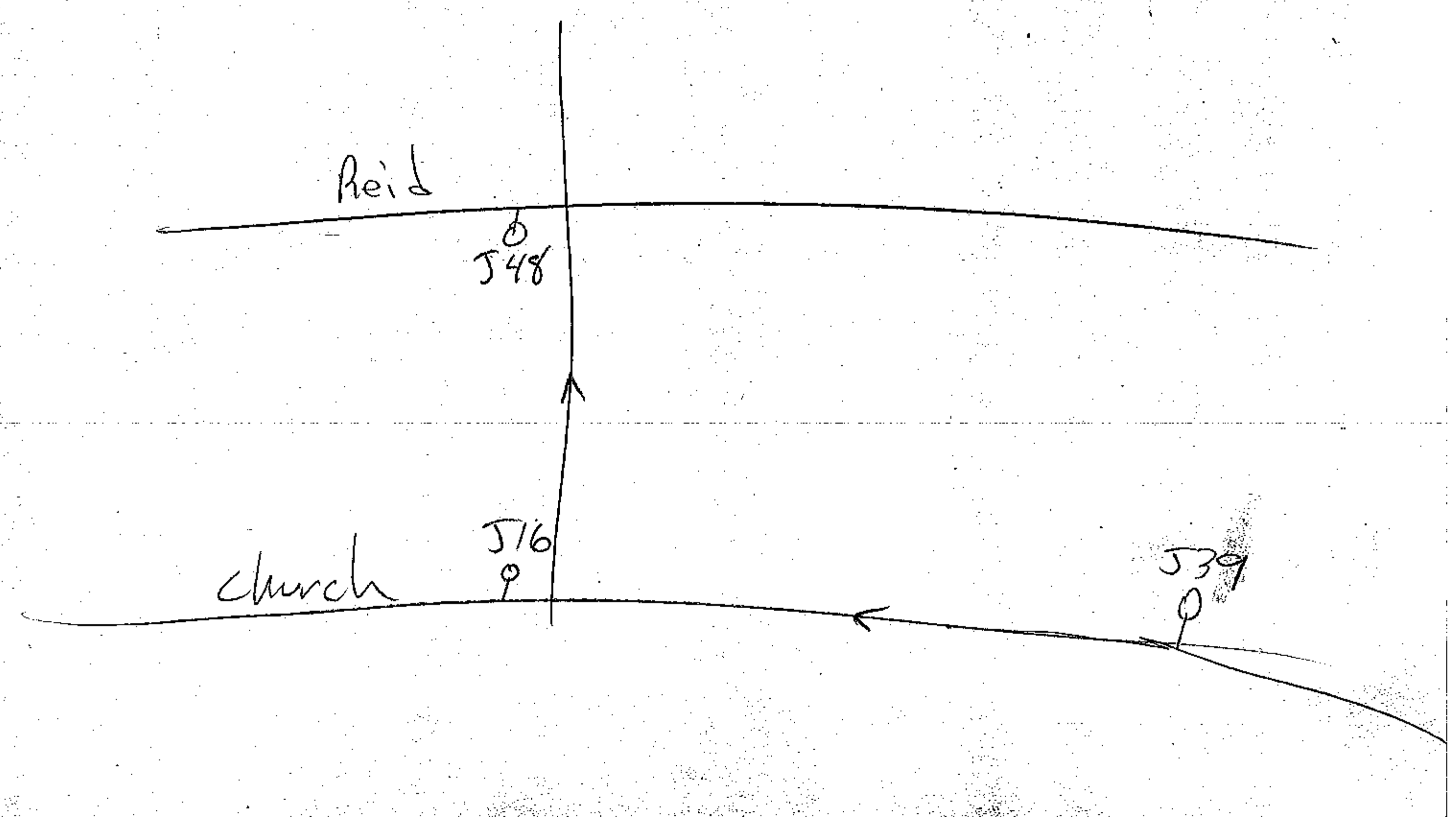
SIZE NOZZLE 2"

PITOT READING 14 TOTAL GPM ?

STATIC B 66 psi RESIDUAL B 64 psi

PROJECTED RESULTS @ 20 psi gpm, or @ psi RESIDUAL gpm

REMARKS



HYDRANT FLOW TEST REPORT #49
CITY OF WRANGELL

LOCATION Reid St and Mission St DATE 10-20-00

TEST MADE BY Gary and Rob TIME 1:53 P.M.

REPRESENTATIVE OF PUBLIC Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J49 A1 J48 A2 A3 A4

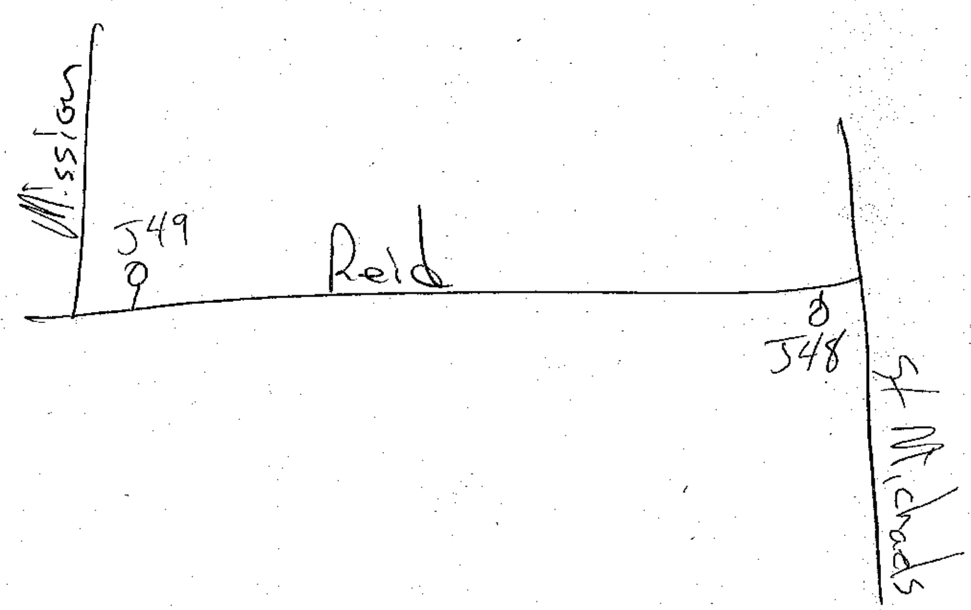
SIZE NOZZLE 2"

PITOT READING 14 TOTAL GPM ?

STATIC B 50 psi RESIDUAL B 22 psi

PROJECTED RESULTS @ 20 psi gpm, or @ psi RESIDUAL gpm

REMARKS



HYDRANT FLOW TEST REPORT #50
CITY OF WRANGELL

LOCATION Reid St and Grief St. DATE 10-20-00

TEST MADE BY Gary and Rob TIME 2:00 P.M.

REPRESENTATIVE OF PUBLIC Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J50 A1 J49 A2 A3 A4

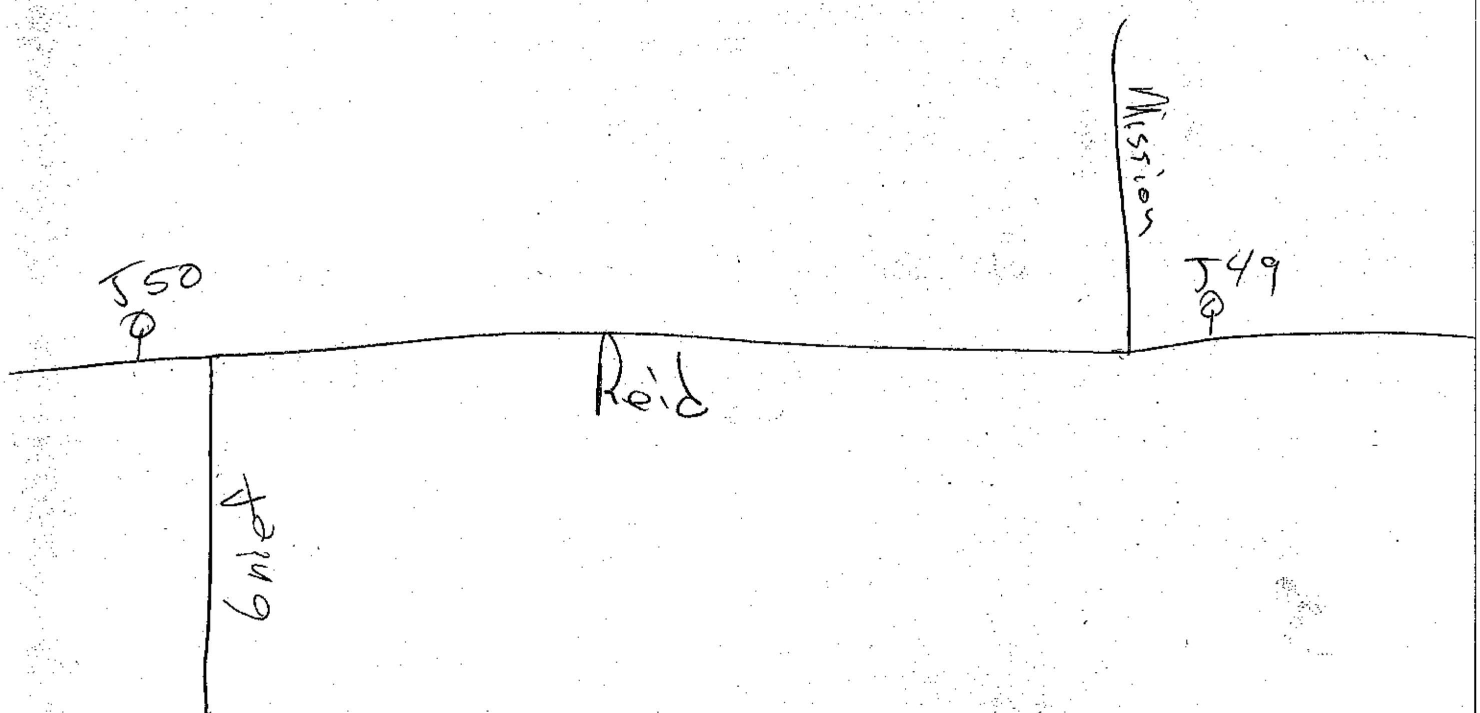
SIZE NOZZLE 2"

PITOT READING 26 TOTAL GPM ?

STATIC B 50 psi RESIDUAL B 48 psi

PROJECTED RESULTS @ 20 psi gpm, or @ psi RESIDUAL gpm

REMARKS Home owner has filled in around hydrant. Needs to be dug out.



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #51 Mission St & 3rd ~~Ave~~ St DATE 11-6-00

TEST MADE BY Rob & Jet TIME 2:20 P.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #51 A1 #52 A2 A3 A4

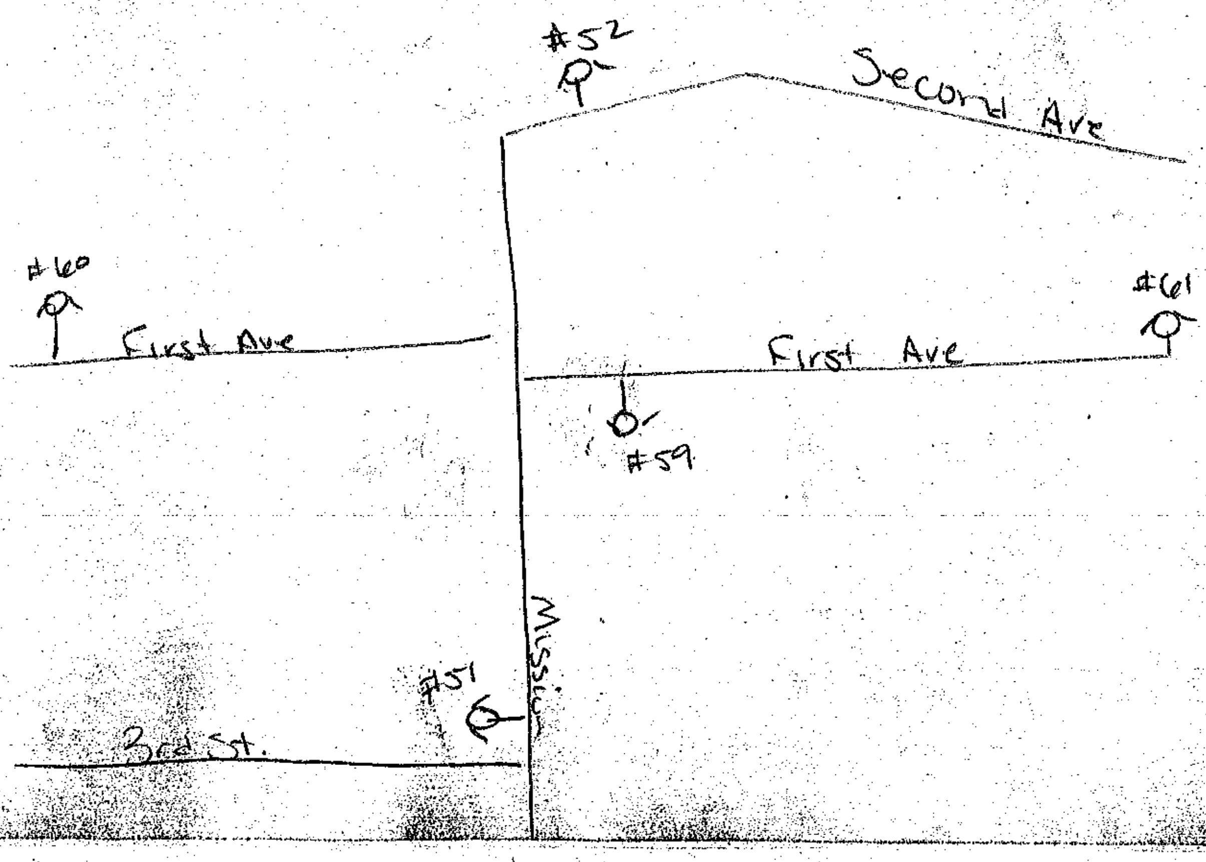
SIZE NOZZLE

PITOT READING 57 psi TOTAL GPM 857

STATIC B 66 psi RESIDUAL B 38 psi

PROJECTED RESULTS @ 20 psi 1120 gpm, or @ 0 psi RESIDUAL 1361 gpm

REMARKS needs to be raised



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #52 Mission St & Second Ave DATE 11-6-00

TEST MADE BY Rob & Jef TIME 1:43 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #52 A1 #53 A2 A3 A4

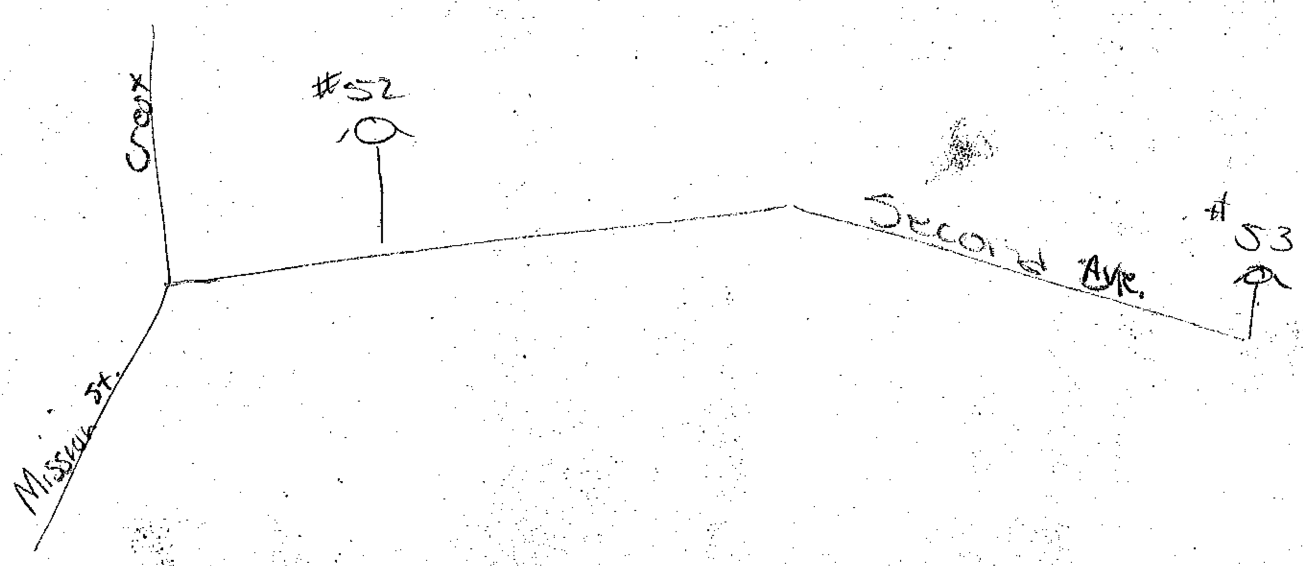
SIZE NOZZLE 2"

PITOT READING 40 TOTAL GPM 752

STATIC B 84 psi RESIDUAL B 60 psi

PROJECTED RESULTS @ 20 psi 1278 gpm, or @ 0 psi RESIDUAL 1480 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

#53

LOCATION ST MICHAELS & SECOND AVE DATE 19OCT08

TEST MADE BY ROB & JOE TIME 10:51 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J53 A1 J56 A2 A3 A4

SIZE NOZZLE 2"

PITOT READING 48 TOTAL GPM 824

STATIC B 98 psi RESIDUAL B 86 psi

PROJECTED RESULTS @ 20 psi 2261 gpm, or @ 0 psi RESIDUAL 2558 gpm

REMARKS

ST MICHAELS
&
SECOND
J53

BENNETT
&
SECOND AVE
J56

DOWN
STREAM

HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION ST MICHAEL & THIRD #54 DATE 19OCT

TEST MADE BY JOE & ROB TIME 11:10 A .M.

REPRESENTATIVE OF PUBLIC Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J54 A1 J55 A2 A3 A4

SIZE NOZZLE 2"

PITOT READING 50 TOTAL GPM 841

STATIC B 98 psi RESIDUAL B 78 psi

PROJECTED RESULTS @ 20 psi 1753 gpm, or @ 0 psi RESIDUAL 1984 gpm

REMARKS NEEDS BRUSHED OUT

ST MICHAEL & THIRD

BENNETT & THIRD

J55

J54

DOWN STREAM

HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION THIRD AVE & BONNETT 55 DATE 19OCT ØØ

TEST MADE BY ROB & JOE TIME 11:03 A.M.

REPRESENTATIVE OF PublicWorks

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J55 A1 J56 A2 A3 A4

SIZE NOZZLE 2"

PITOT READING 54 TOTAL GPM 873

STATIC B 98 psi RESIDUAL B 74 psi

PROJECTED RESULTS @ 20 psi 1650 gpm, or @ 0 psi RESIDUAL 1866 gpm

REMARKS

THIRD & BONNETT

J55

SECOND & BONNETT

J56

DOWN STREAM

HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION SECOND Ave & BENNETT St 56 DATE 19 OCT 06

TEST MADE BY ROB & JOE TIME 10:42 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J56 A1 J57 A2 A3 A4

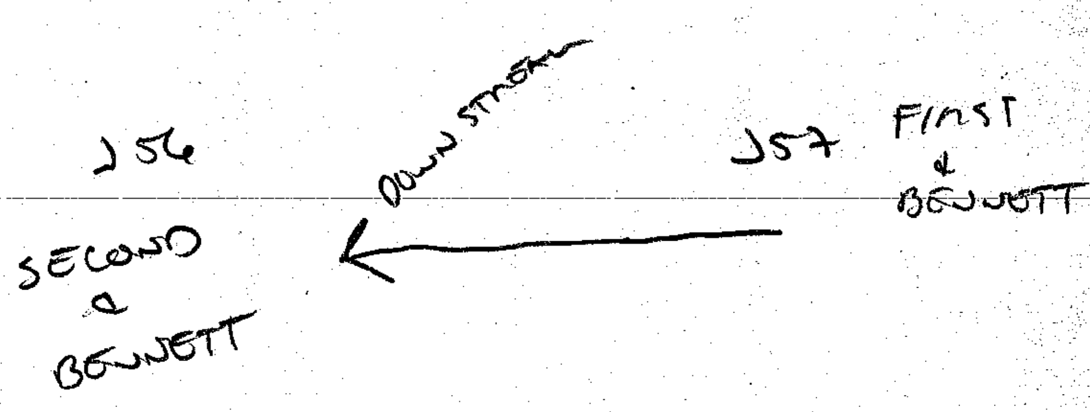
SIZE NOZZLE 2"

PITOT READING 60 TOTAL GPM 920

STATIC B 100 psi RESIDUAL B 74 psi

PROJECTED RESULTS @ 20 psi 1688 gpm, or @ 0 psi RESIDUAL 1903 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

\# 57

LOCATION BENNETT St & FIRST AVE DATE 19OCT00

TEST MADE BY JOE & ROB TIME 10:19 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS # J57 A1 @ J47 A2 A3 A4

SIZE NOZZLE 2"

PITOT READING 70 TOTAL GPM 994

STATIC B 100 psi RESIDUAL B 90 psi

PROJECTED RESULTS @ 20 psi 3054 gpm, or @ 0 psi RESIDUAL 3443 gpm

REMARKS residual was taken from the incorrect Hydrant.

BENNETT & FIRST
J57

BENNETT & REID
J47

← DOWN STREAM

HYDRANT FLOW TEST REPORT
CITY OF WRANGELL #58

LOCATION HEAD START END OF FIRST AVENUE DATE 19OCT00

TEST MADE BY JOE & ROB TIME 10:34 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J58 A1 J57 A2 A3 A4

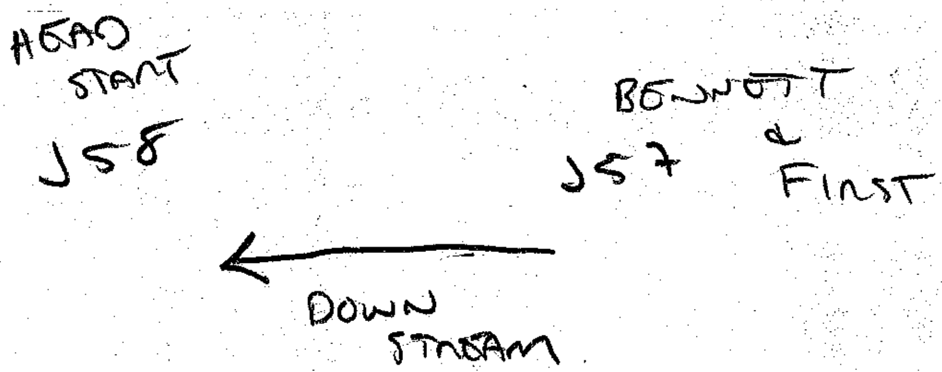
SIZE NOZZLE 2"

PITOT READING 52 TOTAL GPM 857

STATIC B 100 psi RESIDUAL B 76 psi

PROJECTED RESULTS @ 20 psi 1643 gpm, or @ 0 psi RESIDUAL 1853 gpm

REMARKS HYDRANT NEEDS RAISED BADLY



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #59 First Ave (Mark Seimers) DATE 11-6-00

TEST MADE BY Rob i Jef TIME 2:05 P.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 59 A1 52 A2 A3 A4

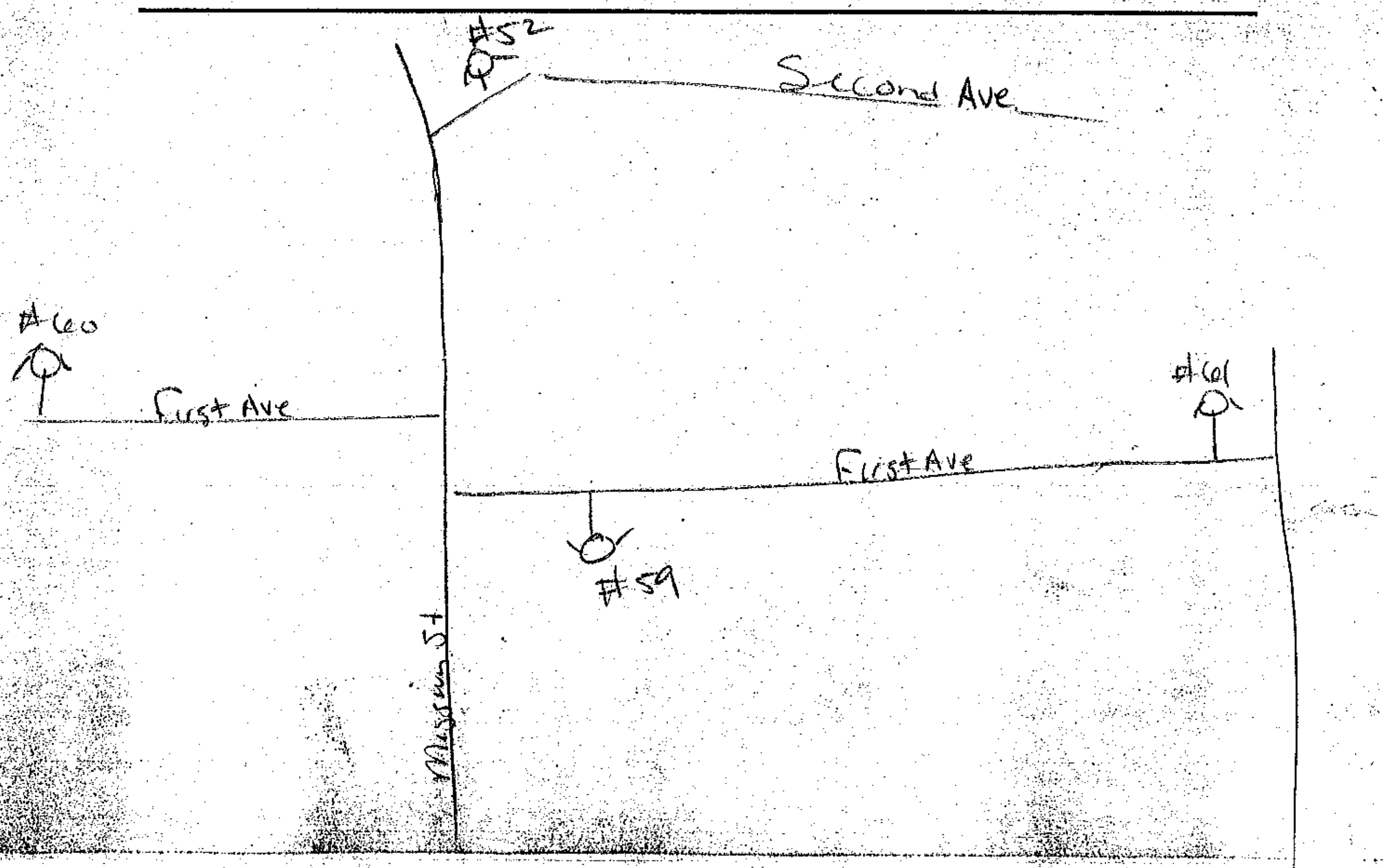
SIZE NOZZLE

PITOT READING 44 TOTAL GPM 788

STATIC B 66 psi RESIDUAL B 42 psi

PROJECTED RESULTS @ 20 psi 1121 gpm, or @ psi RESIDUAL 1362 gpm

REMARKS needs to be raised



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION # 60 First Ave (Leonard Angerman) DATE 11-6-00

TEST MADE BY Rob : Jet TIME 1:50 P.M.

REPRESENTATIVE OF PUBLIC Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #60 A1 52 A2 A3 A4

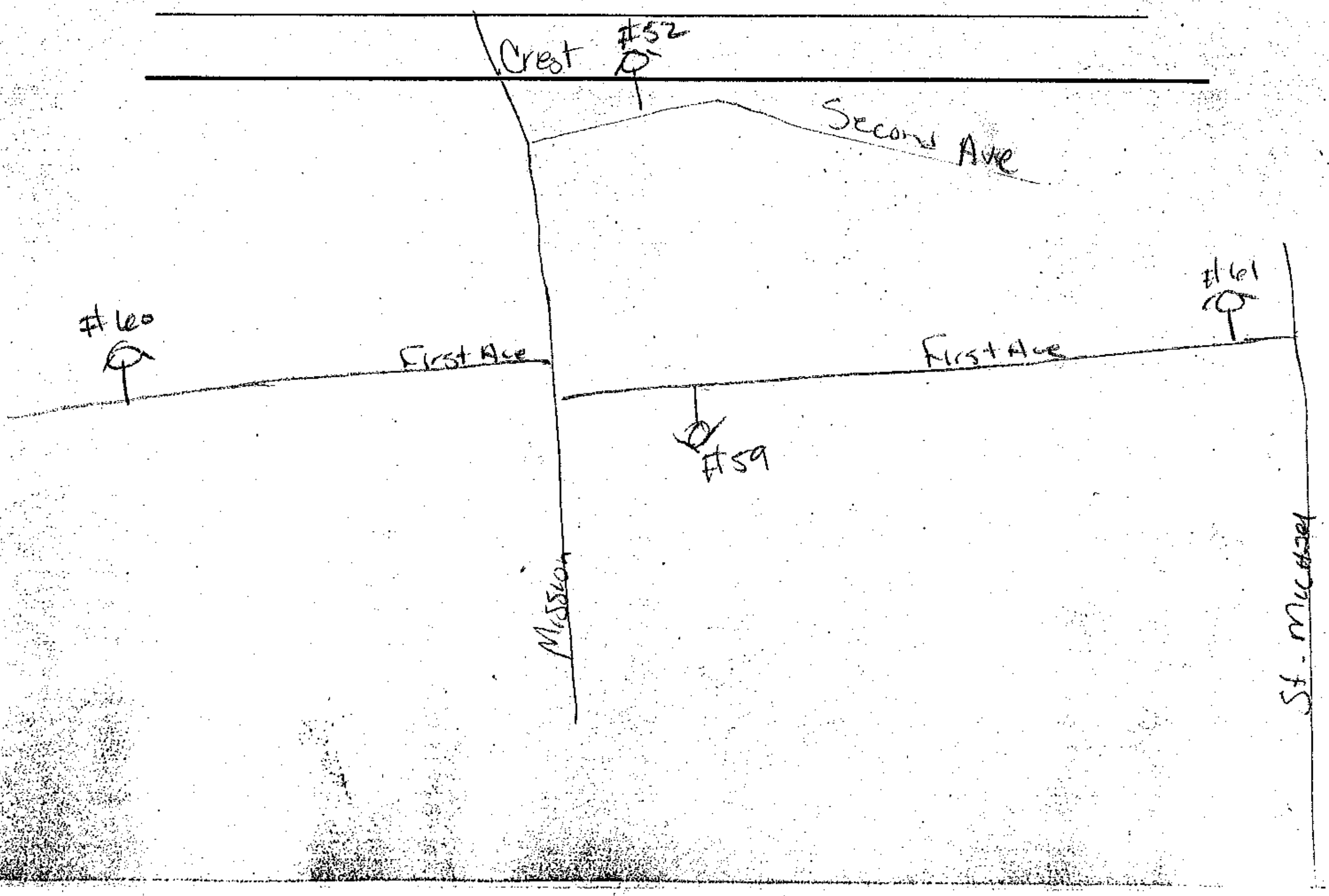
SIZE NOZZLE

PITOT READING 42 psi TOTAL GPM 770

STATIC B 66 psi RESIDUAL B 42 psi

PROJECTED RESULTS @ 20 psi 1095 gpm, or @ 0 psi RESIDUAL 1331 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #61 First Ave & St. Michael St DATE 11-6-00

TEST MADE BY Jef & Rob TIME 2:30 P.M.

REPRESENTATIVE OF Public Works

WITNESS ______

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ______

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ______

FLOW HYDRANTS #61 A1 #59 A2 ______ A3 ______ A4 ______

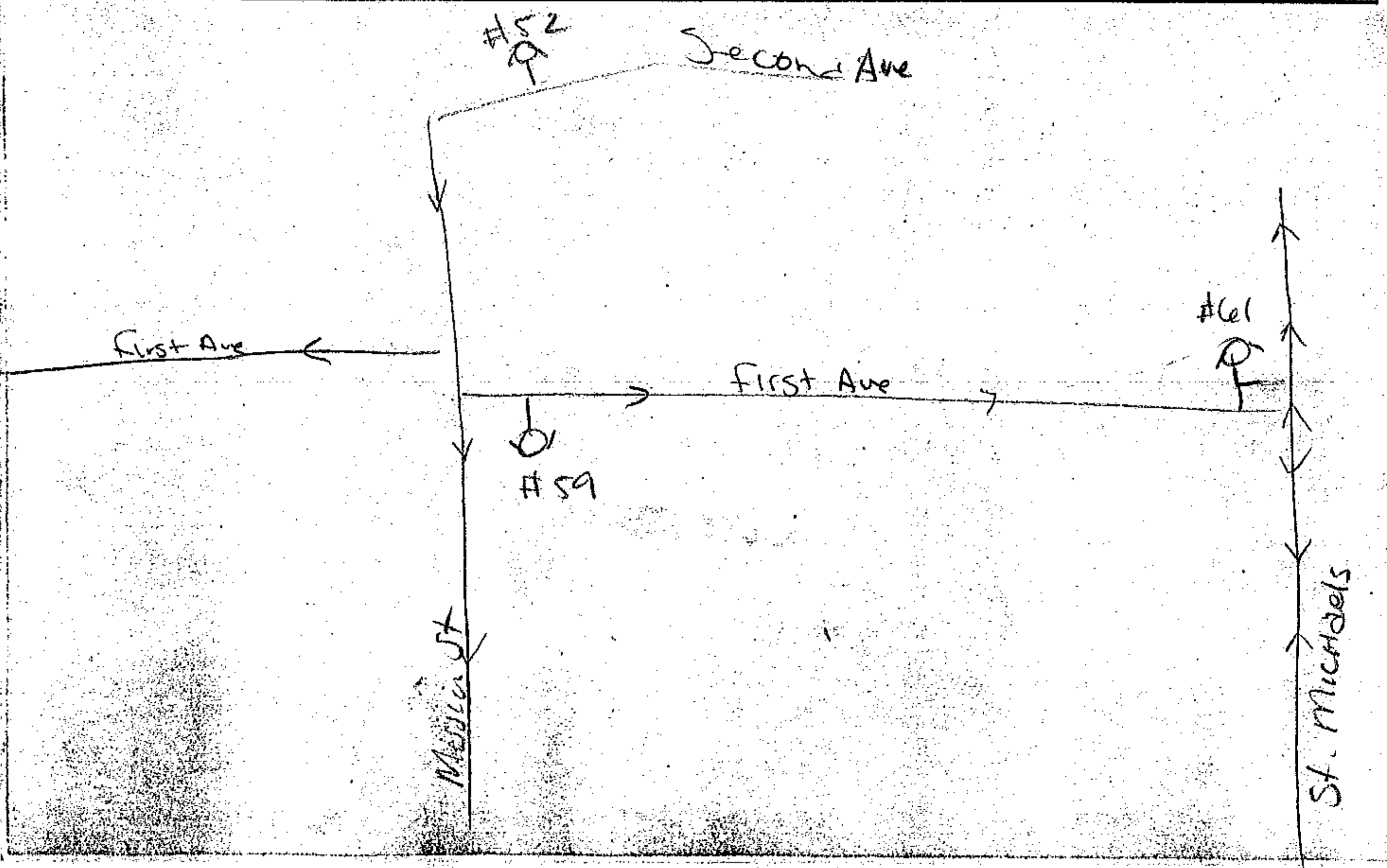
SIZE NOZZLE ______

PITOT READING 44 TOTAL GPM 788

STATIC B 80 psi ______ RESIDUAL B 52 psi

PROJECTED RESULTS @ 20 psi 1188 gpm, or @ 0 psi RESIDUAL 1388 gpm

REMARKS Dresser - needs to be raised or replaced



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #62 3rd (Gunderon) DATE 12-28-00

TEST MADE BY Gary and Rob TIME 11:22 A.M.

REPRESENTATIVE OF PUBLIC Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 3rd (Gunderson) A1 3rd + Mission A2 A3 A4

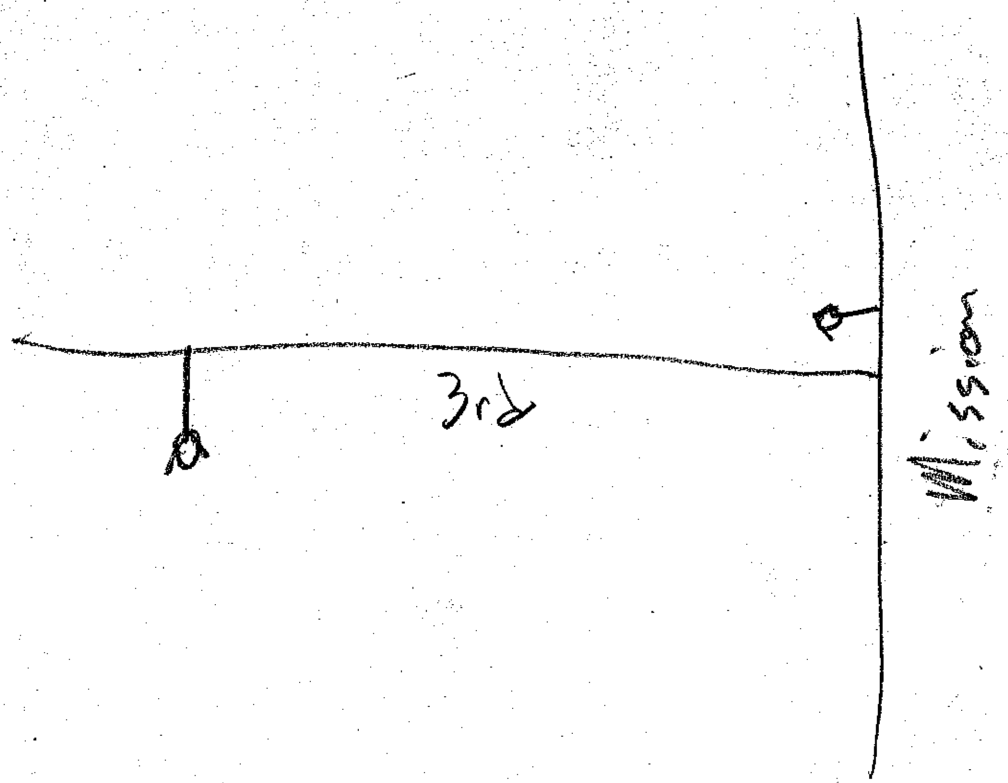
SIZE NOZZLE 2"

PITOT READING 40 psi TOTAL GPM 685

STATIC B 82 psi RESIDUAL B 62 psi

PROJECTED RESULTS @ 20 psi 1263 gpm, or @ 0 psi RESIDUAL 1468 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

#62A
LOCATION Mount Dewey DATE 12-28-00

TEST MADE BY Garry and Rob TIME 11:30A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS Mount Dewey A1 3rd (Gunderson) A2 A3 A4

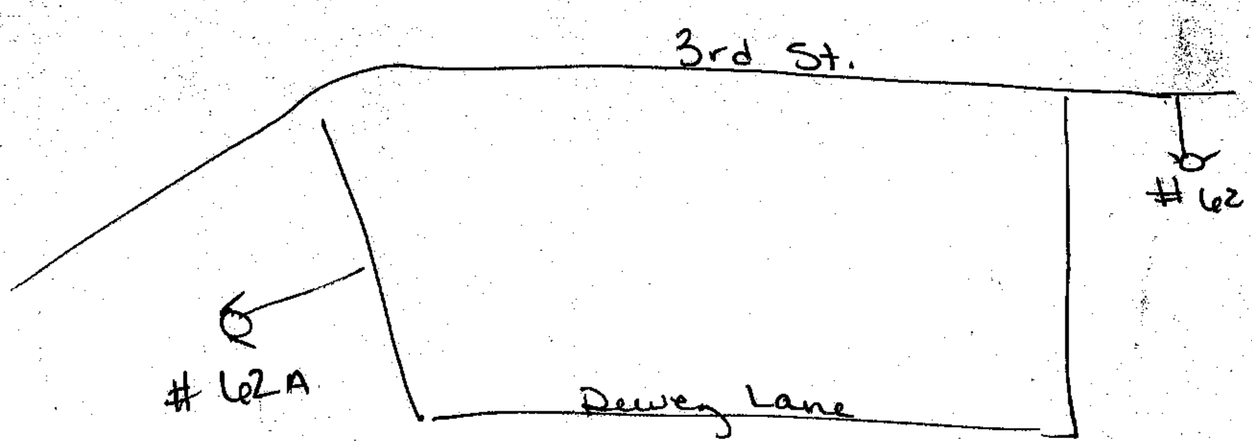
SIZE NOZZLE 1 1/2

PITOT READING 54 psi TOTAL GPM 418

STATIC B 76 psi RESIDUAL B 58 psi

PROJECTED RESULTS @ 20 psi 771 gpm, or @ ~~20~~ psi RESIDUAL 911 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #63 Penninsula St DATE 10-18-00

TEST MADE BY Rob & Gary TIME 3-3:30 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #63 A1 #26 A2 A3 A4

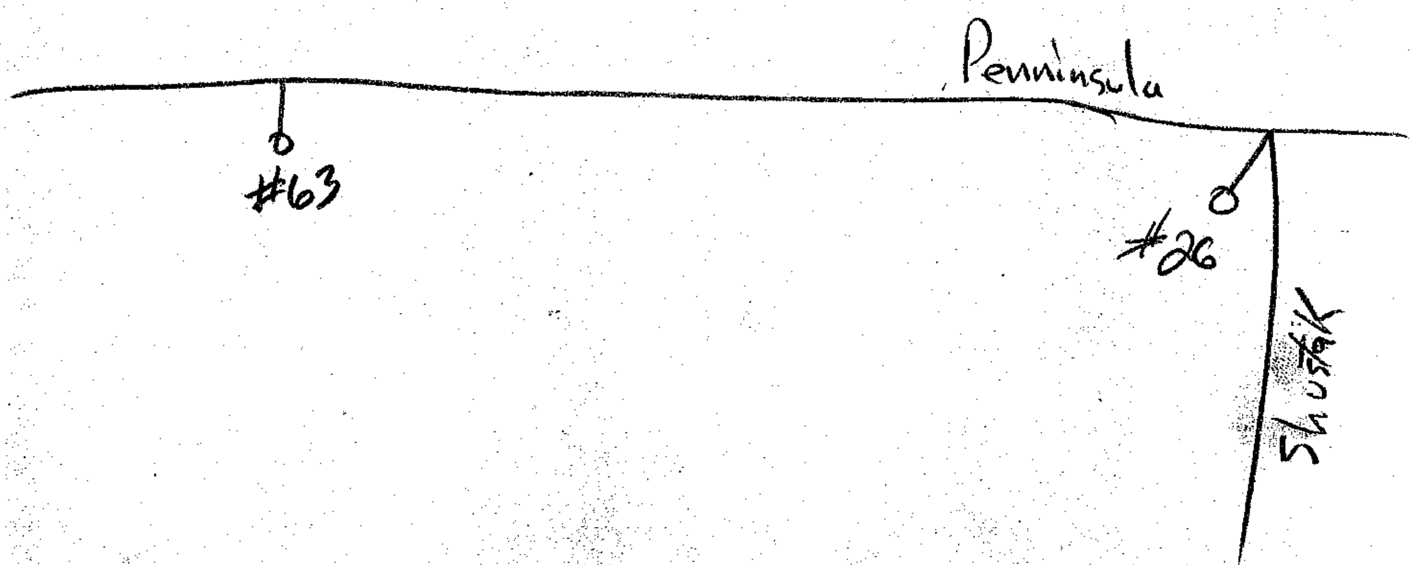
SIZE NOZZLE 2"

PITOT READING 46 psi TOTAL GPM 920

STATIC B 80 psi RESIDUAL B 76 psi

PROJECTED RESULTS @ 20 psi 3976 gpm, or @ psi RESIDUAL 4648 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #64 Penninsula St. DATE 10-18-00

TEST MADE BY Rob & Gary TIME 3-330 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #64 A1 #63 A2 A3 A4

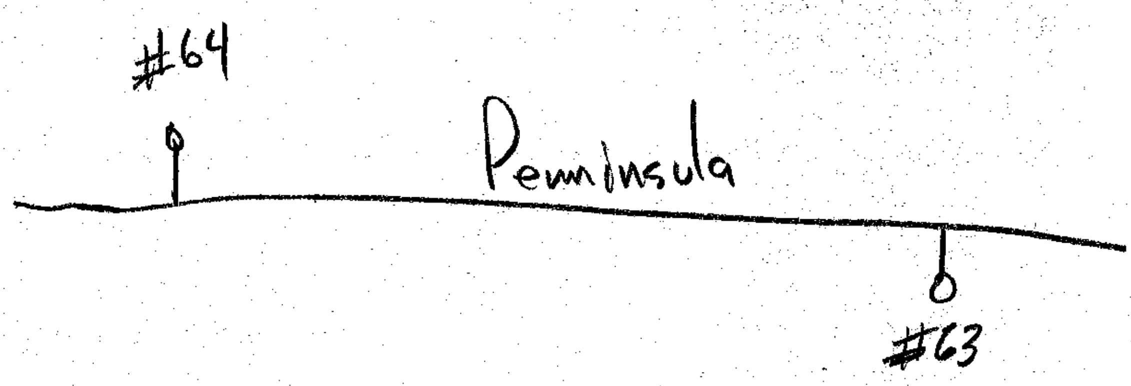
SIZE NOZZLE 2"

PITOT READING 56 psi TOTAL GPM 889

STATIC B 82 psi RESIDUAL B 76 psi

PROJECTED RESULTS @ 20 psi 3140 gpm, or @ psi RESIDUAL 3651 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #65 Penninsula St (DeltaWestern) DATE 10-18-00

TEST MADE BY Rob & Gary TIME 3:30 - 4 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #65 A1 64 A2 A3 A4

SIZE NOZZLE

PITOT READING psi TOTAL GPM

STATIC B psi RESIDUAL B psi

PROJECTED RESULTS @ 20 psi gpm, or @ psi RESIDUAL gpm

REMARKS Private Hydrant - Not maintaned by the city

HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #66 Penninsula St. DATE 10-18-00

TEST MADE BY Rob & Gary TIME 3:30 - 4 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #66 A1 #64 A2 A3 A4

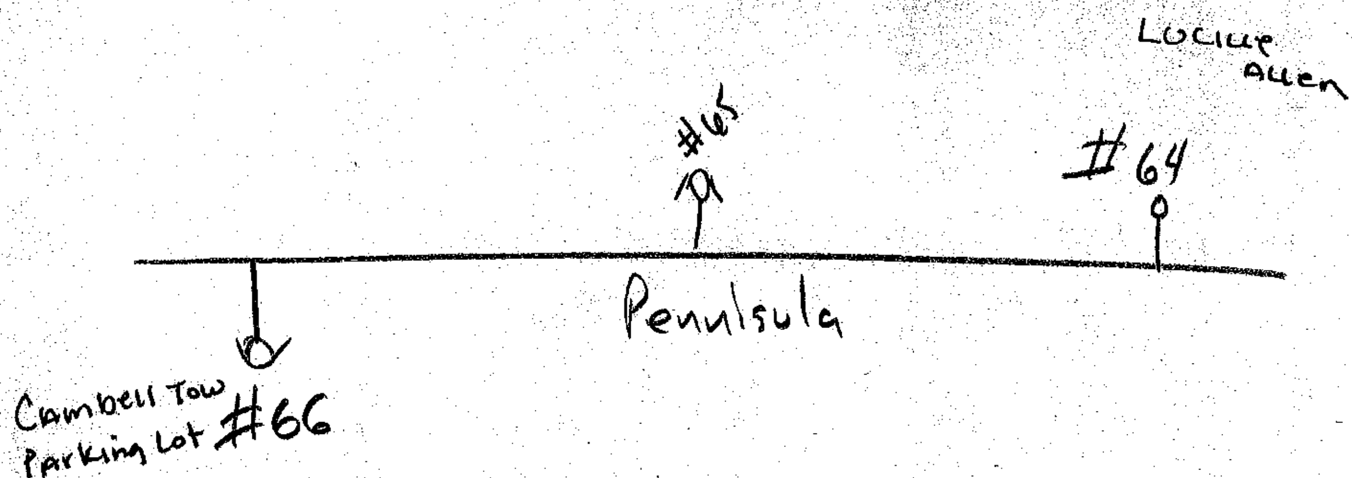
SIZE NOZZLE 2"

PITOT READING 54 psi TOTAL GPM 873

STATIC B 80 psi RESIDUAL B 75 psi

PROJECTED RESULTS @ 20 psi 3331 gpm, or @ 0 psi RESIDUAL 3894 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #67 Fish and Game Dock DATE 12-28-00

TEST MADE BY Gary and Rob TIME 9:18A .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST FLOW

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS F+G Dock A1 Lucille Allen A2 A3 A4

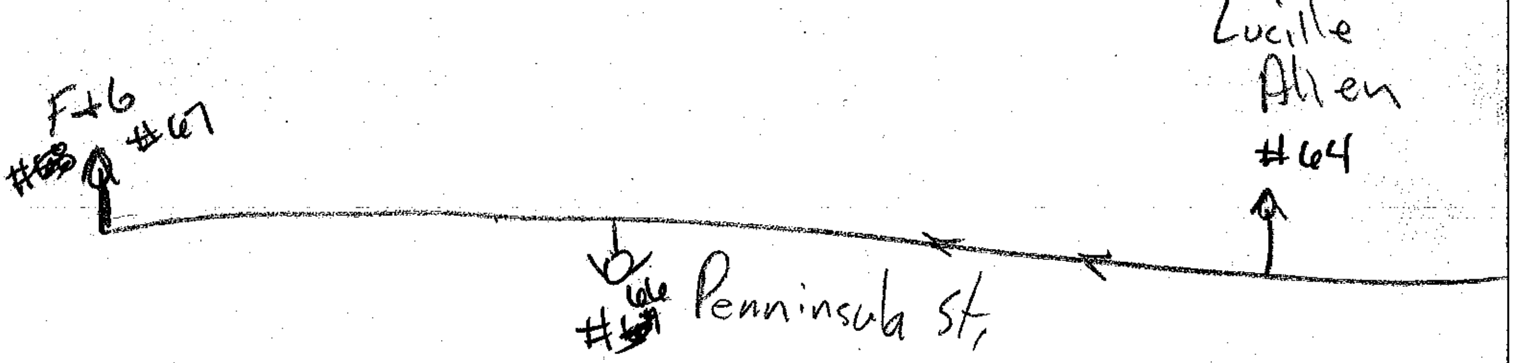
SIZE NOZZLE 2

PITOT READING 55 psi TOTAL GPM 811

STATIC B 68 psi RESIDUAL B 66 psi

PROJECTED RESULTS @ 20 psi 4524 gpm, or @ 0 psi RESIDUAL 5458 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #68 Oceanview Dr. & Sunset BLVD DATE 10-18-00

TEST MADE BY Rob & Gary TIME 4:00 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS #68 A1 #66 A2 A3 A4

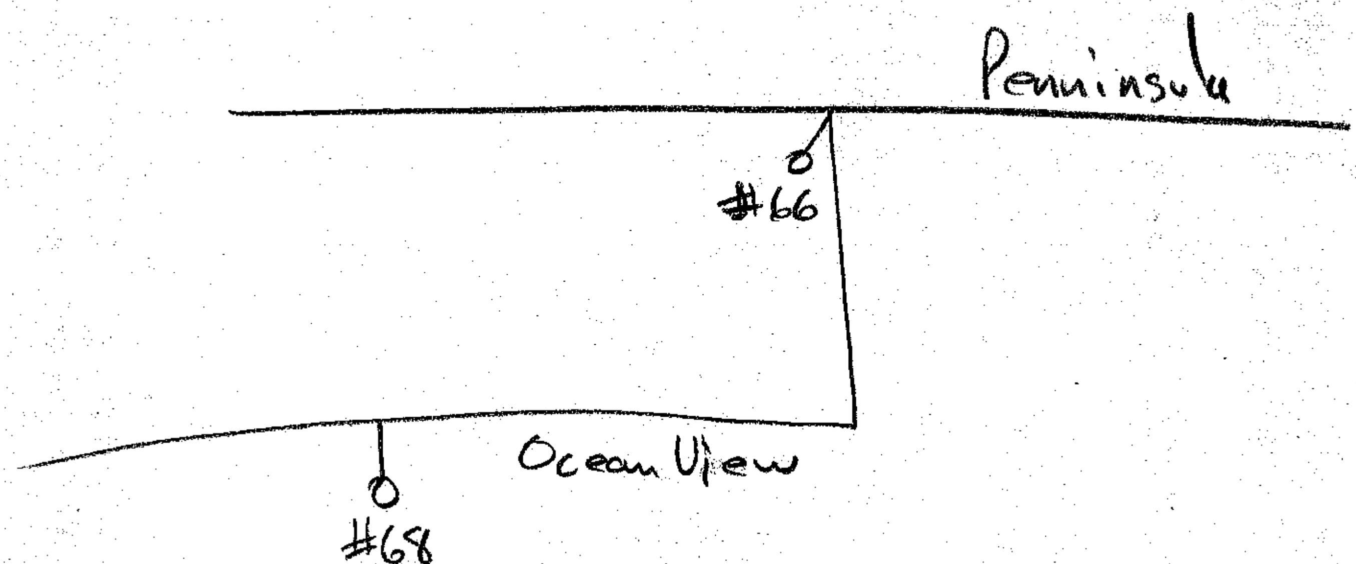
SIZE NOZZLE 2"

PITOT READING 50 psi TOTAL GPM 841

STATIC B 76 psi RESIDUAL B 72 psi

PROJECTED RESULTS @ 20 psi 3504 gpm, or @ 0 psi RESIDUAL 4133 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

#69

LOCATION Legion Hall DATE 10-20-00

TEST MADE BY Gary and Rob TIME 11:03 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J69 A1 J18 A2 A3 A4

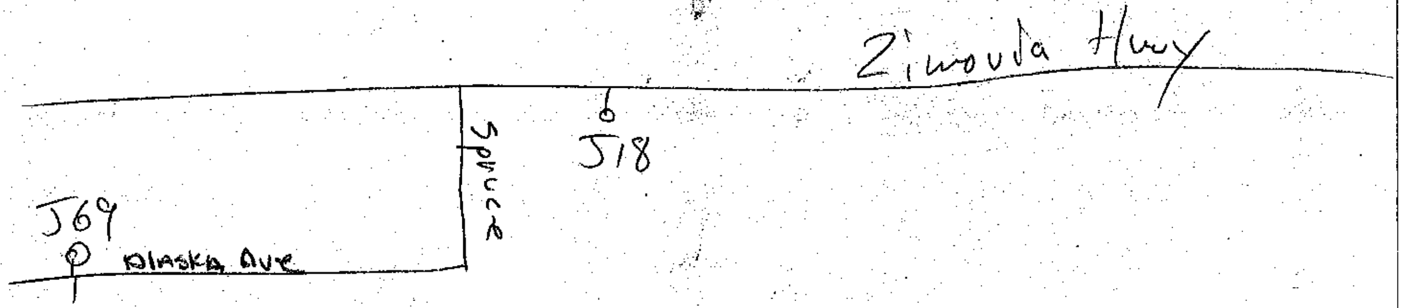
SIZE NOZZLE 2"

PITOT READING 82 TOTAL GPM 1076

STATIC B 128 psi RESIDUAL B 104 psi

PROJECTED RESULTS @ 20 psi 2425 gpm, or @ 0 psi RESIDUAL 2659 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL #71

LOCATION Ash St. DATE 10-20-00

TEST MADE BY Gary and Rob TIME 10:00 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J71 A1 A2 A3 A4

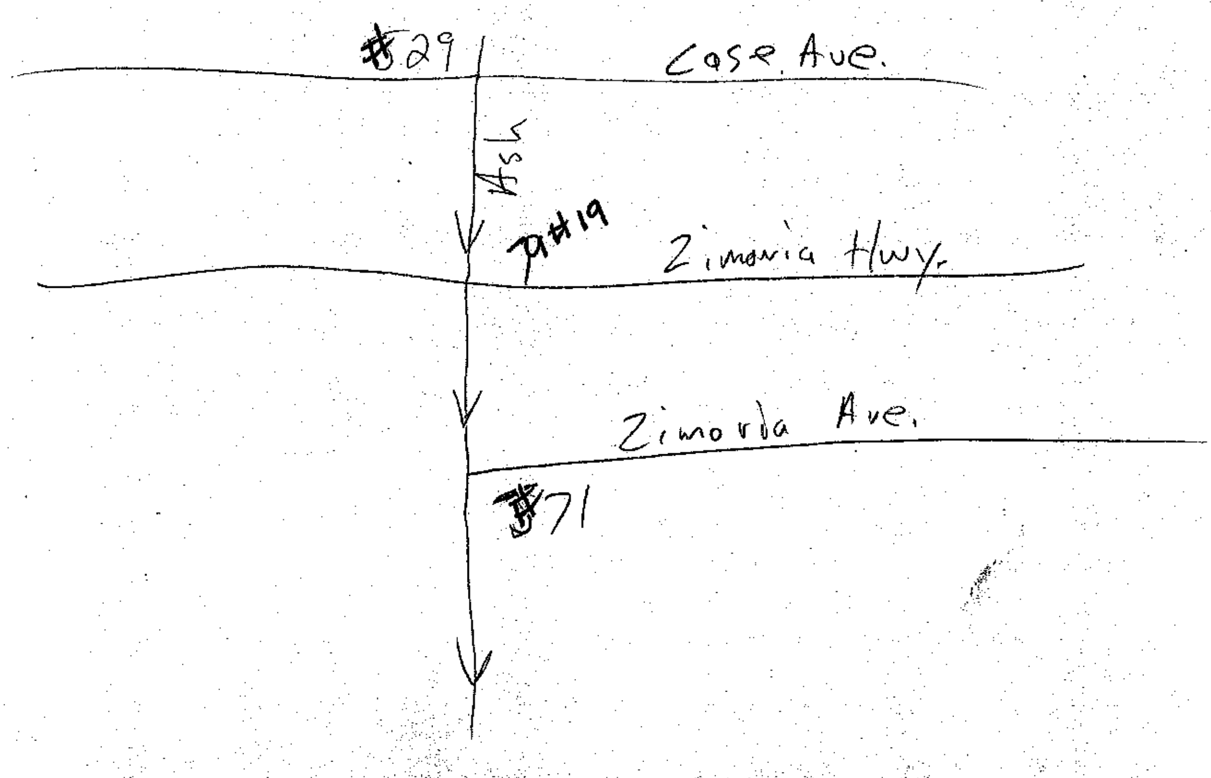
SIZE NOZZLE 2"

PITOT READING 30 TOTAL GPM ?

STATIC B J29 80 psi RESIDUAL B 78 psi

PROJECTED RESULTS @ 20 psi gpm, or @ psi RESIDUAL gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Upper Ash St. #71 DATE 12-28-00

TEST MADE BY Gary and Rob TIME 8:55A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS Uper Ash A1 Low Press. Valt A2 A3 A4

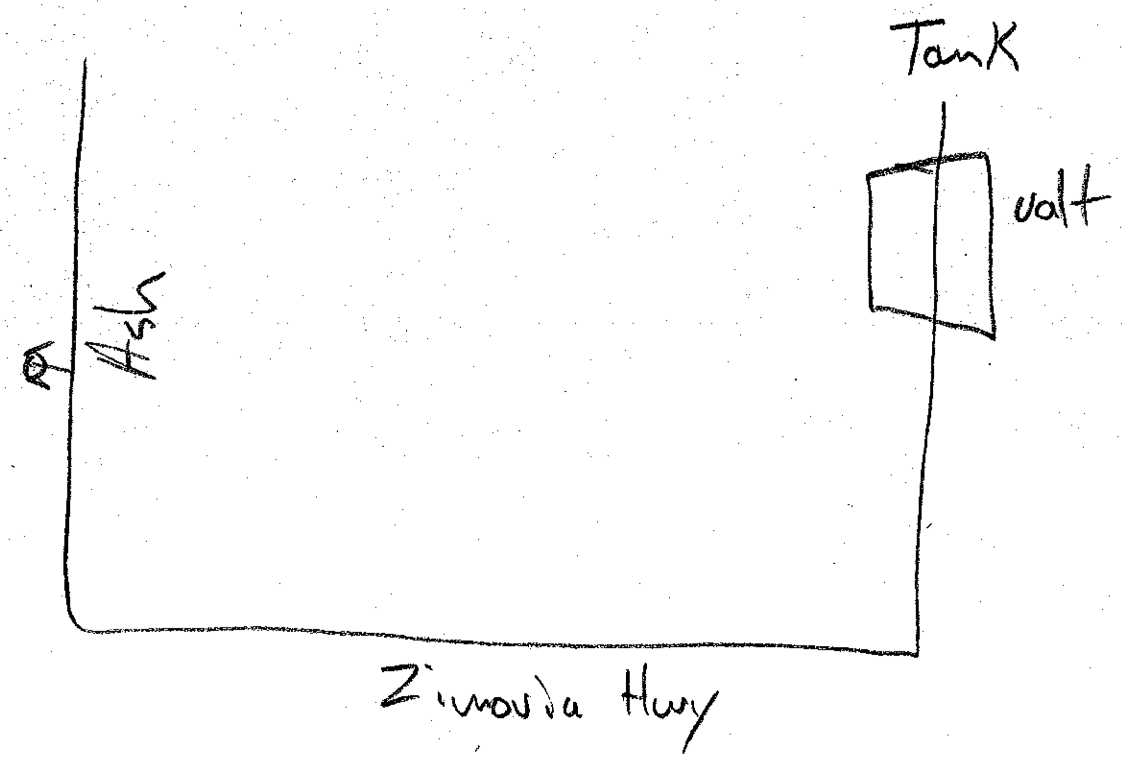
SIZE NOZZLE 3/4

PITOT READING 40 psi TOTAL GPM

STATIC B 40 psi RESIDUAL B 40 psi

PROJECTED RESULTS @ 20 psi gpm, or @ psi RESIDUAL gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #72 Lemieux DATE 12-28-00

TEST MADE BY Gary and Rob TIME 9:00A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS Lemieux A1 upper Ash A2 A3 A4

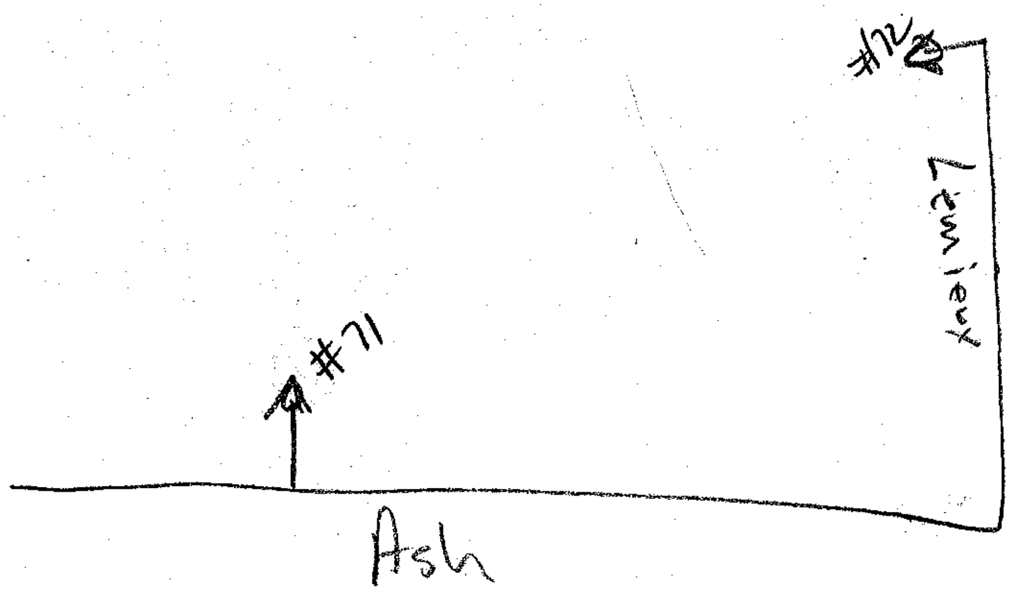
SIZE NOZZLE 3/4

PITOT READING 32 psi TOTAL GPM

STATIC B 42 psi RESIDUAL B 40 psi

PROJECTED RESULTS @ 20 psi ______ gpm, or @ ____ psi RESIDUAL ______ gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL #72

LOCATION Lemieux St DATE 10-20-00

TEST MADE BY Gary and Rob TIME 10:12 A.M.

REPRESENTATIVE OF PUBLIC Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J72 A1 J71 A2 A3 A4

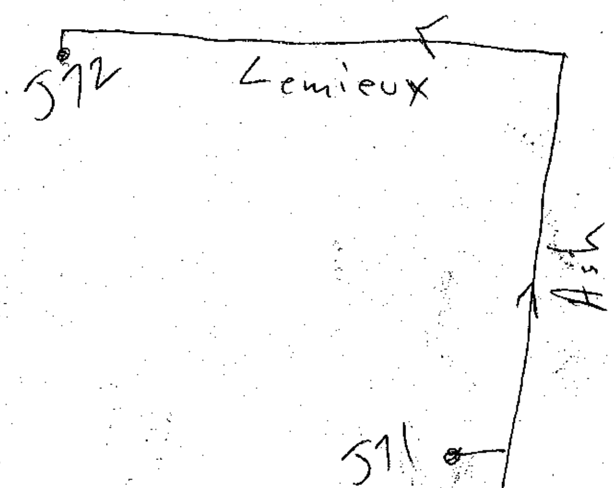
SIZE NOZZLE

PITOT READING 20 TOTAL GPM ?

STATIC B J71 52 psi RESIDUAL B 46 psi

PROJECTED RESULTS @ 20 psi gpm, or @ psi RESIDUAL gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #73 Shakes St L-52 DATE 10-24-00

TEST MADE BY Gary and Rob TIME 8:19 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 73 A1 33 A2 A3 A4

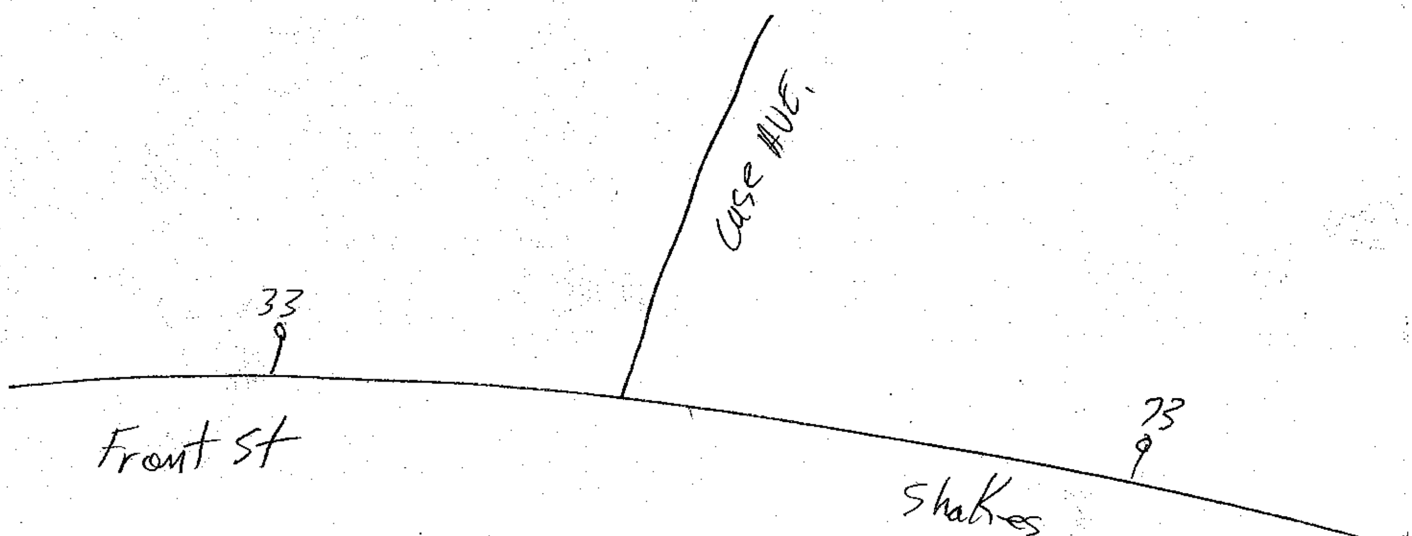
SIZE NOZZLE 2"

PITOT READING psi TOTAL GPM

STATIC B psi RESIDUAL B psi

PROJECTED RESULTS @ 20 psi gpm, or @ psi RESIDUAL gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #74 Relience Dock L-57 DATE 10-24-00

TEST MADE BY Gary and Rob TIME 8:30 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS ______

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ______

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ______

FLOW HYDRANTS #74 A1 73 A2 ______ A3 ______ A4 ______

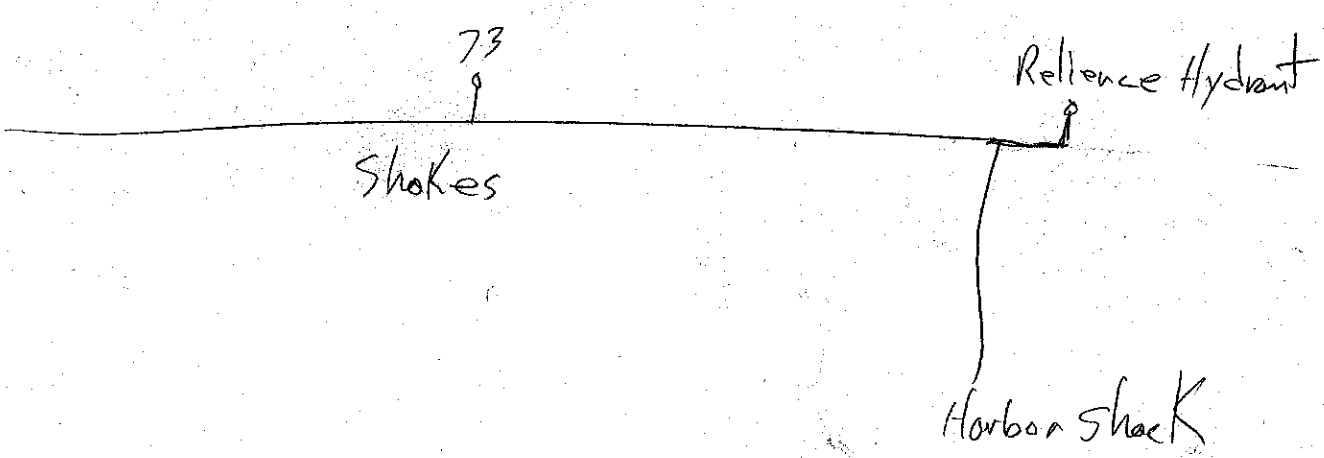
SIZE NOZZLE 2"

PITOT READING 58 psi TOTAL GPM 905

STATIC B 72 psi RESIDUAL B 66 psi

PROJECTED RESULTS @ 20 psi 2904 gpm, or @ 0 psi RESIDUAL 3465 gpm

REMARKS ______



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #75 Berger St. (Bobs' IGA) DATE 10-25-00

TEST MADE BY Gonyou Rob TIME 8:11 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 75 A1 37 A2 A3 A4

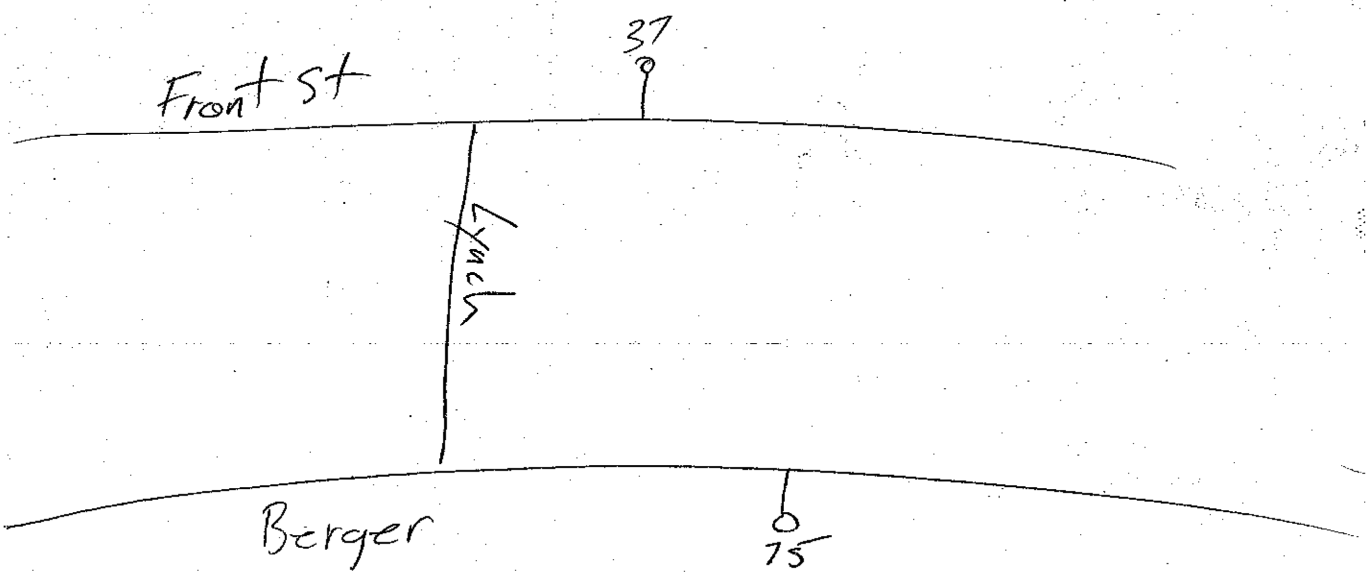
SIZE NOZZLE 2"

PITOT READING 54 psi TOTAL GPM 873

STATIC B 72 psi RESIDUAL B 68 psi

PROJECTED RESULTS @ 20 psi 3492 gpm, or @ 0 psi RESIDUAL 4166 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #76 Berger St DATE 10-25-00

TEST MADE BY Gary and Rob TIME 8:05 .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 76 A1 37 A2 A3 A4

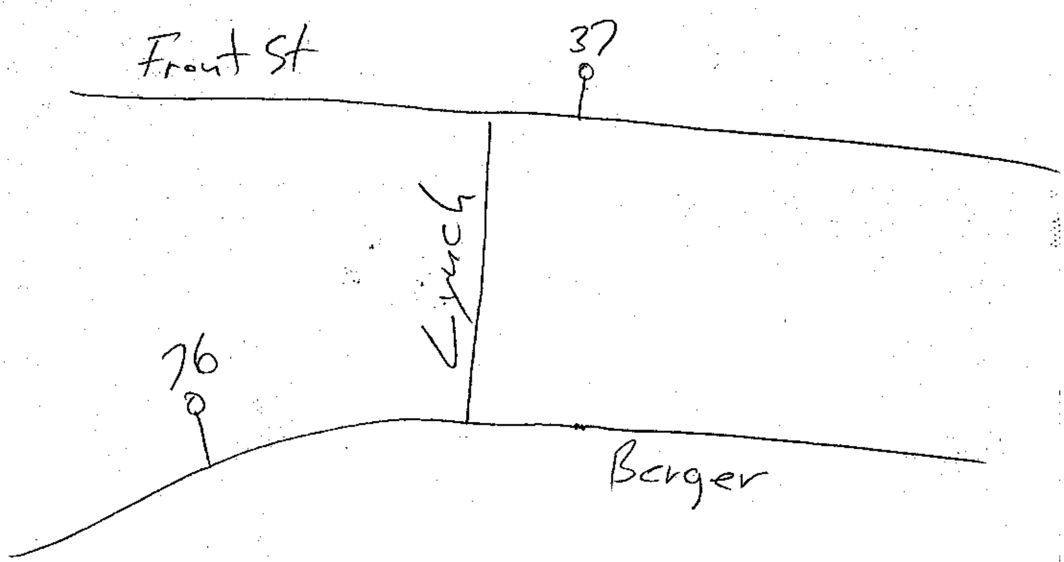
SIZE NOZZLE 2"

PITOT READING 52 psi TOTAL GPM 857

STATIC B 72 psi RESIDUAL B 68 psi

PROJECTED RESULTS @ 20 psi 3428 gpm, or @ 0 psi RESIDUAL 4090 gpm

REMARKS



HYDRANT FLOW TEST REPORT #11
CITY OF WRANGELL

LOCATION Cassiar St and Bevier St DATE 10-20-00

TEST MADE BY Gary and Rob TIME 2:10 P.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J77 A1 J50 A2 A3 A4

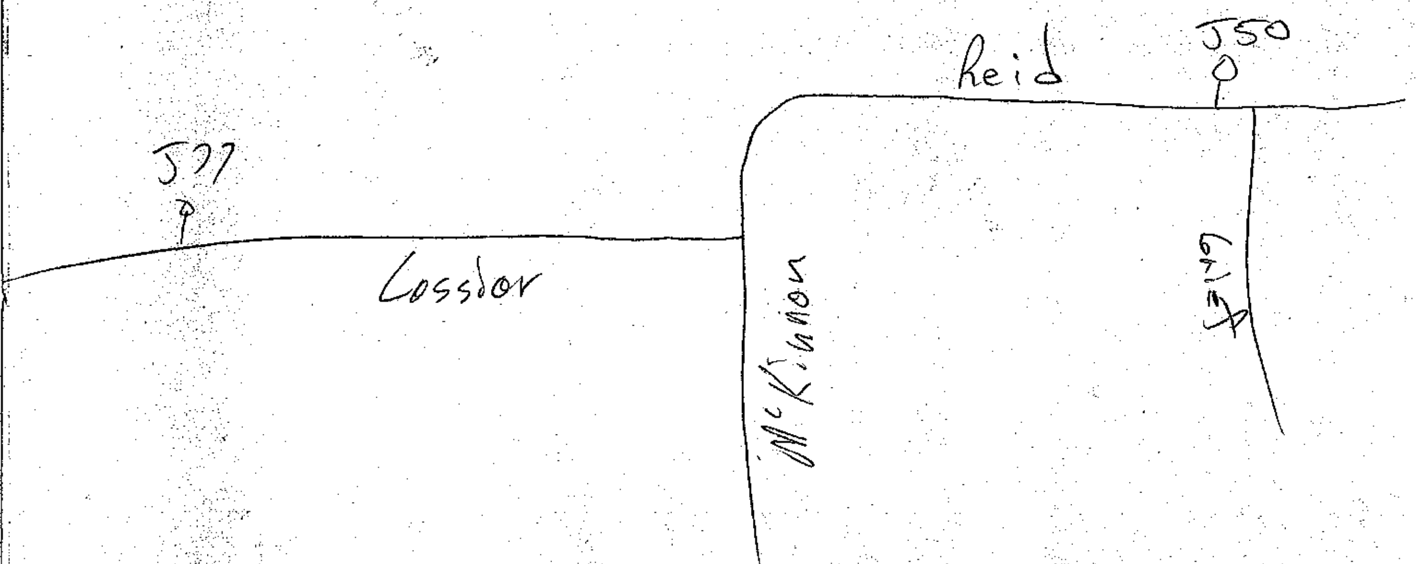
SIZE NOZZLE 2"

PITOT READING 36 TOTAL GPM

STATIC B 58 psi RESIDUAL B 48 psi

PROJECTED RESULTS @ 20 psi ____ gpm, or @ ____ psi RESIDUAL ____ gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL #78

LOCATION Sam Prilett Cassiar St. DATE 10-20-00

TEST MADE BY Gary and Rob TIME 2:20 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J78 A1 J77 A2 A3 A4

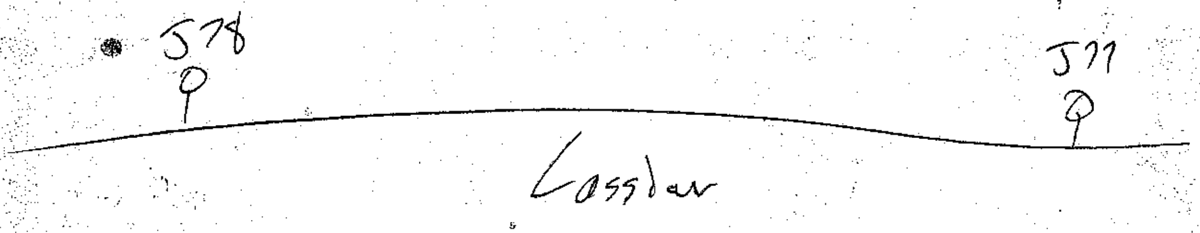
SIZE NOZZLE 2"

PITOT READING 30 TOTAL GPM

STATIC B 64 psi RESIDUAL B 58 psi

PROJECTED RESULTS @ 20 psi gpm, or @ psi RESIDUAL gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #79 Evergreen Ave DATE 10-17-00

TEST MADE BY Rob Davidson & Gary Pullman TIME 2-2:30 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING Stikine / Evergreen (NOT Running)

FLOW HYDRANTS #79 A1 #4 A2 A3 A4

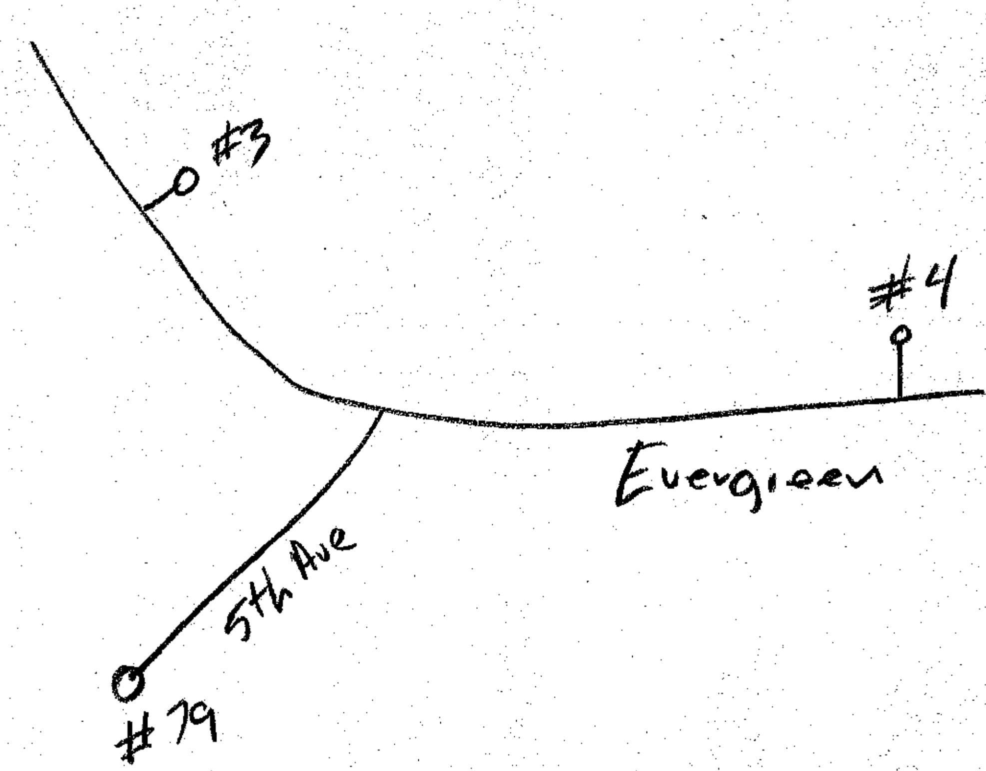
SIZE NOZZLE 2"

PITOT READING 60 psi TOTAL GPM 920

STATIC B 72 psi RESIDUAL B 64 psi

PROJECTED RESULTS @ 20 psi 2529 gpm, or @ 0 psi RESIDUAL 3017 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #80 Panhandle Trailer Court DATE 10-24-00

TEST MADE BY Gary and Rob TIME 9:19 .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS ______

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ______

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ______

FLOW HYDRANTS Panhandle A1 J21 A2 ______ A3 ______ A4 ______

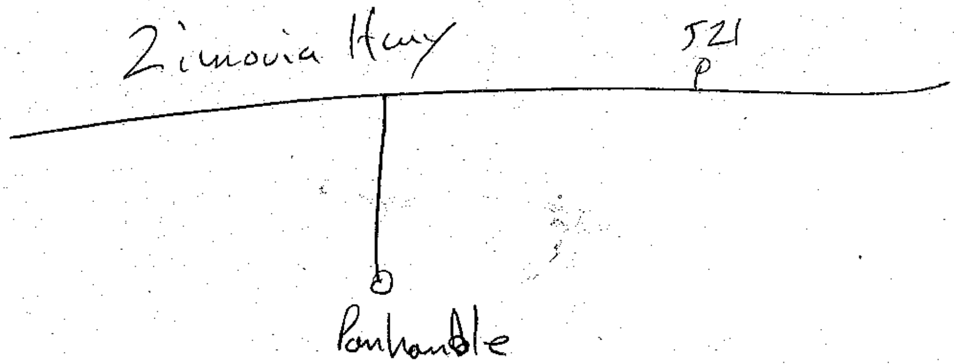
SIZE NOZZLE 2"

PITOT READING 50 psi TOTAL GPM 841

STATIC B 66 psi RESIDUAL B 62 psi

PROJECTED RESULTS @ 20 psi 3153 gpm, or @ 0 psi RESIDUAL 3830 gpm

REMARKS ______



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

#81

LOCATION Wastewater Treatment Plant DATE 10-24-00

TEST MADE BY Gary and Rob TIME 9:40 .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS J81 A1 City Rock Pit A2 A3 A4

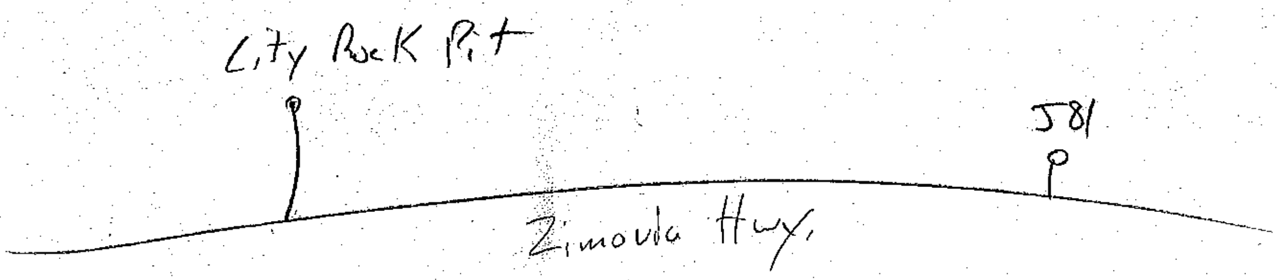
SIZE NOZZLE 2"

PITOT READING 98 psi TOTAL GPM 1176

STATIC B 142 psi RESIDUAL B 110 psi

PROJECTED RESULTS @ 20 psi 2423 gpm, or @ 0 psi RESIDUAL 2629 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #82 Front St and Federal Way DATE 10-25-00

TEST MADE BY Gary and Rob TIME 7:16 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS – 82 A1 38 A2 A3 A4

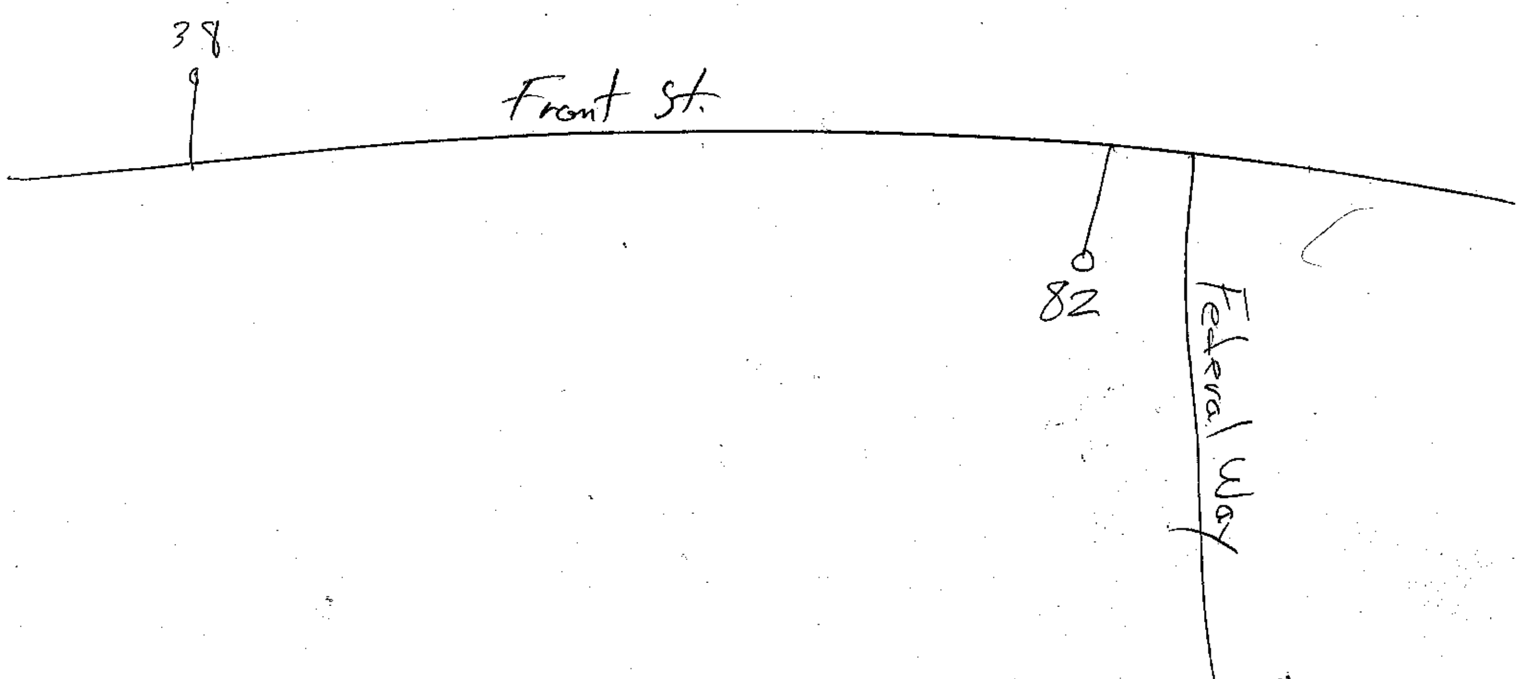
SIZE NOZZLE 2"

PITOT READING 58 psi TOTAL GPM 905

STATIC B 72 psi RESIDUAL B 68 psi

PROJECTED RESULTS @ 20 psi 3626 gpm, or @ 0 psi RESIDUAL 4319 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #83 Spring St. DATE 10-17-00

TEST MADE BY Rob & Gary TIME 3:00-3:30 p.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING Stikine/Evergreen (NOT Running)

FLOW HYDRANTS #83 A1 #6 A2 A3 A4

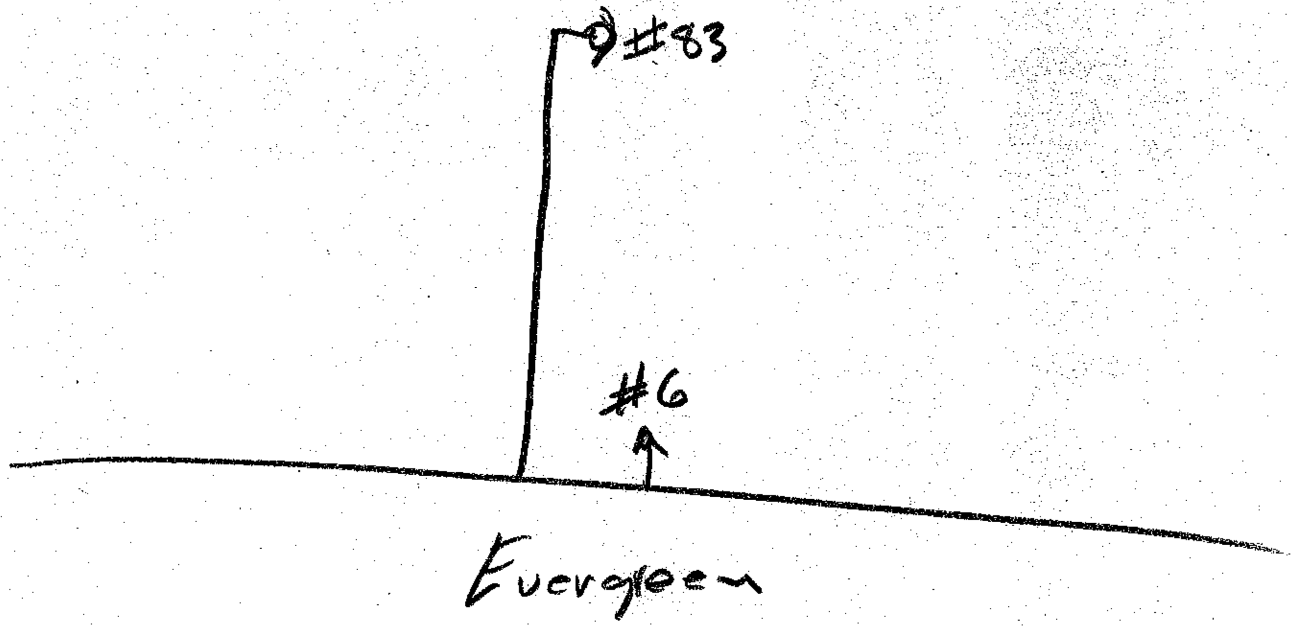
SIZE NOZZLE 2"

PITOT READING 40 psi TOTAL GPM 752

STATIC B 80 psi RESIDUAL B 74 psi

PROJECTED RESULTS @ 20 psi 2608 gpm, or @ 0 psi RESIDUAL 3048 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #84 WTP (inside fence) DATE 10-24-00

TEST MADE BY Gary and Rob TIME ____ .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS ____

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ____

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ____

FLOW HYDRANTS WTP A1 City/rock pit A2 ____ A3 ____ A4 ____

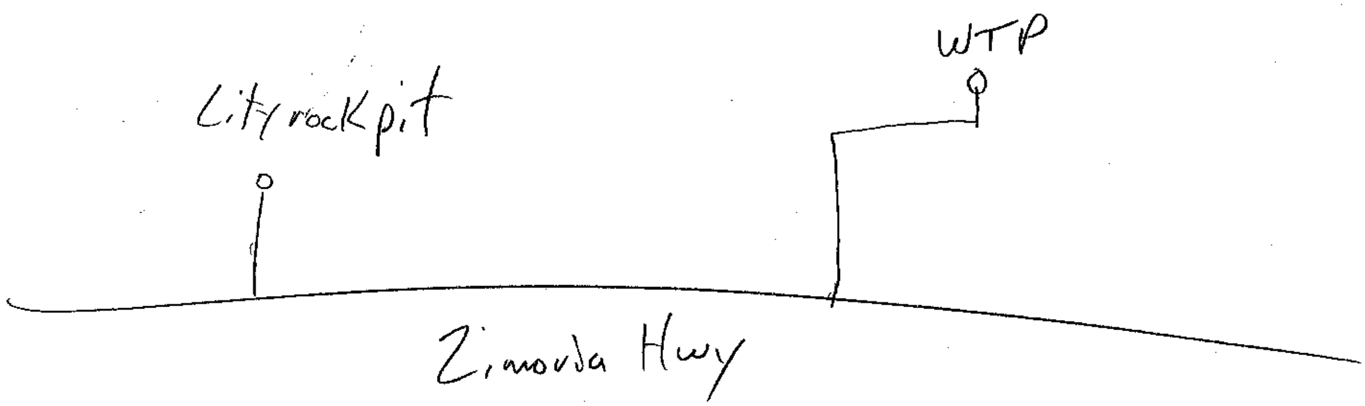
SIZE NOZZLE 2"

PITOT READING 84 psi TOTAL GPM 1089

STATIC B 142 psi RESIDUAL B 120 psi

PROJECTED RESULTS @ 20 psi 2842 gpm, or @ 0 psi RESIDUAL 3084 gpm

REMARKS ____



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL #85

LOCATION ASHA DATE 10-20-00

TEST MADE BY Bony and Rob TIME 10:43 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS ______

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ______

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ______

FLOW HYDRANTS 85 A1 J19 A2 ____ A3 ____ A4 ____

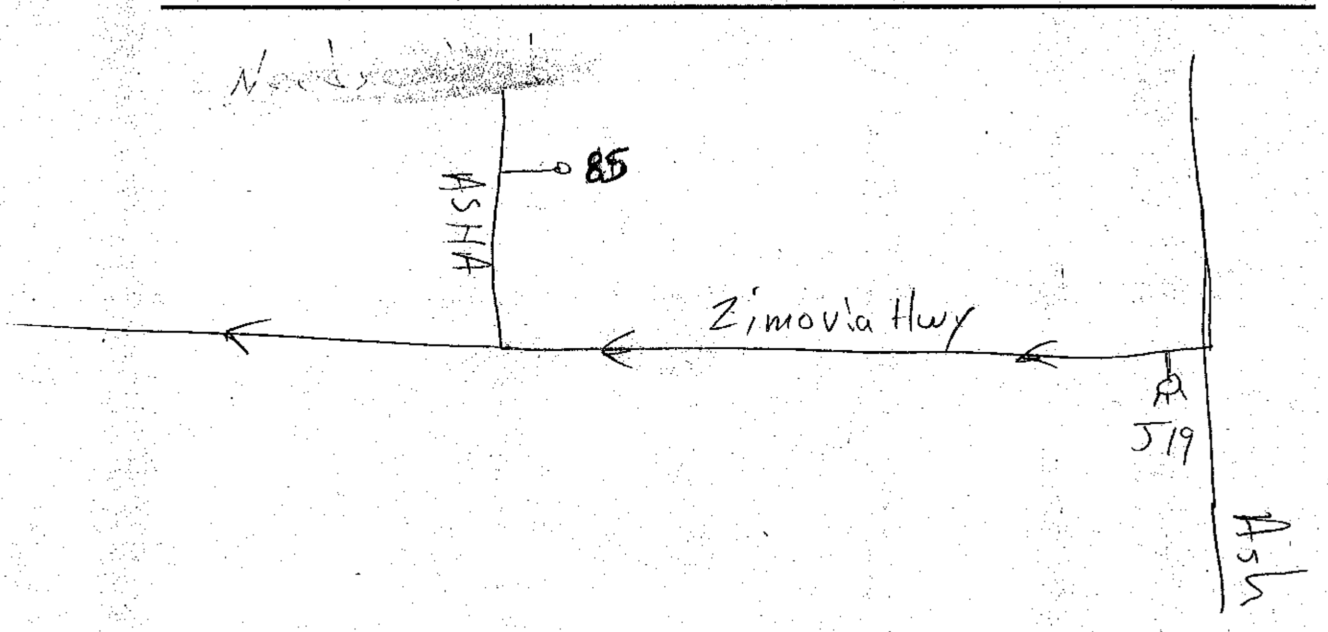
SIZE NOZZLE 2"

PITOT READING 74 TOTAL GPM 1023

STATIC B 120 psi ______ RESIDUAL B 112 psi

PROJECTED RESULTS @ 20 psi 4005 gpm, or @ 0 psi RESIDUAL 4422 gpm

REMARKS Needs Raised



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Housing top #86 DATE 19OCT00

TEST MADE BY ROB & JOE TIME 11:43 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 86 A1 85 A2 A3 A4

SIZE NOZZLE 2"

PITOT READING 66 TOTAL GPM 965

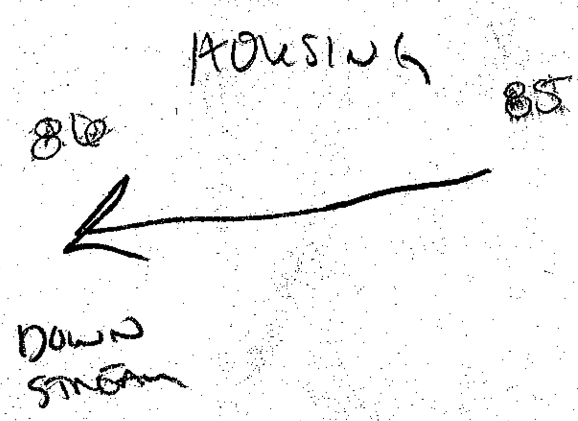
STATIC B 98 psi RESIDUAL B 90 psi

PROJECTED RESULTS @ 20 psi 3304 gpm, or @ 0 psi RESIDUAL 3737 gpm

REMARKS A = START AT HOUSING APTS

A1 = TOP OF DRIVEWAY

HYDRANT NEEDS RAISED



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION WEST END OF HOWELL #87 DATE 19OCT08

TEST MADE BY JOE ROB TIME 2:34 P .M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS WEST END OF HOWELL A1 J53 A2 A3 A4

SIZE NOZZLE 2"

PITOT READING 46 TOTAL GPM 806

STATIC B 100 psi RESIDUAL B 75 psi

PROJECTED RESULTS @ 20 psi 1510 gpm, or @ 0 psi RESIDUAL 1703 gpm

REMARKS

J53

WEST END OF HOWELL #87

SECOND
&
ST MICHAELS

DOWN
STREAM

HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION WEST SIDE OF THIRD AVE & ST. MICHAELS DATE 19OCT00

TEST MADE BY JOE & ROB TIME 2:41 .M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS WEST SIDE OF THIRD & ST MICHAELS A1 J53 A2 A3 A4

SIZE NOZZLE 2"

PITOT READING 50 TOTAL GPM 841

STATIC B 100 psi RESIDUAL B 68 psi

PROJECTED RESULTS @ 20 psi 1379 gpm, or @ 0 psi RESIDUAL 1555 gpm

REMARKS NO WATER @ [illegible]

J53

WEST SIDE OF
THIRD
&
ST MICHAELS

#88

SECOND
&
ST. MICHAELS

DOWN
STREAM

HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION 4th ; St. Michaels #89 DATE 19 Oct. 00

TEST MADE BY Rob ; Joe TIME 2:50 P .M.

REPRESENTATIVE OF Public Works

WITNESS ______

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ______

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ______

FLOW HYDRANTS 89 A1 54 A2 ______ A3 ______ A4 ______

SIZE NOZZLE 2"

PITOT READING 48 TOTAL GPM 824

STATIC B 100 psi ______ RESIDUAL B 68 psi

PROJECTED RESULTS @ 20 psi 1351 gpm, or @ 0 psi RESIDUAL 1524 gpm

REMARKS ______

#89

54 3rd ; St. Michaels.

2

4th ; St. Michaels

HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION SHtAx' Heen Circle #90 DATE 19 oct 00

TEST MADE BY Rob & Joe TIME 3:05 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 90 A1 86 A2 A3 A4

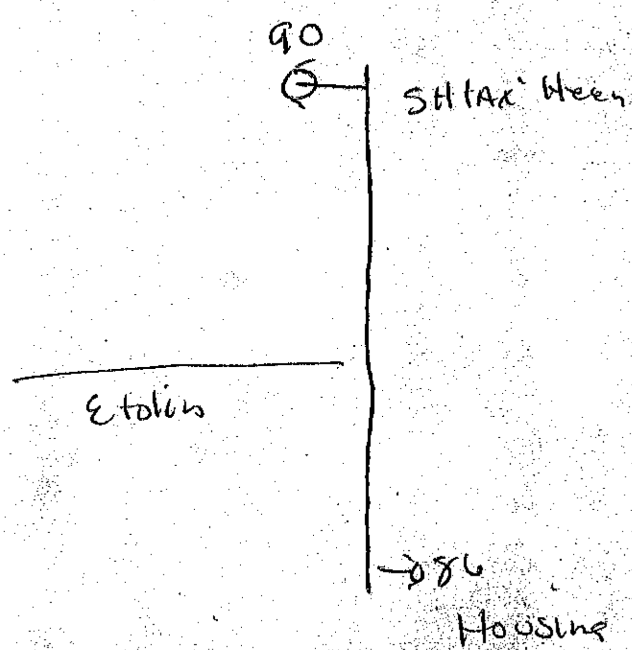
SIZE NOZZLE 2"

PITOT READING 56 TOTAL GPM 889

STATIC B 106 psi RESIDUAL B 84 psi

PROJECTED RESULTS @ 20 psi 1920 gpm, or @ 0 psi RESIDUAL 2151 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Etolin # 91 DATE 19 oct 00

TEST MADE BY Joe & Rob TIME ____ .M.

REPRESENTATIVE OF Public Works

WITNESS ____

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ____

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ____

FLOW HYDRANTS 91 A1 86 A2 ____ A3 ____ A4 ____

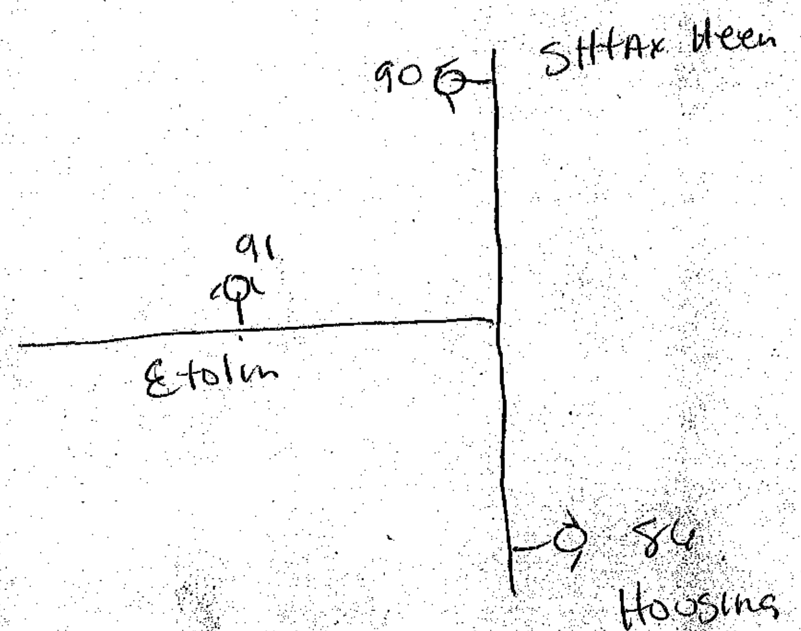
SIZE NOZZLE 2"

PITOT READING 56 TOTAL GPM 889

STATIC B 106 psi ____ RESIDUAL B 86 psi

PROJECTED RESULTS @ 20 psi 1954 gpm, or @ 0 psi RESIDUAL 2189 gpm

REMARKS ____



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Hemlock #92 DATE 19 Oct. 00

TEST MADE BY Joe & Rob TIME 3:15 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 92 A1 91 A2 A3 A4

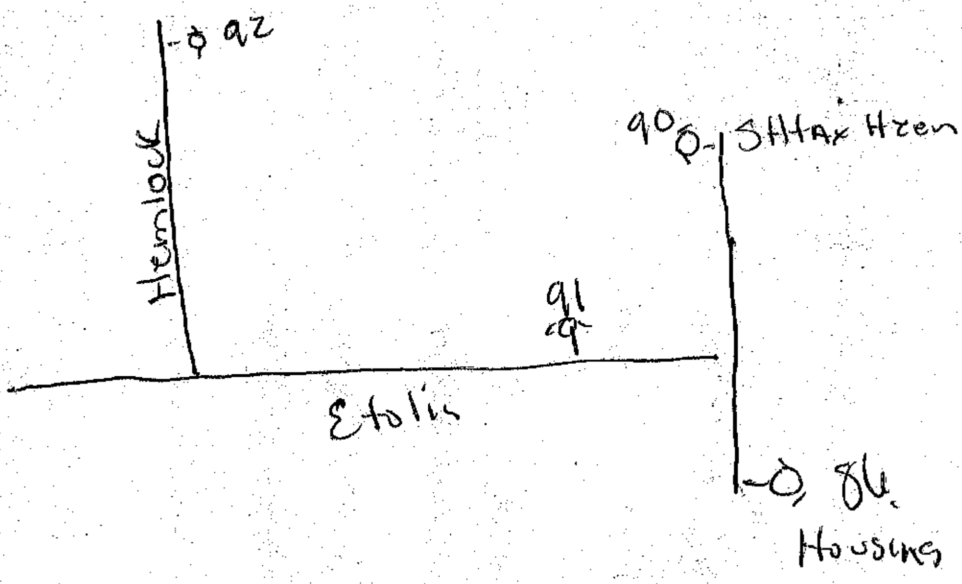
SIZE NOZZLE 2"

PITOT READING 54 TOTAL GPM 873

STATIC B 98 psi RESIDUAL B 75 psi

PROJECTED RESULTS @ 20 psi 1687 gpm, or @ 0 psi RESIDUAL 1908 gpm

REMARKS needs raised



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Etolin #93 DATE 19 oct. 00

TEST MADE BY Joe & Rob TIME 3:30 p .M.

REPRESENTATIVE OF PUBLIC Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 93 A1 91 A2 A3 A4

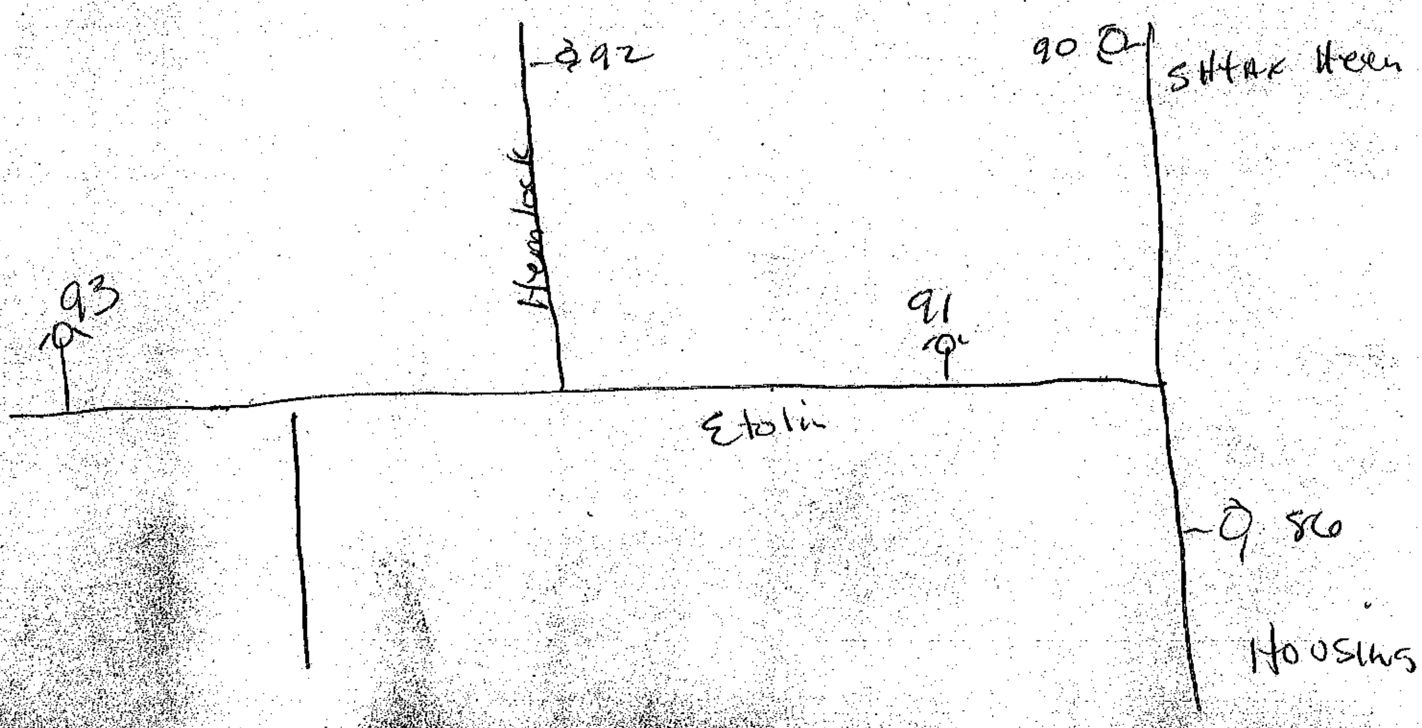
SIZE NOZZLE 2"

PITOT READING 54 TOTAL GPM

STATIC B 98 psi RESIDUAL B 75 psi

PROJECTED RESULTS @ 20 psi 1687 gpm, or @ 0 psi RESIDUAL 1908 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Council Drive #94 DATE 10-20-00

TEST MADE BY Gary & Rob TIME 9:00 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 94 A1 91 A2 A3 A4

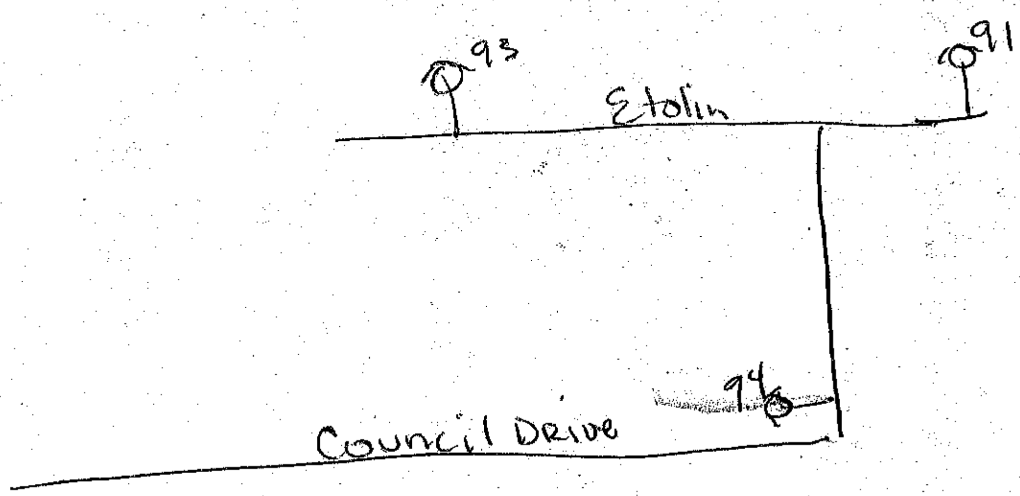
SIZE NOZZLE 2½

PITOT READING 68 TOTAL GPM 980

STATIC B 100 psi RESIDUAL B 76 psi

PROJECTED RESULTS @ 20 psi 1879 gpm, or @ 0 psi RESIDUAL 2119 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Council Drive #95 DATE 10-20-00

TEST MADE BY Gary & Rob TIME 9:38 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 95 A1 94 A2 A3 A4

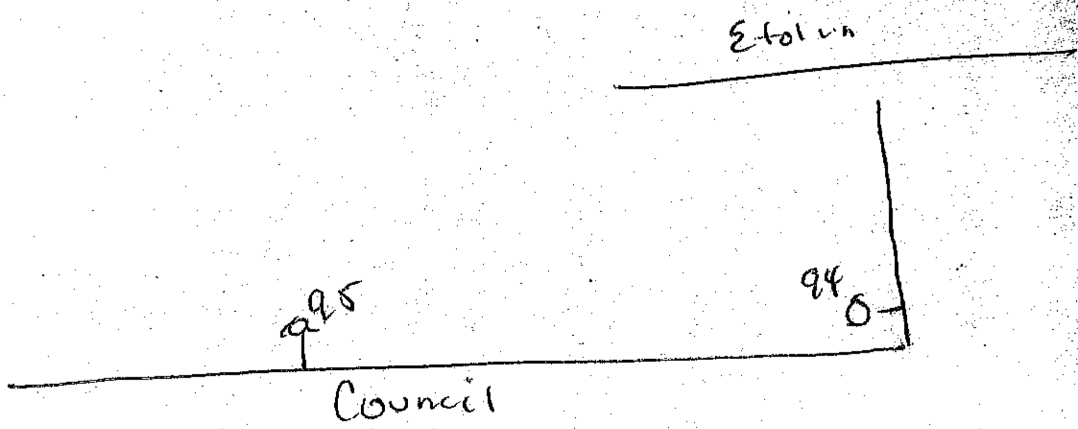
SIZE NOZZLE 2"

PITOT READING 70 TOTAL GPM 994

STATIC B 112 psi RESIDUAL B 92 psi

PROJECTED RESULTS @ 20 psi 2266 gpm, or @ 0 psi RESIDUAL 2521 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Council Drive #96 DATE 10-20-00

TEST MADE BY Gary & Rob TIME 9:40 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 96 A1 95 A2 A3 A4

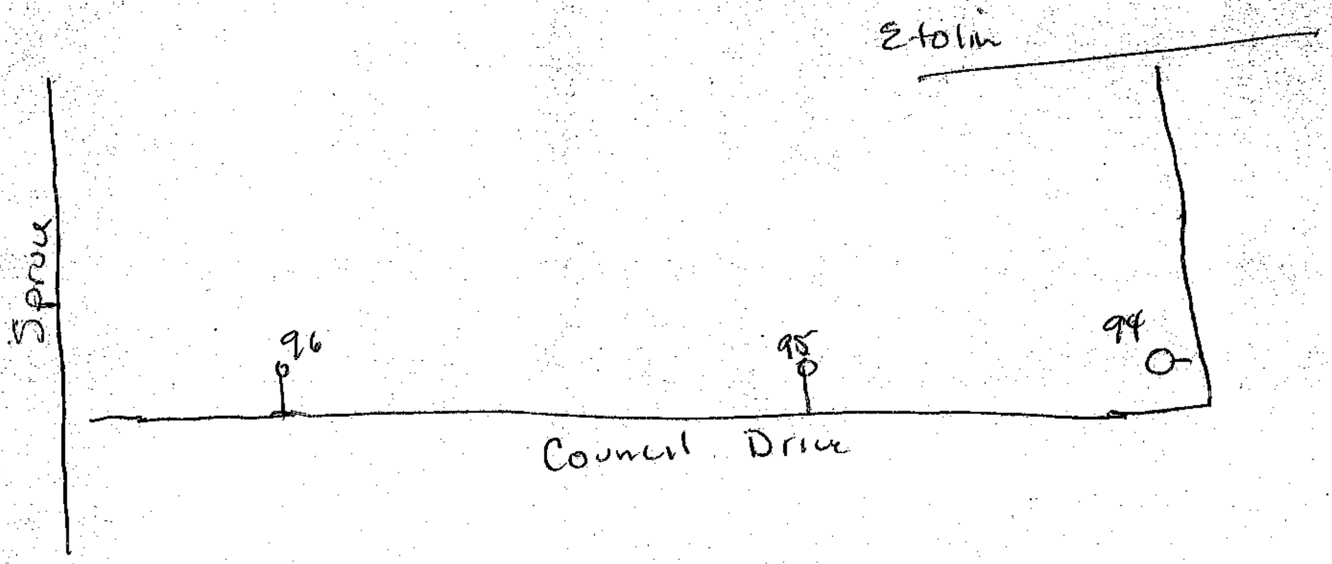
SIZE NOZZLE 2"

PITOT READING 74 TOTAL GPM 1023

STATIC B 114 psi RESIDUAL B 88 psi

PROJECTED RESULTS @ 20 psi 2048 gpm, or @ 0 psi RESIDUAL 2271 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION John Baker #135 DATE 10-24-00

TEST MADE BY Gary and Rob TIME 10:30 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS ____

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ____

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ____

FLOW HYDRANTS #135 A1 J25 A2 ____ A3 ____ A4 ____

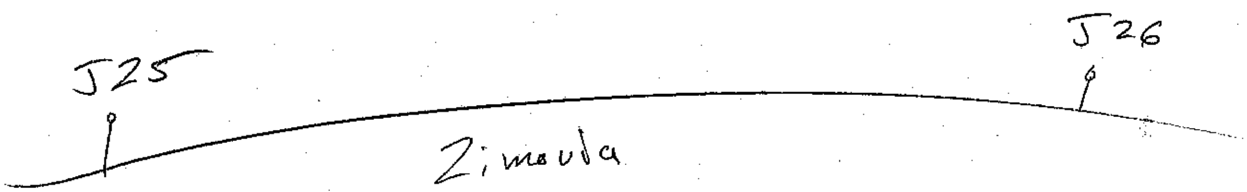
SIZE NOZZLE 2"

PITOT READING 92 psi TOTAL GPM 1140

STATIC B 140 psi RESIDUAL B 116 psi

PROJECTED RESULTS @ 20 psi 2721 gpm, or @ ____ psi RESIDUAL 2957 gpm

REMARKS ____



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Zimovia Hwy #136 DATE 10-24-00

TEST MADE BY Gary and Rob TIME 10:40 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 136 A1 135 A2 A3 A4

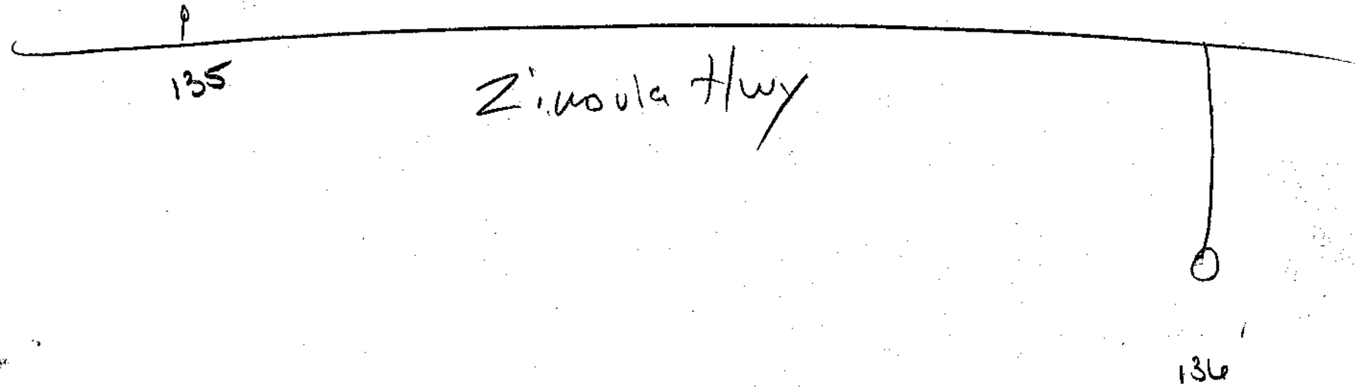
SIZE NOZZLE 2"

PITOT READING 88 psi TOTAL GPM 1115

STATIC B 142 psi RESIDUAL B 100 psi

PROJECTED RESULTS @ 20 psi 1983 gpm, or @ 0 psi RESIDUAL 2152 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Zimovia Hwy #137 DATE 10-24-00

TEST MADE BY Gary and Rob TIME 10:47 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 137 A1 136 A2 A3 A4

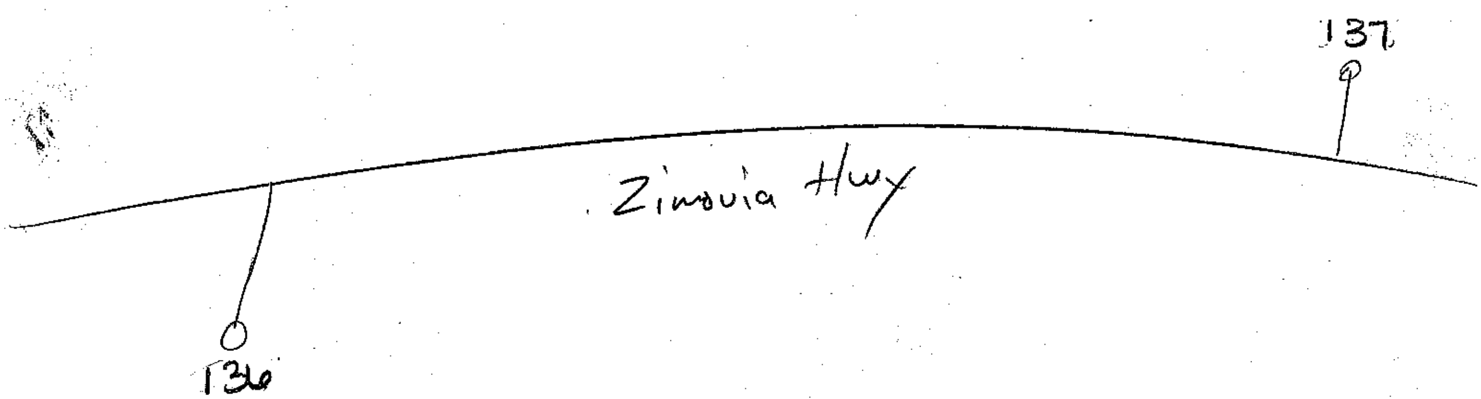
SIZE NOZZLE 2"

PITOT READING 90 psi TOTAL GPM 1128

STATIC B 142 psi RESIDUAL B 100 psi

PROJECTED RESULTS @ 20 psi 2006 gpm, or @ 0 psi RESIDUAL 2177 gpm

REMARKS Needs Raised.



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Zimovia Hwy #138 DATE 10-24-00

TEST MADE BY Gary and Rob TIME 10:55 .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 138 A1 137 A2 A3 A4

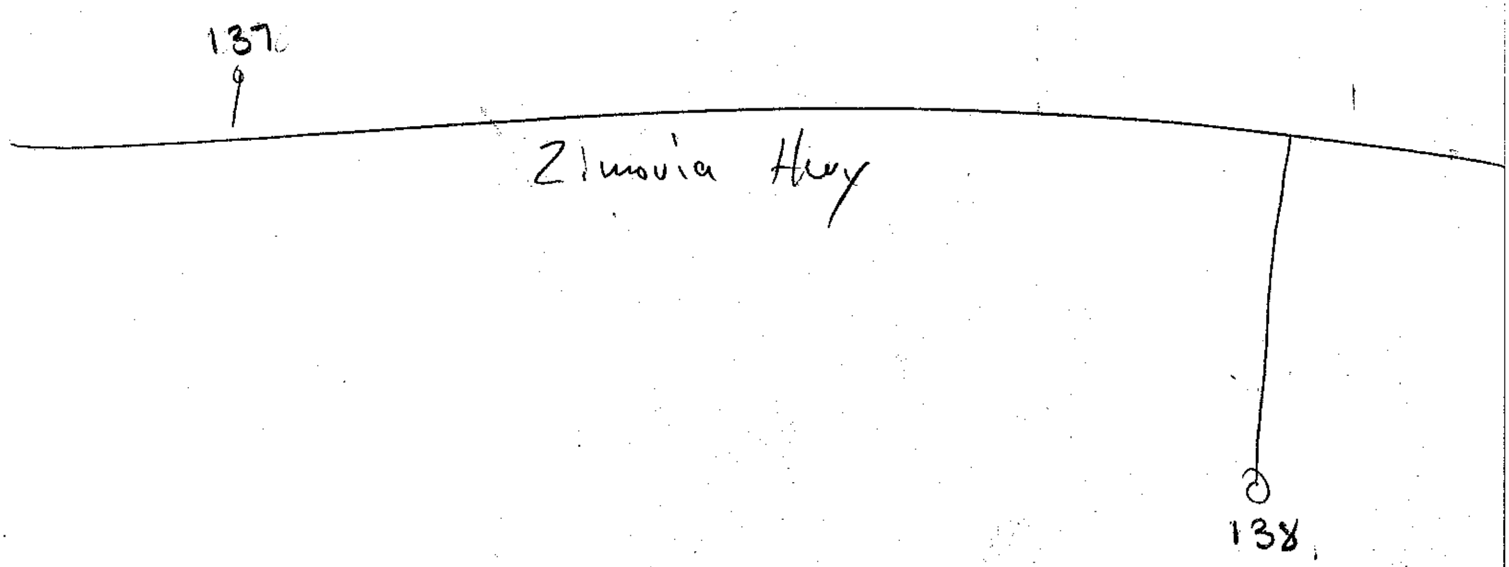
SIZE NOZZLE 2"

PITOT READING 88 psi TOTAL GPM 1115

STATIC B 142 psi RESIDUAL B 102 psi

PROJECTED RESULTS @ 20 psi 2037 gpm, or @ 0 psi RESIDUAL 2210 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Zimovia Hwy #139 DATE 10-24-00

TEST MADE BY Gary and Rob TIME 11:15 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 139 A1 138 A2 A3 A4

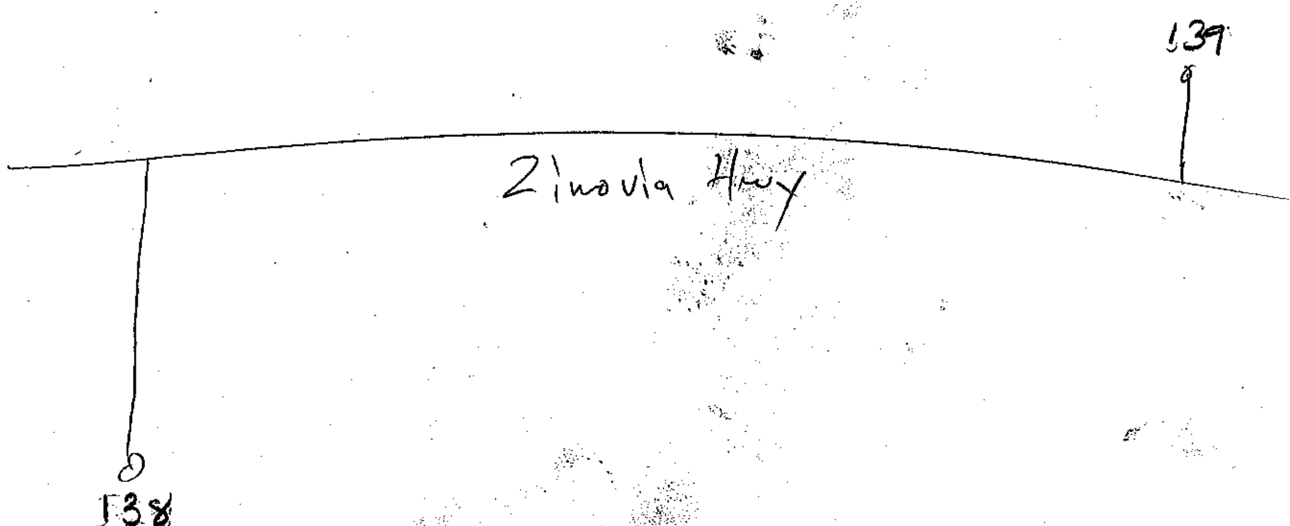
SIZE NOZZLE 2"

PITOT READING 88 psi TOTAL GPM 1115

STATIC B 142 psi RESIDUAL B 100 psi

PROJECTED RESULTS @ 20 psi 1983 gpm, or @ 0 psi RESIDUAL 2152 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Zimovia Hwy #140 DATE 10-24-00

TEST MADE BY Gary and Rob TIME 11:22 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 140 A1 139 A2 A3 A4

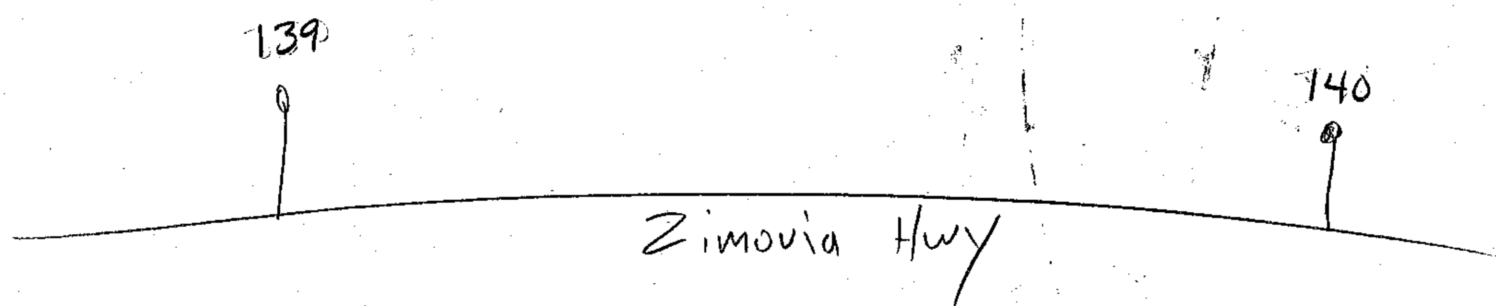
SIZE NOZZLE 2"

PITOT READING 98 psi TOTAL GPM 1128

STATIC B 142 psi RESIDUAL B 100 psi

PROJECTED RESULTS @ 20 psi 2006 gpm, or @ 0 psi RESIDUAL 2177 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

#141

LOCATION Zimovia Hwy DATE 10-24-00

TEST MADE BY Gary and Rob TIME 1:56 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 141 A1 140 A2 A3 A4

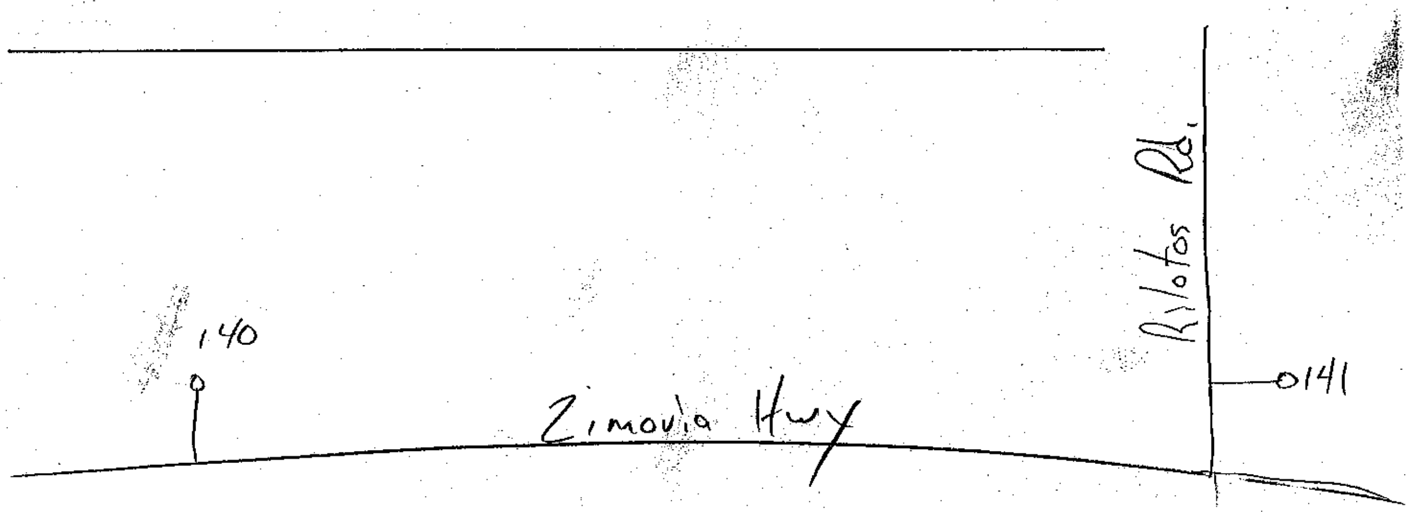
SIZE NOZZLE 2"

PITOT READING 86 psi TOTAL GPM 1102

STATIC B 132 psi RESIDUAL B 100 psi

PROJECTED RESULTS @ 20 psi 2167 gpm, or @ 0 psi RESIDUAL 2368 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #142 Zimovia Hwy DATE 10-24-00

TEST MADE BY Gary w/ Rob TIME 2:00 P .M.

REPRESENTATIVE OF Public Works

WITNESS ______

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ______

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ______

FLOW HYDRANTS 142 A1 141 A2 ______ A3 ______ A4 ______

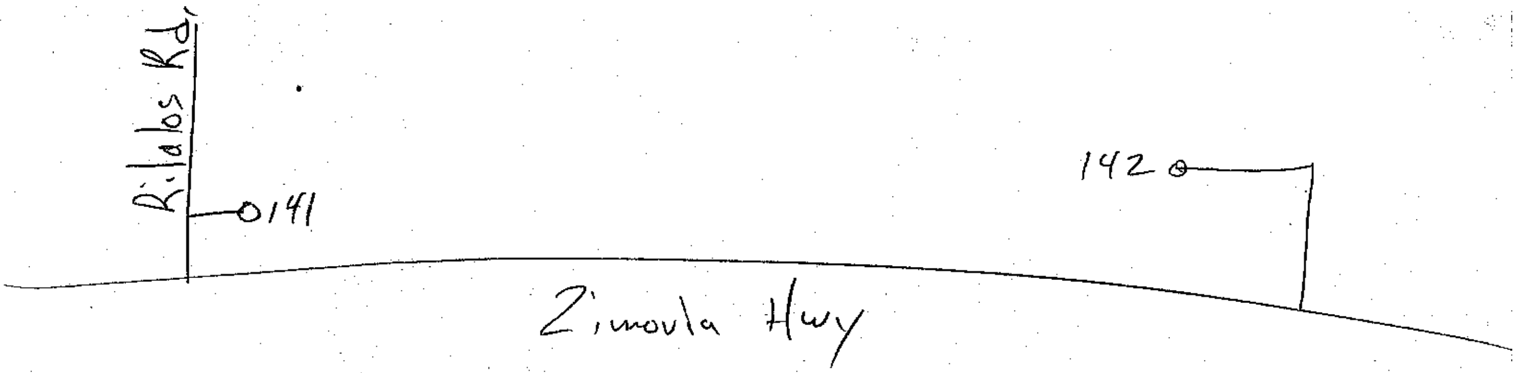
SIZE NOZZLE 2"

PITOT READING 90 psi TOTAL GPM 1128

STATIC B 134 psi RESIDUAL B 102 psi

PROJECTED RESULTS @ 20 psi 2239 gpm, or @ 0 psi RESIDUAL 2443 gpm

REMARKS ______



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #143 Zimovia Hwy DATE 10-24-00

TEST MADE BY Lonny and Bob TIME 2:07 P.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 143 A1 142 A2 A3 A4

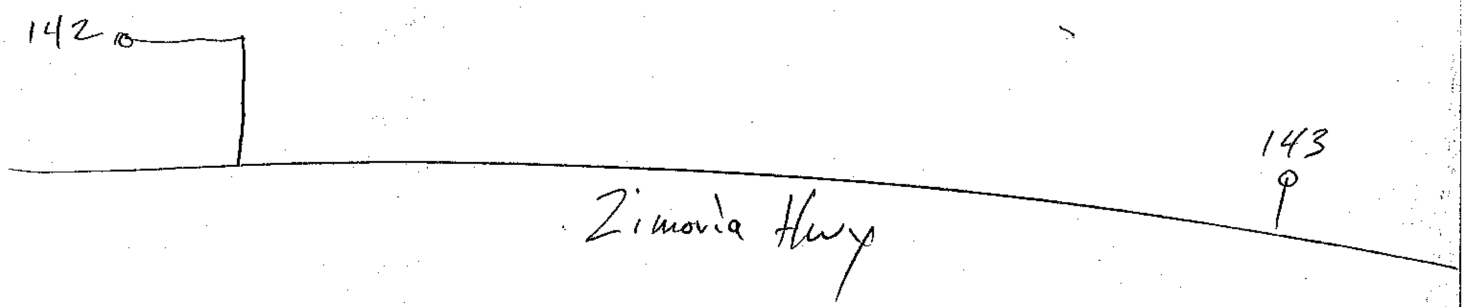
SIZE NOZZLE 2"

PITOT READING 88 psi TOTAL GPM 1115

STATIC B 134 psi RESIDUAL B 100 psi

PROJECTED RESULTS @ 20 psi 2144 gpm, or @ 0 psi RESIDUAL 2340 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #144 Zimovia Hwy DATE 10-24-00

TEST MADE BY Gary and Rob TIME 2:16 P.M.

REPRESENTATIVE OF PUBLIC Works

WITNESS

STATE PURPOSE OF TEST Flows

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 144 A1 143 A2 A3 A4

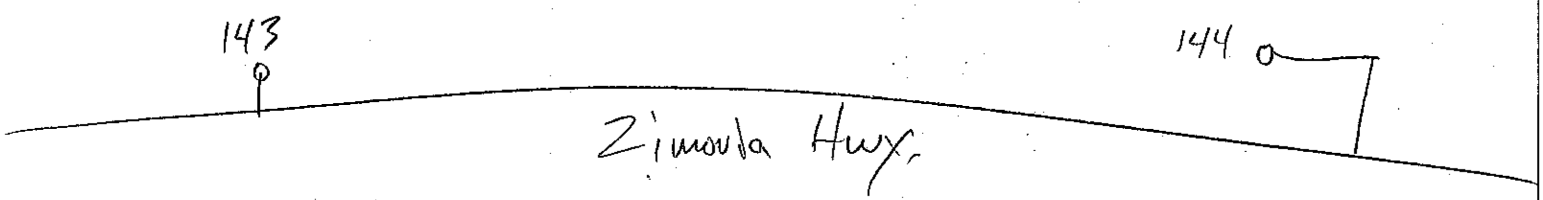
SIZE NOZZLE 2"

PITOT READING 90 psi TOTAL GPM 1128

STATIC B 136 psi RESIDUAL B 102 psi

PROJECTED RESULTS @ 20 psi 2190 gpm, or @ 0 psi RESIDUAL 2385 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #145 Zimovia Hwy. DATE 10-24-00

TEST MADE BY Gary and Rob TIME 2:22 P.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 145 A1 144 A2 A3 A4

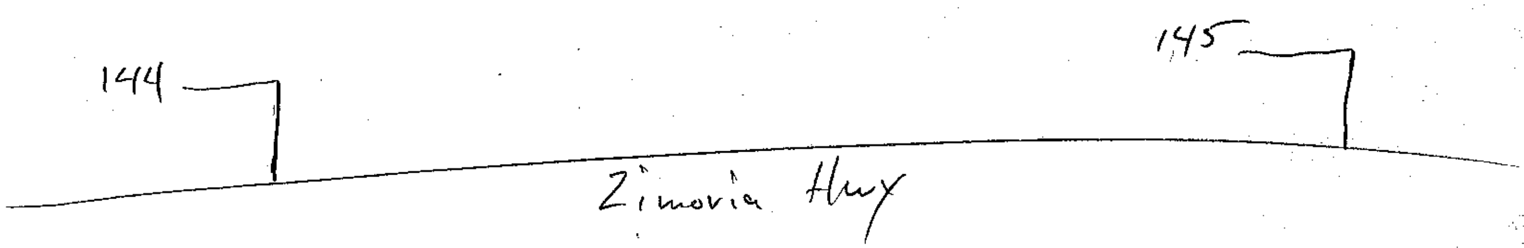
SIZE NOZZLE 2"

PITOT READING 86 psi TOTAL GPM 1102

STATIC B 136 psi RESIDUAL B 102 psi

PROJECTED RESULTS @ 20 psi 2140 gpm, or @ 0 psi RESIDUAL 2330 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #146 Zimovia Hwy DATE 10-24-00

TEST MADE BY Gary and Rob (Homo) TIME 2:31 .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 146 A1 145 A2 A3 A4

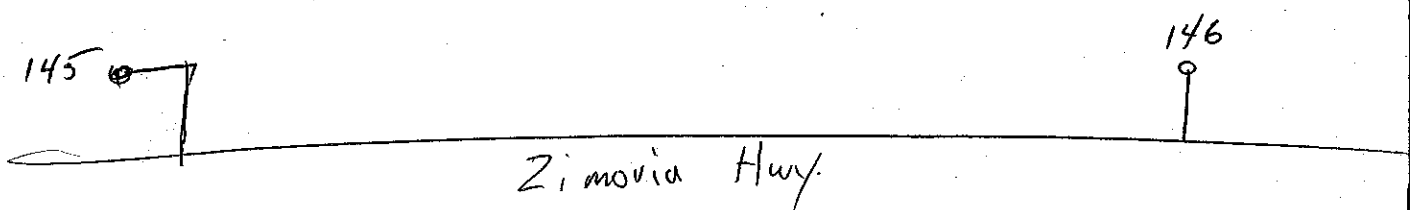
SIZE NOZZLE 2"

PITOT READING 84 psi TOTAL GPM 1089

STATIC B 134 psi RESIDUAL B 100 psi

PROJECTED RESULTS @ 20 psi 2094 gpm, or @ 0 psi RESIDUAL 2285 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #147 Zimovia Hwy DATE 10-24-00

TEST MADE BY Gary and Rob Hand TIME 2:40 .M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 147 A1 146 A2 A3 A4

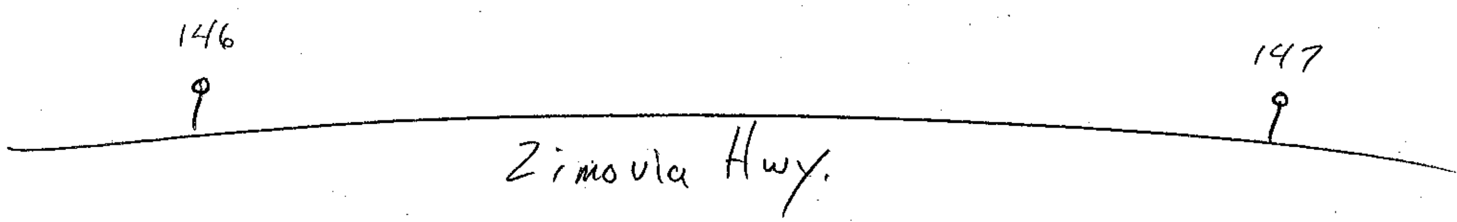
SIZE NOZZLE 2"

PITOT READING 86 psi TOTAL GPM 1102

STATIC B 134 psi RESIDUAL B 100 psi

PROJECTED RESULTS @ 20 psi 2119 gpm, or @ 0 psi RESIDUAL 2312 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #148 Zimovia Hwy. DATE 10-24-00

TEST MADE BY Gary and Rob TIME 2:55 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 148 A1 147 A2 A3 A4

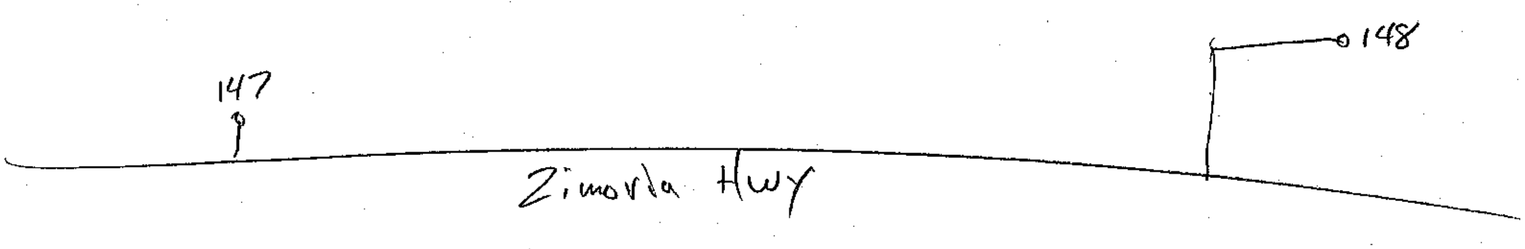
SIZE NOZZLE 2"

PITOT READING 86 psi TOTAL GPM 1102

STATIC B 134 psi RESIDUAL B 100 psi

PROJECTED RESULTS @ 20 psi 2119 gpm, or @ 0 psi RESIDUAL 2312 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #149 Zimovia Hwy DATE 10-24-00

TEST MADE BY Gary and Rob TIME 3:00 P .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS -149 A1 148 A2 A3 A4

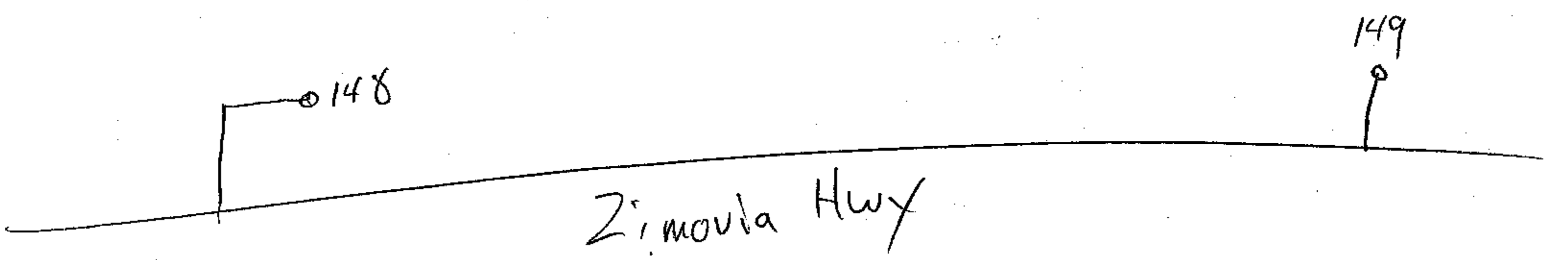
SIZE NOZZLE 2"

PITOT READING 86 psi TOTAL GPM 1102

STATIC B 134 psi RESIDUAL B 98 psi

PROJECTED RESULTS @ 20 psi 2051 gpm, or @ 0 psi RESIDUAL 2239 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #150 Zimovia Hwy. DATE 10-24-00

TEST MADE BY Gory and Rob TIME 3:09 .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS ______

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ______

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ______

FLOW HYDRANTS 150 A1 149 A2 ____ A3 ____ A4 ____

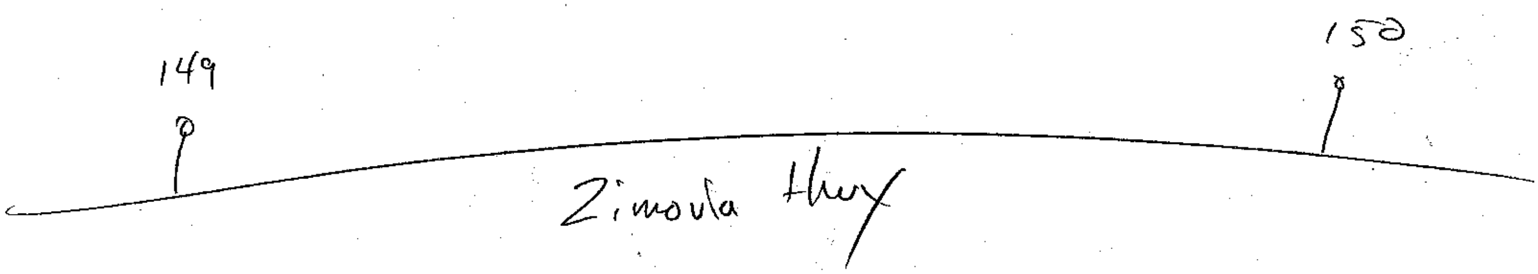
SIZE NOZZLE 2"

PITOT READING 86 psi TOTAL GPM 1102

STATIC B 134 psi RESIDUAL B 98 psi

PROJECTED RESULTS @ 20 psi 2051 gpm, or @ 0 psi RESIDUAL 2240 gpm

REMARKS ______



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #151 Zimovia Hwy DATE 10-24-00

TEST MADE BY Gary and Rob TIME 3:30 P.M.

REPRESENTATIVE OF PUBLIC Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 151 A1 150 A2 A3 A4

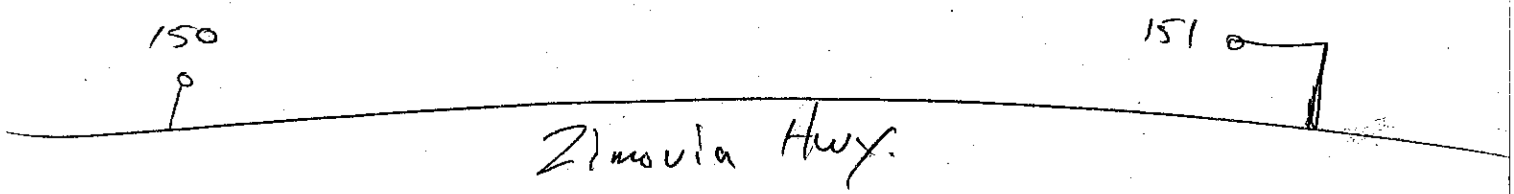
SIZE NOZZLE 2"

PITOT READING 84 psi TOTAL GPM 1089

STATIC B 132 psi RESIDUAL B 98 psi

PROJECTED RESULTS @ 20 psi 2074 gpm, or @ 0 psi RESIDUAL 2267 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #152 Zimovia Hwy DATE 10-24-00

TEST MADE BY Gary and Rob TIME 4:00 P .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS ______

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ______

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ______

FLOW HYDRANTS 152 A1 151 A2 ____ A3 ____ A4 ____

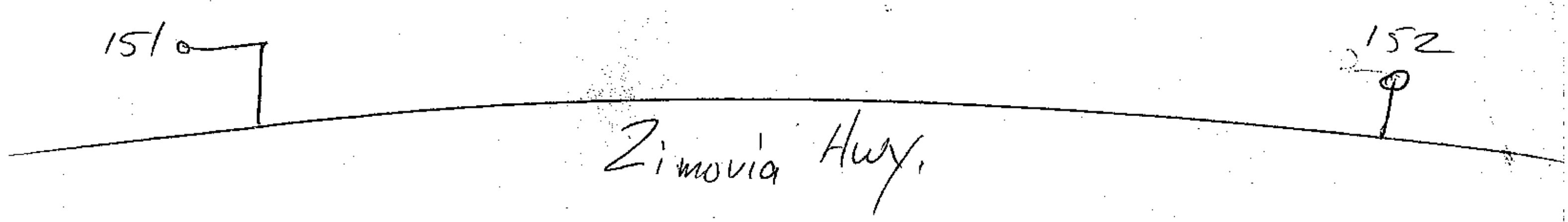
SIZE NOZZLE 2"

PITOT READING 82 psi TOTAL GPM 1076

STATIC B 134 psi RESIDUAL B 96 psi

PROJECTED RESULTS @ 20 psi 1947 gpm, or @ 0 psi RESIDUAL 2125 gpm

REMARKS ______



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #153 Zimovia Hwy DATE 10-27-00

TEST MADE BY Larry and Rob TIME 9:10 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 153 A1 152 A2 A3 A4

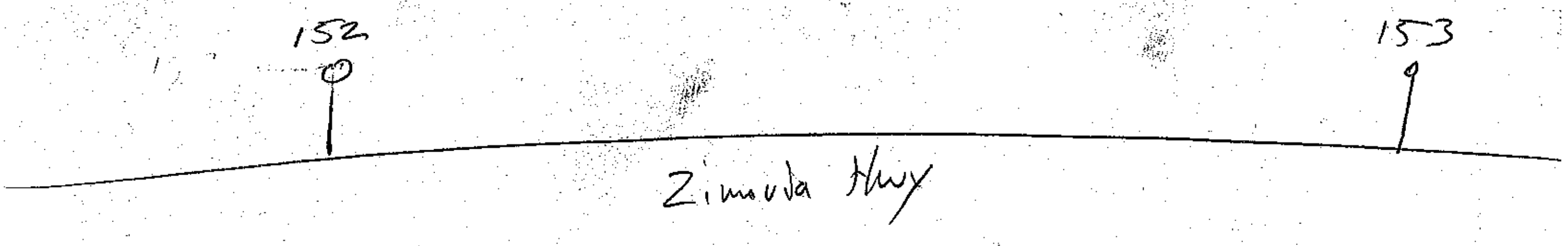
SIZE NOZZLE 2"

PITOT READING 84 psi TOTAL GPM 1089

STATIC B 130 psi RESIDUAL B 93 psi

PROJECTED RESULTS @ 20 psi 1961 gpm, or @ 0 psi RESIDUAL 2145 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #154 Zimovia Hwy DATE 10-27-00

TEST MADE BY Garry and Rob TIME 9:26 M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 154 A1 153 A2 A3 A4

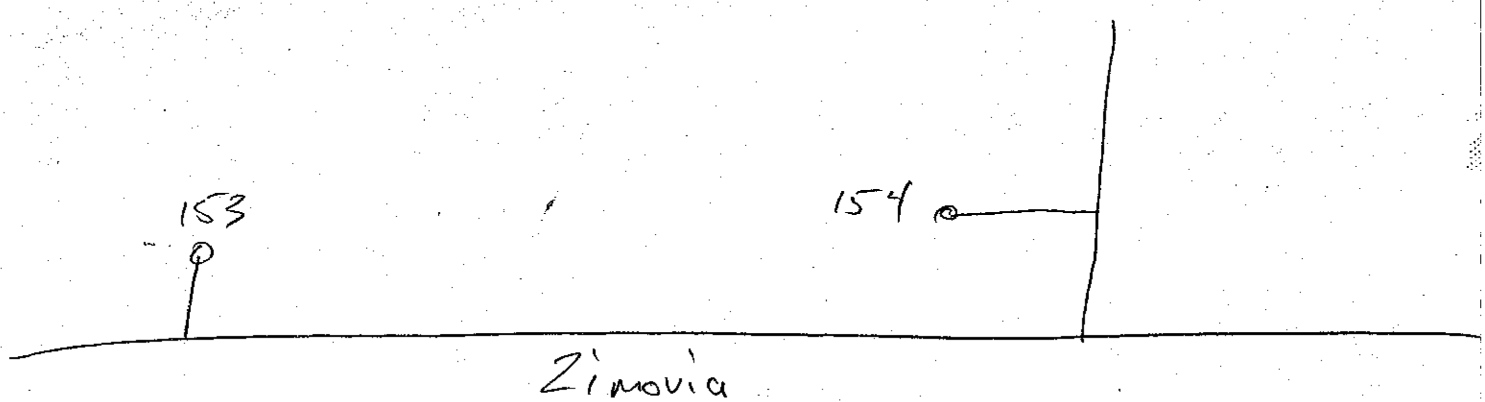
SIZE NOZZLE 2"

PITOT READING 80 psi TOTAL GPM 1063

STATIC B 131 psi RESIDUAL B 93 psi

PROJECTED RESULTS @ 20 psi 1896 gpm, or @ 0 psi RESIDUAL 2074 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #155 Zimovia Hwy DATE 10-27-00

TEST MADE BY Gary and Rob TIME 9:45 A.M.

REPRESENTATIVE OF PUBLIC Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 155 A1 154 A2 A3 A4

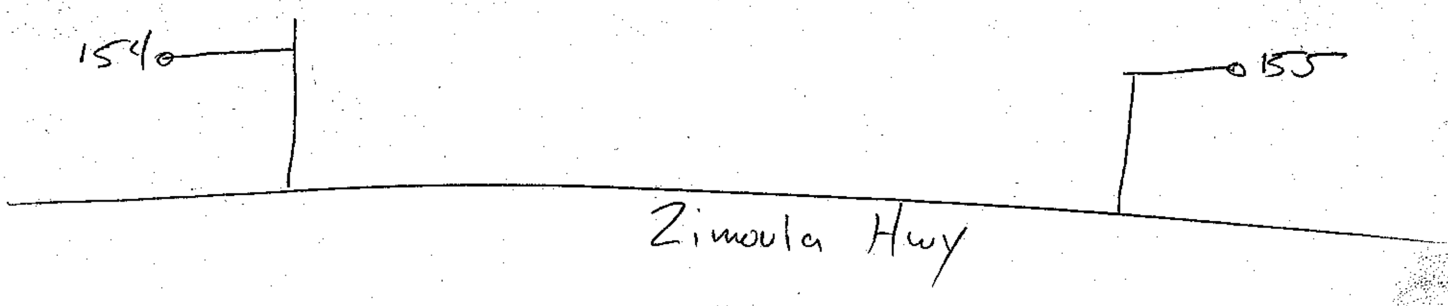
SIZE NOZZLE 2"

PITOT READING 80 psi TOTAL GPM 1063

STATIC B 130 psi RESIDUAL B 93 psi

PROJECTED RESULTS @ 20 psi 1914 gpm, or @ 0 psi RESIDUAL 2094 gpm

REMARKS DID NOT SHUT OFF



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #156 Zimovia Hwy DATE 10-27-00

TEST MADE BY Gary and Rob TIME 10:00 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 156 A1 155 A2 A3 A4

SIZE NOZZLE 2"

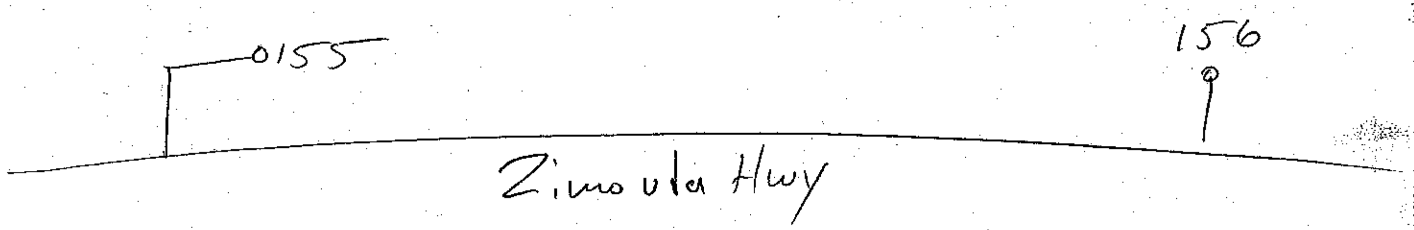
PITOT READING 74 psi TOTAL GPM 1023

STATIC B 125 psi RESIDUAL B 86 psi

PROJECTED RESULTS @ 20 psi 1746 gpm, or @ 0 psi RESIDUAL 1919 gpm

REMARKS Needs raised

155 Did not shut off



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #157 Zimovia Hwy DATE 10-27-00

TEST MADE BY Gary and Rob TIME 10:06 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 157 A1 156 A2 A3 A4

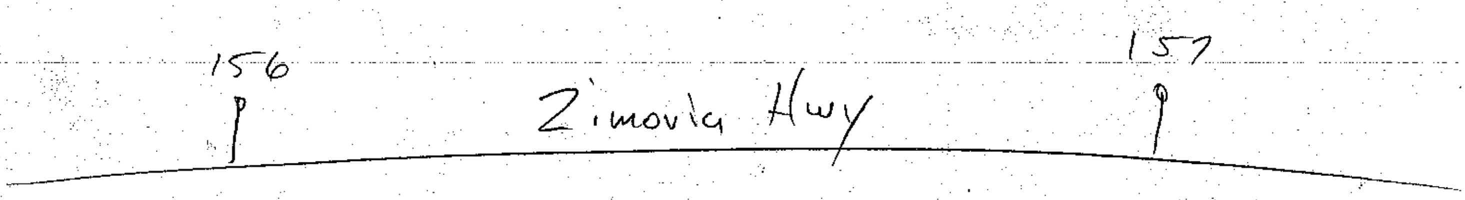
SIZE NOZZLE 2"

PITOT READING 78 TOTAL GPM 1050

STATIC B 128 psi RESIDUAL B 86 psi

PROJECTED RESULTS @ 20 psi 1747 gpm, or @ 0 psi RESIDUAL 1916 gpm

REMARKS Does not shut off!



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION # 158 Zimovia Hwy DATE 10-27-00

TEST MADE BY Gary and Rob TIME 10:31 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 158 A1 157 A2 A3 A4

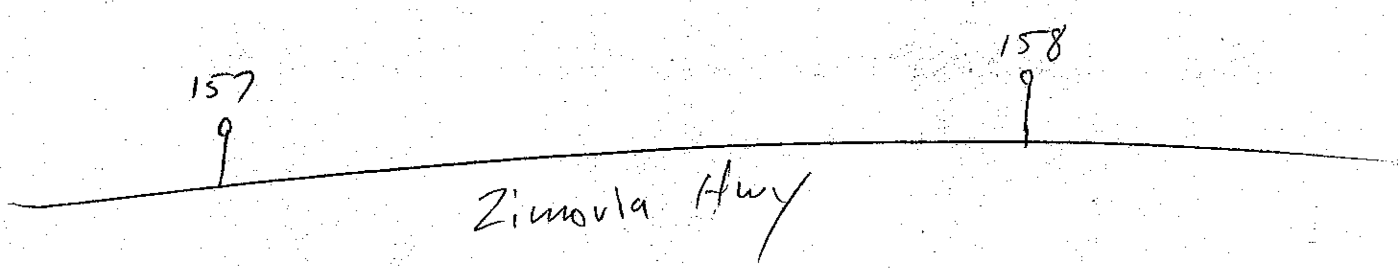
SIZE NOZZLE 2"

PITOT READING 70 TOTAL GPM 994

STATIC B 122 psi RESIDUAL B 86 psi

PROJECTED RESULTS @ 20 psi 1743 gpm, or @ 0 psi RESIDUAL 1921 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #159 Zimovia Hwy DATE 10-27-00

TEST MADE BY Gary and Rob TIME 10:40 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 159 A1 158 A2 A3 A4

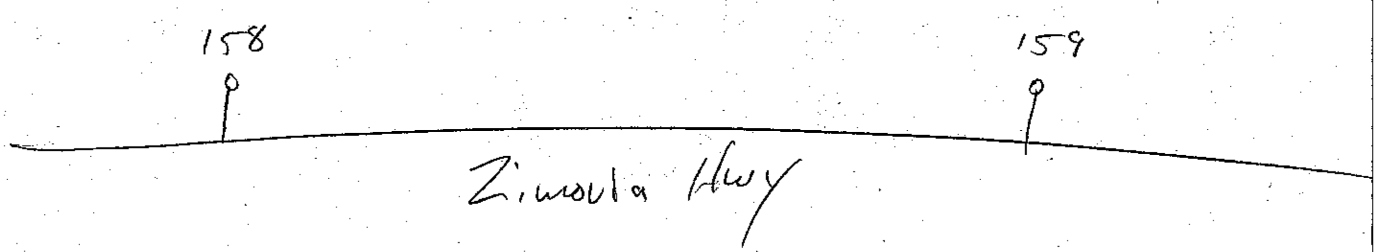
SIZE NOZZLE 2"

PITOT READING 68 TOTAL GPM 980

STATIC B 125 psi RESIDUAL B 80 psi

PROJECTED RESULTS @ 20 psi 1548 gpm, or @ 0 psi RESIDUAL 1702 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Shoemaker Bay DATE 10-27-00

TEST MADE BY Gory and Rob TIME 2:43 P.M.

REPRESENTATIVE OF Public Works

WITNESS ______

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST ______

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING ______

FLOW HYDRANTS South Dock A1 North Dock A2 ______ A3 ______ A4 ______

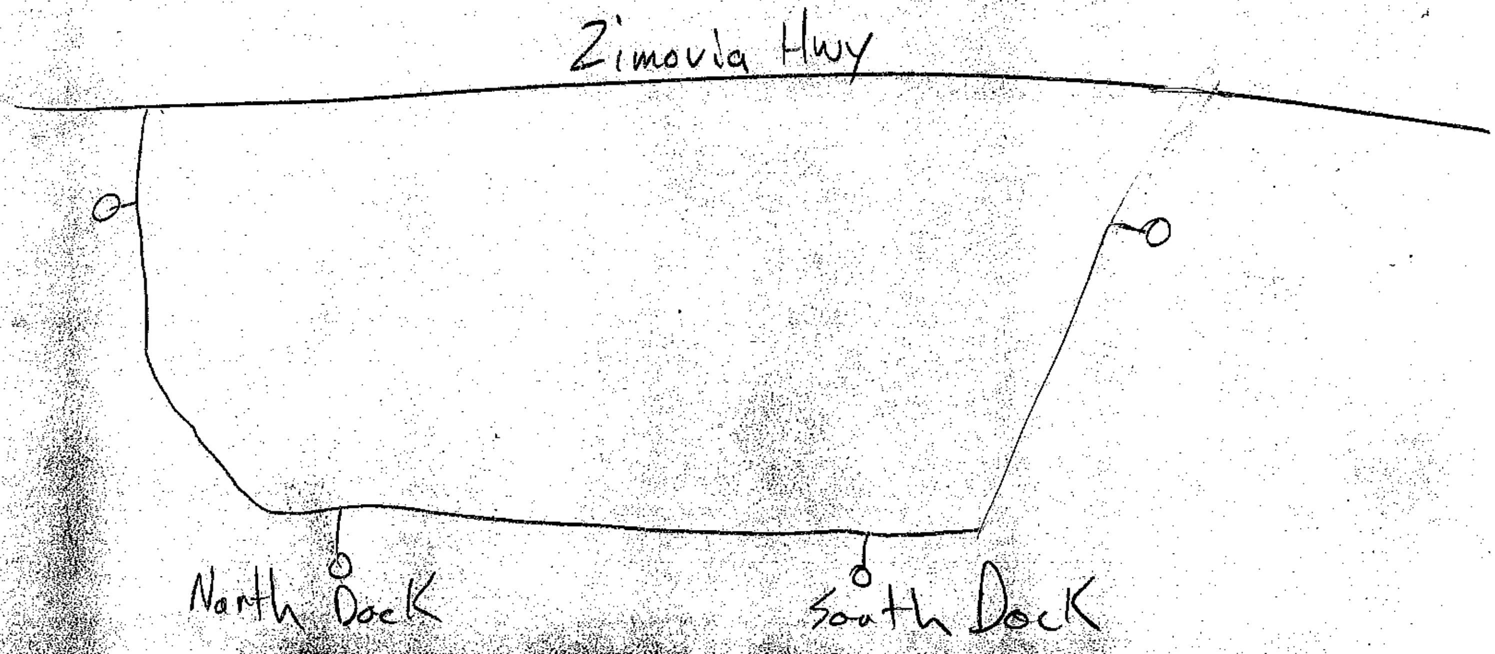
SIZE NOZZLE 2"

PITOT READING 60 TOTAL GPM 920

STATIC B 132 psi ______ RESIDUAL B 74 psi

PROJECTED RESULTS @ 20 psi 1312 gpm, or @ 0 psi RESIDUAL 1434 gpm

REMARKS ______



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Shoemaker Bay DATE 10-27-00

TEST MADE BY Gary and Bob TIME 3:00 P .M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS South Shoemaker A1 South Dock A2 A3 A4

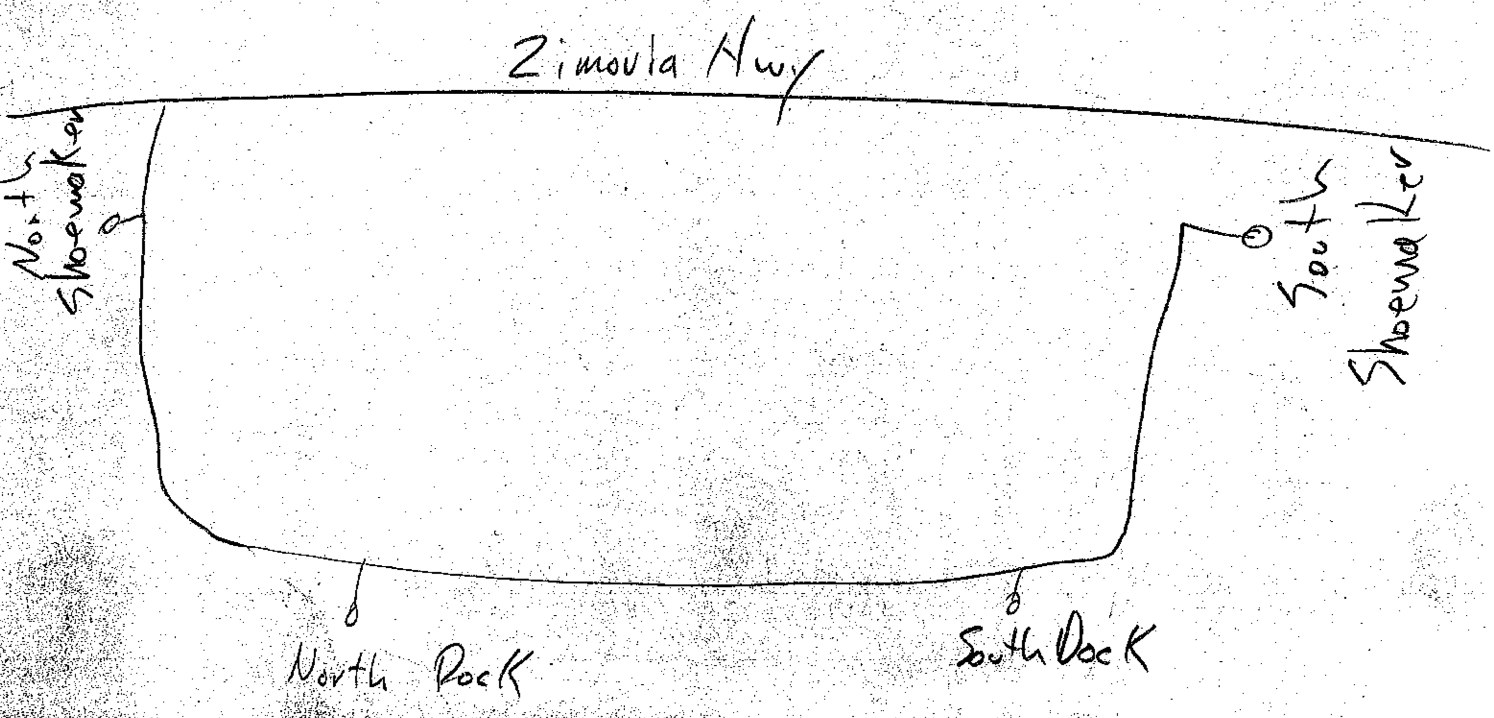
SIZE NOZZLE 2"

PITOT READING 56 TOTAL GPM 889

STATIC B 134 psi RESIDUAL B 74 psi

PROJECTED RESULTS @ 20 psi 1257 gpm, or @ 0 psi RESIDUAL 1372 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY AND BOROUGH OF WRANGELL

LOCATION: Shoemaker Bay Harbor **DATE:** 9-15-15

TESTED BY: G. Pullman and Stan Campbell **TIME:** ______ .M.

REPRESENTATIVE OF: City of Wrangell

WITNESS: ______

PURPOSE OF TEST: Pressure and flow tests for SMB Harbor Construction PND Engineering

CONSUMPTION RATE DURING TEST: ______

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING: ______

FLOW HYDRANTS: 2240 (2240) **A1** Z239 **A2** ______ **A3** ______ **A4** ______

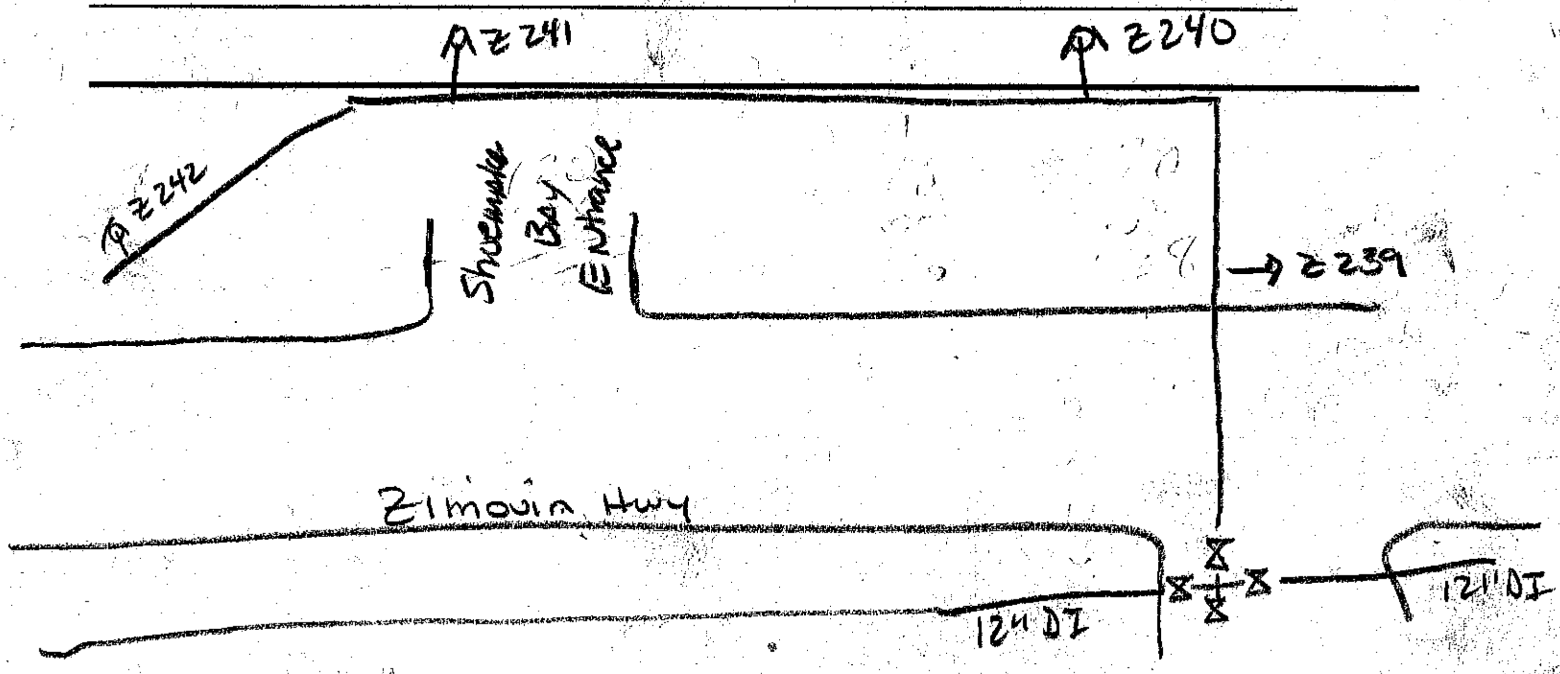
SIZE NOZZLE 2 1/2" Hydrant Port

PITOT READING NA **PSI** **TOTAL GPM** 1116 7 1220

STATIC B (2239) 120 **PSI** ______ **RESIDUAL B** 78 **PSI**

PRJECTED RESULTS @ 20 PSI 1862 **GPM, OR @** 0 **PSI RESIDUAL** 2056 **GPM**

REMARKS: Map on Reverse



HYDRANT FLOW TEST REPORT
CITY AND BOROUGH OF WRANGELL

LOCATION: Shoemaker Bay Harbor DATE: 9-15-15

TESTED BY: G. Pollman TIME: ______ .M.

REPRESENTATIVE OF: City of Wrangell

WITNESS: ______

PURPOSE OF TEST: Pressure and flow test for SMD Harbor Contruction PND Engineering

CONSUMPTION RATE DURING TEST: ______

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING: ______

FLOW HYDRANTS: Z242 A1 Z239 A2 ______ A3 ______ A4 ______

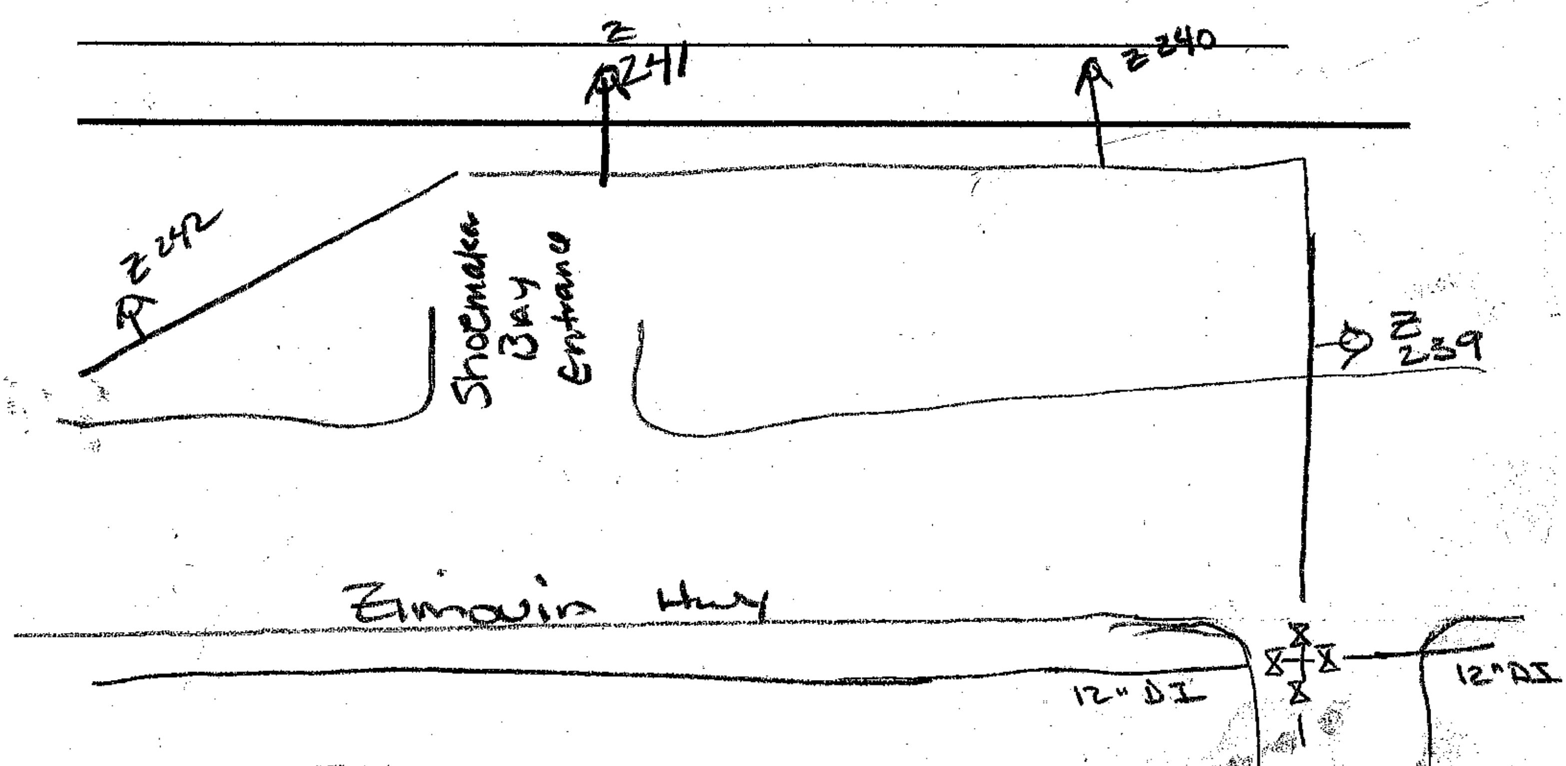
SIZE NOZZLE 2½" Hydrant Port

PITOT READING NA PSI TOTAL GPM 1115

STATIC B 120 PSI ______ RESIDUAL B 80 PSI

PRIJECTED RESULTS @ 20 PSI 1828 GPM, OR @ 0 PSI RESIDUAL 2018 GPM

REMARKS: ______



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #165 Zimovia Hwy DATE 10-27-00

TEST MADE BY Gary and Rob TIME 3:10 P.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 165 A1 164 A2 A3 A4

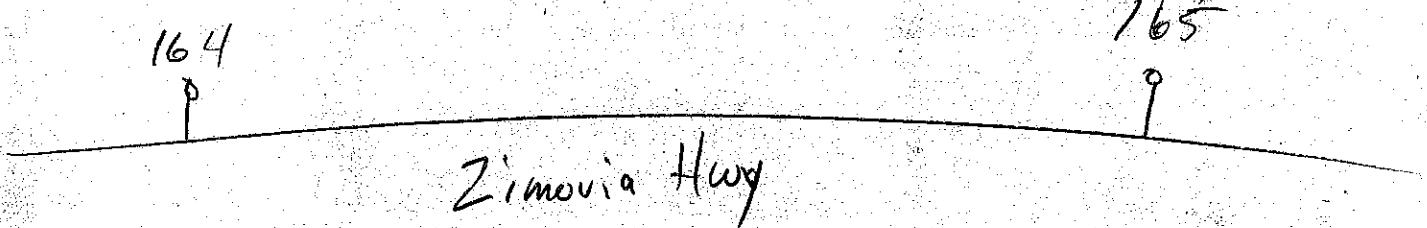
SIZE NOZZLE 2"

PITOT READING 62 TOTAL GPM 936

STATIC B 136 psi RESIDUAL B 74 psi

PROJECTED RESULTS @ 20 psi 1313 gpm, or @ 0 psi RESIDUAL 1430 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #166 Zimovia Hwy DATE 10-27-00

TEST MADE BY Gary and Rob TIME 3:18 P.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST FLOW

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 166 A1 165 A2 A3 A4

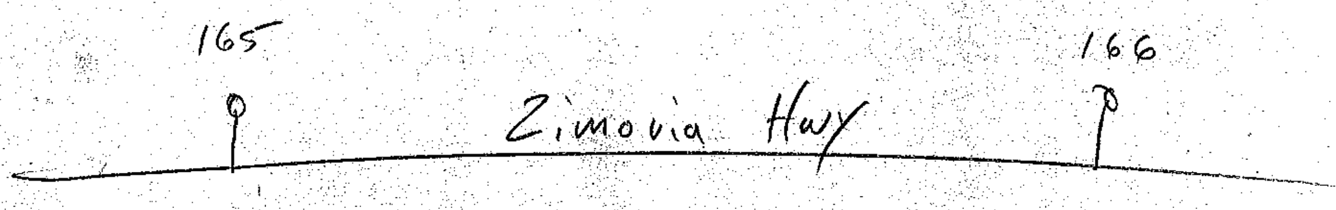
SIZE NOZZLE 2

PITOT READING 60 TOTAL GPM 920

STATIC B 132 psi RESIDUAL B 74 psi

PROJECTED RESULTS @ 20 psi 1312 gpm, or @ 0 psi RESIDUAL 1434 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #167 Zimovia Hwy DATE 10-27-00

TEST MADE BY Gary and Rob TIME 3:27 P.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST FLOW

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 167 A1 166 A2 A3 A4

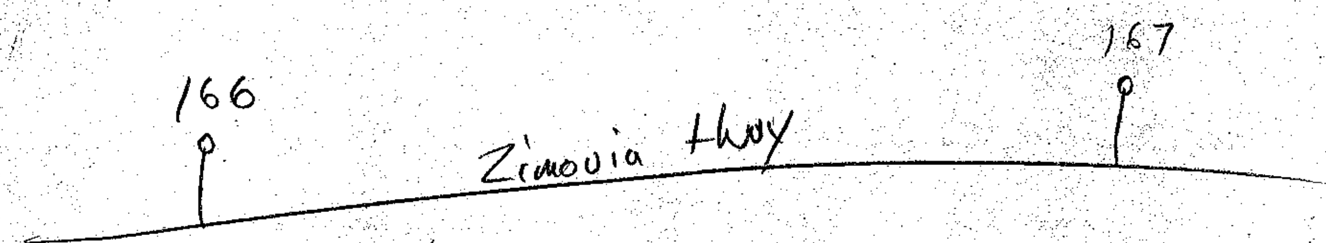
SIZE NOZZLE 2"

PITOT READING 62 TOTAL GPM 936

STATIC B 132 psi RESIDUAL B 70 psi

PROJECTED RESULTS @ 20 psi 1288 gpm, or @ 0 psi RESIDUAL 1408 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #168 Zimovia Hwy DATE 10-27-00

TEST MADE BY Gary and Rob TIME 3:40 P.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 168 A1 167 A2 A3 A4

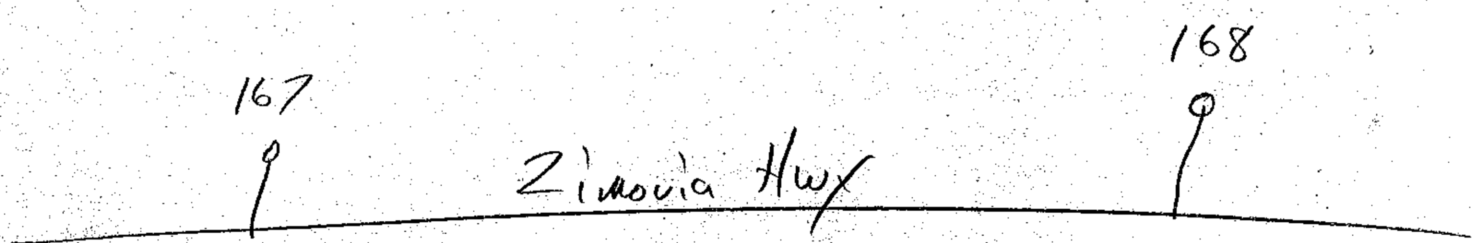
SIZE NOZZLE

PITOT READING 64 TOTAL GPM 957

STATIC B 130 psi RESIDUAL B 72 psi

PROJECTED RESULTS @ 20 psi 1344 gpm, or @ 0 psi RESIDUAL 1470 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #169 Zimovia Hwy DATE 10-27-00

TEST MADE BY Gary and Rob TIME 4:00 P.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 169 A1 170 A2 A3 A4

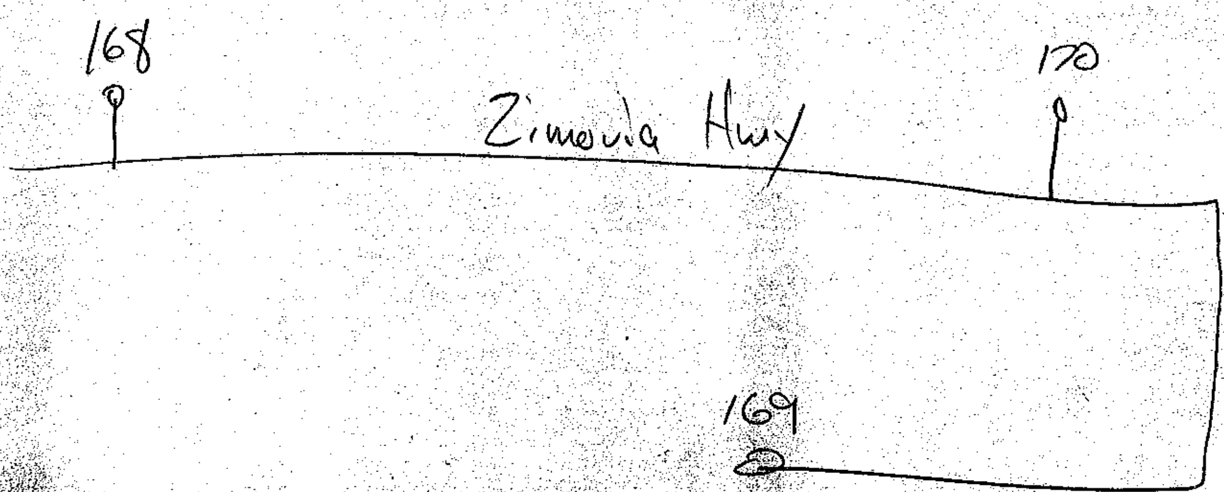
SIZE NOZZLE

PITOT READING 58 TOTAL GPM 905

STATIC B 132 psi RESIDUAL B 70 psi

PROJECTED RESULTS @ 20 psi 1245 gpm, or @ 0 psi RESIDUAL 1360 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION #170 Zimovia Hwy DATE 10-27-00

TEST MADE BY Gary and Rob TIME 3:50 P.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 170 A1 168 A2 A3 A4

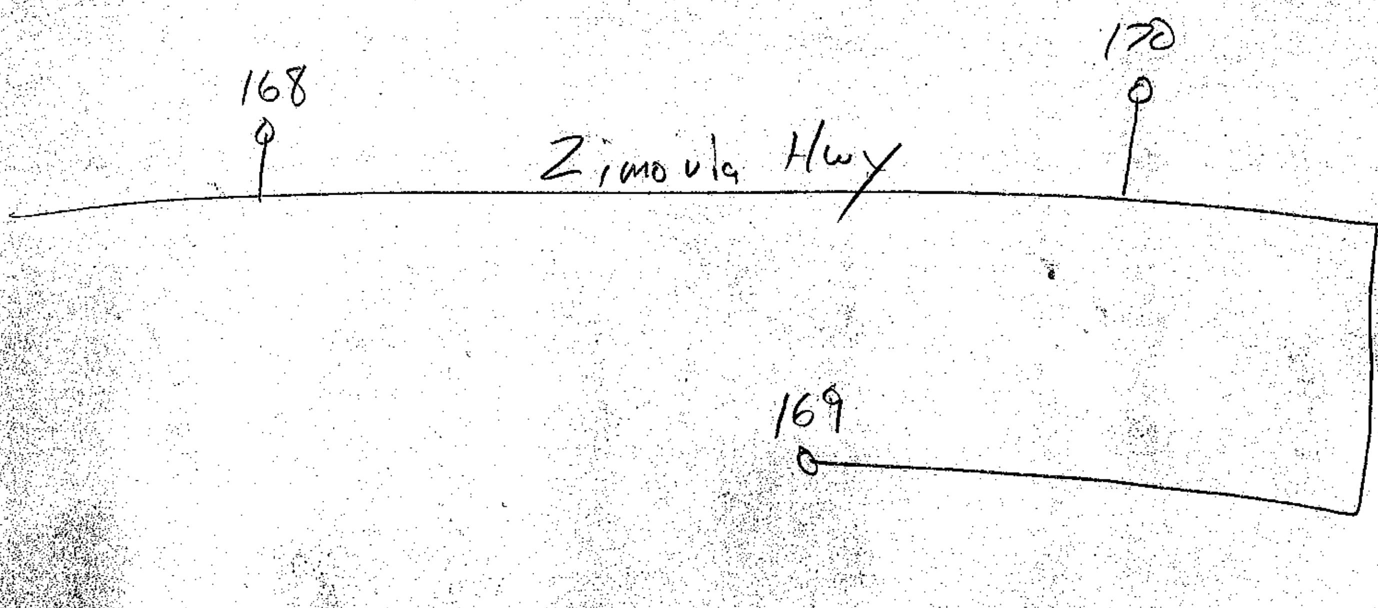
SIZE NOZZLE 2"

PITOT READING 64 TOTAL GPM 951

STATIC B 132 psi RESIDUAL B 76 psi

PROJECTED RESULTS @ 20 psi 1384 gpm, or @ 0 psi RESIDUAL 1511 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Shoemaker Loop #201 DATE 11-3-00

TEST MADE BY Gary and Carl TIME 1:26 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 201 A1 170 A2 A3 A4

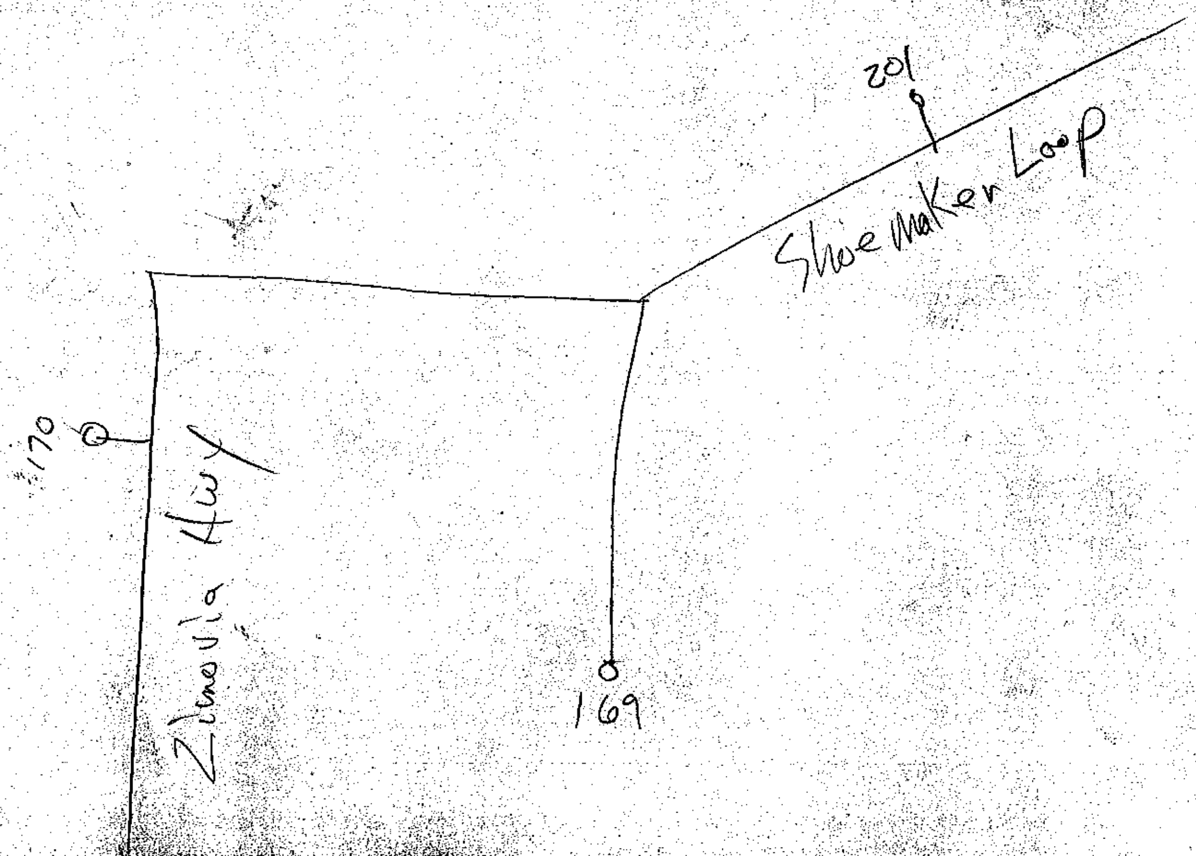
SIZE NOZZLE 2"

PITOT READING 54 TOTAL GPM 873

STATIC B 126 psi RESIDUAL B 66 psi

PROJECTED RESULTS @ 20 psi 1188 gpm, or @ 0 psi RESIDUAL 1304 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Shoemaker Loop #202 DATE 11-3-00

TEST MADE BY Carl and Gary TIME 8:56 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 202 A1 201 A2 A3 A4

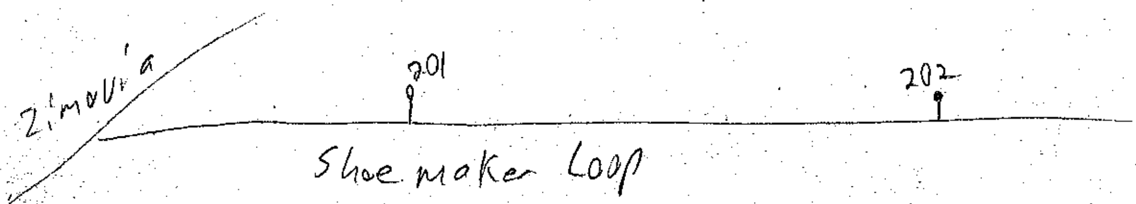
SIZE NOZZLE 2"

PITOT READING 54 TOTAL GPM 873

STATIC B 126 psi RESIDUAL B 64 psi

PROJECTED RESULTS @ 20 psi 1166 gpm, or @ 0 psi RESIDUAL 1280 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Shoemaker Loop Road #203 DATE 11-3-00

TEST MADE BY Carl and Gary TIME 9:05 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 203 A1 202 A2 A3 A4

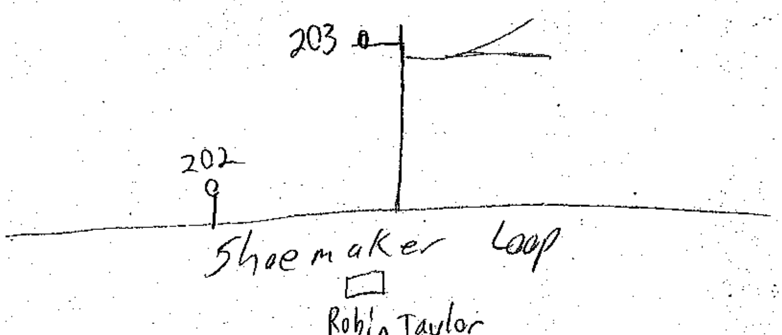
SIZE NOZZLE 2"

PITOT READING 50 TOTAL GPM 841

STATIC B 126 psi RESIDUAL B 68 psi

PROJECTED RESULTS @ 20 psi 1165 gpm, or @ 0 psi RESIDUAL 1278 gpm

REMARKS Hydrant has no riser and lid on the valve.



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Shoemaker Loop #204 DATE 11-3-00

TEST MADE BY Carl and Gary TIME 9:15 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 204 A1 202 A2 A3 A4

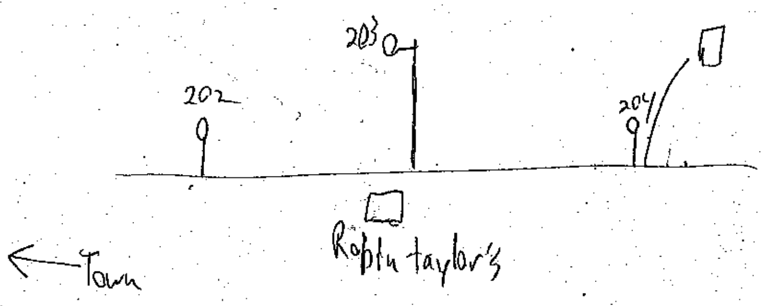
SIZE NOZZLE 2"

PITOT READING 54 TOTAL GPM 873

STATIC B 126 psi RESIDUAL B 66 psi

PROJECTED RESULTS @ 20 psi 1188 gpm, or @ 0 psi RESIDUAL 1304 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Shoemaker Loop #205 DATE 11-3-00

TEST MADE BY Carl and Gary TIME 9:26 A .M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 205 A1 204 A2 A3 A4

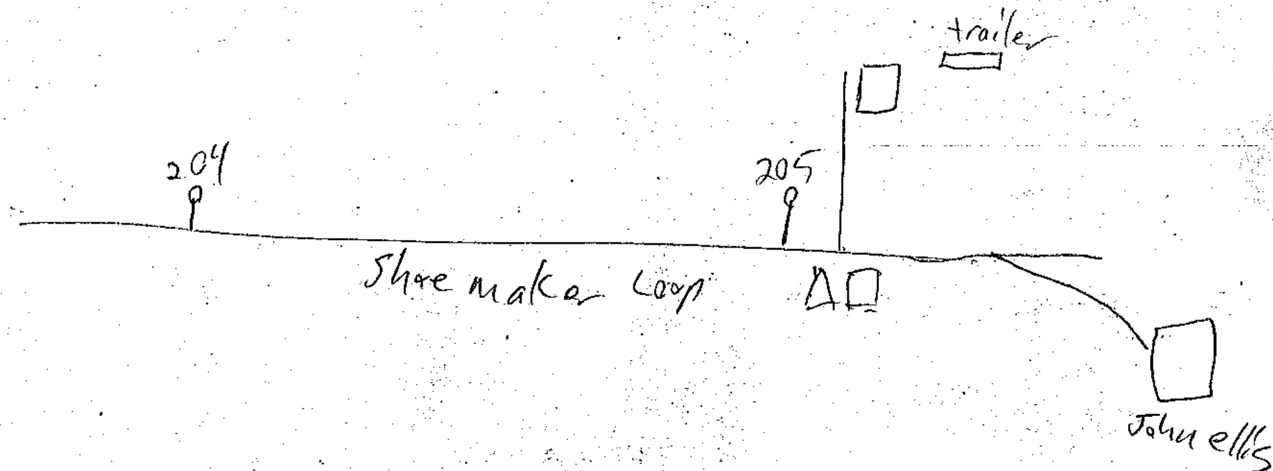
SIZE NOZZLE

PITOT READING 54 TOTAL GPM 873

STATIC B 130 psi RESIDUAL B 62 psi

PROJECTED RESULTS @ 20 psi 1132 gpm, or @ 0 psi RESIDUAL 1239 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Nemeyer Road #206 DATE 11-3-00

TEST MADE BY Carl and Gary TIME 9:35 A.M.

REPRESENTATIVE OF Public Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 206 A1 205 A2 A3 A4

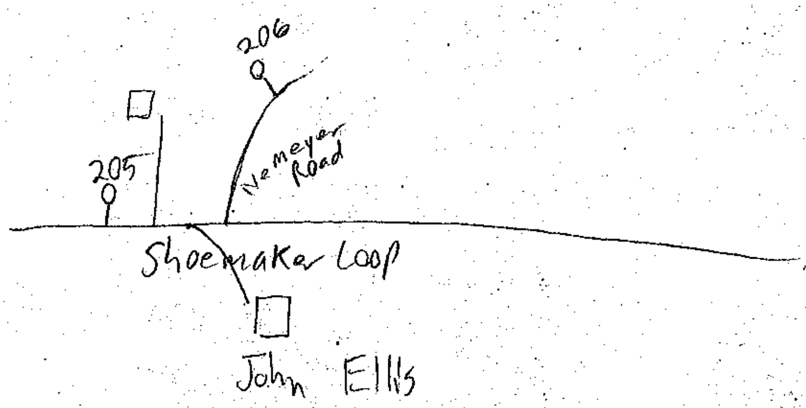
SIZE NOZZLE 2"

PITOT READING 50 TOTAL GPM 841

STATIC B 130 psi RESIDUAL B 70 psi

PROJECTED RESULTS @ 20 psi 1167 gpm, or @ 0 psi RESIDUAL 1277 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Shoemaker Loop #207 DATE 11-3-00

TEST MADE BY Carl and Gary TIME 9:50 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 207 A1 205 A2 A3 A4

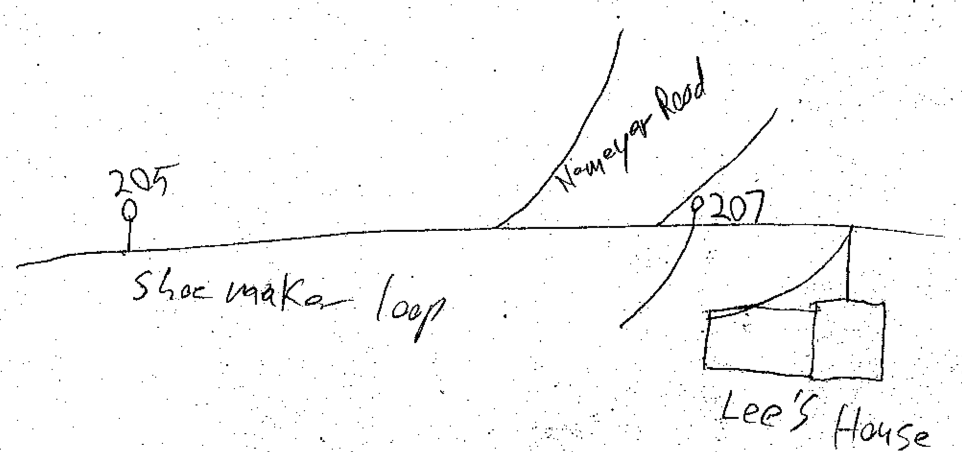
SIZE NOZZLE 2"

PITOT READING 54 TOTAL GPM 873

STATIC B 130 psi RESIDUAL B 64 psi

PROJECTED RESULTS @ 20 psi 1150 gpm, or @ 0 psi RESIDUAL 1258 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Shoemaker Loop #208 DATE 11-3-00

TEST MADE BY Carl and Gary TIME 9:59 A.M.

REPRESENTATIVE OF PUBLIC WORKS

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 208 A1 207 A2 A3 A4

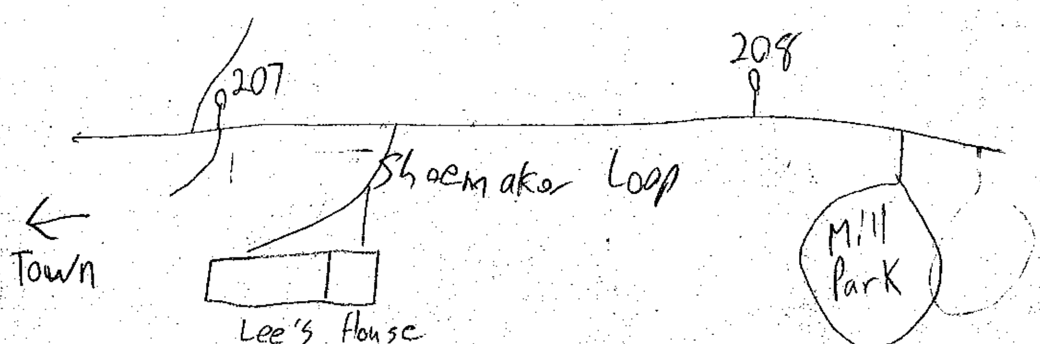
SIZE NOZZLE 2"

PITOT READING 54 TOTAL GPM 873

STATIC B 132 psi RESIDUAL B 62 psi

PROJECTED RESULTS @ 20 psi 1125 gpm, or @ 0 psi RESIDUAL 1229 gpm

REMARKS



HYDRANT FLOW TEST REPORT
CITY OF WRANGELL

LOCATION Shoemaker Loop #209 DATE 11-3-00

TEST MADE BY Carl and Gary TIME 10:11 A.M.

REPRESENTATIVE OF PUBLIC Works

WITNESS

STATE PURPOSE OF TEST Flow

CONSUMPTION RATE DURING TEST

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING

FLOW HYDRANTS 209 A1 208 A2 A3 A4

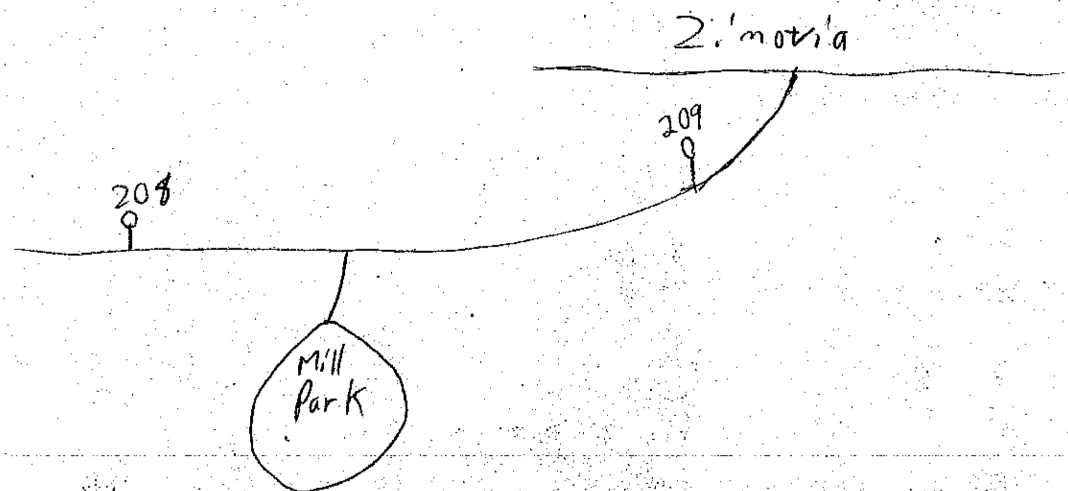
SIZE NOZZLE 2

PITOT READING 48 TOTAL GPM 824

STATIC B 130 psi RESIDUAL B 68 psi

PROJECTED RESULTS @ 20 psi 1123 gpm, or @ 0 psi RESIDUAL 1228 gpm

REMARKS



WRANGELL WATER DISTRIBUTION SYSTEM

Wrangell, Alaska 2012

Influent						
Month	Date	Daily Flow (GPD x 1K)	pH	Temp (C°)	Color (Pt-Co)	Turb (NTU)
April	April -1	646				
	April -2	647	6.6	4.6	33	0.31
	April -3	704	6.2	4.7	30	1.67
	April -4	665	6.3	4.5	33	0.39
	April -5	765	5.5	5.3	31	1.52
	April -6	777	6.2	4.0	30	1.68
	April -7	650				
	April -8	651				
	April -9	651	6.3	5.2	37	1.48
	April -10	926	6.0	6.1	33	1.07
	April -11	788	6.5	5.0	31	1.52
	April -12	716	6.8	5.9	33	1
	April -13	578	6.5	5.7	30	1.1
	April -14	609				
	April -15	609				
	April -16	609	6.5	5.5	37	1.09
	April -17	700	6.4	6.1	33	1.33
	April -18	620	6.4	5.0	34	0.91
	April -19	699	6.5	5.4	32	1.39
	April -20	699	6.5	5.9	32	1.22
	April -21	533				
	April -22	535				
	April -23	533	6.5	6.2	33	0.96
	April -24	753	6.7	5.3	30	1.02
	April -25	536	6.7	5.3	31	1.3
	April -26	802	6.5	6.1	32	1.57
	April -27	549	6.3	6.4	31	1.24
	April -28	543				
	April -29	543				
	April -30	543	6.5	5.9	30	1.18
May	May -1	613	5.6	6.5	42	1.19
	May -2	730	6.5	8.1	33	3.13
	May -3	720	6.5	5.7	30	1.53
	May -4	633	6.4	6.3	34	1.37
	May -5	682				
	May -6	617				
	May -7	617	6.4	6.8	39	1.18
	May -8	713	6.4	6.7	37	1.37
	May -9	655	6.4	7.7	40	1.09
	May -10	574	6.5	6.5	38	1.13
	May -11	419	6.4	7.3	39	2.76
	May -12	634				
	May -13	634				
	May -14	635	6.8	6.6	37	1.45
	May -15	706	6.4	7.0	39	2.06
	May -16	615	6.6	7.2	42	0.81
	May -17	662	6.2	8.5	39	0.98
	May -18	717	6.5	7.3	38	3.41
	May -19		6.4	7.9	40	0.87
	May -20	590	6.4	7.6	36	0.86
	May -21	721	6.3	7.2	39	1.11
	May -22	636	6.3	7.2	45	0.86
	May -23	592	6.4	8.7	37	1.7
	May -24	567				
	May -25					
	May -26	567				
	May -27	568				
	May -28	568				
	May -29	567	6.0	8.2	38	0.63
	May -30	629	6.2	7.9	37	1.56
	May -31	635	6.7	8.3	38	0.91

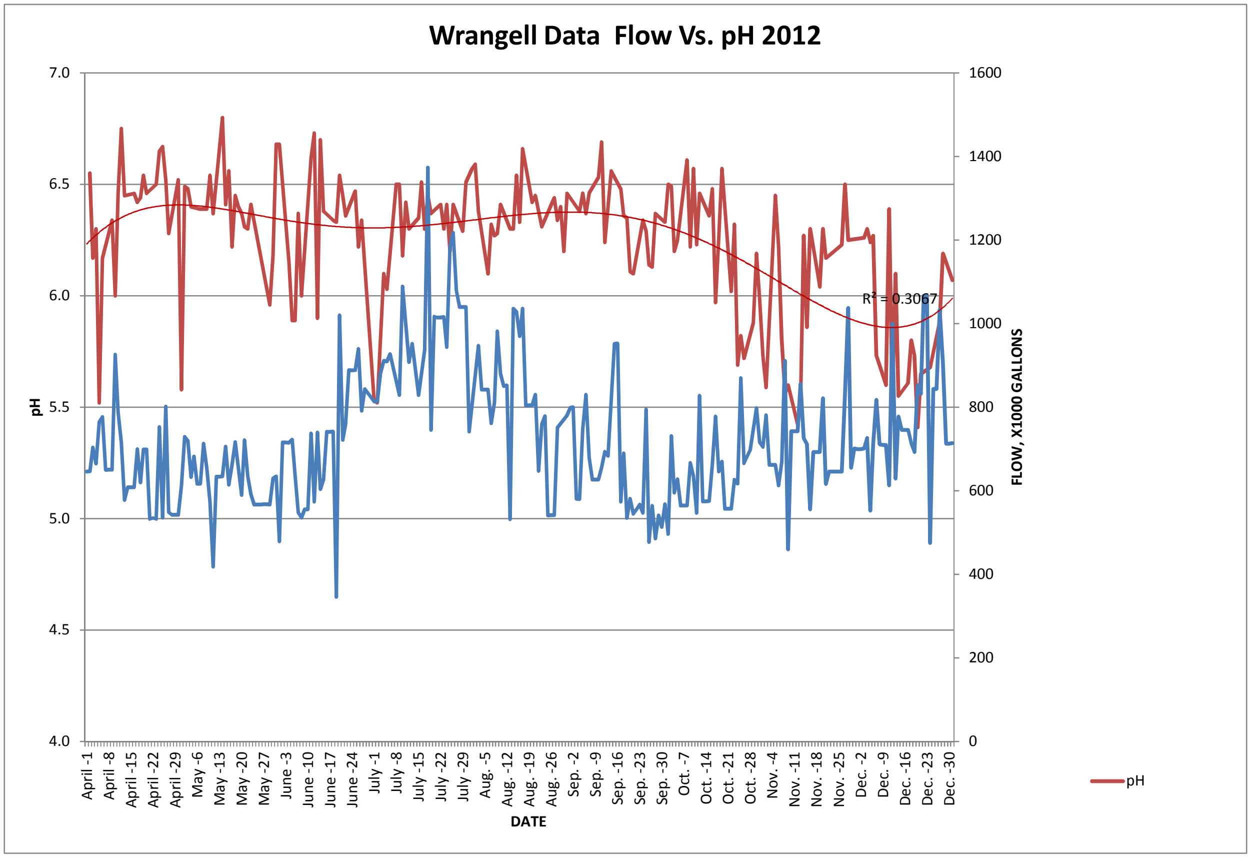
June	June -1	479	6.7	7.9	32	1.62
	June -2	716				
	June -3	716				
	June -4	715	6.2	7.9	32	0.97
	June -5	723	5.9	9.5	34	0.99
	June -6	638	5.9	9.5	34	1.11
	June -7	548	6.4	9.0	34	1.12
	June -8	536	6.0	10.2	41	2.93
	June -9	556				
	June -10	556				
	June -11	737	6.6	11.0	38	0.86
	June -12	574	6.7	9.4	28	1.32
	June -13	740	5.9	9.1	35	0.96
	June -14	604	6.7	9.6	33	1.01
	June -15	628	6.4	9.7	26	0.88
	June -16	741				
	June -17	741				
	June -18	742	6.3	10.2	32	0.95
	June -19	346	6.3	10.1	31	2.73
	June -20	1020	6.5	9.9	31	0.98
	June -21	722	6.5	10.5	39	0.82
	June -22	760	6.4	9.8	44	1.13
	June -23	889				
	June -24	888				
	June -25	889	6.5	11.4	38	0.89
	June -26	940	6.2	10.9	30	1.03
	June -27	792	6.3	11.1	32	0.85
	June -28	844				
	June -29					
	June -30					
July	July -1	814	5.5	11.2	33	0.91
	July -2	814	5.5	11.1	32	0.89
	July -3	882				
	July -4	911	6.1	11.5	30	0.94
	July -5	910	6.0	11.7	32	0.97
	July -6	927				
	July -7					
	July -8		6.5	12.0	34	0.94
	July -9	829	6.5	12.0	31	1.29
	July -10	1089	6.2	11.8	33	1.03
	July -11	999	6.4	12.3	38	1.06
	July -12	908	6.3	12.9	42	1.12
	July -13	952				
	July -14					
	July -15	829	6.4	13.3	43	1.53
	July -16		6.5	13.0	39	1.73
	July -17	937	6.3	13.3	38	1.88
	July -18	1374	6.5	13.3	36	1.51
	July -19	746	6.4	13.6	37	1.41
	July -20	1017				
	July -21	1015				
	July -22	1015	6.4	13.2	38	1.59
	July -23	1016	6.3	13.4	40	1.39
	July -24	944	6.4	12.6	37	1.29
	July -25	1183	6.2	13.4	36	1.37
	July -26	1218	6.4	13.7	39	1.41
	July -27	1080				
	July -28	1040				
	July -29	1040	6.3	13.3	35	1.67
	July -30	1040	6.5	13.5	35	1.28
	July -31	742				

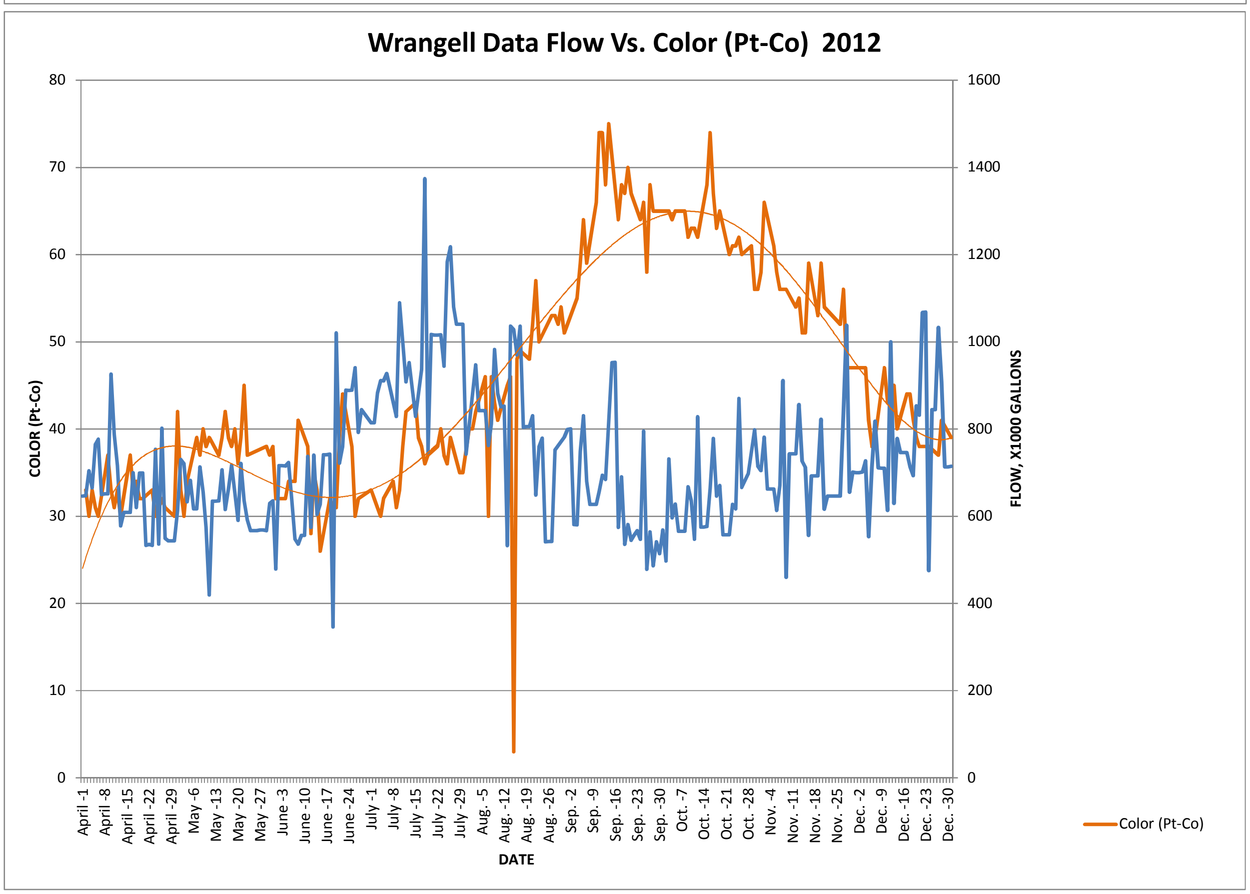
August	Aug. -1		6.6	13.7	40	1.88
	Aug. -2		6.6	14.4	40	1.67
	Aug. -3	947	6.4	13.8	42	1.52
	Aug. -4	842				
	Aug. -5	842				
	Aug. -6	842	6.1	13.8	46	2.55
	Aug. -7	762	6.3	12.6	30	1.57
	Aug. -8	811	6.3	14.3	46	2.01
	Aug. -9	982	6.3	13.9	43	1.87
	Aug. -10	881	6.4	13.2	41	1.84
	Aug. -11	851				
	Aug. -12	852				
	Aug. -13	532	6.3	12.9	45	1.72
	Aug. -14	1036	6.3	12.4	46	1.64
	Aug. -15	1028	6.5	12.8	3	0.98
	Aug. -16	970	6.3	12.7	48	1.57
	Aug. -17	1036	6.7	12.6	49	1.48
	Aug. -18	804				
	Aug. -19	805				
	Aug. -20	805	6.4	12.8	48	2.04
	Aug. -21	830	6.5	12.7	52	2.23
	Aug. -22	648	6.4	13.8	57	2.12
	Aug. -23	759	6.3	12.9	50	2.59
	Aug. -24	779				
	Aug. -25	541				
	Aug. -26	542				
	Aug. -27	542	6.4	12.6	53	3.01
	Aug. -28	752	6.3	13.0	53	2.5
	Aug. -29		6.4	12.3	52	2.65
	Aug. -30		6.2	12.5	54	2.93
	Aug. -31	781	6.5	12.1	51	2.47
September	Sep. -1	799				
	Sep. -2	800				
	Sep. -3	581				
	Sep. -4	580	6.4	12.8	55	2.87
	Sep. -5	749	6.5	12.5	59	2.92
	Sep. -6	830	6.4	13.7	64	3.4
	Sep. -7	680	6.5	12.1	59	2.15
	Sep. -8	627				
	Sep. -9	627				
	Sep. -10	627	6.5	11.6	66	1.93
	Sep. -11	656	6.7	12.3	74	2.95
	Sep. -12	694	6.2	12.3	74	2.91
	Sep. -13	684			68	3.29
	Sep. -14		6.6	10.7	75	2.99
	Sep. -15	952				
	Sep. -16	953				
	Sep. -17	574	6.5	10.5	64	2.34
	Sep. -18	690	6.4	10.6	68	1.95
	Sep. -19	535	6.4	10.9	67	2.32
	Sep. -20	581	6.1	10.9	70	1.72
	Sep. -21	545	6.1	10.8	67	1.59
	Sep. -22	556				
	Sep. -23	567				
	Sep. -24	547	6.3	10.3	64	1.86
	Sep. -25	795	6.3	10.7	66	1.93
	Sep. -26	478	6.1	11.2	58	1.96
	Sep. -27	564	6.1	11.5	68	1.66
	Sep. -28	486	6.4	10.5	65	2.19
	Sep. -29	541				
	Sep. -30	514				

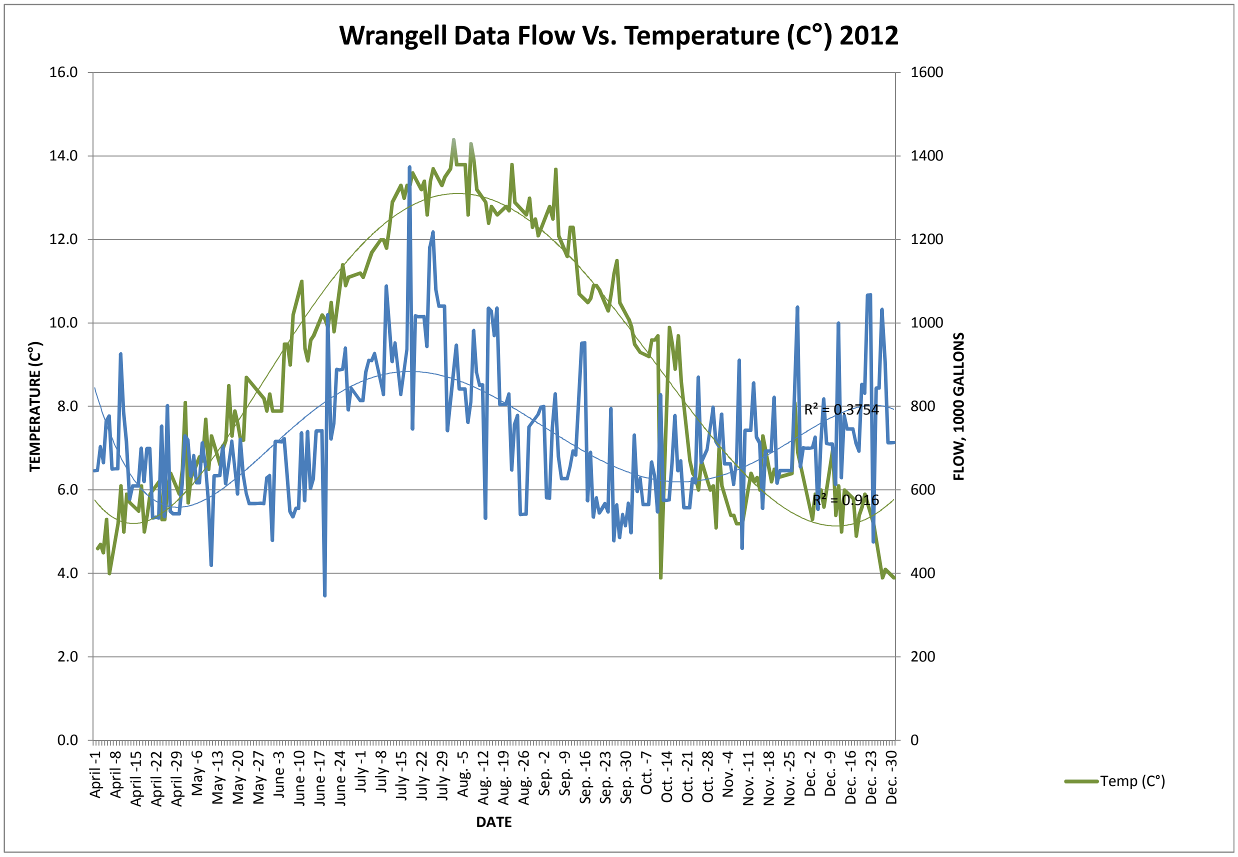
October	Oct. -1	568	6.3	10.1	65	3.12
	Oct. -2	497	6.5	9.9	65	1.79
	Oct. -3	731	6.5	9.5	65	1.47
	Oct. -4	596	6.2	9.4	64	1.39
	Oct. -5	628	6.3	9.3	65	1.59
	Oct. -6	565				
	Oct. -7	565				
	Oct. -8	565	6.6	9.2	65	1.47
	Oct. -9	667	6.2	9.6	62	1.44
	Oct. -10	635	6.6	9.6	63	1.34
	Oct. -11	547	6.2	9.7	63	1.25
	Oct. -12	828	6.5	3.9	62	1.49
	Oct. -13	575				
	Oct. -14	575				
	Oct. -15	576	6.4	9.9	68	1.94
	Oct. -16	664	6.5	9.5	74	1.45
	Oct. -17	778	6.0	8.9	67	1.58
	Oct. -18	646	6.3	9.7	63	1.1
	Oct. -19	670	6.6	8.6	65	1.25
	Oct. -20	557				
	Oct. -21	557				
	Oct. -22	557	6.0	6.7	60	1.47
	Oct. -23	627	6.3	6.4	61	1.14
	Oct. -24	617	5.7	6.3	61	1.15
	Oct. -25	870	5.8	6.0	62	1.23
	Oct. -26	666	5.7	6.7	60	1.13
	Oct. -27					
	Oct. -28	697				
	Oct. -29		5.9	6.0	61	1.13
	Oct. -30	798	6.2	6.1	56	1.08
	Oct. -31	716	6.0	5.1	56	1.23
November	Nov. -1	705	5.7	7.0	58	1.54
	Nov. -2	781	5.6	6.1	66	1.14
	Nov. -3	662				
	Nov. -4	662				
	Nov. -5	662	6.5	5.4	61	1.55
	Nov. -6	613	6.2	5.4	58	1.54
	Nov. -7	670	5.8	5.2	56	1.51
	Nov. -8	911	5.6	5.2	56	1.45
	Nov. -9	460	5.6	5.2	56	1.21
	Nov. -10	743				
	Nov. -11	743				
	Nov. -12	743	5.4	6.4	54	1.29
	Nov. -13	856	5.6	6.2	55	1.2
	Nov. -14	726	6.3	6.3	51	1.52
	Nov. -15	712	5.9	6.0	51	1.17
	Nov. -16	556	6.3	7.3	59	1.37
	Nov. -17	692.67				
	Nov. -18	692.67				
	Nov. -19	692.67	6.0	6.2	53	1.13
	Nov. -20	822	6.3	6.5	59	1.16
	Nov. -21	616	6.2	6.3	54	1.21
	Nov. -22	646.4				
	Nov. -23	646.4				
	Nov. -24	646.4				
	Nov. -25	646.4				
	Nov. -26	646.4	6.2	6.4	52	1.07
	Nov. -27	833	6.5	8.1	56	1.72
	Nov. -28	1038	6.3	6.9	47	1.06
	Nov. -29	655				
	Nov. -30	701				

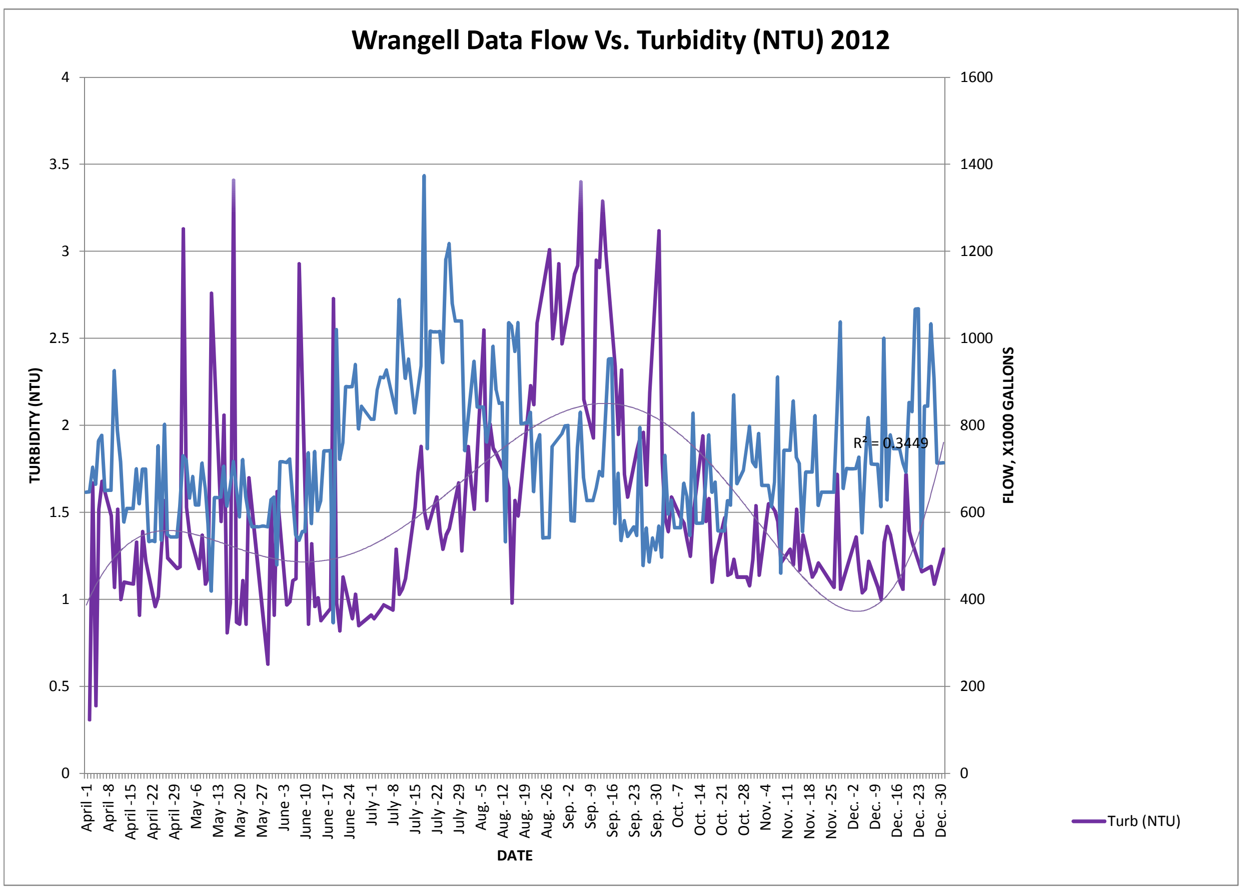
December	Dec. -1	700				
	Dec. -2	700				
	Dec. -3	701	6.3	5.3	47	1.36
	Dec. -4	727	6.3	5.9	47	1.17
	Dec. -5	553	6.2	5.8	41	1.04
	Dec. -6	711	6.3	6.0	38	1.06
	Dec. -7	818	5.7	5.6	39	1.22
	Dec. -8	711				
	Dec. -9	710				
	Dec. -10	710	5.6	7.0	47	1.07
	Dec. -11	613	6.4	5.4	43	1
	Dec. -12	1000	5.5	6.1	45	1.33
	Dec. -13	629	6.1	5.0	45	1.42
	Dec. -14	778	5.6	6.0	40	1.37
	Dec. -15	746				
	Dec. -16	746				
	Dec. -17	746	5.6	5.8	44	1.1
	Dec. -18	713	5.8	4.9	44	1.06
	Dec. -19	693	5.7	5.4	41	1.72
	Dec. -20	853	5.4	5.6	39	1.39
	Dec. -21	832	5.7	5.9	38	1.32
	Dec. -22	1067				
	Dec. -23	1068				
	Dec. -24	475	5.7	5.2	38	1.16
	Dec. -25	844				
	Dec. -26	844				
	Dec. -27	1033	5.9	3.9	37	1.19
	Dec. -28	907	6.2	4.1	41	1.09
	Dec. -29	713				
	Dec. -30	713				
	Dec. -31	714	6.1	3.9	39	1.29
	AVG	**723**				

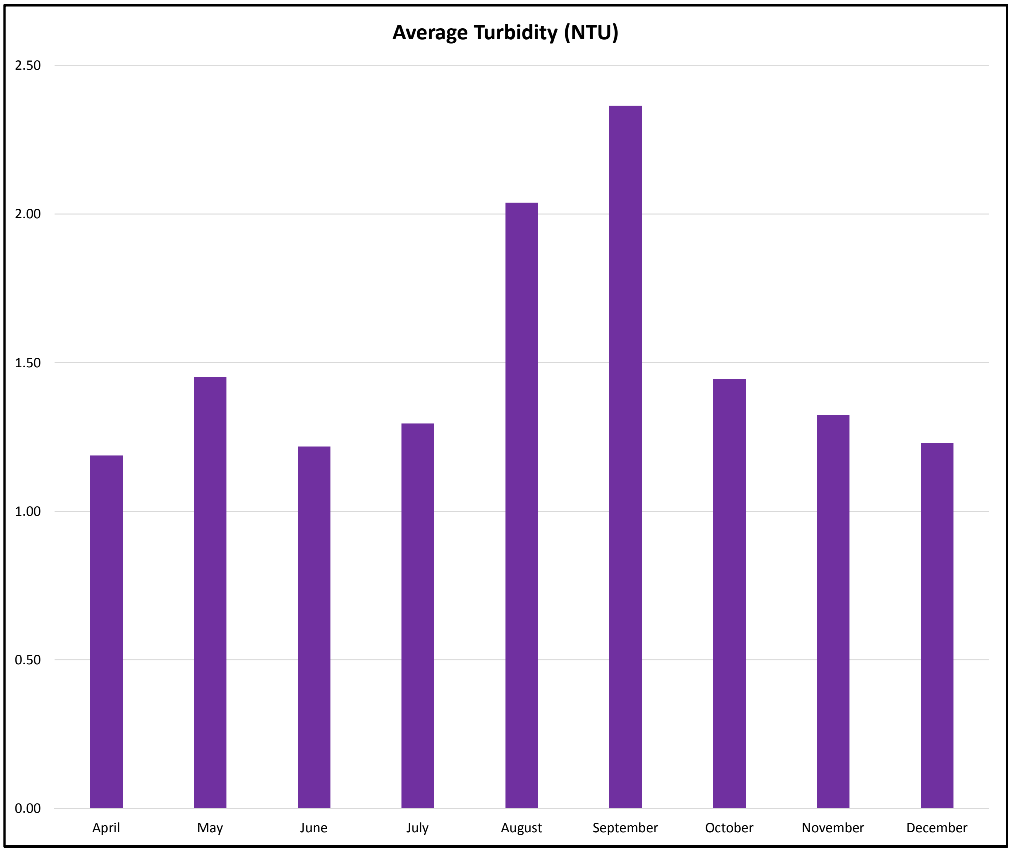
Statistical Analysis															
Month	Turbidity (NTU)			Flow (gdp x 1000)			pH			Color (Pt-Co)			Temp (C°)		
	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min
April	1.19	1.68	0.31	653	926	533	6.4	6.8	5.5	32	37	30	5.4	6.4	4.0
May	1.45	3.41	0.63	628	730	419	6.4	6.8	5.6	38	45	30	7.3	8.7	5.7
June	1.22	2.93	0.82	706	1020	346	6.3	6.7	5.9	34	44	26	9.8	11.4	7.9
July	1.30	1.88	0.89	973	1374	742	6.3	6.5	5.5	36	43	30	12.7	13.7	11.1
August	2.04	3.01	0.98	807	1036	532	6.4	6.7	6.1	45	57	3	13.1	14.4	12.1
September	2.36	3.4	1.59	649	953	478	6.4	6.7	6.1	66	75	55	11.4	13.7	10.3
October	1.44	3.12	1.08	639	870	497	6.2	6.6	5.7	63	74	56	8.1	10.1	3.9
November	1.32	1.72	1.06	706	1038	460	6.0	6.5	5.4	56	66	47	6.2	8.1	5.2
December	1.23	1.72	1	767	1068	475	5.9	6.4	5.4	42	47	37	5.4	7.0	4

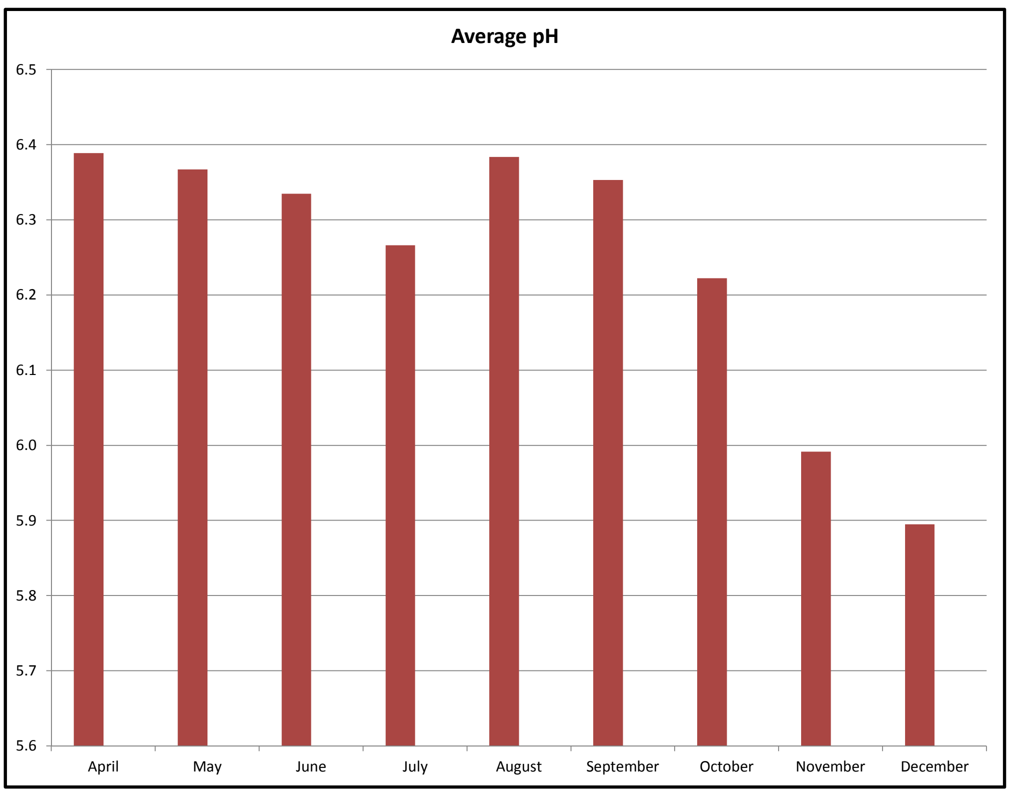

Wrangell Data Flow Vs. pH 2012
pH
FLOW, X1000 GALLONS
DATE
$R^2 = 0.3067$
pH
7.0
6.5
6.0
5.5
5.0
4.5
4.0
1600
1400
1200
1000
800
600
400
200
0
April -1
April -8
April -15
April -22
April -29
May -6
May -13
May -20
May -27
June -3
June -10
June -17
June -24
July -1
July -8
July -15
July -22
July -29
Aug. -5
Aug. -12
Aug. -19
Aug. -26
Sep. -2
Sep. -9
Sep. -16
Sep. -23
Sep. -30
Oct. -7
Oct. -14
Oct. -21
Oct. -28
Nov. -4
Nov. -11
Nov. -18
Nov. -25
Dec. -2
Dec. -9
Dec. -16
Dec. -23
Dec. -30

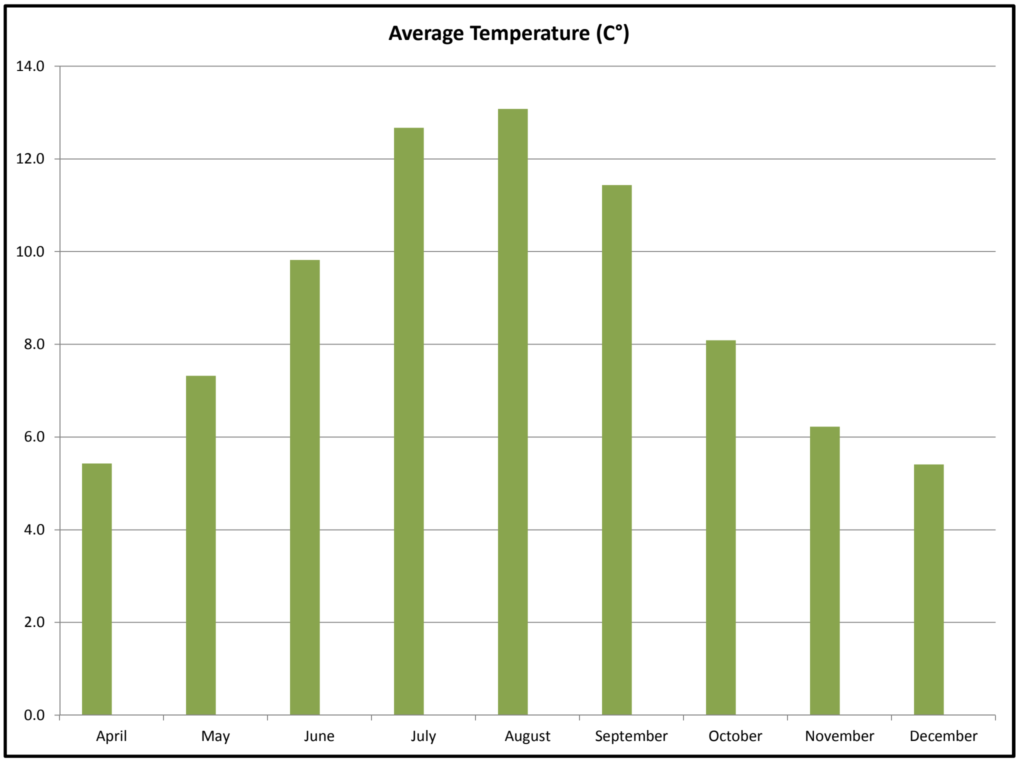

Wrangell Data Flow Vs. Color (Pt-Co) 2012
COLOR (Pt-Co)
FLOW, X1000 GALLONS
DATE
Color (Pt-Co)
80
70
60
50
40
30
20
10
0
1600
1400
1200
1000
800
600
400
200
0
April -1
April -8
April -15
April -22
April -29
May -6
May -13
May -20
May -27
June -3
June -10
June -17
June -24
July -1
July -8
July -15
July -22
July -29
Aug. -5
Aug. -12
Aug. -19
Aug. -26
Sep. -2
Sep. -9
Sep. -16
Sep. -23
Sep. -30
Oct. -7
Oct. -14
Oct. -21
Oct. -28
Nov. -4
Nov. -11
Nov. -18
Nov. -25
Dec. -2
Dec. -9
Dec. -16
Dec. -23
Dec. -30

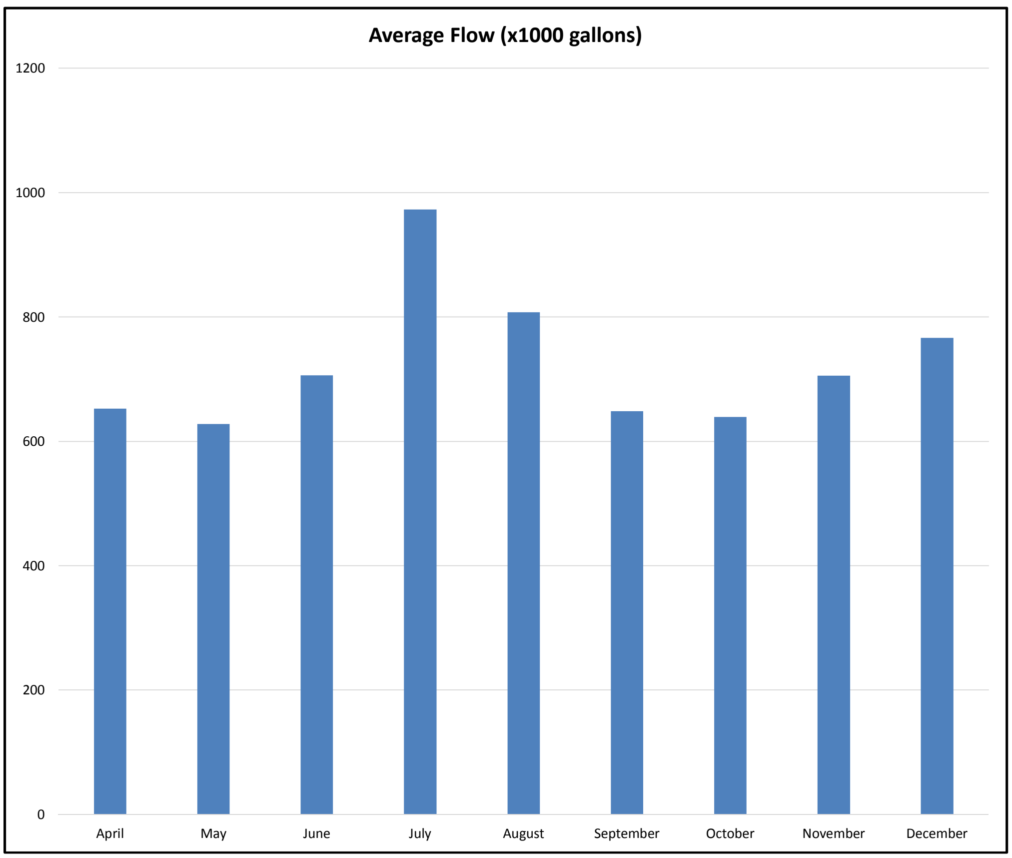

Wrangell Data Flow Vs. Temperature (C°) 2012
TEMPERATURE (C°)
FLOW, 1000 GALLONS
DATE
R² = 0.3754
R² = 0.916
Temp (C°)

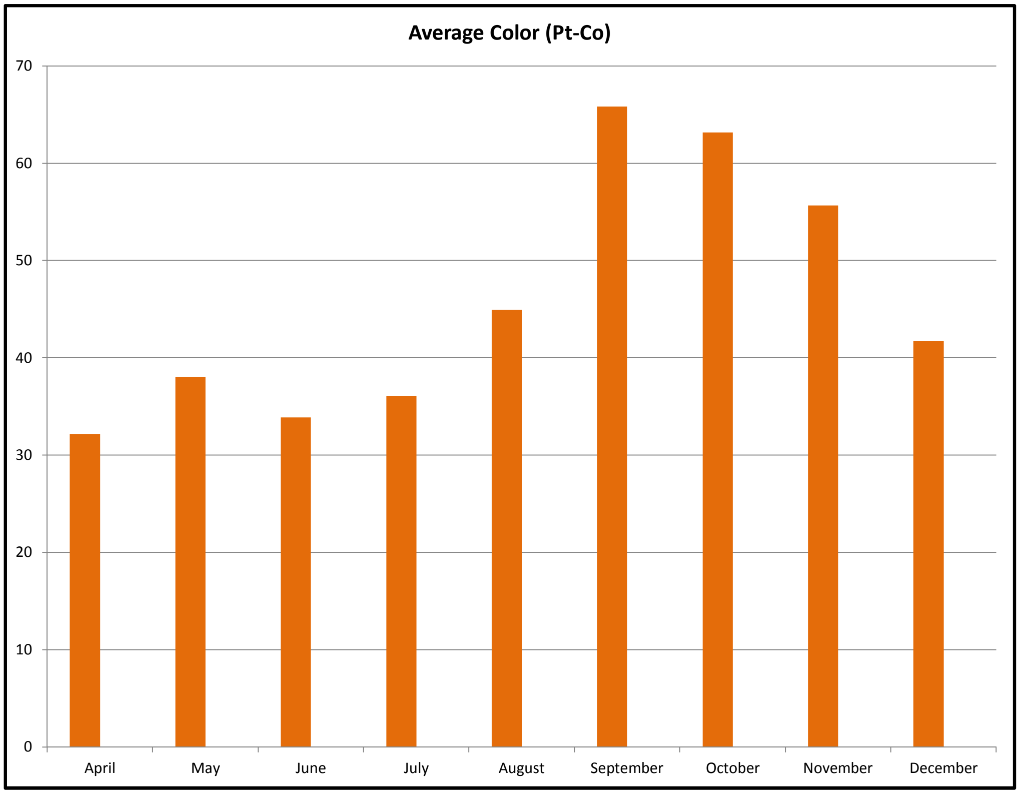

Wrangell Data Flow Vs. Turbidity (NTU) 2012
TURBIDITY (NTU)
FLOW, X1000 GALLONS
DATE
R² = 0.3449
Turb (NTU)


Average Turbidity (NTU)
2.50
2.00
1.50
1.00
0.50
0.00
April
May
June
July
August
September
October
November
December


Average pH
6.5
6.4
6.3
6.2
6.1
6.0
5.9
5.8
5.7
5.6
April
May
June
July
August
September
October
November
December


Average Temperature (C°)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
April
May
June
July
August
September
October
November
December


Average Flow (x1000 gallons)
1200
1000
800
600
400
200
0
April
May
June
July
August
September
October
November
December


Average Color (Pt-Co)
70
60
50
40
30
20
10
0
April
May
June
July
August
September
October
November
December

WRANGELL WATER DISTRIBUTION SYSTEM

Wrangell, Alaska 2013

		Influent				
Month	Date	Daily Flow (GPD x 1K)	pH	Temp (C°)	Color (Pt-Co)	Turb (NTU)
January	January -1	678				
	January -2	678	6.0	5.1	48	1.32
	January -3	634	5.9	4.3	38	1.35
	January -4	770	5.8	5.3	45	1.39
	January -5	650				
	January -6	650				
	January -7	651	6.0	4.1	43	1.49
	January -8	610	6.0	4.3	40	1.49
	January -9	951	5.9	3.9	39	1.39
	January -10	652	5.9	4.0	40	1.61
	January -11	780	5.8	5.0	36	1.4
	January -12	634				
	January -13	634				
	January -14	635	5.8	5.1	41	1.22
	January -15	622	5.8	5.2	38	0.94
	January -16	736	5.9	5.8	39	2.21
	January -17	710	6.2	6.2	39	1.48
	January -18	553	5.7	5.1	29	1.91
	January -19	688				
	January -20	688				
	January -21	689				
	January -22	535	6.4	4.2	34	1.34
	January -23	513	6.3	5.3	41	1.25
	January -24	587	6.3	5.0	41	1.19
	January -25	738	6.1	3.7	36	1.17
	January -26	610.6				
	January -27	610.4				
	January -28	611	5.8	4.0	44	1.01
	January -29	690	5.7	4.9	44	0.97
	January -30	768	5.5	4.0	34	0.91
	January -31	642	6.3	3.8	38	1.05
February	February -1	573	5.6	3.6	40	0.85
	February -2	594				
	February -3	594				
	February -4	595	6.3	4.3	3	1.23
	February -5	569	6.3	4.4	32	1.21
	February -6	812	6.2	4.7	32	0.91
	February -7	472	5.7	3.5	34	0.81
	February -8	640	5.8	4.0	31	1.16
	February -9	740.5				
	February -10		6.1	5.2	27	0.93
	February -11		5.6	4.5	34	1.26
	February -12	610	5.8	5.1	32	0.76
	February -13	646	5.7	5.0	32	0.83
	February -14	827	5.6	5.2	32	0.97
	February -15	458	6.6	5.5	41	1.35
	February -16	560				
	February -17	560				
	February -18	560				
	February -19	560	5.9	3.9	31	0.85
	February -20	509	6.2	4.4	32	1.08
	February -21	680	6.1	4.5	30	1.02
	February -22	499	6.2	4.1	36	0.98
	February -23	685				
	February -24	686				
	February -25	686	6.0	5.0	40	0.72
	February -26	643	5.9	4.7	44	0.7
	February -27	699	5.4	5.3	43	0.72
	February -28	524	5.9	5.6	40	1.02
	February -29					

March	March -1	703	5.4	4.5	40	0.76
	March -2	619.3				
	March -3	619.3				
	March -4	619.4	6.5	4.0	39	0.96
	March -5	575	6.3	3.9	38	0.74
	March -6	645	6.3	5.6	37	0.68
	March -7	672	6.4	4.8	39	0.81
	March -8	649	6.4	5.0	42	0.65
	March -9	670				
	March -10	670				
	March -11	670	6.2	5.7	45	0.68
	March -12	707	6.4	4.9	42	0.68
	March -13	726	6.3	4.5	40	0.61
	March -14	671	6.2	5.0	39	0.58
	March -15	720	6.2	5.1	39	0.61
	March -16	705				
	March -17	706				
	March -18	703	6.4	4.5	40	0.85
	March -19	696	6.5	7.0	48	0.79
	March -20	862	6.3	4.9	31	0.68
	March -21	616	6.2	4.7	36	0.83
	March -22	725	6.4	5.0	41	0.72
	March -23	689				
	March -24	689				
	March -25	689				
	March -26	689	6.3	4.7	37	1.13
	March -27	730	6.5	4.8	40	1.12
	March -28	776	6.3	4.8	36	1.1
	March -29	849	6.2	5.5	46	1.22
	March -30	897				
	March -31	899				
April	April -1	897	6.7	6.0	35	1.25
	April -2	1040	6.5	4.1	35	1.13
	April -3	599	6.5	6.0	37	1.23
	April -4	727	6.5	6.1	37	1.26
	April -5	783	6.4	6.3	36	1.08
	April -6	688				
	April -7	688				
	April -8	689	6.2	6.9	37	1.05
	April -9	722	6.2	5.8	39	1.13
	April -10	832	6.2	6.4	35	1.04
	April -11	733	6.2	5.8	30	0.78
	April -12	555	6.2	6.1	35	1.05
	April -13	683				
	April -14	683				
	April -15	683	6.6	6.2	35	1.07
	April -16	320	6.5	6.6	38	0.89
	April -17	729	6.8	6.6	30	1.26
	April -18		6.3	5.9	33	1.11
	April -19	1472	6.2	6.5	36	1.51
	April -20	591				
	April -21	592				
	April -22	592	6.5	5.8	31	1.06
	April -23	613	6.2	6.6	36	0.91
	April -24	758	6.3	6.4	36	1.19
	April -25	777	6.4	6.8	37	0.8
	April -26	732	6.2	6.9	39	1.17
	April -27	569				
	April -28	569				
	April -29	570	6.5	6.2	42	0.81
	April -30	712	6.4	5.5	44	0.74

	May -1	683	6.5	6.7	41	0.79
	May -2	622	6.2	6.2	46	0.8
	May -3	821	6.4	7.1	40	0.73
	May -4	869				
	May -5	642				
	May -6	433	6.3	7.0	39	1.52
	May -7	659	6.2	6.7	41	0.94
	May -8	732	6.4	6.2	42	0.7
	May -9	593	6.1	6.3	41	0.74
	May -10	603	6.3	6.2	43	0.72
	May -11	601				
	May -12	600				
	May -13	602	6.3	6.8	45	0.8
	May -14	630	6.3	8.0	44	1.4
	May -15	589	6.3	7.5	42	1.08
May	May -16	789	6.3	7.4	45	0.71
	May -17	676	6.3	7.5	43	0.75
	May -18	653				
	May -19	653				
	May -20	653	6.3	7.3	41	0.72
	May -21	697	6.1	7.0	32	0.89
	May -22	802	6.2	7.7	43	0.75
	May -23	862	6.4	7.6	45	0.84
	May -24	866				
	May -25	866				
	May -26	866				
	May -27	866				
	May -28					
	May -29	677	6.5	8.5	43	0.81
	May -30	624	6.2	8.0	41	1.25
	May -31	815	6.4	8.8	45	0.81
	June -1	687.6				
	June -2	687.6				
	June -3	687.8	6.3	8.7	40	0.9
	June -4	524	6.4	9.5	41	1.02
	June -5	720	6.3	9.5	45	0.86
	June -6	943	6.1	8.8	40	0.83
	June -7	850	6.2	9.4	43	0.84
	June -8	654				
	June -9	654				
	June -10	654	6.6	9.4	37	0.091
	June -11	646	6.4	10.1	38	0.85
	June -12	648	6.3	10.2	37	1.03
	June -13	683	6.4	10.7	34	0.93
	June -14	686	6.4	10.2	35	1.45
June	June -15	722.6				
	June -16	722.6				
	June -17	722.8	6.2	11.3	38	0.98
	June -18	860	6.4	10.9	39	1.66
	June -19	827	6.5	10.7	34	1.1
	June -20	905	6.2	11.3	36	1.03
	June -21	918	6.2	11.0	38	0.98
	June -22	740				
	June -23	840				
	June -24	840	6.4	12.4	38	1.16
	June -25	702	6.2	12.0	50	1.84
	June -26	836	6.1	12.4	38	1.26
	June -27	1417	6.2	12.0	34	1.25
	June -28	1308	6.2	12.3	37	1.21
	June -29	893.6				
	June -30	893.6				

July	July -1	893.8	6.2	12.5	39	1.28
	July -2	978	6.1	13.2	35	1.2
	July -3	1408	6.2	12.9	42	1.14
	July -4					
	July -5		6.3	13.0	35	1.34
	July -6					
	July -7	1141.3				
	July -8		6.5	13.0	48	1.61
	July -9	923	6.1	13.4	39	1.62
	July -10	1272	6.3	13.5	43	1.57
	July -11	1072	6.3	14.0	39	1.63
	July -12	1361	6.4	14.0	39	1.64
	July -13	869				
	July -14	869				
	July -15	869	6.4	14.4	42	2.04
	July -16	995	6.3	14.0	42	2.09
	July -17	1239	6.3	14.4	46	2.12
	July -18	1444	6.5	14.9	41	0.1.96
	July -19	1016	6.5	14.3	40	2.22
	July -20	993				
	July -21	993				
	July -22	993	6.5	13.7	42	2.42
	July -23	960	6.2	14.5	44	2.23
	July -24	1301	6.5	14.6	39	2.14
	July -25	1067	6.5	15.2	51	2.14
	July -26	888	6.4	14.5	51	2.72
	July -27	1034				
	July -28	1039				
	July -29	1030	6.3	14.5	50	2.86
	July -30	1188	6.5	14.9	53	2.54
	July -31	1363	6.8	15.3	57	2.74
August	Aug. -1					
	Aug. -2					
	Aug. -3	1130				
	Aug. -4	1130				
	Aug. -5	1131	6.6	14.6	55	3.35
	Aug. -6	1131	6.4	14.7	55	3.1
	Aug. -7	1308	6.3	14.5	57	2.66
	Aug. -8	1199	6.4	15.2	53	2.45
	Aug. -9	1230	6.5	15.4	66	2.72
	Aug. -10	1248				
	Aug. -11	1248				
	Aug. -12	1249	6.3	15.4	60	4.32
	Aug. -13	1316	6.5	15.4	65	4.55
	Aug. -14	1556	6.6	15.6	63	3.23
	Aug. -15	1106	6.4	15.7	64	3.22
	Aug. -16					
	Aug. -17	853				
	Aug. -18	854	6.3	15.5	66	2.91
	Aug. -19	1314	6.4	15.8	73	3.08
	Aug. -20	1197	6.3	15.2	68	2.61
	Aug. -21	1181	6.4	15.3	70	3.04
	Aug. -22	955	6.5	15.0	69	2.79
	Aug. -23	1313				
	Aug. -24	1313				
	Aug. -25		6.4	15.2	66	3.51
	Aug. -26	742	6.5	14.8	63	4.29
	Aug. -27	1099	6.6	14.6	68	3.27
	Aug. -28	1029	6.3	15.0	67	3.4
	Aug. -29	1318				
	Aug. -30	870				
	Aug. -31	906				

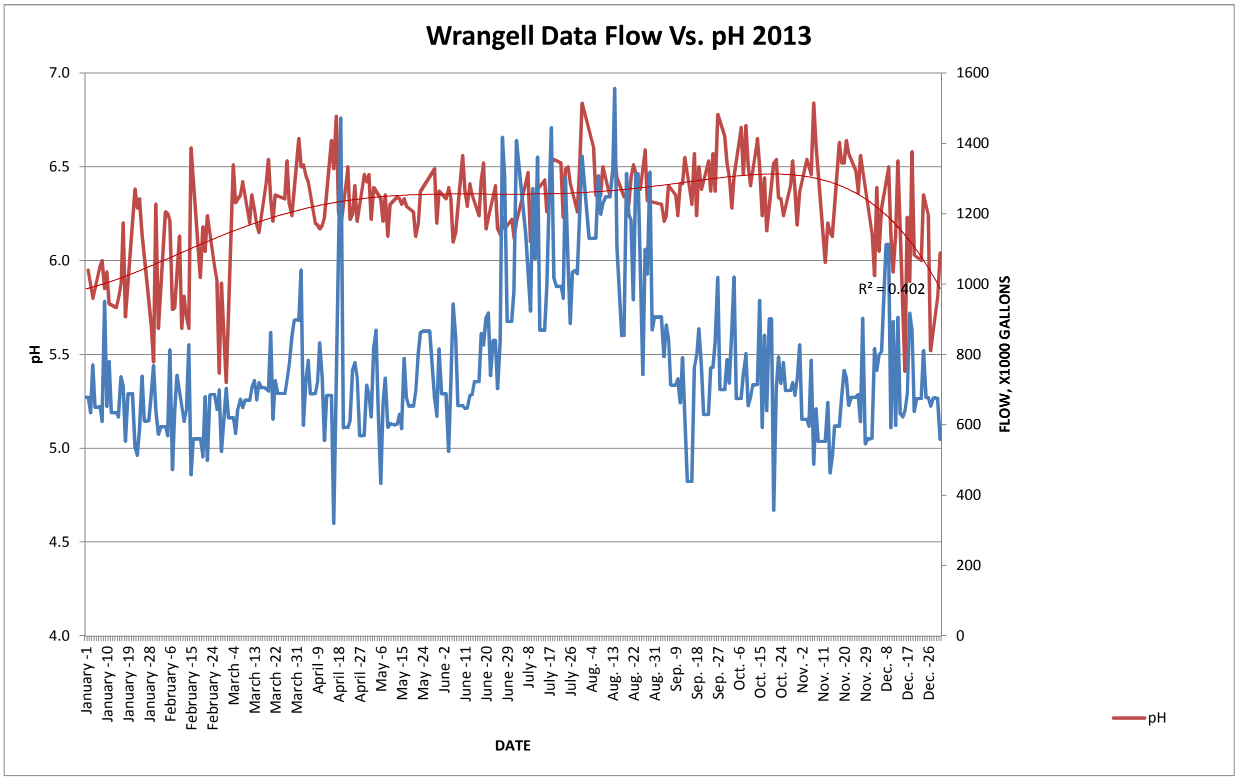
September	Sep. -1	906				
	Sep. -2	906				
	Sep. -3	906	6.3	15.2	68	3.78
	Sep. -4	793	6.2	14.9	61	4.34
	Sep. -5	883	6.2	15.6		
	Sep. -6	843	6.4	14.7	64	3.96
	Sep. -7	713				
	Sep. -8	712				
	Sep. -9	713	6.4	14.9	60	3.14
	Sep. -10	731	6.2	15.0	62	4.01
	Sep. -11	662	6.4	15.0	62	3.63
	Sep. -12	791	6.4	15.4	61	4.28
	Sep. -13		6.6	15.6	63	4.24
	Sep. -14	439				
	Sep. -15	439				
	Sep. -16	439	6.3	15.3	59	4.27
	Sep. -17	765	6.6	14.4	63	4.42
	Sep. -18	801	6.2	13.7	58	5.43
	Sep. -19	872	6.5	14.4	64	3.56
	Sep. -20	765	6.4	15.9	73	3.99
	Sep. -21	629				
	Sep. -22	629				
	Sep. -23	630	6.5	12.4	59	4.13
	Sep. -24	762	6.4	12.6	59	3.4
	Sep. -25	763	6.6	11.7	62	3.02
	Sep. -26	835	6.4	12.3	54	3.13
	Sep. -27	1019	6.8	11.7	56	2.69
	Sep. -28	700				
	Sep. -29	700				
	Sep. -30	700	6.7	11.0	55	2.4
October	Oct. -1	785	6.5	11.1	55	3
	Oct. -2	719	6.4	11.7	55	2.36
	Oct. -3	869	6.3	10.8	54	2.28
	Oct. -4	1020	6.5	10.5	51	2.23
	Oct. -5	674				
	Oct. -6	674				
	Oct. -7	675	6.7	11.1	55	1.86
	Oct. -8	744	6.5	10.2	58	1.72
	Oct. -9	802	6.7	10.3	61	1.36
	Oct. -10	654	6.5	10.1	70	1.39
	Oct. -11	678	6.4	9.8	60	1.44
	Oct. -12	713				
	Oct. -13	713				
	Oct. -14	714	6.7	10.8	57	1.41
	Oct. -15	953	6.5	9.5	75	2.73
	Oct. -16	592	6.2	9.4	62	1.32
	Oct. -17	854	6.4	8.7	55	1.17
	Oct. -18	640	6.2	8.6	59	1.44
	Oct. -19	901				
	Oct. -20	901				
	Oct. -21	357	6.5	9.3	65	1.52
	Oct. -22	705	6.5	9.0	58	1.23
	Oct. -23	792	6.3	10.2	55	1.09
	Oct. -24	718	6.3	9.9	61	1.48
	Oct. -25	777	6.2	10.0	59	1.3
	Oct. -26	697				
	Oct. -27	697				
	Oct. -28	698	6.4	8.8	50	3.16
	Oct. -29	720	6.5	8.4	56	0.99
	Oct. -30	684	6.4	10.4	64	2.19
	Oct. -31	733	6.2	9.2	58	0.96

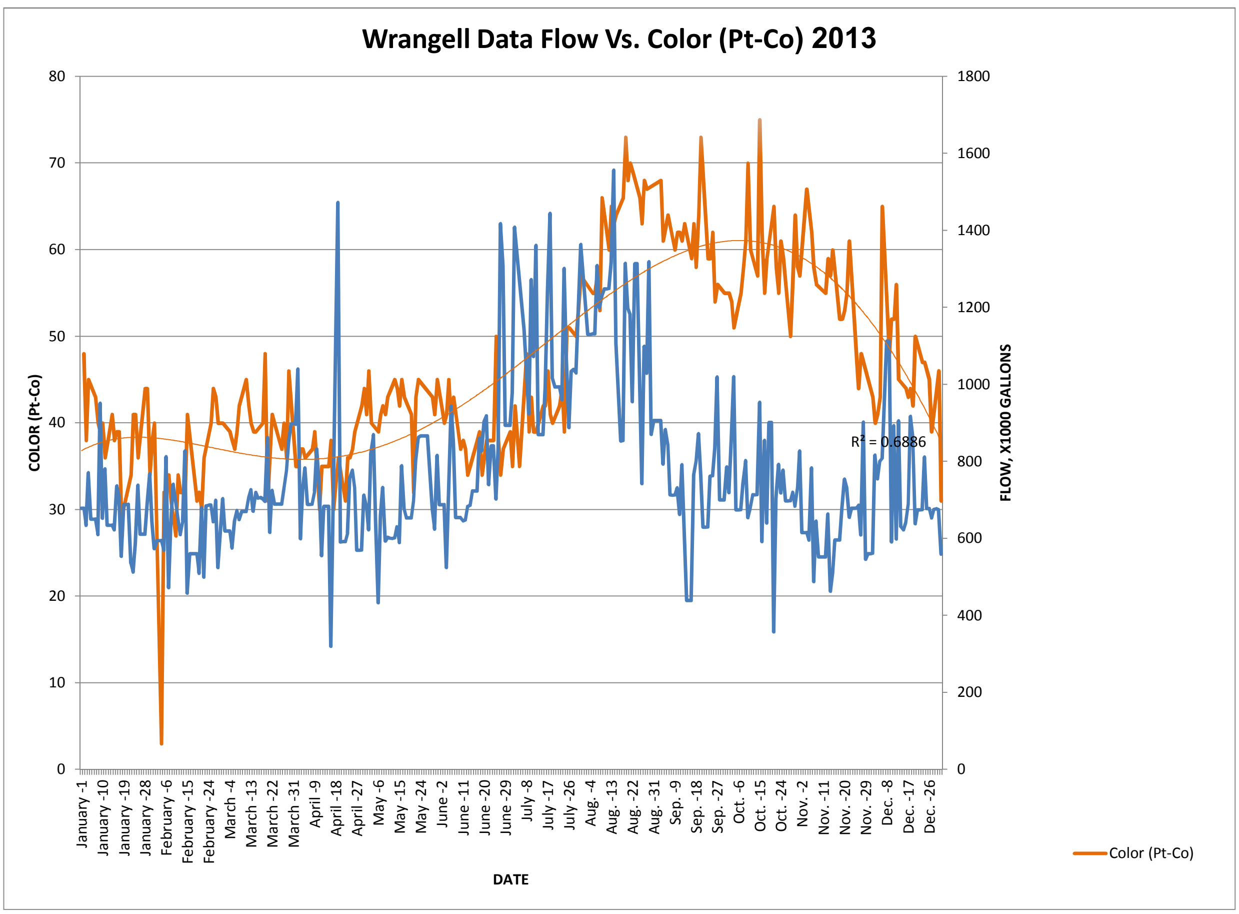
November	Nov. -1	827	6.4	9.7	57	1.15
	Nov. -2	615				
	Nov. -3	615				
	Nov. -4	616	6.5	7.7	67	0.91
	Nov. -5	596				
	Nov. -6	783	6.5	7.5	62	1.06
	Nov. -7	488	6.8	7.1	58	0.98
	Nov. -8	645	6.6	7.1	56	0.77
	Nov. -9	552				
	Nov. -10	552				
	Nov. -11	552				
	Nov. -12	552	6.0	6.5	55	0.96
	Nov. -13	663	6.2	6.5	59	0.76
	Nov. -14	463	6.2	6.4	57	0.81
	Nov. -15	510	6.1	6.3	60	1.27
	Nov. -16	596				
	Nov. -17	596				
	Nov. -18	596	6.6	3.9	52	0.94
	Nov. -19	677	6.5	4.8	52	0.94
	Nov. -20	754	6.5	4.1	53	0.83
	Nov. -21	732	6.6	4.9	55	0.79
	Nov. -22	655	6.6	4.5	61	0.77
	Nov. -23	678				
	Nov. -24	678				
	Nov. -25	679	6.5	5.0	48	0.96
	Nov. -26	686	6.4	4.2	44	0.88
	Nov. -27	609	6.6	4.8	48	0.9
	Nov. -28	902				
	Nov. -29	546				
	Nov. -30	560				
December	Dec. -1	560				
	Dec. -2	562	6.1	5.4	43	1.04
	Dec. -3	816	5.9	3.9	40	1.2
	Dec. -4	755	6.4	4.9	41	0.93
	Dec. -5	800	6.1	4.3	43	0.86
	Dec. -6	809	6.3	5.7	65	1.07
	Dec. -7					
	Dec. -8	1112				
	Dec. -9	1112	6.5	5.4	48	0.85
	Dec. -10	591	6.1	6.3	52	0.75
	Dec. -11	893	5.9	4.6	52	0.91
	Dec. -12	598	6.1	5.8	56	0.85
	Dec. -13	905	6.5	4.7	45	0.91
	Dec. -14	631				
	Dec. -15	622				
	Dec. -16	641	5.4	6.9	44	1.33
	Dec. -17	690	6.2	4.4	43	0.9
	Dec. -18	917	5.9	4.4	44	0.87
	Dec. -19	867	6.6	5.4	42	0.74
	Dec. -20	638	6.0	4.6	50	0.82
	Dec. -21	674				
	Dec. -22	674				
	Dec. -23	675	6.0	5.1	47	0.87
	Dec. -24	811	6.4	4.1	47	0.94
	Dec. -25	677				
	Dec. -26	677	6.2	3.8	45	0.81
	Dec. -27	653	5.5	4.4	39	1.02
	Dec. -28	676				
	Dec. -29	677				
	Dec. -30	675	5.8	4.7	46	0.83
	Dec. -31	559	6.0	3.9	31	1.05

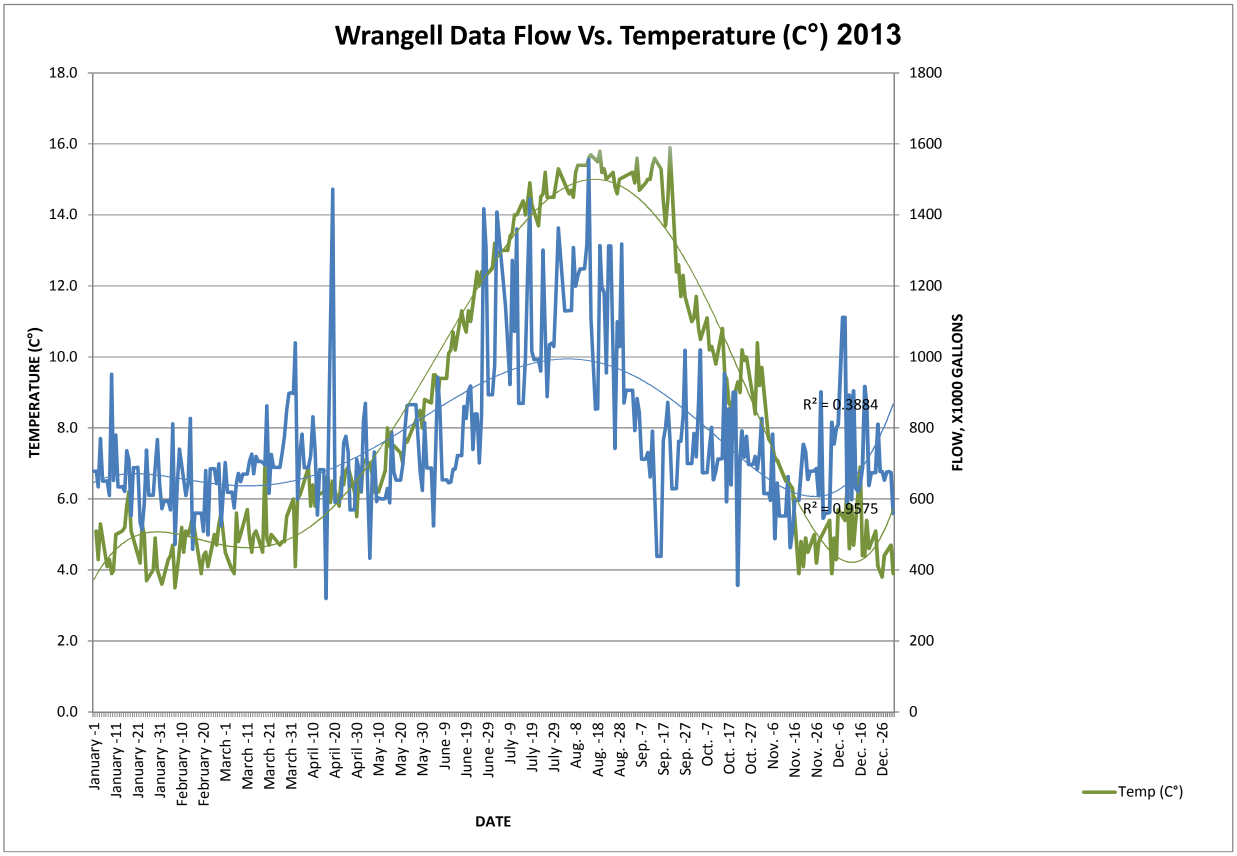
AVG **767**

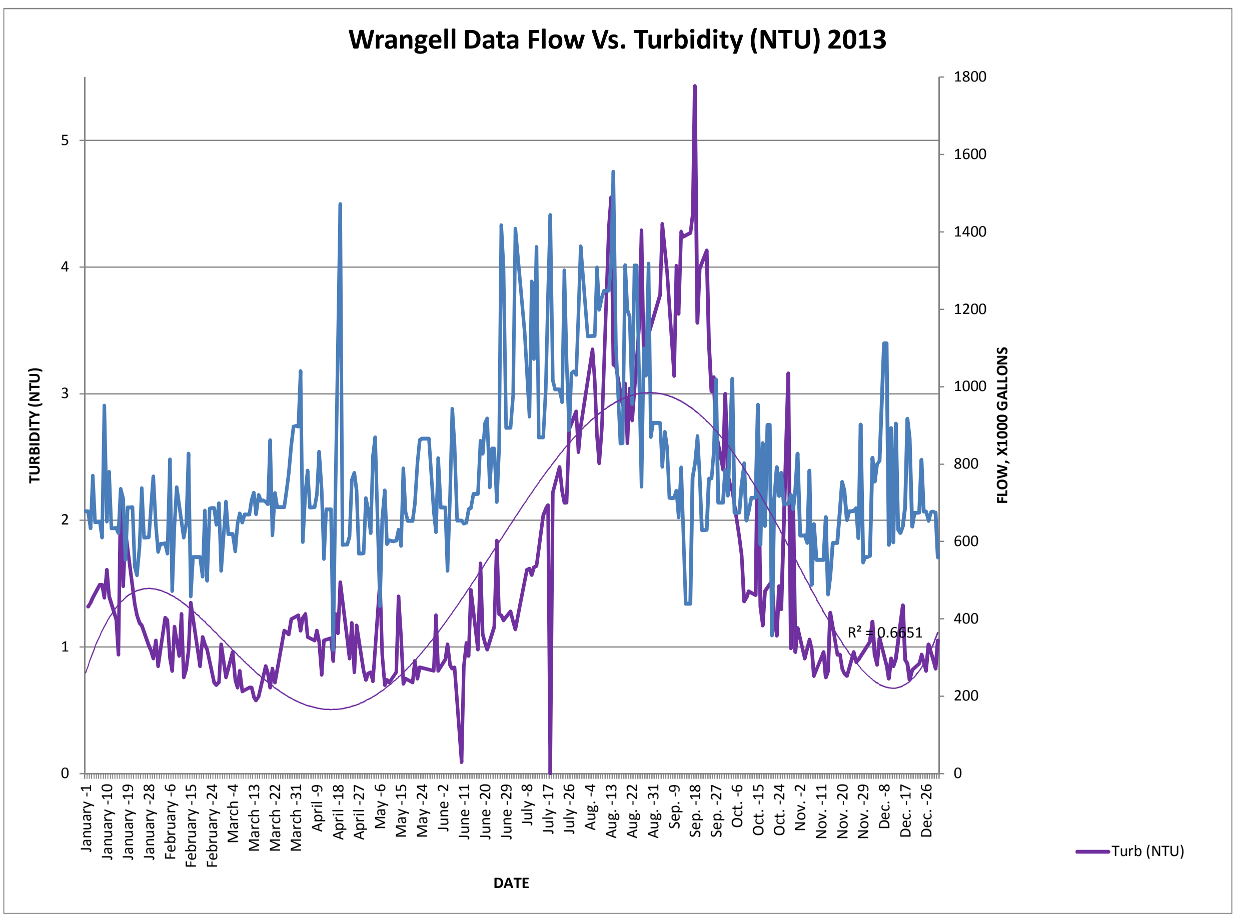
Statistical Analysis

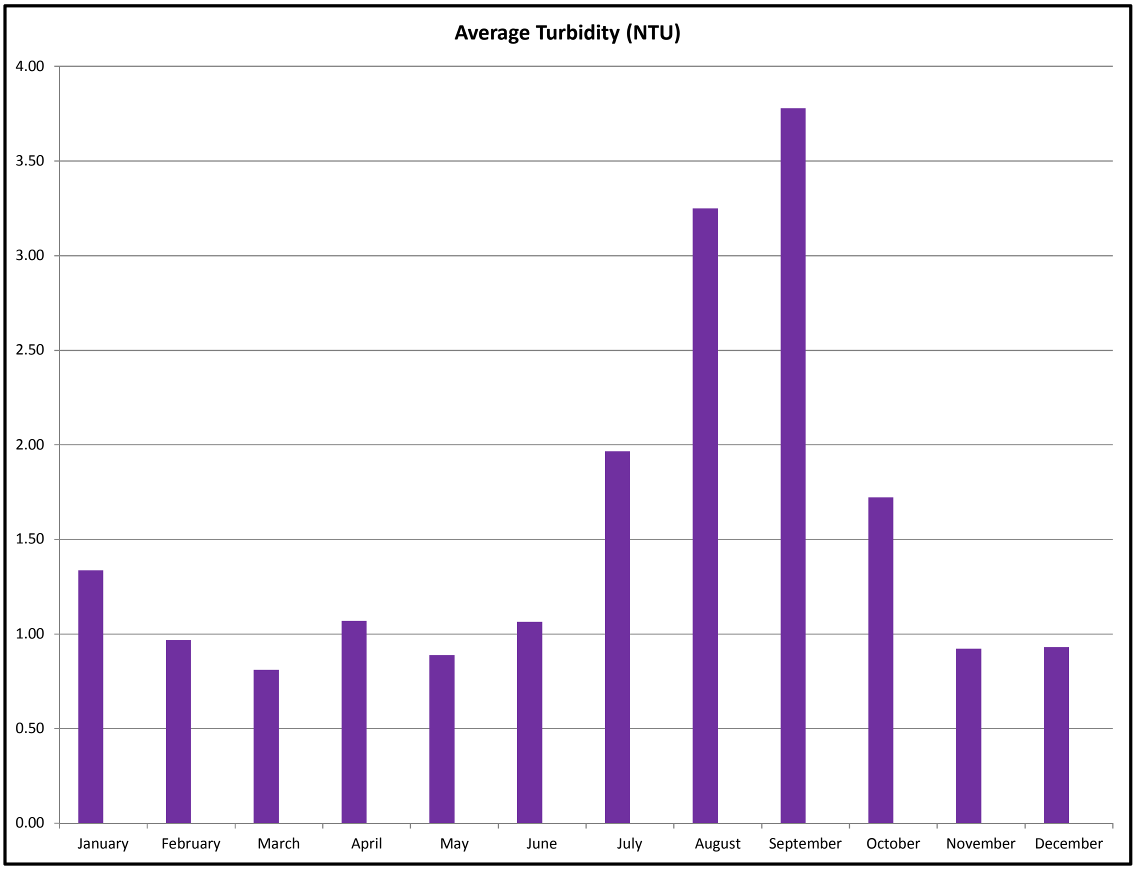
Month	Turbidity (NTU)			Flow (gdp x 1000)			pH			Color (Pt-Co)			Temp (C°)		
	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min
January	1.34	2.21	0.91	664.45	951	513	5.9	6.4	5.5	39	48	29	4.7	6.2	3.7
February	0.97	1.35	0.7	614.67	827	458	5.9	6.6	5.4	33	44	3	4.6	5.6	3.5
March	0.81	1.22	0.58	705.03	899	575	6.3	6.5	5.4	40	48	31	4.9	7.0	3.9
April	1.07	1.51	0.74	710.28	1472	320	6.4	6.8	6.2	36	42	30	6.2	6.9	4.1
May	0.89	1.52	0.7	701.47	869	433	6.3	6.5	6.1	42	46	32	7.2	8.8	6.2
June	1.06	1.84	0.091	795.77	1417	524	6.3	6.6	6.1	39	50	34	10.6	12.4	8.7
July	1.97	2.86	1.14	1081.45	1444	869	6.4	6.8	6.1	44	57	35	14.0	15.3	12.5
August	3.25	4.55	2.45	1145.41	1556	742	6.4	6.6	6.3	64	73	53	15.2	15.8	14.5
Septembe	3.78	5.43	2.4	739.52	1019	439	6.4	6.8	6.2	61	73	54	14.1	15.9	11.0
October	1.72	3.16	0.96	737.19	1020	357	6.4	6.7	6.2	59	75	50	9.9	11.7	8.4
November	0.92	1.27	0.76	632.43	902	463	6.4	6.8	6.0	56	67	44	5.9	9.7	3.9
December	0.93	1.33	0.74	731.57	1112	559	6.1	6.6	5.4	46	65	31	4.9	6.9	4

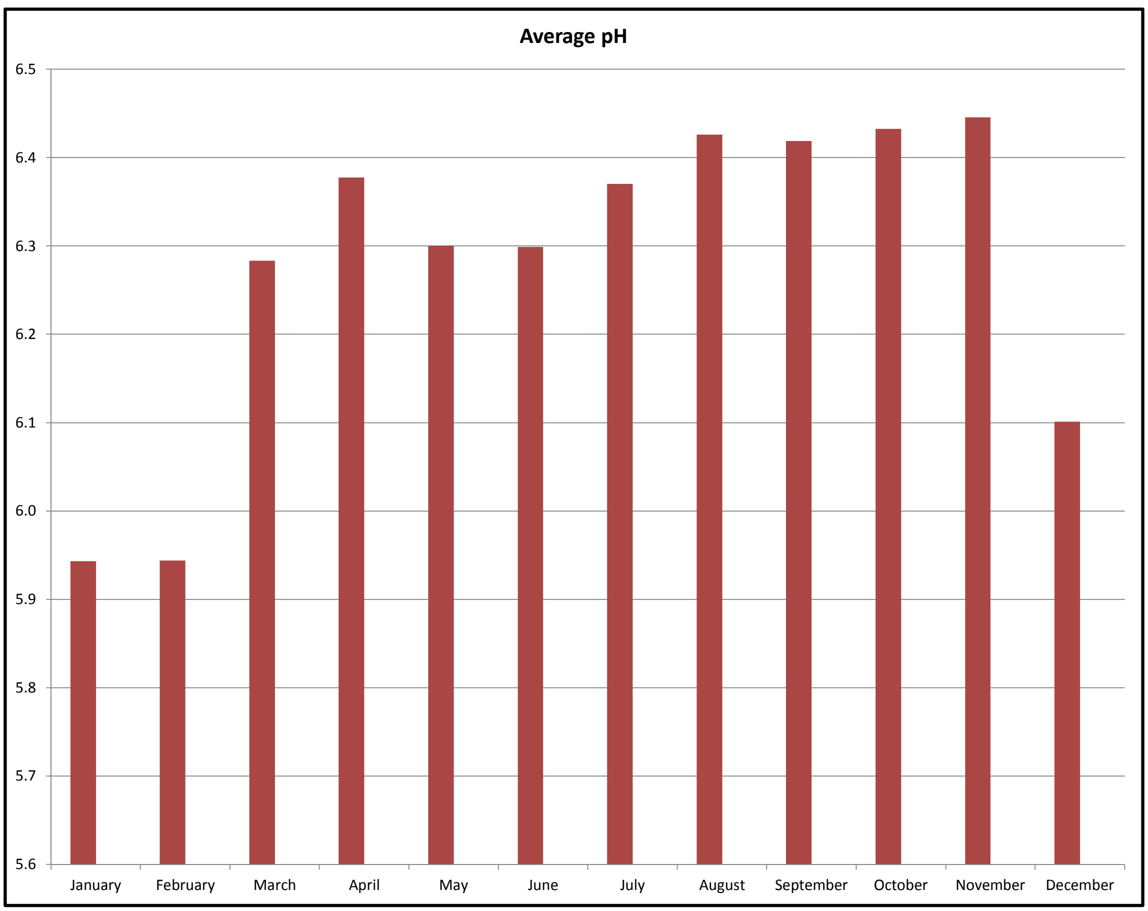

Wrangell Data Flow Vs. pH 2013
pH
FLOW, X1000 GALLONS
DATE
R² = 0.402
pH

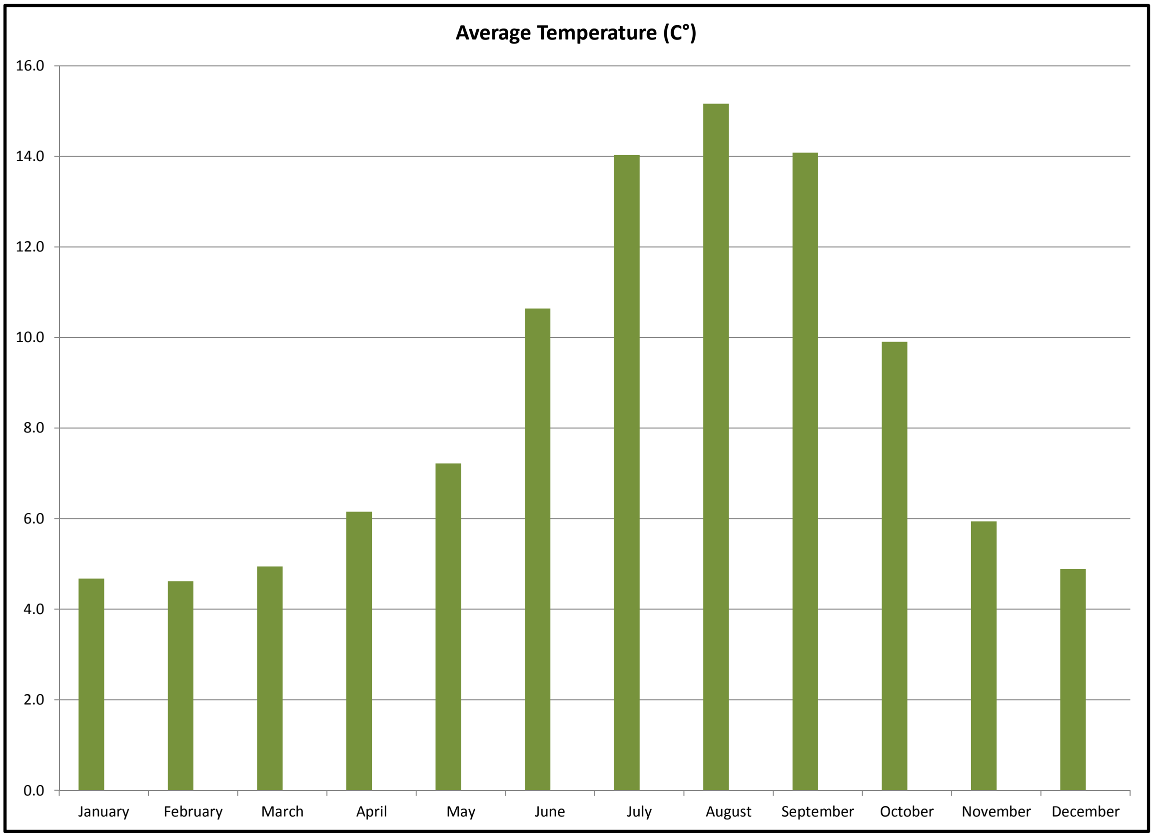

Wrangell Data Flow Vs. Color (Pt-Co) 2013
COLOR (Pt-Co)
FLOW, X1000 GALLONS
DATE
R² = 0.6886
Color (Pt-Co)

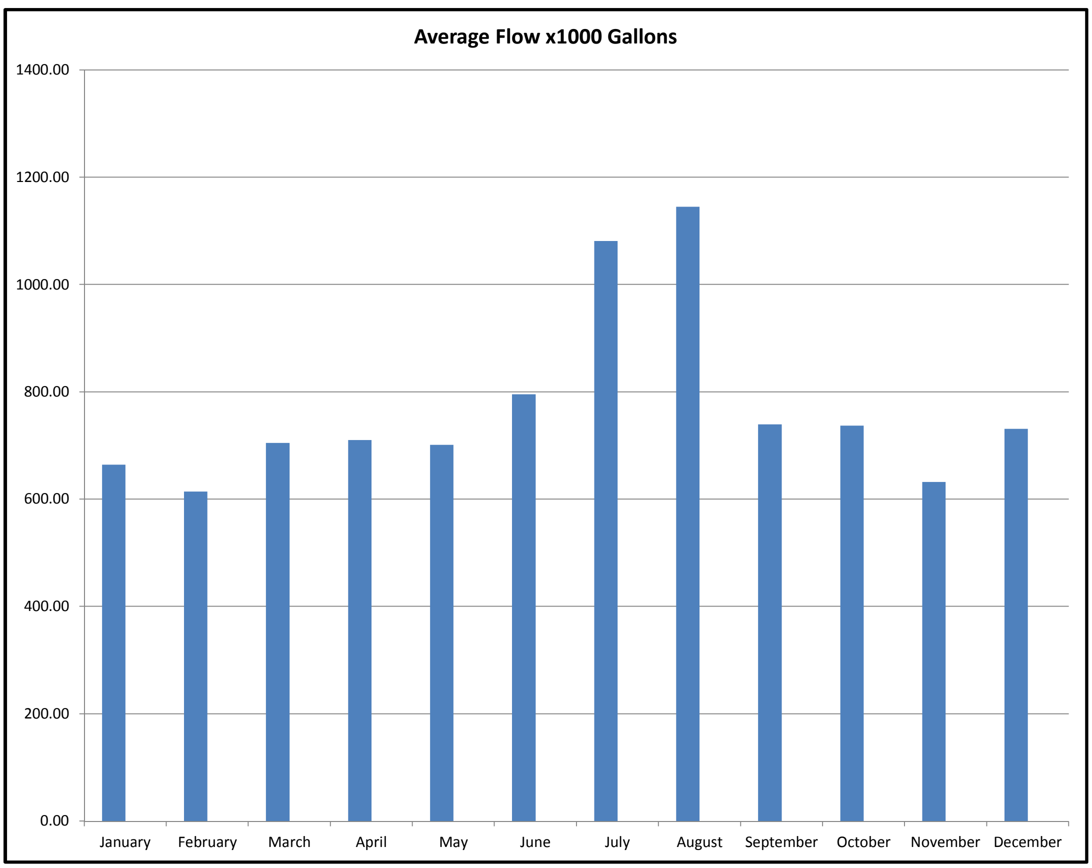

Wrangell Data Flow Vs. Temperature (C°) 2013
TEMPERATURE (C°)
FLOW, X1000 GALLONS
DATE
R² = 0.3884
R² = 0.9575
Temp (C°)

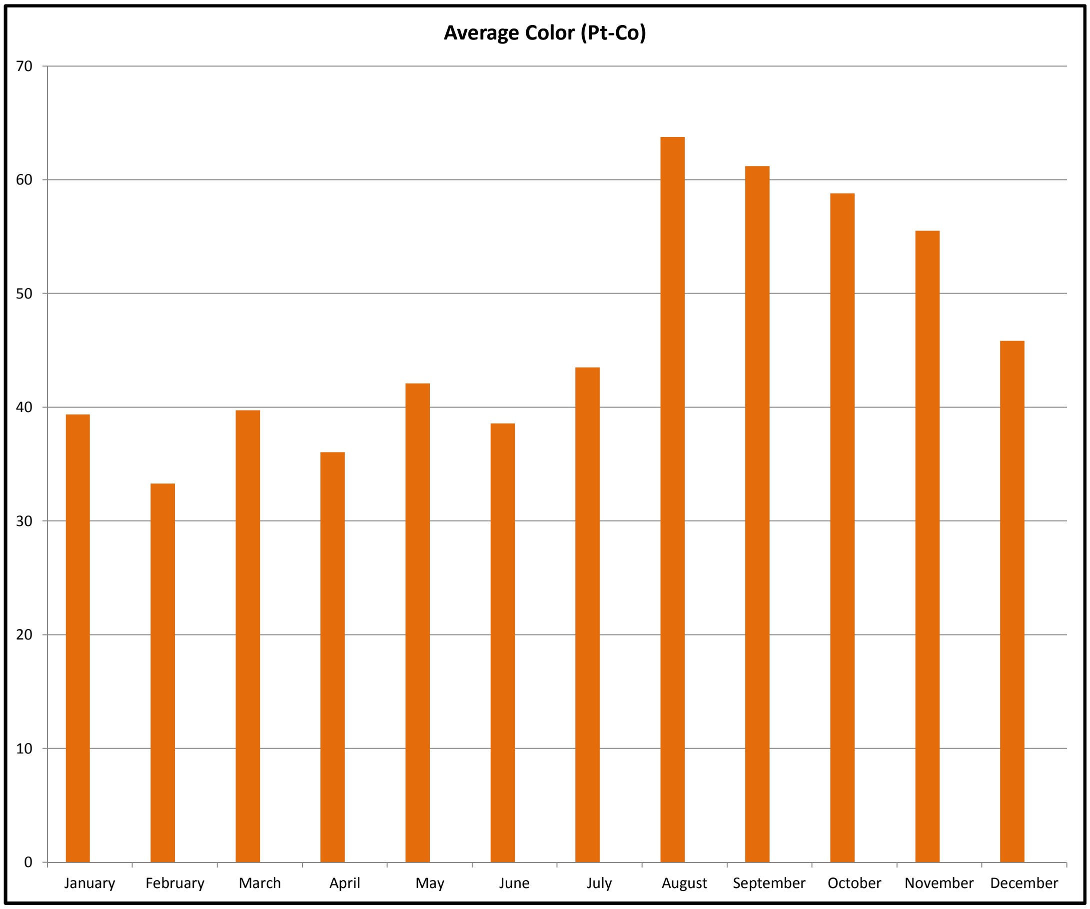

Wrangell Data Flow Vs. Turbidity (NTU) 2013
TURBIDITY (NTU)
FLOW, X1000 GALLONS
DATE
R² = 0.6651
Turb (NTU)


Average Turbidity (NTU)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
January
February
March
April
May
June
July
August
September
October
November
December


Average pH
6.5
6.4
6.3
6.2
6.1
6.0
5.9
5.8
5.7
5.6
January
February
March
April
May
June
July
August
September
October
November
December


Average Temperature (C°)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
January
February
March
April
May
June
July
August
September
October
November
December


Average Flow x1000 Gallons
1400.00
1200.00
1000.00
800.00
600.00
400.00
200.00
0.00
January
February
March
April
May
June
July
August
September
October
November
December


Average Color (Pt-Co)
70
60
50
40
30
20
10
0
January
February
March
April
May
June
July
August
September
October
November
December

WRANGELL WATER DISTRIBUTION SYSTEM

Wrangell, Alaska 2014

		Influent				
Month	Date	Daily Flow (GPD x 1K)	pH	Temp (C°)	Color (Pt-Co)	Turb (NTU)
January	January -1	518				
	January -2	518	6.3	4.4	33	1.32
	January -3	828	6.6	5.4	36	1.86
	January -4	637				
	January -5	637				
	January -6	637	6.4	4.4	39	1.55
	January -7	823	6.3	5.1	36	0.91
	January -8	657	6.2	3.8	38	0.86
	January -9	584	6.5	4.6	37	1
	January -10	647	6.7	4.2	37	0.98
	January -11	708				
	January -12	708				
	January -13	710				
	January -14	304	6.7	6.1	42	1.69
	January -15	580	6.0	4.7	44	1.88
	January -16	632	6.3	4.6	39	1.6
	January -17	598	6.0	4.8	38	1.69
	January -18	595				
	January -19	595				
	January -20	595				
	January -21	596	6.0	5.2	38	1.14
	January -22	646	6.7	5.3	40	1.24
	January -23	821	6.3	5.3	36	1.34
	January -24	603	6.3	5.5	34	0.84
	January -25	633				
	January -26	633				
	January -27	634	6.2	4.6	41	0.91
	January -28	560	6.3	5.5	40	0.94
	January -29	667	6.3	5.3	37	1.13
	January -30	672	6.1	4.8	37	1.17
	January -31	701	6.1	4.8	36	0.96
February	February -1	715				
	February -2	715				
	February -3	717	6.2	4.9	37	0.97
	February -4	692	6.6	5.7	41	0.89
	February -5	866	5.9	4.3	38	0.91
	February -6	772	6.9	5.2	41	1.18
	February -7	909	6.4	4.3	38	0.97
	February -8	787				
	February -9	788				
	February -10	788	6.2	4.5	38	1.32
	February -11	862	6.3	4.4	37	0.94
	February -12	804	6.4	4.7	35	1.02
	February -13	831	5.4	5.5	39	0.88
	February -14	827	6.2	5.1	40	1.02
	February -15	750				
	February -16	751				
	February -17	750				
	February -18	751	6.1	3.9	35	1.02
	February -19	1122	5.9	4.0	37	1
	February -20	536	6.0	4.0	36	0.9
	February -21	813	6.0	4.7	35	0.99
	February -22	811				
	February -23	811				
	February -24	812	6.1	3.7	37	0.93
	February -25	888	6.4	5.2	39	0.95
	February -26	802	6.5	5.5	40	1.18
	February -27	805	6.1	4.9	38	1.12
	February -28	802	6.2	5.4	39	1.08
	February -29					
	March -1	853				
	March -2	853				
	March -3	855	6.6	3.2	39	1.01
	March -4	803	5.7	4.1	44	1.23
	March -5	1091	6.6	3.6	41	1
	March -6	729	6.3	3.9	37	0.98
	March -7	957	6.5	3.4	35	0.93
	March -8	892				
	March -9	892				
	March -10	892	5.4	5.2	41	1.1
	March -11	916	6.4	4.3	38	1.04
	March -12	1391	6.3	5.0	39	1.06

March	March -13	1117	5.9	6.2	36	1.06
	March -14	1196	6.4	4.5	36	1.16
	March -15	841				
	March -16	840				
	March -17	841	5.6	4.8	33	1.11
	March -18	1054	6.2	4.9	34	1.08
	March -19	943	5.9	5.0	31	1.04
	March -20	932	5.7	3.7	30	0.99
	March -21	969	6.4	4.5	31	0.97
	March -22	934				
	March -23	934				
	March -24	934	6.4	5.1	31	1.06
	March -25	1070	6.0	5.4	34	0.97
	March -26	945	6.4	5.8	31	1.29
	March -27	872	5.8	5.1	33	1.12
	March -28	789	5.7	5.2	26	0.59
	March -29					
	March -30					
	March -31					
April	April -1		5.9	4.2	25	1.05
	April -2	1285	6.6	5.4	25	0.97
	April -3	649	6.7	5.3	29	1.14
	April -4	698	5.9	5.4	24	0.83
	April -5	728.3				
	April -6	728.3				
	April -7	728.4	6.6	5.3	24	0.99
	April -8	816	6.0	3.9	30	3.21
	April -9	699	5.7	4.6	21	1.59
	April -10	769	6.5	5.7	24	1.22
	April -11	683	5.7	6.6	26	1.63
	April -12	683				
	April -13	683				
	April -14	684	6.6	5.8	32	0.82
	April -15	691	6.5	7.5	31	0.85
	April -16	696	6.6	6.9	32	0.86
	April -17	649	6.5	6.0	31	0.81
	April -18	645	5.7	6.6	33	0.74
	April -19	638				
	April -20	638				
	April -21	639	6.1	6.0	33	0.71
	April -22	800	6.7	7.5	34	0.74
	April -23	484	6.3	6.2	33	0.71
	April -24	641	6.1	6.8	42	1.08
	April -25	763	5.9	6.3	32	0.72
	April -26	645				
	April -27	646				
	April -28	646	6.5	7.0	37	1.03
	April -29	682	6.2	8.1	33	1.84
	April -30	809	5.9	5.9	32	0.86

May	May -1	774	5.6	6.2	31	1.06
	May -2	695	6.0	6.4	32	0.88
	May -3	686.3				
	May -4	686.3				
	May -5	686.4	5.4	7.1	32	0.94
	May -6		6.4	9.4	34	0.8
	May -7		5.7	7.6	34	0.75
	May -8	800	6.3	8.7	33	0.91
	May -9	840	5.9	6.8	37	0.8
	May -10	765				
	May -11	765				
	May -12	767	6.1	8.4	34	1.51
	May -13	747	5.7	8.8	32	1.09
	May -14	756	5.9	9.0	33	0.82
	May -15	800	6.5	8.9	35	0.8
	May -16	665	6.0	10.0	34	0.82
	May -17	743				
	May -18	743				
	May -19	743	6.1	10.2	36	1.27
	May -20	667	6.4	9.7	30	0.76
	May -21	593				
	May -22	710	6.0	9.9	30	0.75
	May -23	730	6.7	10.0	37	0.88
	May -24	885				
	May -25	632				
	May -26	637				
	May -27	628	5.9	11.1	32	0.8
	May -28	641	5.6	9.7	31	0.88
	May -29	697	6.2	10.4	36	0.85
	May -30	769	5.6	11.1	32	0.79
	May -31	725				
June	June -1	725				
	June -2	725	5.8	10.8	34	0.89
	June -3	684	6.1	10.4	33	0.98
	June -4	918	5.8	10.8	33	0.92
	June -5	601	6.5	10.2	31	1.11
	June -6	760	6.3	10.7	33	1.1
	June -7	930				
	June -8	930				
	June -9	930	6.4	11.2	32	1.05
	June -10		6.2	11.2	31	1.21
	June -11		6.2	11.0	33	2.4
	June -12	693	6.5	11.0	29	0.99
	June -13	823	6.3	11.4	29	1.01
	June -14	756.3				
	June -15	756.3				
	June -16	756.4	5.4	11.8	31	1.19
	June -17	861	5.6	11.2	34	1.15
	June -18	894	5.6	11.8	32	1.28
	June -19	1231	5.8	13.7	32	1.77
	June -20	996	6.2	11.7	32	1.45
	June -21	1040				
	June -22	1040				
	June -23	1040	6.2	12.1	34	1.21
	June -24		6.4	11.8	39	1.29
	June -25	1007				
	June -26	1008	6.0	11.4	38	2.02
	June -27	1062				
	June -28	1062				
	June -29	1062				
	June -30	1063	6.2	11.9	40	1.56

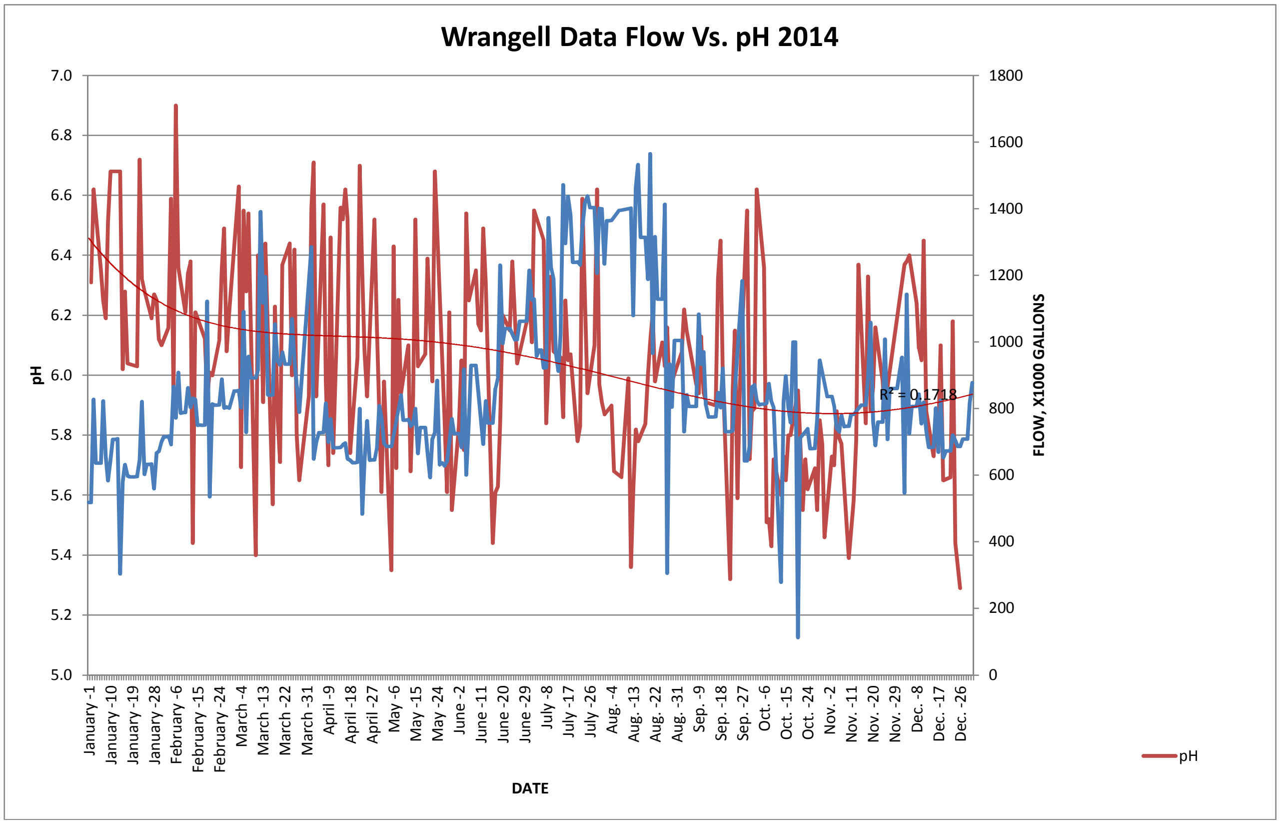
July	July -1	1215	6.3	12.2	40	1.27
	July -2	1127	6.1	12.1	42	1.36
	July -3	1129	6.6	12.4	39	1.29
	July -4	957.75				
	July -5	975.75				
	July -6	975.75				
	July -7	921.75	6.5	12.2	42	1.31
	July -8	923	5.8	12.6	40	1.69
	July -9	1373	6.0	13.2	47	1.63
	July -10	1223	6.3	13.7	42	1.64
	July -11	1188	6.1	13.0	42	1.7
	July -12	968				
	July -13	912				
	July -14	1024	6.1	13.6	43	1.34
	July -15	1472	5.9	13.1	44	2.02
	July -16	1296	6.3	13.2	44	1.66
	July -17	1437	6.1	13.3	44	1.8
	July -18	1382	6.1	13.7	47	1.83
	July -19	1239				
	July -20	1239				
	July -21	1240	5.8	14.0	48	2.22
	July -22	1232	5.8	13.6	49	2.51
	July -23	1342	6.6	13.9	49	2.23
	July -24	1418	6.3	14.3	48	2.42
	July -25	1438	5.9	13.7	51	2.56
	July -26	1404				
	July -27	1404				
	July -28	1404	6.1	14.3	52	2.17
	July -29	1207	6.6	13.7	49	1.96
	July -30	1401	6.0	14.4	57	2.1
	July -31	1400	5.9	13.8	52	2.17
August	Aug. -1	1234	5.9	13.1	46	2.31
	Aug. -2	1364				
	Aug. -3	1364				
	Aug. -4	1365	5.9	13.4	57	2.3
	Aug. -5		5.7	13.6	49	2.01
	Aug. -6					
	Aug. -7	1395				
	Aug. -8	1396	5.7	13.8	54	2.46
	Aug. -9					
	Aug. -10					
	Aug. -11		6.0	15.2	57	4.48
	Aug. -12	1402	5.4	13.3	54	3.21
	Aug. -13	1080	5.6	13.7	65	2.86
	Aug. -14	1464	5.8	13.9	61	2.97
	Aug. -15	1532	5.8	13.7	58	2.06
	Aug. -16	1314				
	Aug. -17	1314				
	Aug. -18	1314	5.8	13.6	61	3.16
	Aug. -19	1188	6.0	13.8	54	2.64
	Aug. -20	1565	6.1	13.1	52	2.51
	Aug. -21	966	6.2	14.0	62	2.46
	Aug. -22	1316	6.0	13.9	65	2.67
	Aug. -23	1129				
	Aug. -24	1129				
	Aug. -25	1129	6.1	14.1	62	2.45
	Aug. -26	1413	6.0	14.0	60	2.51
	Aug. -27	306	6.2	13.6	67	2.95
	Aug. -28	934	5.9	13.8	62	3.05
	Aug. -29	805	6.0	13.5	68	3.25
	Aug. -30	1004.5				
	Aug. -31	1004.5				

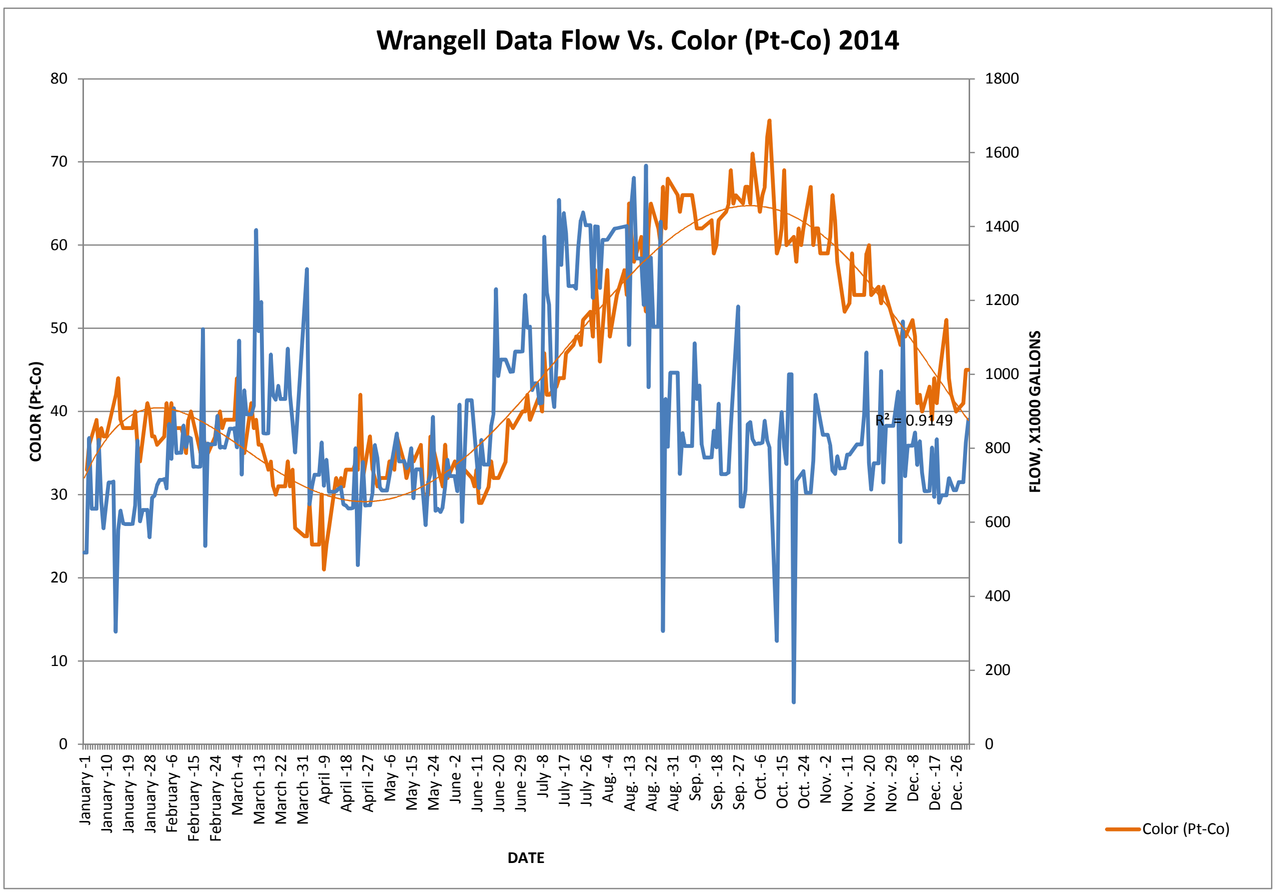
September	Sep. -1	1004.5				
	Sep. -2	1004.5	6.1	13.1	66	2.57
	Sep. -3	731	6.2	12.9	64	2.39
	Sep. -4	841	6.2	13.1	66	2.52
	Sep. -5	806.5				
	Sep. -6	806.5				
	Sep. -7	806.5				
	Sep. -8	806.5	6.0	12.9	66	3.02
	Sep. -9	1084	5.9	12.5	64	2.4
	Sep. -10	934	6.1	12.9	62	2.6
	Sep. -11	970	5.9	12.8	62	2.3
	Sep. -12	810	5.9	12.6	62	2.44
	Sep. -13	775				
	Sep. -14	775				
	Sep. -15	775				
	Sep. -16	776	5.9	12.8	63	2.56
	Sep. -17	848	6.3	12.7	59	2.61
	Sep. -18	803	6.5	12.3	60	2.93
	Sep. -19	921	6.0	12.3	63	3.02
	Sep. -20	730.33				
	Sep. -21	730.33				
	Sep. -22	730.34	5.3	12.4	64	4.32
	Sep. -23	735	6.0	11.8	65	3.18
	Sep. -24	857	6.2	11.4	69	2.54
	Sep. -25		5.6	11.9	65	2.61
	Sep. -26		6.0	12.9	66	2.08
	Sep. -27	1184				
	Sep. -28	643				
	Sep. -29	643	6.6	11.4	65	2.25
	Sep. -30	687	5.7	11.7	67	1.83
October	Oct. -1	865	5.9	11.7	67	1.99
	Oct. -2	871	5.9	10.2	65	1.71
	Oct. -3	825	6.6	11.8	71	1.7
	Oct. -4	812				
	Oct. -5	813				
	Oct. -6	813	6.4	11.3	64	1.4
	Oct. -7	816	5.5	10.8	66	1.26
	Oct. -8	875	5.5	10.9	67	1.18
	Oct. -9	820	5.4	11.7	73	1.33
	Oct. -10	802	5.7	11.4	75	1.07
	Oct. -11					
	Oct. -12					
	Oct. -13	279	5.6	10.8	59	1.38
	Oct. -14	820	5.7	10.5	60	1.17
	Oct. -15	898	5.7	11.1	62	1.01
	Oct. -16	804	5.8	11.7	69	1.55
	Oct. -17	758	5.8	10.6	60	1.12
	Oct. -18	1000				
	Oct. -19	1000				
	Oct. -20	113	6.0	10.0	61	1.4
	Oct. -21	713	5.8	9.7	58	1.38
	Oct. -22		5.6	10.0	62	1.69
	Oct. -23		5.7	10.0	60	0.99
	Oct. -24	739	5.6	10.3	62	1.23
	Oct. -25	680				
	Oct. -26	680				
	Oct. -27	681	5.7	9.2	67	0.95
	Oct. -28	767	5.6	9.2	60	0.97
	Oct. -29	945	5.9	9.5	62	0.97
	Oct. -30		5.8	9.5	62	0.99
	Oct. -31		5.5	9.1	59	1.2

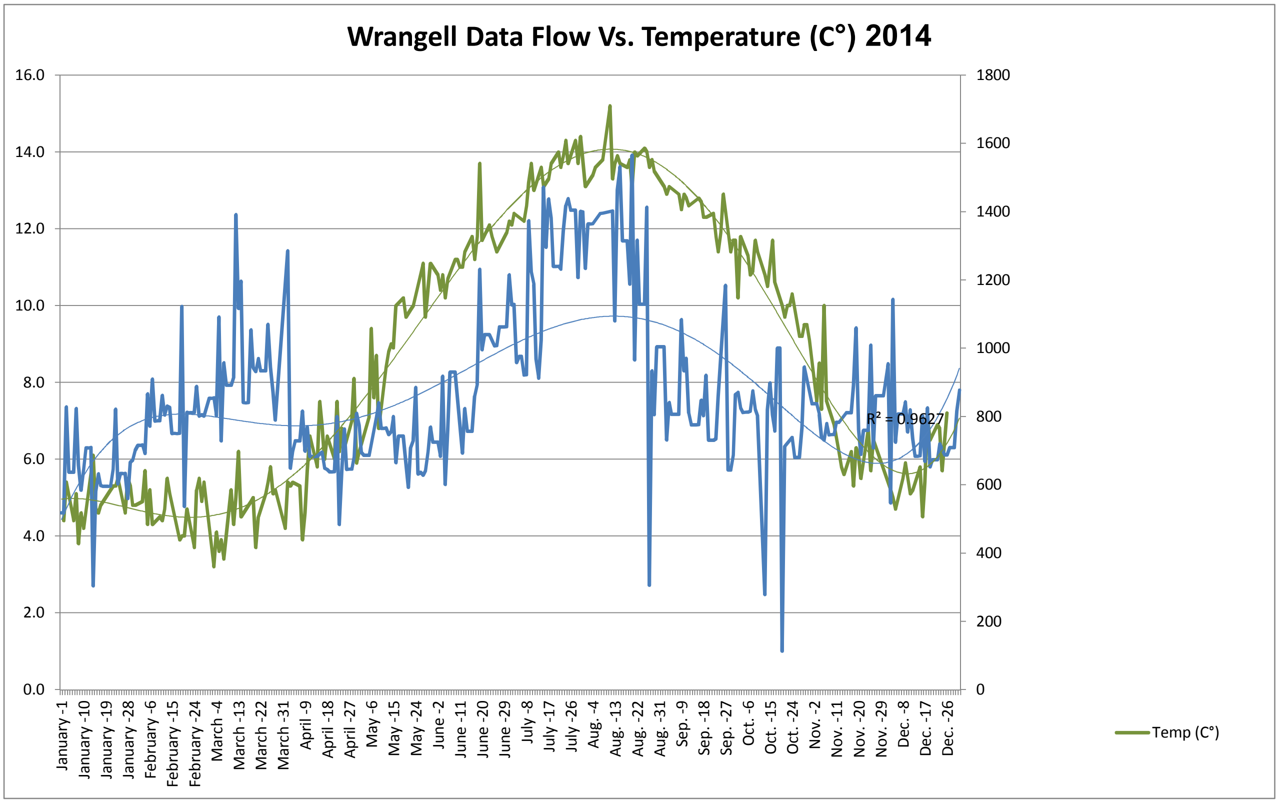
November	Nov. -1	837				
	Nov. -2	837				
	Nov. -3	837	5.7	7.5	59	0.79
	Nov. -4	807	5.7	8.5	61	0.9
	Nov. -5	740	5.9	7.3	66	1.1
	Nov. -6	731	5.8	10.0	63	2.91
	Nov. -7	779	5.8	7.5	58	0.7
	Nov. -8	746				
	Nov. -9	747				
	Nov. -10	747	5.4	6.9	52	0.7
	Nov. -11	783				
	Nov. -12	783	5.6	6.2	53	0.72
	Nov. -13		5.8	5.8	59	0.65
	Nov. -14		6.4	5.6	54	0.67
	Nov. -15	811				
	Nov. -16	811				
	Nov. -17	811	5.8	6.2	54	0.71
	Nov. -18	892	6.3	5.3	54	0.8
	Nov. -19	1059	5.9	6.3	59	0.76
	Nov. -20	761	6.0	6.1	60	0.71
	Nov. -21	689	6.2	5.5	54	0.91
	Nov. -22	759.33				
	Nov. -23	759.34				
	Nov. -24	759.33	6.0	6.8	55	0.86
	Nov. -25	1009	5.9	5.7	53	0.77
	Nov. -26	708	6.0	6.5	55	0.82
	Nov. -27	861				
	Nov. -28	861				
	Nov. -29	861				
	Nov. -30	861				
December	Dec. -1					
	Dec. -2	954				
	Dec. -3	547	6.4	5.2	48	1.01
	Dec. -4	1143	6.4	5.0	50	0.95
	Dec. -5	725	6.4	4.7	49	0.94
	Dec. -6	807				
	Dec. -7	807				
	Dec. -8	807	6.2	5.5	51	1.62
	Dec. -9	843	6.1	5.9	49	0.89
	Dec. -10	755	6.1		41	1
	Dec. -11	819	6.5	5.1	42	1.05
	Dec. -12	735	5.9	5.2	40	0.85
	Dec. -13	684				
	Dec. -14	684				
	Dec. -15	685	5.7	5.8	43	0.75
	Dec. -16	802	5.9	4.5	39	0.84
	Dec. -17	669	5.8	5.4	44	0.73
	Dec. -18	825	6.1	7.1	41	0.88
	Dec. -19	653	5.7	6.5	44	0.79
	Dec. -20	673				
	Dec. -21	673				
	Dec. -22	673	5.7	6.9	51	1.01
	Dec. -23	720	6.2	6.8	44	0.84
	Dec. -24	703	5.4	5.7	42	0.87
	Dec. -25	687				
	Dec. -26	687	5.3	7.2	40	0.8
	Dec. -27	708.6				
	Dec. -28	708.6				
	Dec. -29	708.8			41	0.86
	Dec. -30	817			45	0.83
	Dec. -31	878			45	1.07
	AVG	**856**				

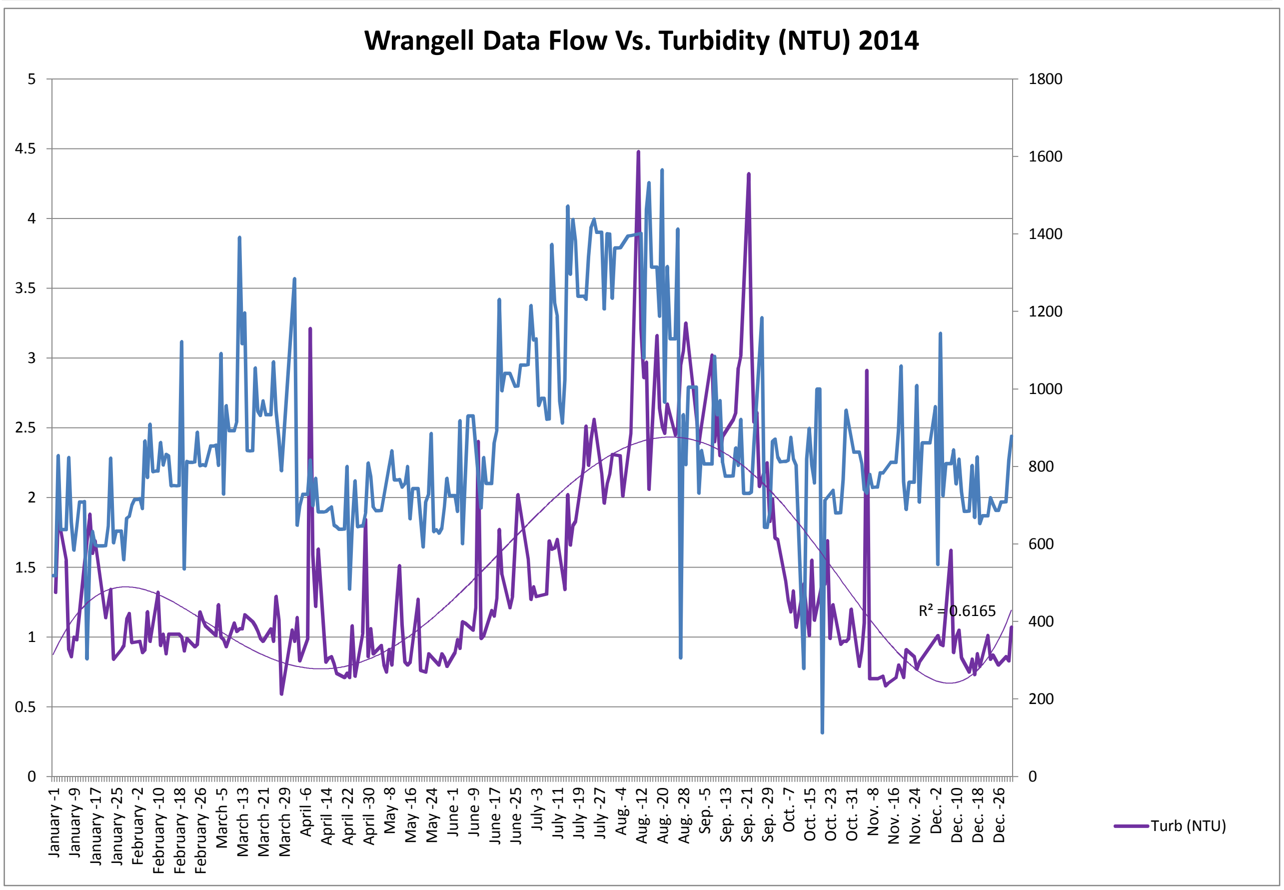
Statistical Analysis

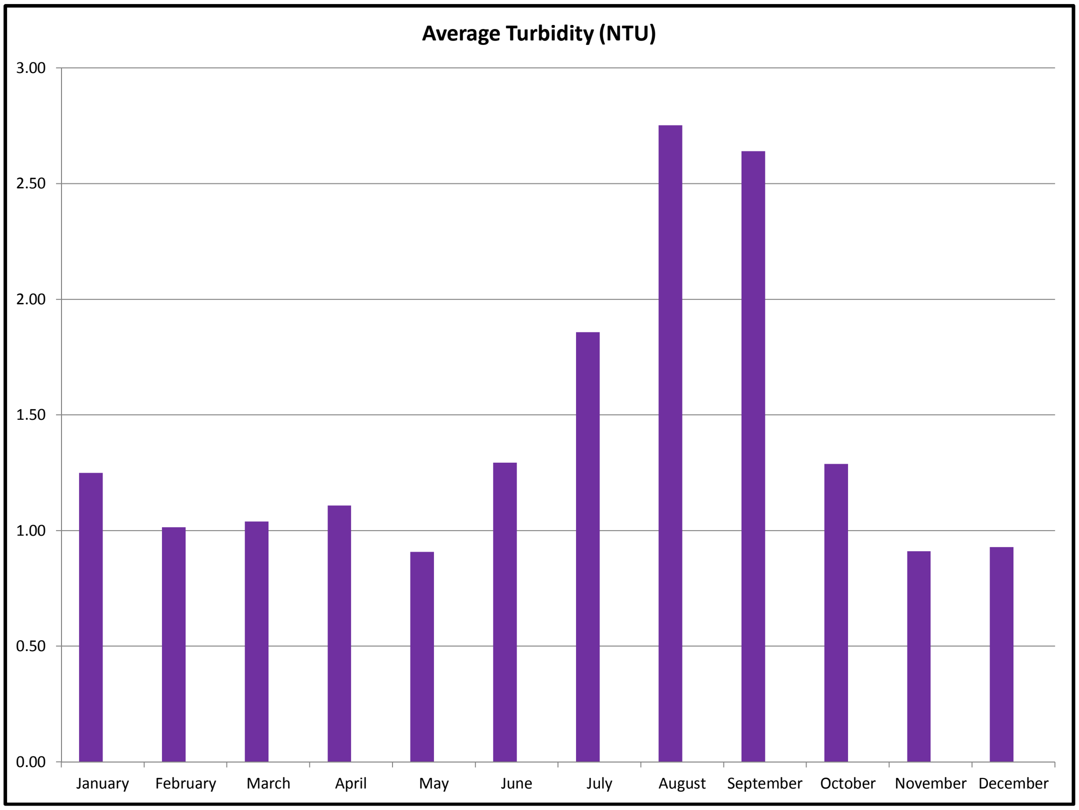
Month	Turbidity (NTU)			Flow (gdp x 1000)			pH			Color (Pt-Co)			Temp (C°)		
	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min
January	1.25	1.88	0.84	634.74	828	304	6.3	6.7	6.0	38	44	33	4.9	6.1	3.8
February	1.01	1.32	0.88	795.61	1122	536	6.2	6.9	5.4	38	41	35	4.7	5.7	3.7
March	1.04	1.29	0.59	940.54	1391	729	6.1	6.6	5.4	35	44	26	4.6	6.2	3.2
April	1.11	3.21	0.71	708.48	1285	484	6.2	6.7	5.7	30	42	21	6.0	8.1	3.9
May	0.91	1.51	0.75	723.31	885	593	6.0	6.7	5.4	33	37	30	9.0	11.1	6.2
June	1.29	2.4	0.89	902.00	1231	601	6.1	6.5	5.4	33	40	29	11.4	13.7	10.2
July	1.86	2.56	1.27	1221.55	1472	912	6.1	6.6	5.8	46	57	39	13.4	14.4	12.1
August	2.75	4.48	2.01	1208.73	1565	306	5.9	6.2	5.4	59	68	46	13.7	15.2	13.1
Septembe	2.64	4.32	1.83	829.21	1184	643	6.0	6.6	5.3	64	69	59	12.4	13.1	11.4
October	1.29	1.99	0.95	767.56	1000	113	5.8	6.6	5.4	64	75	58	10.5	11.8	9.1
November	0.91	2.91	0.65	808.82	1059	689	5.9	6.4	5.4	57	66	52	6.7	10.0	5.3
December	0.93	1.62	0.73	752.70	1143	547	6.0	6.5	5.3	44	51	39	5.8	7.2	5

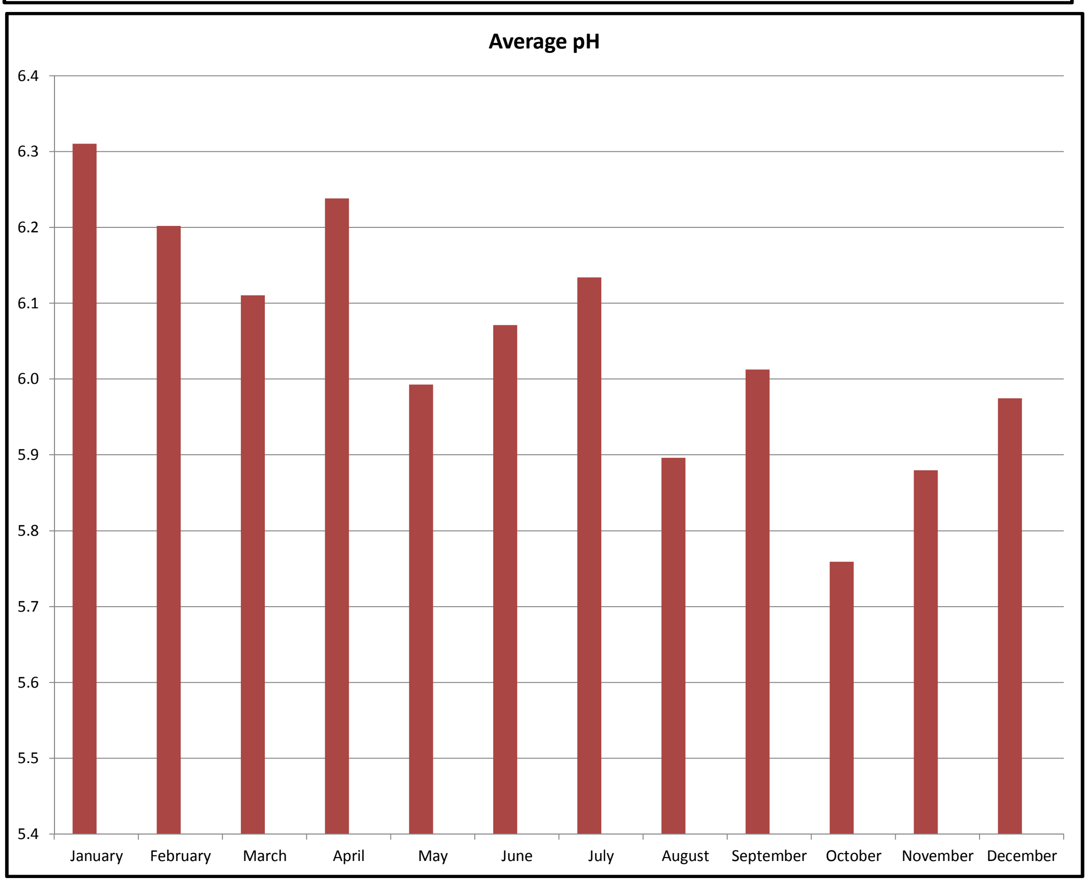

Wrangell Data Flow Vs. pH 2014
pH
FLOW, X1000 GALLONS
DATE
R^2 = 0.1718
pH

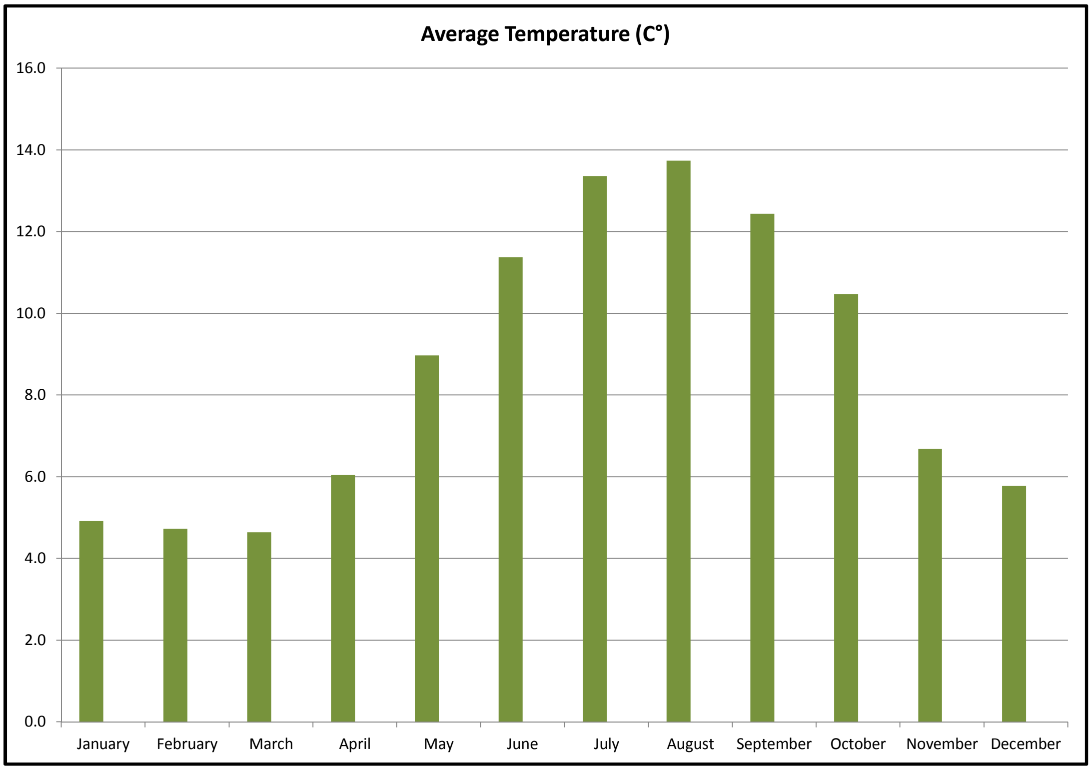

Wrangell Data Flow Vs. Color (Pt-Co) 2014
COLOR (Pt-Co)
FLOW, X1000 GALLONS
DATE
R^2 = 0.9149
Color (Pt-Co)

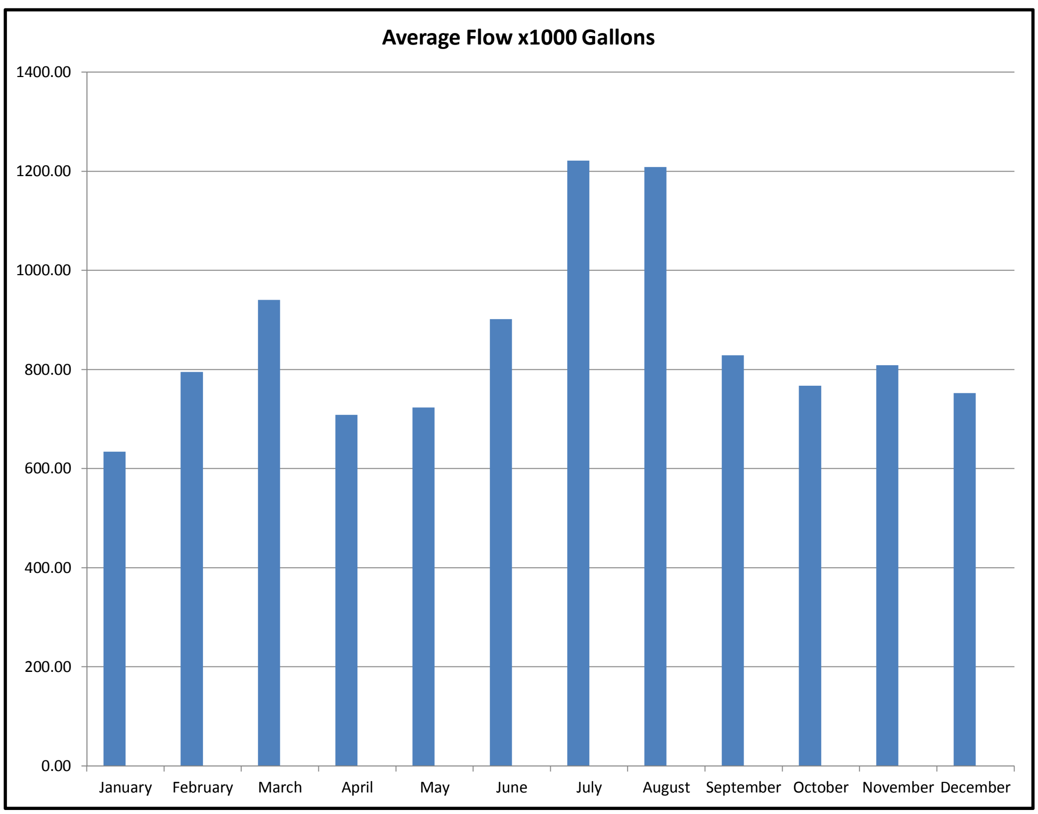

Wrangell Data Flow Vs. Temperature (C°) 2014
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
1800
1600
1400
1200
1000
800
600
400
200
0
R² = 0.9627
Temp (C°)

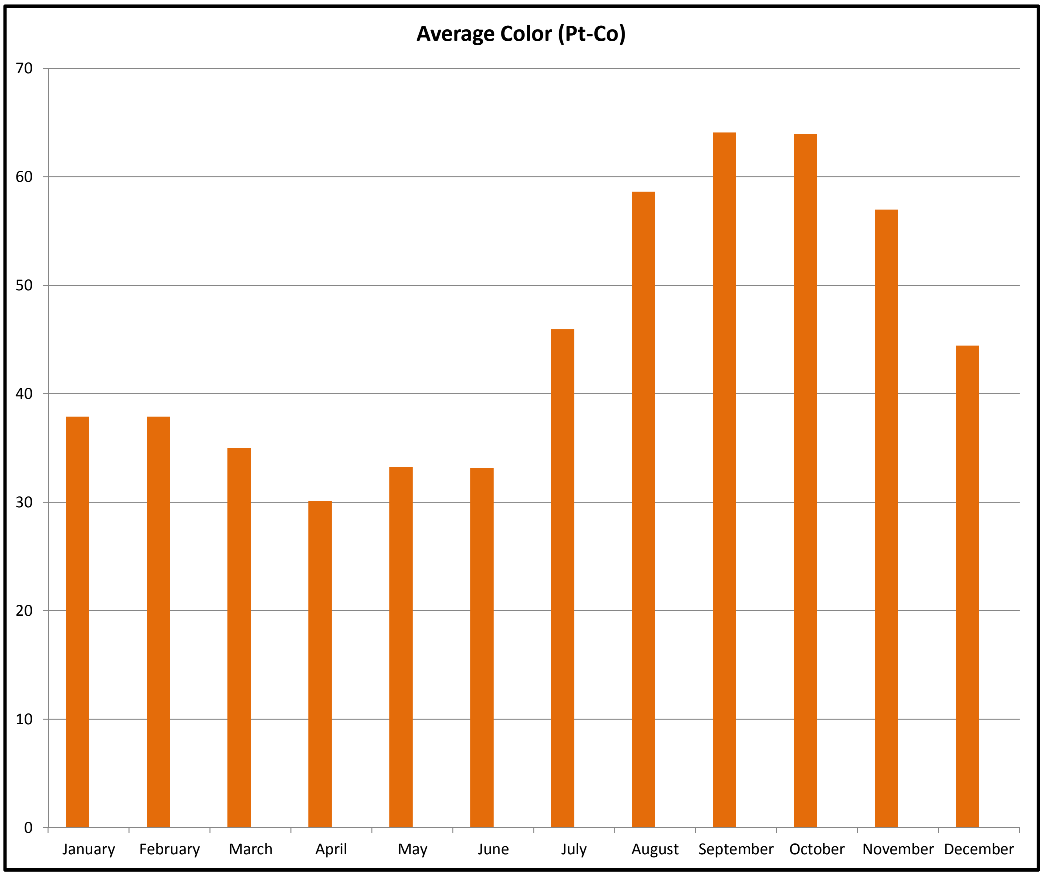

Wrangell Data Flow Vs. Turbidity (NTU) 2014
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1800
1600
1400
1200
1000
800
600
400
200
0
R² = 0.6165
Turb (NTU)


Average Turbidity (NTU)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
January
February
March
April
May
June
July
August
September
October
November
December


Average pH
6.4
6.3
6.2
6.1
6.0
5.9
5.8
5.7
5.6
5.5
5.4
January
February
March
April
May
June
July
August
September
October
November
December


Average Temperature (C°)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
January
February
March
April
May
June
July
August
September
October
November
December


Average Flow x1000 Gallons
1400.00
1200.00
1000.00
800.00
600.00
400.00
200.00
0.00
January
February
March
April
May
June
July
August
September
October
November
December


Average Color (Pt-Co)
70
60
50
40
30
20
10
0
January
February
March
April
May
June
July
August
September
October
November
December

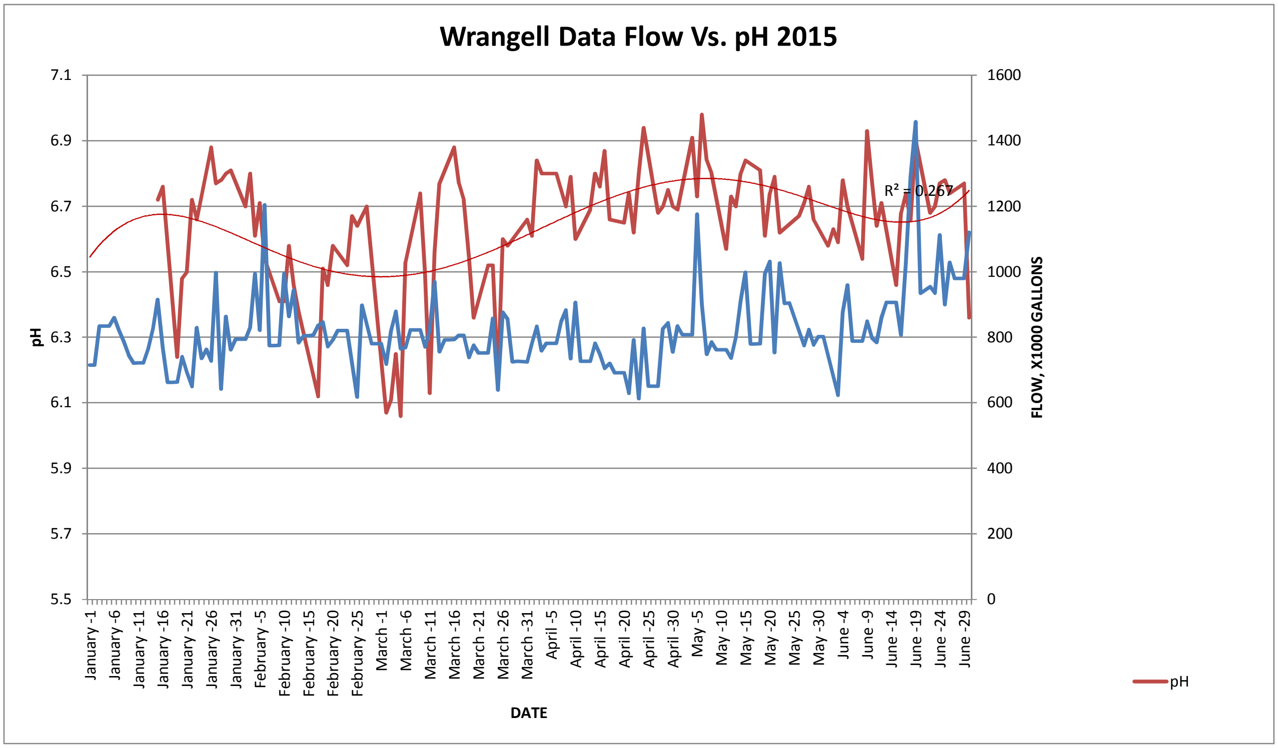
WRANGELL WATER DISTRIBUTION SYSTEM

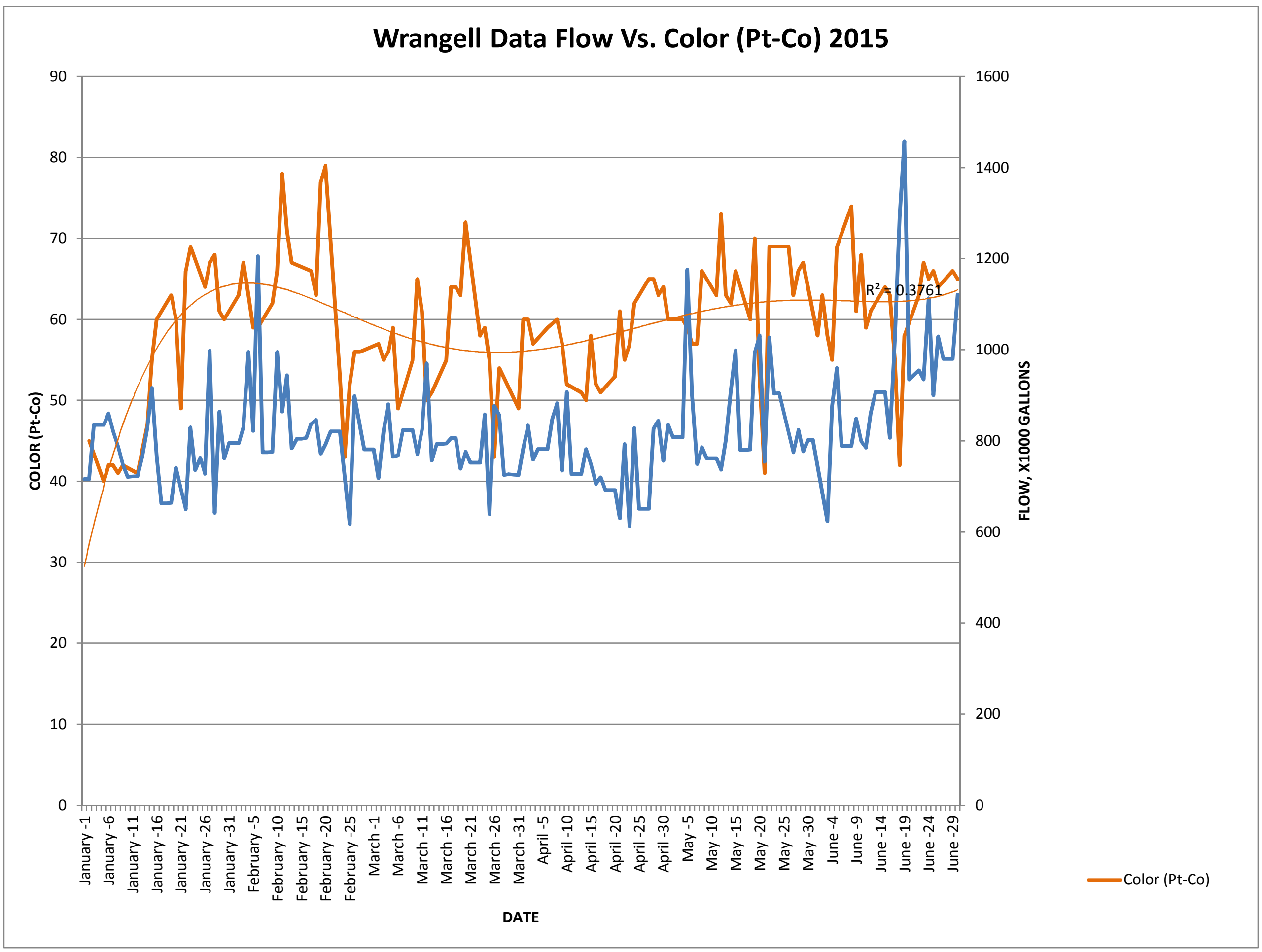
Wrangell, Alaska 2015

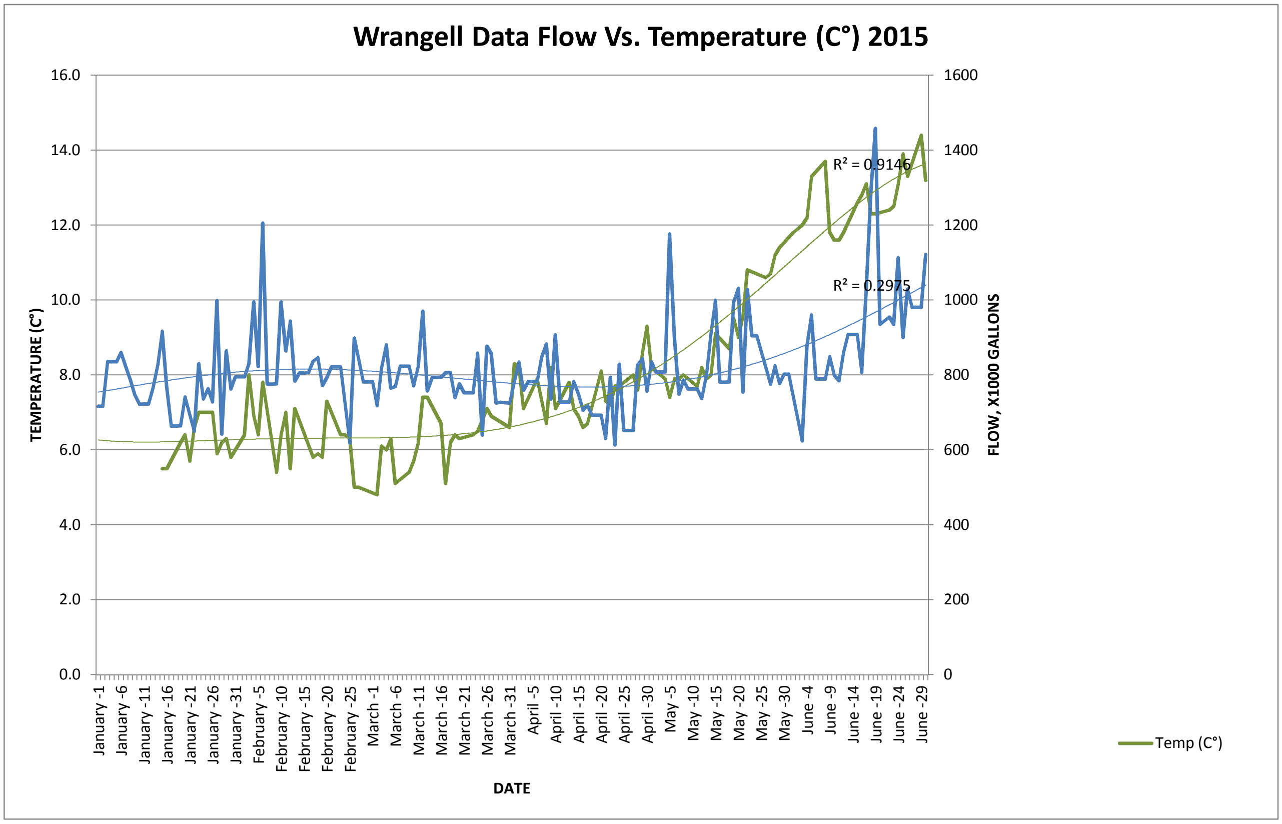
		Influent				
Month	Date	Daily Flow (GPD x 1K)	pH	Temp (C°)	Color (Pt-Co)	Turb (NTU)
January	January -1	716				
	January -2	716			45	1.07
	January -3	835				
	January -4	835				
	January -5	835			40	0.9
	January -6	860			42	1.04
	January -7	821			42	0.89
	January -8	787			41	1.08
	January -9	747			42	0.92
	January -10	721				
	January -11	722				
	January -12	722			41	0.95
	January -13	765				
	January -14	827			47	1
	January -15	916	6.7	5.5	55	0.85
	January -16	768	6.8	5.5	60	1.09
	January -17	663				
	January -18	663				
	January -19	664	6.2	6.2	63	0.87
	January -20	741	6.5	6.4	60	0.87
	January -21	693	6.5	5.7	49	1.29
	January -22	650	6.7	6.6	66	2.06
	January -23	830	6.7	7.0	69	1
	January -24	736				
	January -25	763				
	January -26	728	6.9	7.0	64	1.01
	January -27	998	6.8	5.9	67	0.81
	January -28	642	6.8	6.2	68	0.68
	January -29	864	6.8	6.3	61	0.69
	January -30	762	6.8	5.8	60	0.89
	January -31	795				
February	February -1	795				
	February -2	795	6.7	6.4	63	0.76
	February -3	832	6.8	8.0	67	0.79
	February -4	995	6.6	6.9	63	1.61
	February -5	822	6.7	6.4	59	0.78
	February -6	1205	6.5	7.8	59	1.33
	February -7	775				
	February -8	775				
	February -9	776	6.4	5.4	62	0.68
	February -10	995	6.4	6.4	66	0.68
	February -11	864	6.6	7.0	78	8.06
	February -12	944	6.5	5.5	71	
	February -13	784	6.4	7.1	67	0.68
	February -14	805				
	February -15	805				
	February -16	807				
	February -17	837	6.1	5.8	66	0.66
	February -18	846	6.5	5.9	63	0.8
	February -19	772	6.5	5.8	77	0.67
	February -20	793	6.6	7.3	79	0.95
	February -21	821				
	February -22	821				
	February -23	821	6.5	6.4	53	1.48
	February -24		6.7	6.4	43	0.67
	February -25	618	6.6	6.3	52	0.62
	February -26	898	6.7	5.0	56	0.88
	February -27		6.7	5.0	56	0.88
	February -28	781				
	February -29					

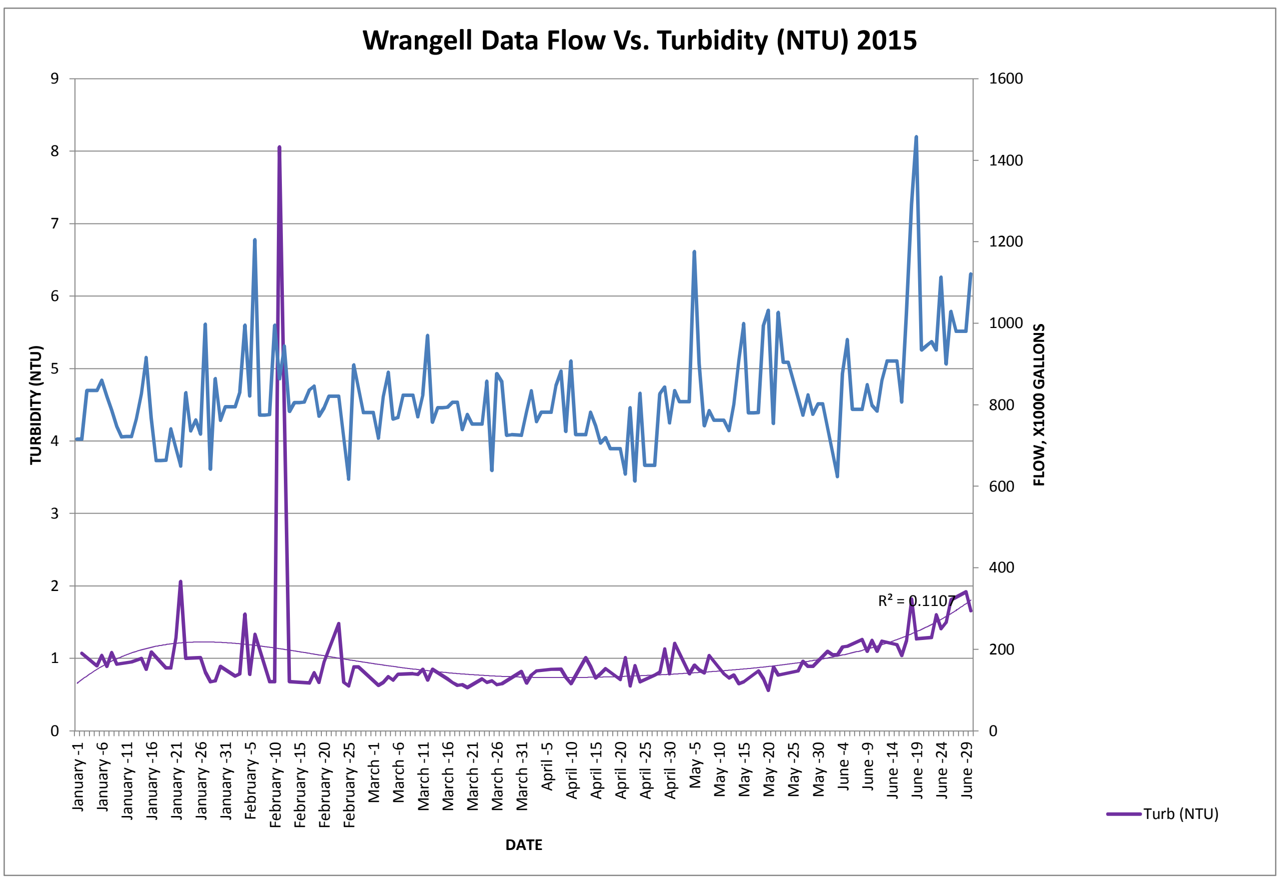
March	March -1	781				
	March -2	718	6.1	4.8	57	0.63
	March -3	820	6.1	6.1	55	0.67
	March -4	880	6.3	6.0	56	0.75
	March -5	765	6.1	6.3	59	0.7
	March -6	769	6.5	5.1	49	0.78
	March -7	823.3				
	March -8	823.3				
	March -9	823.4	6.7	5.4	55	0.79
	March -10	771	6.5	5.7	65	0.78
	March -11	825	6.1	6.2	61	0.85
	March -12	970	6.6	7.4	50	0.7
	March -13	757	6.8	7.4	51	0.85
	March -14	793				
	March -15	793				
	March -16	794	6.9	6.7	55	0.72
	March -17	806	6.8	5.1	64	0.67
	March -18	806	6.7	6.2	64	0.63
	March -19	739	6.6	6.4	63	0.64
	March -20	776	6.4	6.3	72	0.6
	March -21	752.33				
	March -22	752.34				
	March -23	752.33	6.5	6.4	58	0.72
	March -24	858	6.5	6.5	59	0.67
	March -25	639	6.2	6.8	55	0.69
	March -26	877	6.6	7.1	43	0.64
	March -27	856	6.6	6.9	54	0.65
	March -28	725				
	March -29	727				
	March -30	726				
	March -31	725	6.7	6.6	49	0.82
April	April -1	783	6.6	8.3	60	0.66
	April -2	834	6.8	8.2	60	0.77
	April -3	759	6.8	7.1	57	0.83
	April -4	782				
	April -5	782				
	April -6	782	6.8	7.9	59	0.85
	April -7	848				
	April -8	883	6.7	6.7	60	0.85
	April -9	735	6.8	8.2	57	0.74
	April -10	907	6.6	7.1	52	0.65
	April -11	727				
	April -12	727				
	April -13	727	6.7	7.8	51	1.01
	April -14	782	6.8	7.1	50	0.89
	April -15	749	6.8	6.9	58	0.73
	April -16	706	6.9	6.6	52	0.79
	April -17	720	6.7	6.7	51	0.86
	April -18	692				
	April -19	692				
	April -20	692	6.7	8.1	53	0.71
	April -21	630	6.7	7.3	61	1.01
	April -22	793	6.6	7.2	55	0.62
	April -23	613	6.8	7.7	57	0.9
	April -24	828	6.9	7.7	62	0.68
	April -25	651				
	April -26	651				
	April -27	651	6.7	8.0	65	0.77
	April -28	827	6.7	7.6	65	0.81
	April -29	844	6.8	8.6	63	1.13
	April -30	756	6.7	9.3	64	0.79

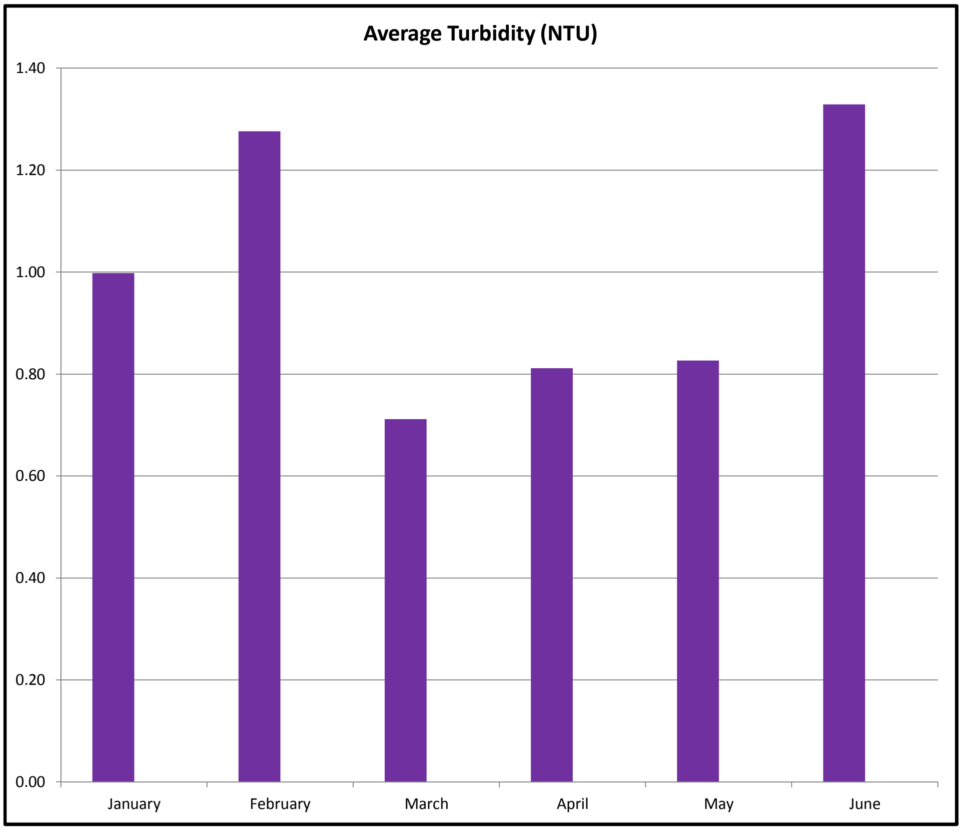
May	May -1	835	6.7	8.2	60	1.21
	May -2	808				
	May -3	808				
	May -4	808	6.9	7.9	60	0.79
	May -5	1176	6.7	7.4	59	0.91
	May -6	901	7.0	7.9	57	0.84
	May -7	749	6.8	7.9	57	0.8
	May -8	786	6.8	8.0	66	1.04
	May -9	762				
	May -10	762				
	May -11	762	6.6	7.7	63	0.79
	May -12	737	6.7	8.2	73	0.73
	May -13	801	6.7	7.9	63	0.77
	May -14	911	6.8	8.0	62	0.65
	May -15	999	6.8	9.1	66	0.68
	May -16	780				
	May -17	780				
	May -18	781	6.8	8.7	60	0.83
	May -19	996	6.6	9.5	70	0.72
	May -20	1032	6.7	9.0	53	0.56
	May -21	754	6.8	9.6	41	0.88
	May -22	1027	6.6	10.8	69	0.77
	May -23	904				
	May -24	904.5				
	May -25					
	May -26		6.7	10.6	69	0.83
	May -27	775	6.7	10.7	63	0.96
	May -28	824	6.8	11.2	66	0.89
	May -29	777	6.7	11.4	67	0.89
	May -30	802				
	May -31	802				
June	June -1		6.6	11.8	58	1.1
	June -2		6.6	11.9	63	1.05
	June -3	624	6.6	12.0	58	1.05
	June -4	877	6.8	12.2	55	1.16
	June -5	960	6.7	13.3	69	1.17
	June -6	788.67				
	June -7	788.63				
	June -8	788.7	6.5	13.7	74	1.26
	June -9	849	6.9	11.8	61	1.1
	June -10	799	6.8	11.6	68	1.25
	June -11	785	6.6	11.6	59	1.1
	June -12	860	6.7	11.8	61	1.24
	June -13	907.33				
	June -14	907.34				
	June -15	907.33	6.5	12.6	64	1.19
	June -16	807	6.7	12.8	63	1.04
	June -17	1024	6.7	13.1	55	1.25
	June -18	1291	6.7	12.3	42	1.82
	June -19	1458	6.9	12.3	58	1.27
	June -20	935				
	June -21	945				
	June -22	955	6.7	12.4	63	1.29
	June -23	935	6.7	12.5	67	1.6
	June -24	1113	6.8	13.1	65	1.41
	June -25	900	6.8	13.9	66	1.5
	June -26	1029	6.7	13.3	64	1.81
	June -27	980				
	June -28	980				
	June -29	980	6.8	14.4	66	1.92
	June -30	1121	6.4	13.2	65	1.66
	AVG	**819**				

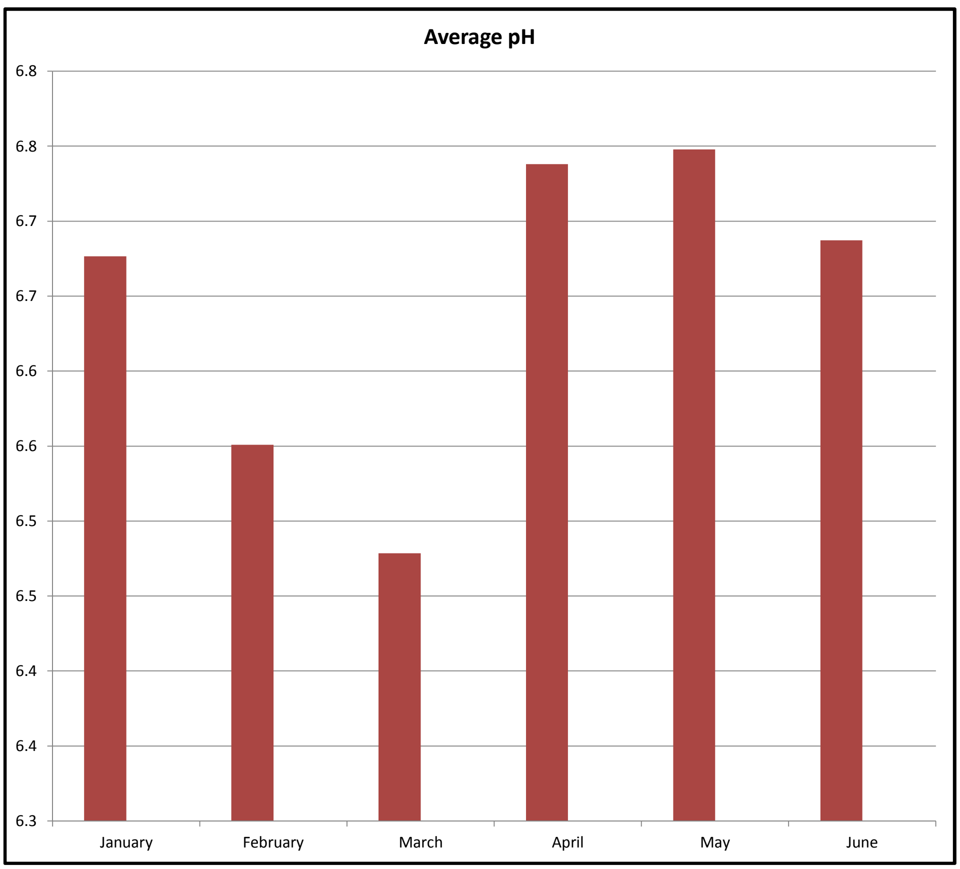

Wrangell Data Flow Vs. pH 2015
pH
FLOW, X1000 GALLONS
DATE
$R^2 = 0.267$
pH
7.1
6.9
6.7
6.5
6.3
6.1
5.9
5.7
5.5
1600
1400
1200
1000
800
600
400
200
0
January -1
January -6
January -11
January -16
January -21
January -26
January -31
February -5
February -10
February -15
February -20
February -25
March -1
March -6
March -11
March -16
March -21
March -26
March -31
April -5
April -10
April -15
April -20
April -25
April -30
May -5
May -10
May -15
May -20
May -25
May -30
June -4
June -9
June -14
June -19
June -24
June -29

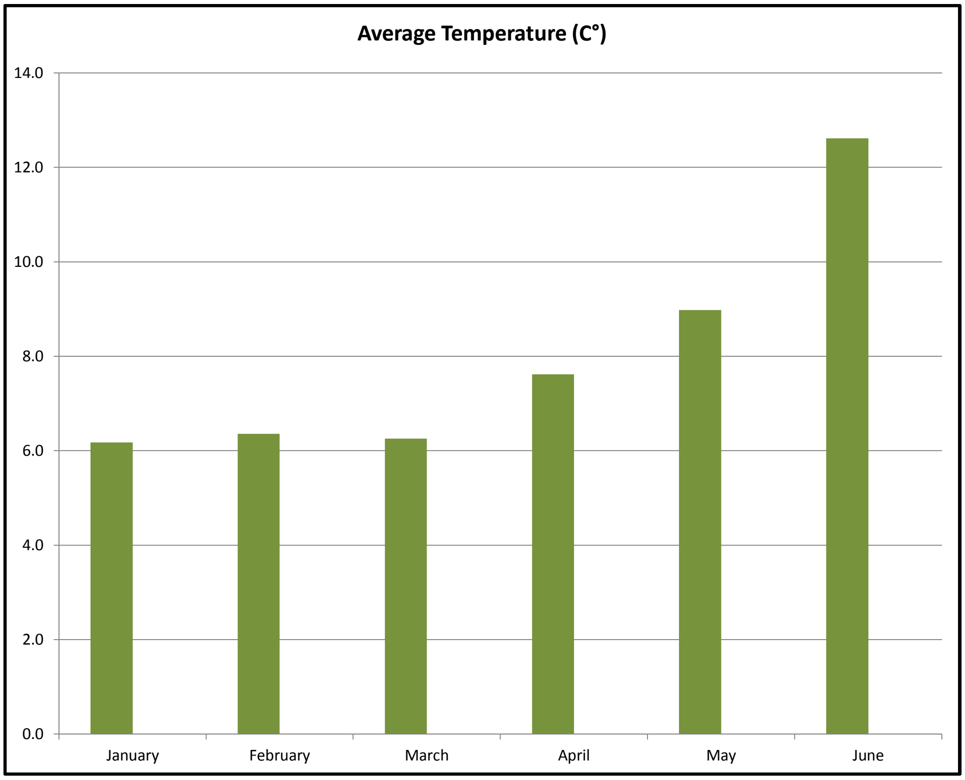

Wrangell Data Flow Vs. Color (Pt-Co) 2015
COLOR (Pt-Co)
FLOW, X1000 GALLONS
DATE
$R^2 = 0.3761$
Color (Pt-Co)
90
80
70
60
50
40
30
20
10
0
1600
1400
1200
1000
800
600
400
200
0
January -1
January -6
January -11
January -16
January -21
January -26
January -31
February -5
February -10
February -15
February -20
February -25
March -1
March -6
March -11
March -16
March -21
March -26
March -31
April -5
April -10
April -15
April -20
April -25
April -30
May -5
May -10
May -15
May -20
May -25
May -30
June -4
June -9
June -14
June -19
June -24
June -29

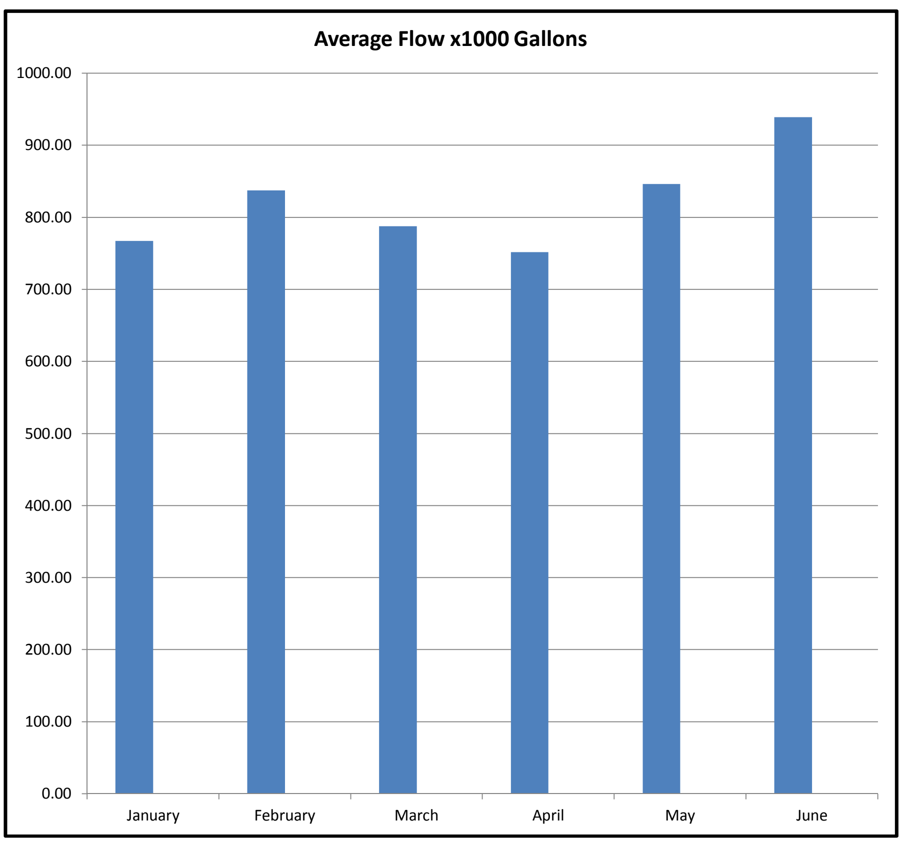

Wrangell Data Flow Vs. Temperature (C°) 2015
TEMPERATURE (C°)
FLOW, X1000 GALLONS
DATE
$R^2 = 0.9146$
$R^2 = 0.2975$
Temp (C°)

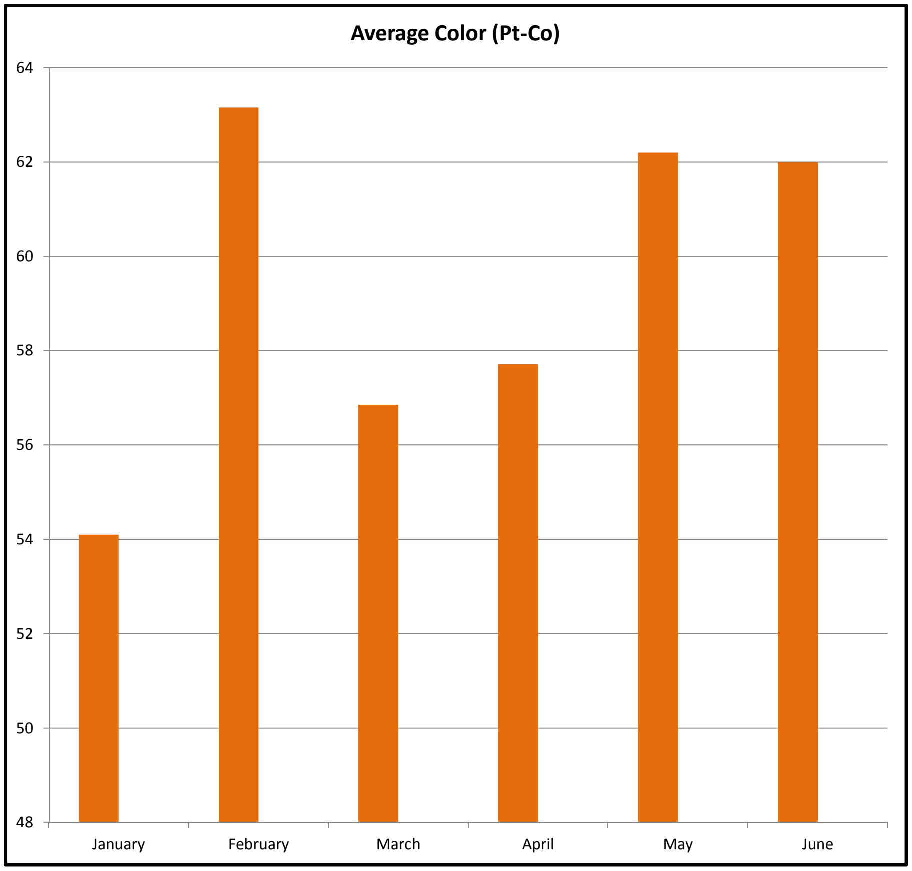

Wrangell Data Flow Vs. Turbidity (NTU) 2015
TURBIDITY (NTU)
FLOW, X1000 GALLONS
DATE
$R^2 = 0.1107$
Turb (NTU)


Average Turbidity (NTU)
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
January
February
March
April
May
June


Average pH
6.8
6.8
6.7
6.7
6.6
6.6
6.5
6.5
6.4
6.4
6.3
January
February
March
April
May
June


Average Temperature (C°)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
January
February
March
April
May
June


Average Flow x1000 Gallons
1000.00
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
January
February
March
April
May
June


Average Color (Pt-Co)
64
62
60
58
56
54
52
50
48
January
February
March
April
May
June

Statistical Analysis

Month	Turbidity (NTU)			Flow (gdp x 1000)			pH			Color (Pt-Co)			Temp (C°)		
	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min
January	1.00	2.06	0.68	767.26	998	642	6.7	6.9	6.2	54	69	40	6.2	7.0	5.5
February	1.28	8.06	0.62	837.77	1205	618	6.6	6.8	6.1	63	79	43	6.4	8.0	5.0
March	0.71	0.85	0.6	787.84	970	639	6.5	6.9	6.1	57	72	43	6.3	7.4	4.8
April	0.81	1.13	0.62	751.77	907	613	6.7	6.9	6.6	58	65	50	7.6	9.3	6.6
May	0.83	1.21	0.56	846.33	1176	737	6.7	7.0	6.6	62	73	41	9.0	11.4	7.4
June	1.33	1.92	1.04	939.11	1458	624	6.7	6.9	6.4	62	74	42	12.6	14.4	11.6

Appendix C – Regulations Summary

1. REGULATIONS SUMMARY

1.1. Primary Contaminants

Contaminants are grouped into two general categories: primary contaminants and secondary contaminants. Primary contaminants are delineated into the following subcategories:

- Inorganic Contaminants (also includes arsenic, lead and copper)
- Organic Contaminants (includes volatile and synthetic organics)
- Microbial Contaminants and Turbidity (Sections 1.3 through 1.6)
- Disinfection By-Products (Section 1.8)
- Radionuclides

Primary contaminants are those considered to present health risks if ingested through drinking water. These contaminants are regulated by measuring their concentrations in drinking water and comparing them to “maximum contaminant levels” (MCLs) established by EPA. Every public water system is required to regularly monitor for and report measured concentrations of primary contaminants to ensure that the MCL standards are being met. A summary of the monitoring requirements for CBW is included in this Appendix.

The State of Alaska Department of Environmental Conservation (ADEC) maintains a sample database for CBW which shows sample results, sample schedules, the current monitoring summary, and any violations or enforcement actions. The site can be accessed through State’s Drinking Water Watch website:

http://dec.alaska.gov:8080/DWW/JSP/WaterSystemDetail.jsp?tinwsys_is_number=4115&tinwsys_st_code=AK&wsnumber=AK2120143

1.2. Secondary Contaminants

EPA has established National Secondary Drinking Water Regulations that define non-mandatory water quality standards for 15 “secondary” contaminants. Known as “secondary maximum contaminant levels (SMCLs)", these standards are established as guidelines to assist public water systems in managing their drinking water for aesthetic considerations such as taste, color, and odor. At the SMCL, these contaminants are not considered to present risks to human health, but may cause maintenance and palatability issues. Nevertheless, they are used by regulatory agencies to encourage the use of treated drinking water, in lieu of drinking non-potable water that may be perceived to look and taste good.

1.3. Total Coliform Rule (TCR) and Revised TCR.

The TCR requires public water systems to test for the presence of total coliforms in their distribution systems. Coliforms are bacteria that, when present, indicate that water may have been contaminated by human and/or animal waste. The most practical way to reduce the likelihood of coliform bacteria presence is to disinfect the water and maintain a minimum disinfectant residual in the distribution system. This objective is usually accomplished with the addition of a cost effective disinfectant such as chlorine. Systems that do not disinfect are required to undergo water source monitoring.

The TCR requires CBW to:

- Establish a Sample Site Plan identifying the locations in the distribution system where water sampling will be performed.
- Take two monthly water samples to test for the presence of total coliform bacteria.
- Provide public notification and reporting requirements.
- Conduct a system-wide sanitary survey every 3 years.

EPA recently revised the TCR to include the following requirements:

- Public water systems vulnerable to microbial contamination shall assess, identify and fix sanitary deficiencies that lead to contamination.
- Reduced monitoring for "well-operated" water systems.
- Increased monitoring for high-risk systems with unacceptable compliance history.
- Elimination of *total coliform* MCL and MCL goal.
- Implementation of *E. coli* MCL goal of zero.

The Revised TCR will become effective on April 1, 2016.

1.4. Surface Water Treatment Rule (SWTR)

The SWTR, established by EPA in 1989, sets maximum contaminant levels (MCLs) for specific pathogenic microbial contaminants. The SWTR requires the use of filtration and disinfection that will result in a prescribed level of removal or inactivation of specified microbial contaminants. The basic rule requires that filtration and disinfection processes achieve a 3-log (99.9%) removal or inactivation of *Giardia* and a 4-log (99.99%) removal/inactivation of viruses. In addition, disinfectant residual at the distribution system entry point may not be less than 0.2 mg/L. Further, turbidity levels are used as a surrogate for measuring the performance of the filtration process at specified time intervals (continuously, every 4 hours, or daily, depending on population). The SWTR initially established for conventional and direct filtration a threshold of 0.5 NTU, below which 95% of sample measurements are required to fall for each monthly reporting period. This threshold was lowered in later regulatory updates to the SWTR (Section 1.5). For slow sand filtration, the turbidity threshold was established at 1 NTU and continues to be regulated at this level. Turbidity measurements are required to be reported to ADEC every month.

Because CBW uses a surface water source, it currently employs filtration and disinfection processes, and is subject to all SWTR regulations that apply to "small" water systems (i.e., systems that serve populations less than 10,000 persons), including later updates to SWTR as outlined in Sections 1.6 and 1.7.

1.5. Interim Enhanced Surface Water Treatment Rule (IESWTR)

The IESWTR was established in 1998 by EPA to include 2-log (99%) removal/activation of *Cryptosporidium* microbial pathogens and reduce the maximum allowable turbidity level to 0.3 NTU in 95% of measurements for both direct and conventional filtration systems. When turbidity levels are exceeded in certain frequencies, treatment system evaluations are required and performed by the plant operator and/or State agency personnel. With exception to sanitary survey provisions, these requirements initially applied only to "large" public water systems (serving populations greater than 10,000 persons) using surface water sources or "Groundwater under the Direct Influence of Surface Water" (GWDISW). The IESWTR requires that sanitary surveys be conducted on all community water systems every 3 years.

1.6. Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR)

The LT1ESWTR, established in 2002, requires that all surface water and GWUDI public water systems, including small systems, meet the drinking water standards established in the IESWTR. This regulatory update also requires that "individual filter effluent" (IFE) streams be monitored continuously for turbidity levels, while "combined filter effluent" (CFE) turbidity levels are measured every 4 hours. For water systems that employ two or less filters, continuous monitoring of CFE can be provided in lieu of IFE monitoring. Similar to the IESWTR, specific incidences of excessive turbidity measurements trigger evaluative action by the operator and by the State agency.

1.7. Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR)

The LT2ESWTR, established in 2006, imposes more stringent standards on all public water systems using surface water and GWDISW. Over a 1 or 2-year time period, these systems have been required to determine the microbial quality of their source water using prescribed procedures for monitoring *Cryptosporidium* concentrations or surrogate measurements. Depending on the concentration of *Cryptosporidium* in their source water and the filtration system employed, public water systems are required to meet increased removal/inactivation standards (up to 3 log additional removal) and employ various treatment technologies.

"Small" water systems serving a population of less than 10,000 persons have been required to sample for *Escherichia Coli (E. coli)* as a surrogate for *Cryptosporidium* every 2 weeks for 12 consecutive months. If the *E. coli* trigger level is exceeded, the system must conduct an additional 12 to 24 months of source water monitoring for *Cryptosporidium*. In lieu of this monitoring, a filtered water system may commit to providing a total of at least 5.5 log removal of *Cryptosporidium,* which is equivalent to meeting the treatment requirement of Bin 4 (i.e., the base log removal plus additional log removal). CBW has performed this monitoring without the subsequent imposition of any additional log removals.

This Rule also disallows the construction of new uncovered reservoirs for finished (treated) water. Public water systems having uncovered reservoirs at the time the Rule was promulgated are required to provide coverings to protect stored finished water from contamination, or provide additional treatment to the water discharged from these reservoirs.

1.8. Filter Backwash Recycling Rule (FBRR)

The FBRR, promulgated in 2001, requires that water systems operating direct and conventional filtration plants to review their backwash water recycling practices and make approved changes, as necessary, to ensure they do not compromise pathogenic microbial control, particularly in passing *Cryptosporidium* through the filter. Generally, this rule requires that pertinent systems introduce recyclable water to the head of the WTP for treatment using existing unit processes. The FBRR would be applicable to CBW's treatment system if filter backwash recycling is used in the future.

1.9. Stage 1 and Stage 2 Disinfectant/Disinfection Byproducts Rule (D/DBPR)

The D/DBPR requires water systems that disinfect their water to monitor and take corrective action for excessive by-products created as a result of disinfection. Regulated DBPs include total trihalomethanes (TTHMs) and five haloacetic acids (HAA_5). The formation of DBPs is a function of several factors: the existence of precursors (organics in the water), disinfectant dosage, pH level, water temperature, and the reaction time - either initially during storage, or during distribution.

The D/DBPR has been promulgated in two separate rulings: Stage 1 and Stage 2. The Stage 1 ruling establishes MCLs for TTHM and HAA_5 and required testing for DBPs in all sampling areas. This stage required the running annual average (RAA) of DBPs in all sampling areas to meet the MCLs. The Stage 2 ruling requires that each sampled area maintain a "locational" running annual average (LRAA) at or below the MCL. The second stage is implemented by first determining the locations within the distribution system that will likely have the highest concentrations of DBPs. This is accomplished by performing an Initial Distribution System Evaluation (IDSE) whereby DBP monitoring is performed at various locations within the distribution system. The second step in implementing the Stage 2 ruling is meeting the MCLs established in the Stage 1 ruling.

CBW's water source has elevated levels of organic carbon and its treated water is disinfected using chlorine. Consequently, the Stage 1 and Stage 2 D/DBPRs apply. The City's monitoring frequency for the distribution system is once per quarter, averaged on a locational running annual average (LRAA) using two sampling locations.

1.10. Lead and Copper Rule (LCR)

The LCR was established in 1991 to control the levels of lead and copper at the taps of consumers. Treated water can be sufficiently aggressive or corrosive to cause lead and copper to leach out from piping materials or otherwise become suspended in the water. When the "action levels" for lead (0.015 mg/L) or copper (1.3 mg/L) are exceeded in more than 10% of samples taken, a mandated procedure is initiated, with the objective of mitigating the concentrations of lead and copper in the water system. CBW currently samples distribution water from 10 locations every 3 years, most recently in 2014.

First, source waters are tested for specific parameters to provide some understanding of the nature of the water that contributes to high lead and copper levels. Next, a "desk-top" study is performed to identify a corrective action program that will reduce lead and copper concentrations at the customer's tap. Based on this study, recommendations are submitted to ADEC for acceptance. If the recommendations are accepted by ADEC, it then authorizes the implementation of the corrective action strategies. After implementation, water testing follows to evaluate the performance of the corrective action and verify that the water system is brought back into regulatory compliance. Further optimization or pursuit of a different approach may be required if such performance falls short of expectations. In this case, ADEC is obligated to work with the public water system to mitigate copper and lead concentrations.

EPA will be implementing "Long-Term" revisions to the LCR that would improve the effectiveness of corrosion control treatment in reducing exposure to lead and copper, and trigger additional actions that would reduce public exposure to lead and copper when corrosion control treatment is not effective. A final rule is not expected before 2018.

1.11. Arsenic Rule

The "Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring" Rule (Arsenic Rule) was published by the EPA in the Federal Register in January 2001 and supersedes the arsenic MCL established by the U.S. Public Health Services in 1942. Studies have shown a link between the existence of arsenic and different types of cancer, including bladder, lung, and skin cancer. The Arsenic Rule lowered the previous MCL for arsenic from 50 micrograms per liter (µg/L) to 10 µg/L. This new Rule requires community water systems with surface water sources to collect and test water samples each entry point to the water distribution system once each year. Systems that exceed the MCL are required to sample quarterly. The new Arsenic MCL became enforceable in January 2006.

Since arsenic is not present in CBW's source at significant levels, the City is required to sample and test for this contaminant only once every 9 years.

1.12. Emerging Contaminants

The EPA is currently considering other contaminants for future regulation in their Unregulated Contaminant Monitoring (UCM) and Contaminant Candidates List (CCL) programs. Both programs are used to identify drinking water contaminants of concern from those not yet currently regulated.

EPA uses the CCL to identify contaminants that may harm health, may occur in public water systems, and may require drinking water regulation. Many contaminants in the CCL require further research which involves monitoring through the UCM program to discern if and how often various contaminants of concern occur in drinking water. Ultimately such contaminants may become regulated by the EPA in the future.

The EPA is currently considering regulation of the following contaminants:

- Strontium
- Perchlorate
- Nitrosamines
- Chlorate
- Various organic compounds that are deemed carcinogenic
- Various microbial contaminants

Regulatory determinations are made after each 5-year publishing cycle on at least five of the listed CCL contaminants to decide whether or not a formal process should be initiated to begin regulation of any of them. Through the first two of three CCL cycles thus far, EPA identified only one contaminant for regulation, perchlorate, and rejected 20 others. A final rule for perchlorate is not expected before 2018.

In 2014, EPA published its Preliminary CCL3 Determination, which identified strontium for regulation and rejected the regulation of four other contaminants. In the Final Third Regulatory Determination, which is expected in 2015 or 2016, the recommendation to regulate strontium would be finalized, with a final rule expected in 2019 or 2020. EPA also decided to evaluate chlorate and nitrosamines as part of the larger DBP group in its “Third Six-Year” review of existing regulations. Determinations from this review are anticipated to be released in 2016.

1.13. Alaska Pollutant Discharge Elimination System (APDES)

In 2008, regulatory primacy was transferred from EPA to the State of Alaska for wastewater discharges. With this primacy, ADEC manages the APDES program, which regulates certain discharges of pollutants into the environment. By way of an individual permit or general permit, public or private entities are allowed to convey contaminated water and air into receiving environments within established levels and under various stipulations. In July 2014, ADEC promulgated General Permit AKG380000, *Wastewater Discharges from Drinking Water Treatment Facilities,* which now regulates backwash or reject water that is discharged to surface waters of the United States located in the State of Alaska. This general permit provides coverage for potable water treatment systems and condition operations that specifically feature:

- Conventional and direct filtration.
- Ion exchange.
- Membrane filtration.

All of these types of technologies produce wastewater that is contaminated with relatively high concentrations of compounds which may be harmful to the receiving environment. Such compounds may range from high aluminum concentrations from coagulation processes to acids, bases or salts used in media regeneration processes. Discharges from other technologies not listed above may be eligible for coverage under this general permit if approved by ADEC. CBW currently discharges treatment-based wastewater to the environment, but not with a process identified above. Nevertheless, CBW will still need to comply with the MCLs and other regulation stipulated under this general permit.

END

Appendix D – Water Crisis and Disaster Documentation and Exceedance Reports

City and Borough of Wrangell Disaster Declaration with Request for State Assistance

WHEREAS, commencing on July 2, 2016, due to reduced rainfall/snowpack and filtration system insufficiencies, the Wrangell Public Works Water Treatment Plant has been unable to meet the demand for treated water within the community; from July 2-19, the City and Borough of Wrangell has attempted to mitigate the effects by issuing water conservation measures throughout the community and discontinuing water service to all cruise ships, all Ports & Harbors facilities (for one day) and the Public Swimming Pool (for 2 days).

WHEREAS, the City and Borough of Wrangell is a political subdivision within the State of Alaska; and

WHEREAS, the following conditions exist as a result of the reduced ability to treat water: reduced capability to provide treated water to local homes, businesses, medical facilities, and public facilities; reduced capability to respond to local fires; inability to provide sufficient quantities of water to local fish processing plants. The fish processing plants have made drastic changes to their systems in order to operate under reduced water constraints. Any additional reduction will likely result in their inability to operate, causing a large economic impact to the processing plants and the community. Closure of local fish processing plants could result in a reduction of over 250 jobs.

WHEREAS, the severity and magnitude of the emergency is beyond the timely and effective response capability of local resources; the reduced water capabilities will require professional assistance for immediate measures to improve the capacity for treated water.

THEREFORE, be it resolved that the Borough Manager and Borough Assembly of Wrangell (at an emergency meeting held July 19, 2016) does declare a Disaster Emergency per AS 26.23.140 to exist in the City and Borough of Wrangell.

FURTHERMORE, it is requested that the Governor declare a Disaster Emergency to exist as described in AS 26.23 and provide State assistance to the City and Borough of Wrangell in its response and recovery from this event. The City and Borough of Wrangell specifically requests public disaster assistance to assist in evaluating the current conditions and determine repairs needed at the Borough's water treatment facility. The City and Borough has considered the following measures for immediate relief: improvements to specific filtration components of the existing facility, a modular filtration system, or a portable water treatment plant.

FURTHER, the undersigned certifies that the City and Borough of Wrangell has or will expend local resources in the amount of $25,000 as a result of this disaster for which no State or Federal reimbursement will be requested.

SIGNED this 20th day of July, 2016

City and Borough Manager with approval of the City and Borough of Wrangell Assembly

Jeff Jabusch 7/20/16

CITY AND BOROUGH OF WRANGELL

INCORPORATED MAY 30, 2008

P.O. BOX 531 (907)-874-2381
Wrangell, AK 99929 FAX (907)-874-3952

July 20, 2016

To: All Wrangell Water Users

Subject: **Water Crisis-The Borough Assembly has declared Wrangell's Water Crisis a Disaster and has implemented our Disaster Program.**

The community of Wrangell is experiencing a water crisis. The crisis is because the amount of water we can treat at the treatment plant is less than the current demand or the amount being used. Rain will not solve this problem and the problem will be for the entire summer. This has hit the seafood processors the hardest and they are both large employers and contribute to the community's economic viability.

We need for the public to reduce the amount of water they use by as much as possible, but the goal should be 30% to 50%. I can't tell you how to do that, but I know we waste water as a community because we are not metered and in the past we have only rarely had to conserve. Here are some ideas that could help:

- Don't water lawns- it is likely we will get rain from time to time even in a dry summer.
- Don't wash your car.
- Collect rain water for watering plants or other uses that don't require treated water
- Spend less time in the shower.
- Only have facets running when needed.
- If you have leaks of any kind, get them fixed or if you need assistance from the city, call.
- Use water save cycles on dishwasher and wash machines if available.
- Borough personnel will be empowered to enforce water conservation among our community where violations are witnessed and can discontinue service if conditions are not corrected per Wrangell Municipal Code 15.04.510.

The city is doing everything we can think of both at the treatment plant and within our own facilities and the seafood processors are also making major changes to reduce treated water coming from our plant. We have some long term solutions but we will not have time to do those this summer. The public will have to do their part to make this work. Thank you.

Jeff Jabusch
Borough Manager

Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) Operational Evaluation Report

PWS Name: Wrangell **PWSID #:** 120143

Date of Evaluation: Nov 25, 2016 **Date of Submittal:**__________

Complete this report to the best of your knowledge and submit it to the DEC **no later than __________ which is 90 days from the date of receiving notification of the sample results that triggered this operational evaluation**. Use additional pages if needed for further explanations. Include your PWSID # on each page.

Operational Evaluation Level exceeded:

	Quarter			**Operational Evaluation Value**
	Results from Two Quarters Ago	Prior Quarter's Results	Current Quarter	
	A	B	C	**D= (A+B+(2xC))/~~4~~3**
Date & location of sample	Feb 18, 2016 N7	May N7	Aug 16, 2016 N7	
TTHM (mg/L)				
HAA5 (mg/L)	0.086	Did not sample	0.06	0.069

Note: The operational evaluation value is calculated by adding the results of the two previous quarters of TTHM or HAA5 plus two times the current quarters' result, then dividing by 4.0. If the value exceeds 0.080 mg/L for TTHM or 0.060 mg/L for HAA5, an OEL exceedance has occurred.

Has an OEL exceedance occurred at this location in the past? ☑ Yes ☐ No

If "No" proceed to Section A. If "Yes" when did exceedance occur? __________

Was the cause determined for the previous exceedance(s)? ☐ Yes ☐ No

Are the previous evaluations/determination applicable to the current OEL exceedance? ☐ Yes ☐ No

A. Source & Source Water Quality

1. Have you made any changes at the source? *e.g. changed the intake depth or intake structure, changed pumping rates, pumping times or frequency, pumping depth, well rehab, etc.*
   ☐ Yes ☐ No

2. Have you changed/added sources? *e.g. started using a different raw water source or well, turned on emergency sources, drilled new well, etc.*
   ☐ Yes ☐ No

3. Have you seen changes in source water quality? *e.g. higher than usual turbidity (other than usual raw water turbidity spikes during specific seasons), TOC, color, pH, temperature, alkalinity, or hardness.*
   ☐ Yes ☐ No

PWSID # 120143

4. Has anything else changed that could affect your source? *e.g. drought conditions, heavier than usual rainfall, changes in snowmelt/ break up times and intensity, changes in animal movement at the source, agricultural practices, etc. Surface water systems should also consider algae blooms, forest fires in the watershed, mud slides, high or low water levels at the source, etc.*

☐Yes ☐No

If you answered **"Yes"** to any of the questions above (Section A), please explain:

Did the source water quality cause or contribute to your OEL exceedance(s)?

☐Yes ☐No ☐Possibly

If **"Yes"** or **"Possibly"** please explain:

B. Treatment Operations

1. Have you changed the amount or type of disinfectant? *e.g. changed disinfectant dosage, or switched from chlorine to chloramines, etc.*

☐Yes ☐No

2. Have you changed or added locations of disinfectant points? *e.g. added booster stations, etc.*

☐Yes ☐No

3. Other than disinfection, have you changed or made additions or changes to any treatment processes?

☐Yes ☐No

4. Have you made changes to any other chemical applications? *e.g. changed any chemicals (changed coagulant type or filter aid), changes in application points, had to adjust dosages more often or increase dosages of any chemical more than usual, etc.*

☐Yes ☐No

5. Have you had significant changes in chlorine demand to maintain Entry Point Chlorine residuals?

☐Yes ☐No

6. Have you had to increase filter changes or number of backwash cycles due to changes in raw water conditions?

☐Yes ☐No

7. Are you using Granular Activated Carbon (GAC) in your treatment system?

☐Yes ☐No

If **"Yes"** when was filter/media last exchanged? Date: ________________

PWSID # 120143

If you answered **"Yes"** to any of the questions above (Section B), please explain:

Did the treatment system cause or contribute to your OEL exceedance(s)?
☐Yes ☐No ☐Possibly

If **"Yes"** please explain:

C. Distribution System Operations

1. Have you added additional service connections (industry or residential)? *e.g. installed additional distribution mains or annexing additional areas of service which could change water residence times.*
☐Yes ☐No

2. Have you experienced significant increases or decreases in water demand? *e.g. drought restrictions, industry/business opening/closing, population change.*
☐Yes ☐No

3. Have there been any new loops or dead-ends created in the distribution system?
☐Yes ☐No

4. Does your storage tank fill and drain from the bottom (potentially causing stagnation at the top)?
☐Yes ☐No

5. Have there been any water temperature fluctuations?
☐Yes ☐No

6. Has the water residence time of your tank(s) increased or decreased? *e.g. are tanks being filled/drained more or less often.*
☐Yes ☐No

7. How many days' supply do your storage tank(s) hold?____ days

8. What is the longest time that goes by between filling your storage tanks?____ days

9. Explain how your storage tanks are interconnected: *e.g. in series/parallel.* ______________________________

10. Have you had distribution or service line breaks or major construction in your distribution system?
☐Yes ☐No

11. If applicable, do you purchase water that has no disinfectant or a different disinfectant than you currently use? *e.g. you purchase water with chloramines and you add chlorine.*
☐Yes ☐No ☐NA

PWSID # 120143

12. Do you have areas in your distribution system where disinfectant residual levels are below the minimum regulatory requirement?
☐ Yes ☐ No

13. Have you had significant changes in chlorine demand to maintain distribution residuals?
☐ Yes ☐ No

14. Have you changed your distribution flushing procedures?
☐ Yes ☐ No

15. Have you had any changes in treatment that occur in distribution? *e.g. changes in booster chlorination or dosage.*
☐ Yes ☐ No

16. Have you had an increase in customer complaints regarding odor, color or taste of the water?
☐ Yes ☐ No

17. Have there been any changes in tank or distribution water temperatures? *e.g. have you had to turn on add heat and circulation earlier or for longer periods of time etc.*
☐ Yes ☐ No

If you answered **"Yes"** to any of the questions above (Section C), please explain:

Did the distribution system cause or contribute to your OEL exceedance(s)?
☐ Yes ☐ No ☐ Possibly

If **"Yes"** or **"Possibly"** please explain:

D. Additional Questions

1. Do you have tank management/operational procedures? *e.g. cleaning schedule, set operational levels of your tank (high and low) etc.*
☐ Yes ☐ No
Date tank(s) was last cleaned?________________

2. Can you allow the tank(s) to drain lower to flush out "older" water?
☐ Yes ☐ No

3. Can you reduce chlorine/chloramines dosage and still maintain required residuals at the entry point to the distribution and in the distribution system?
☐ Yes ☐ No

4. Have you performed Disinfection Profiling and Benchmarking?
☐ Yes ☐ No

PWSID # 120143

5. Do you have a flushing program? Storage tanks: ☐ Yes ☐ No; Distribution System: ☐ Yes ☐ No

6. If applicable, can you work with the system you purchase water from to optimize water age, reducing DBP formations?
☐ Yes ☐ No ☐ NA

If you answered **"No"** to any of the questions above (Section D), please explain:

E. Additional Information

Please explain what steps you could take to minimize future TTHM/HAA5 formations. *e.g. changes in operation, optimizing time frame when pumping raw water, not pumping water during high turbidity/TOC/Color events such as at break-up or after heavy rainfalls, changes to the treatment process, any changes to the tank configurations or operation to minimize water residence time, any changes in inlet configuration, increased tank cleaning schedules or changes to the distribution maintenance including cleaning and flushing lines to decrease chlorine demand.*
Also include any dates for planned upgrades, such as plans for installing a new treatment plant etc.:

I certify that the information in this entire report, including any attachments, is true and accurate to the best of my knowledge.

Signature: ______________________ Date: ______________

Printed Name: ______________________

Contact Email address: ______________________

Contact Phone Number: ______________

Send the completed report to the DEC no later than ____________ which is 90 days from the date of receiving notification of the sample results that triggered this operational evaluation.

Mailing Address
DEC-Drinking Water Program
43335 Kalifornsky Beach Rd
Suite 11
Soldotna, AK 99669-9792

Fax
907-262-2294

Email Address
Kenia Peninsula Systems
DEC.DWData.Kenai@alaska.gov
Southeast Systems
DEC.DWData.Juneau@alaska.gov

Print Form

Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) Operational Evaluation Report

PWS Name: Wrangell **PWSID #:** 120143

Date of Evaluation: Jun 24, 2016 **Date of Submittal:** ______

Complete this report to the best of your knowledge and submit it to the DEC **no later than ______ which is 90 days from the date of receiving notification of the sample results that triggered this operational evaluation.** Use additional pages if needed for further explanations. Include your PWSID # on each page.

Operational Evaluation Level exceeded:

	Quarter			**Operational Evaluation Value**
	Results from Two Quarters Ago	Prior Quarter's Results	Current Quarter	
	A	B	C	**D= (A+B+(2xC))/4**
Date & location of sample	Aug 19, 2015 N17	Nov 18, 2015 N17	Feb 2, 2016 N17	
TTHM (mg/L)				
HAA5 (mg/L)	0.094	0.089	0.086	0.089

Note: The operational evaluation value is calculated by adding the results of the two previous quarters of TTHM or HAA5 plus two times the current quarters' result, then dividing by 4.0. If the value exceeds 0.080 mg/L for TTHM or 0.060 mg/L for HAA5, an OEL exceedance has occurred.

Has an OEL exceedance occurred at this location in the past? ☑ Yes ☐ No

If "No" proceed to Section A. If "Yes" when did exceedance occur? Jan 1, 2012

Was the cause determined for the previous exceedance(s)? ☑ Yes ☐ No

Are the previous evaluations/determination applicable to the current OEL exceedance? ☐ Yes ☑ No

A. Source & Source Water Quality

1. Have you made any changes at the source? *e.g. changed the intake depth or intake structure, changed pumping rates, pumping times or frequency, pumping depth, well rehab, etc.*
   ☐ Yes ☑ No

2. Have you changed/added sources? *e.g. started using a different raw water source or well, turned on emergency sources, drilled new well, etc.*
   ☐ Yes ☑ No

3. Have you seen changes in source water quality? *e.g. higher than usual turbidity (other than usual raw water turbidity spikes during specific seasons), TOC, color, pH, temperature, alkalinity, or hardness.*
   ☐ Yes ☑ No

PWSID # 120143

4. Has anything else changed that could affect your source? *e.g. drought conditions, heavier than usual rainfall, changes in snowmelt/break up times and intensity, changes in animal movement at the source, agricultural practices, etc. Surface water systems should also consider algae blooms, forest fires in the watershed, mud slides, high or low water levels at the source, etc.*

☑ Yes ☐ No

If you answered "Yes" to any of the questions above (Section A), please explain:

4) recent dry years have a profound effect on the raw water insofar as turbidity and color levels, making it harder to remove them at the elevated levels.

Did the source water quality cause or contribute to your OEL exceedance(s)?

☑ Yes ☐ No ☐ Possibly

If "Yes" or "Possibly" please explain:

source water higher in turbidity and organics makes treatment difficult.

B. Treatment Operations

1. Have you changed the amount or type of disinfectant? *e.g. changed disinfectant dosage, or switched from chlorine to chloramines, etc.*

☑ Yes ☐ No

2. Have you changed or added locations of disinfectant points? *e.g. added booster stations, etc.*

☐ Yes ☑ No

3. Other than disinfection, have you changed or made additions or changes to any treatment processes?

☐ Yes ☑ No

4. Have you made changes to any other chemical applications? *e.g. changed any chemicals (changed coagulant type or filter aid), changes in application points, had to adjust dosages more often or increase dosages of any chemical more than usual, etc.*

☐ Yes ☑ No

5. Have you had significant changes in chlorine demand to maintain Entry Point Chlorine residuals?

☑ Yes ☐ No

6. Have you had to increase filter changes or number of backwash cycles due to changes in raw water conditions?

☐ Yes ☑ No

7. Are you using Granular Activated Carbon (GAC) in your treatment system?

☐ Yes ☑ No

If "Yes" when was filter/media last exchanged? Date: ________

PWSID # 120143

If you answered "Yes" to any of the questions above (Section B), please explain:

during the period from September 2014 through January 2016, it was necessary to increase chlorine dosage to account for higher turbidity and organics in the finished water due to the lack of full ozone production.

Did the treatment system cause or contribute to your OEL exceedance(s)?
☑ Yes ☐ No ☐ Possibly

If "Yes" please explain:

it is believed that the lower available levels of ozone for pretreatment of the raw water directly contributed to higher precursor levels, thus higher tthm / haa5 levels in the finished water.

C. Distribution System Operations

1. Have you added additional service connections (industry or residential)? *e.g. installed additional distribution mains or annexing additional areas of service which could change water residence times.*
☐ Yes ☑ No

2. Have you experienced significant increases or decreases in water demand? *e.g. drought restrictions, industry/ business opening/ closing, population change.*
☐ Yes ☑ No

3. Have there been any new loops or dead-ends created in the distribution system?
☐ Yes ☑ No

4. Does your storage tank fill and drain from the bottom (potentially causing stagnation at the top)?
☐ Yes ☑ No

5. Have there been any water temperature fluctuations?
☐ Yes ☑ No

6. Has the water residence time of your tank(s) increased or decreased? *e.g. are tanks being filled/ drained more or less often.*
☐ Yes ☑ No

7. How many days' supply do your storage tank(s) hold? 0.8 days

8. What is the longest time that goes by between filling your storage tanks? 1 days, usual, high demand may stretch this to a week or more.

9. Explain how your storage tanks are interconnected: *e.g. in series/ parallel.* parallel

10. Have you had distribution or service line breaks or major construction in your distribution system?
☐ Yes ☑ No

11. If applicable, do you purchase water that has no disinfectant or a different disinfectant than you currently use? *e.g. you purchase water with chloramines and you add chlorine.*
☐ Yes ☐ No ☑ NA

PWSID #___120143____

12. Do you have areas in your distribution system where disinfectant residual levels are below the minimum regulatory requirement?
☑ Yes ☐ No

13. Have you had significant changes in chlorine demand to maintain distribution residuals?
☑ Yes ☐ No

14. Have you changed your distribution flushing procedures?
☑ Yes ☐ No

15. Have you had any changes in treatment that occur in distribution? *e.g. changes in booster chlorination or dosage.*
☐ Yes ☑ No

16. Have you had an increase in customer complaints regarding odor, color or taste of the water?
☐ Yes ☑ No

17. Have there been any changes in tank or distribution water temperatures? *e.g. have you had to turn on add heat and circulation earlier or for longer periods of time etc.*
☐ Yes ☑ No

If you answered **"Yes"** to any of the questions above (Section C), please explain:

12) our major distribution lines are 12" and there is little demand on them, thus it is difficult to maintain a residual. 13) yes, during the time frame from September 2014 through January 2016, we were operating with only one fully functional ozone generator which greatly lessened our ability to remove precursors. 14) another department is now doing the distribution flushing.

Did the distribution system cause or contribute to your OEL exceedance(s)?
☐ Yes ☐ No ☑ Possibly

If **"Yes"** or **"Possibly"** please explain:

Long residence times in the distribution are believed to be of concern.

D. Additional Questions

1. Do you have tank management/operational procedures? *e.g. cleaning schedule, set operational levels of your tank (high and low) etc.*
☑ Yes ☐ No
Date tank(s) was last cleaned? __2006 I think, for old, and new has been online a short Time

2. Can you allow the tank(s) to drain lower to flush out "older" water?
☑ Yes ☐ No

3. Can you reduce chlorine/chloramines dosage and still maintain required residuals at the entry point to the distribution and in the distribution system?
☐ Yes ☑ No

4. Have you performed Disinfection Profiling and Benchmarking?
☐ Yes ☑ No

PWSID #: 120143

5. Do you have a flushing program? Storage tanks: ☐ Yes ☑ No; Distribution System: ☐ Yes ☑ No

6. If applicable, can you work with the system you purchase water from to optimize water age, reducing DBP formations?
☐ Yes ☐ No ☑ NA

If you answered "No" to any of the questions above (Section D), please explain:

3) the organics remaining in the treated water, plus the extended residence time in some lines makes this impossible. 4) Perhaps during the original pilot study, but I have not. 5) Tank levels can be and are regulated to minimize residence time, but there is no flushing program in place for the distribution system at this time.

E. Additional Information

Please explain what steps you could take to minimize future TTHM/HAA5 formations. *e.g. changes in operation, optimizing time frame when pumping raw water, not pumping water during high turbidity/TOC/Color events such as at break-up or after heavy rainfalls, changes to the treatment process, any changes to the tank configurations or operation to minimize water residence time, any changes in inlet configuration, increased tank cleaning schedules or changes to the distribution maintenance including cleaning and flushing lines to decrease chlorine demand.*
Also include any dates for planned upgrades, such as plans for installing a new treatment plant etc.:

We are unable to vary when we take raw water, as time required to "build" the treated water is lengthy. We are concentrating on the acquisition of another new ozone generator to reduce / eliminate precursors entirely from the raw water. We are starting a water study in mid July with a different treatment technique which should allow faster production, plus eliminate precursors from the pre-chlorinated water. The primary reason for this study was to meet find a plant design to assist us with tthm / haa5 removal, plus meet other water quality standards. There is a desire to test the new pilot plant with our current ozonation capability to produce an even better water. It is desirous to implement a system wide flushing program which should assist greatly in finished water quality, and detention time, thus reducing tthms and haa5s.

I certify that the information in this entire report, including any attachments, is true and accurate to the best of my knowledge.

Signature: [illegible] Date: 6-28-16

Printed Name: WAYNE McHOLLAND

Contact Email address: wrgwtf@aptalaska.net

Contact Phone Number: 907 [redacted] 2381

Send the completed report to the DEC no later than ____________ which is 90 days from the date of receiving notification of the sample results that triggered this operational evaluation.

Mailing Address
DEC-Drinking Water Program
43335 Kalifornsky Beach Rd
Suite 11
Soldotna, AK 99669-9792

Fax
907-262-2294

Email Address
Kenia Peninsula Systems
DEC.DWData.Kenai@alaska.gov
Southeast Systems
DEC.DWData.Juneau@alaska.gov

Print Form

Appendix E – Calculations

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

Appendix F – System Documentation

AWC Water Solutions Ltd.
#101-19074 22nd Avenue
Surrey, British Columbia,
Canada V3Z 3S6
Main: 604 936 4217

Budget Quotation

DATE:	October 16, 2016	**TIME:**	11:09 PM
TO:	Trevor Trask P.E. CRW Engineering Group	**PHONE:** **FAX:**	(907) 562-3252
COPIES	Mike Morris, AWC	**PHONE:**	(360) 886-1396
FROM:	Andrew Stevano	**PHONE:** **FAX:**	(604) 638-0760 (604) 638-0759

Number of pages including this cover 17

Our Ref: 17805

RE: Dissolved Air Flotation (DAF) for Wrangell AK WTP

Thank you for the opportunity to provide our ideas and pricing for our DAF system in Wrangell AK.

We present dissolved air flotation accompanied with chemical coagulation and gravity filtration designed to treat a total flow of 1.8 mgd (1250 gpm) that will be effective for removal of turbidity, color and organics.

These plants are factory assembled, pre-wired and tested and delivered complete with all required controls. Only on-site connections for the raw water feed, treated water discharge, wastewater discharge and power are required. Filter media is shipped separately.

The following provides details and budget pricing.

Pre-Packaged, AWC-DAF-1250-2

Comprises chemical coagulation, DAF clarifier x2, 3 gravity filters to produce 1250 gpm.

DAF System

Plant Type: AWC Water Systems-DAF-1250-2

Two DAF modules each rated at 625 gpm (142 m^3/hr)

Flocculation time:	26.3 mins total
DAF surface loading:	7.72 m/hr (3.16 USgpm/ft^2)
Filter surface loading:	5.31 m/hr (2.17 USgpm/ft^2)
Filter surface loading, max:	8.0 m/hr (3.26 USgpm/ft^2) when 1 in BW

DAF module details:

- Flow splitter and flash mix tank
  - ◊ Powered flash mixer
  - ◊ 5 injection ports
  - ◊ Adjustable wiers
  - ◊ Overflow return
  - ◊ Constructed of marine grade aluminum alloy offering corrosion free service and eliminating the need for painting and tank structure maintenance.
- Inlet flow control valve and meter
- Tank dimensions, flocculation/DAF Clarifier tanks (2):

Width	Height	Length
11 ft	11 ft	43 ft

- Constructed of marine grade aluminum alloy offering corrosion free service and eliminating the need for painting and tank structure maintenance.
- Tank dimensions, filter tank, 3 filters (1):

Width	Height	Length
12 ft	8.5 ft	48 ft

- Constructed of marine grade aluminum alloy offering corrosion free service and eliminating the need for painting and tank structure maintenance.
- Mechanical flocculation
  - ◊ Two stage system, with stilling well, designed to ensure minimal short circuiting
  - ◊ Variable speed drive/mixers and paddles for variable energy input and tapered flocculation
  - ◊ VFDs
- DAF clarifier
  - ◊ Mechanical scraper float removal with adjustable speed and interval timer for float removal
  - ◊ Floor mounted effluent launders for even cell flow distribution
- DAF recycle saturator skid (1) comprising:
  - ◊ Packed tower saturator (1) 30” diameter
  - ◊ Duplex air compressor with receiver and alternating panel

- ◊ Two recycle pumps (1 duty, 1 standby)
- ◊ VFDs

- *Three* dual media, rapid gravity filters
  - ◊ Air/water backwash system
  - ◊ Automatic control valves for effluent, backwash, rinse, air scour
  - ◊ 450 mm (18”) of 1 mm anthracite and 450 mm (18”) of 0.45 mm filter sand

Air scour blower rated for 2.5 scfm/ft^2 at 4.5 psi

Access Stairs, handrails, and walkways as indicated on sketch, see sample drawing

Chemical Systems

- All chemical systems will duplex metering pumps, be pre-plumbed and mounted on a fabricated stand or shelf and will operate by suction lift. Includes multifunction valves, chemical storage day tanks on spill pallets. Pumps are paced to flow.
  - Potassium permanganate (2)
    - ◊ Day tank with powered mixer
  - Coagulant (alum) (2)
  - Soda ash (2)
    - ◊ Automatic volumetric feeder with bag loader and platform with stairs
    - ◊ HDPE mixing tank with powered mixer
  - Sodium hypochlorite (2)
- DAF Instrumentation summary:
  - ◊ Inlet magmeter (1)
  - ◊ Inlet pH (1)
  - ◊ Recycle magmeter. (1)
  - ◊ Turbidity (1 inlet, 3 filtered water)
  - ◊ Saturator and recycle differential pressure transmitter (1)
  - ◊ Filter loss-of-head pressure transmitters (3)
  - ◊ Filter level transmitters (3)
  - ◊ Backwash magmeter (1)
- Junction Boxes

- PLC for fully automatic operation (Allen Bradley CompacLogix with Panelview 1400 HMI) Options for MCC Panels, SCADA systems, and Telemetry systems are available upon request.
- 3 trips, 14 days on-site time by trained AWC commissioning technician for final commissioning and staff training…

O& M manuals / As-Built Drawings

Shipping, FOB Port of Wrangell AK

Budget Price: $1,260,000.00 excluding all applicable taxes

Delivery can usually be made within 12 weeks following approval of final shop drawings

THESE PRICE ESTIMATES DO NOT INCLUDE:

- Any applicable taxes
- Receiving, unloading and suitable storage of material
- Concrete foundation pads
- Field erection of treatment plant and equipment, labor and supervision
- Piping connections, influent and effluent piping, rinse and backwash piping, yard piping, drain piping, interconnecting piping or other piping outside the plant structure
- Field electrical wiring and conduit
- Base meter, split trough, disconnect switches, transformer, if required, are not included
- Field paint or painting labor
- General cleaning of plant
- Installation of chemical feed systems
- Starters and VFDs unless mentioned

Since 1965, AWC's team members have engineered over 500 plants, mostly in Canada and the USA. Our goal is to work closely with engineers, plant owners and operators to develop designs that will provide cost-effective and efficient solutions. AWC Water Systems is a part of AWC Process Solutions. The AWC "one-stop shop" approach allows us to deliver comprehensive, flexible and innovative solutions to our customers' most complex treatment infrastructure challenges.

For more information on our Company and our range of products and services visit our web site at www.awcwater.com.

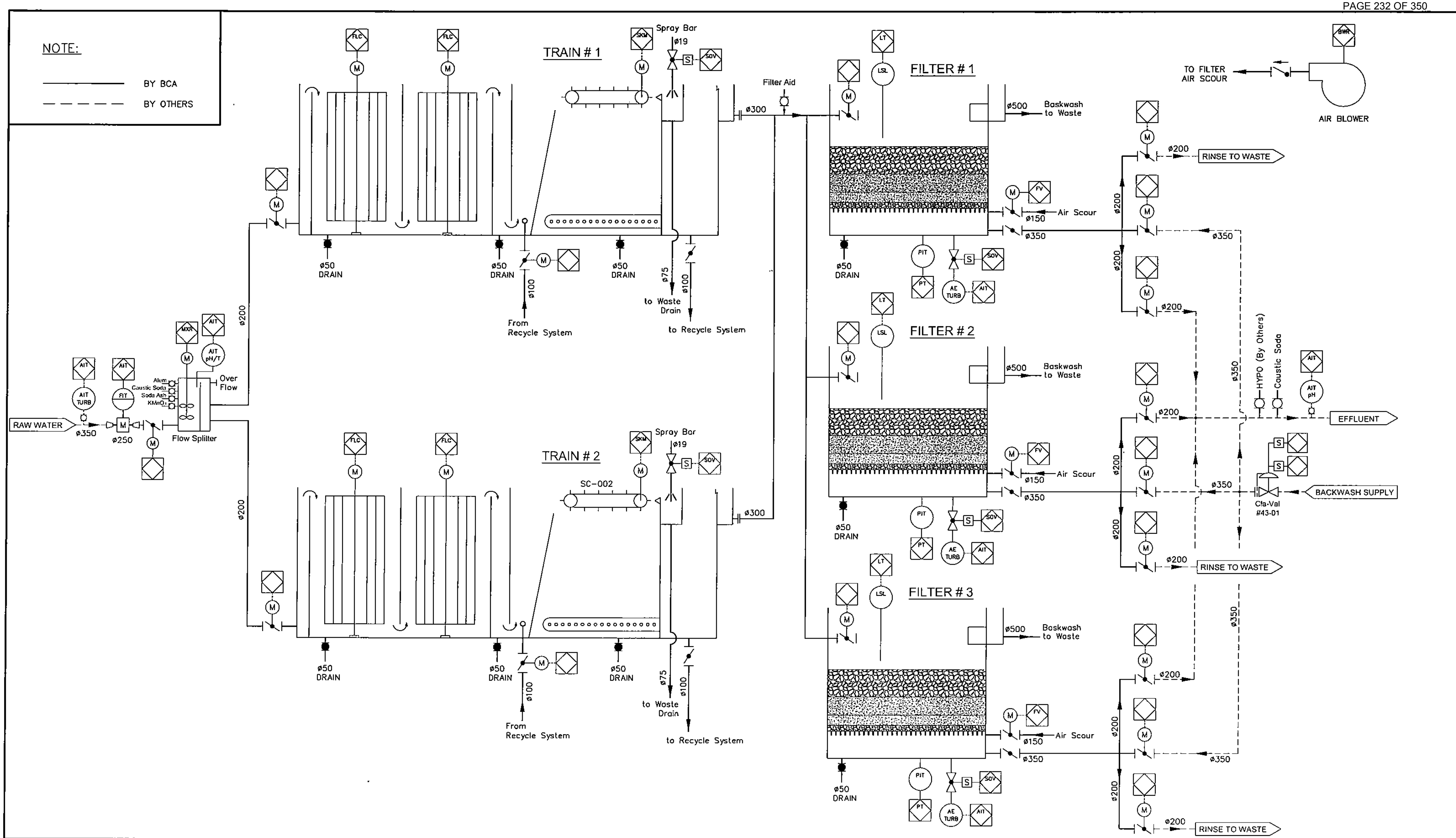
We trust this meets your needs and will be pleased to provide any further information you may require.

Regards,

Andrew Stevano P. Eng.

andrews@adiwater.com

Attachments: Antigonish Sample Drawings



REV	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	Chemical System Added	WW	JB	JY	Jul/19/05

NOTE

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Terasen

DRAWN	WW
DESIGN	JY
CHECKED	JY
APPROVED	JY
DATE	May/30/05
SCALE	N.T.S.

ANTIGONISH WTP (S.O#013459)
BCA DAF-1520-2 WTP
PROCESS & INSTRUMENTATION DIAGRAM

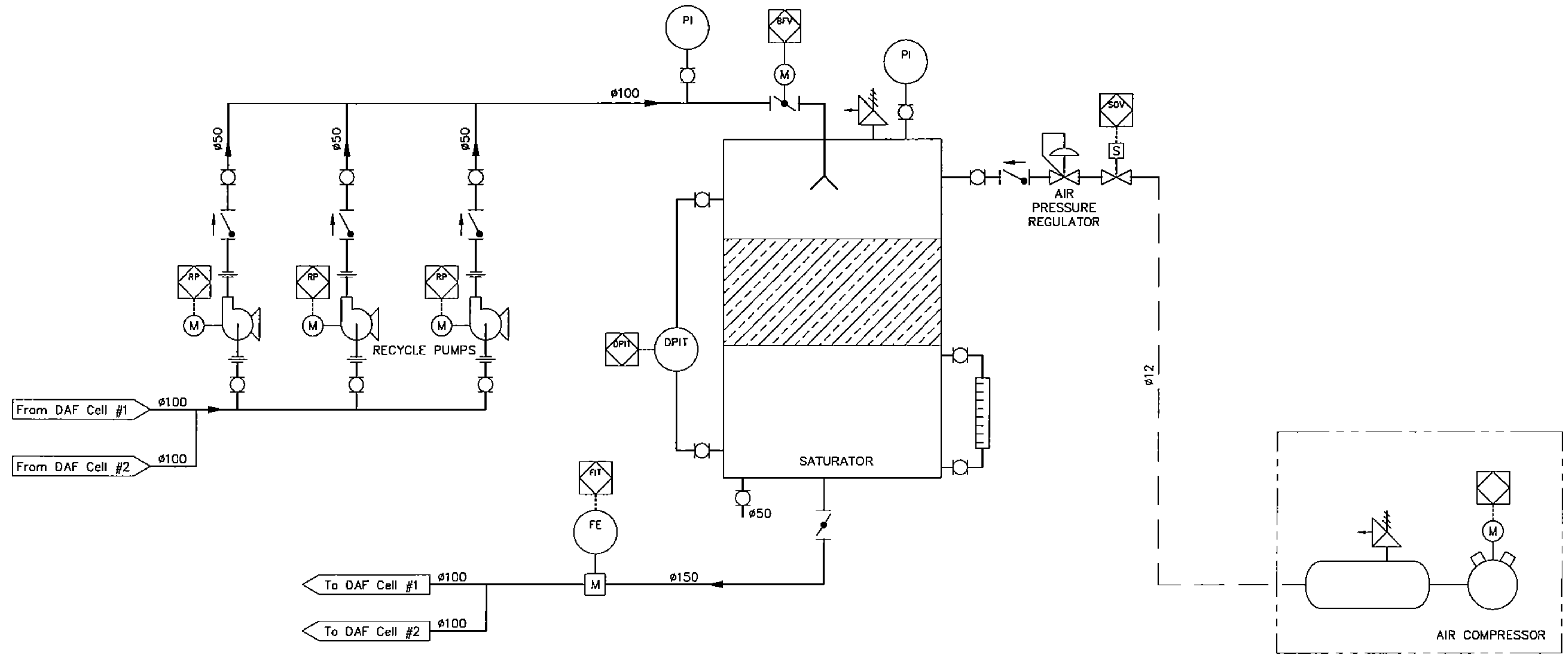
SH.1 OF 3

DRAWING NO. 058342-02 REV A

NOTE:

—— BY BCA

– – – – BY OTHERS



REV	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	Chemical System Added	WW	JB	JY	Jul/19/05

NOTE

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Terasen

DRAWN	WW
DESIGN	JY
CHECKED	JY
APPROVED	JY
DATE	May/30/05
SCALE	N.T.S.

ANTIGONISH WTP (S.O#013459)

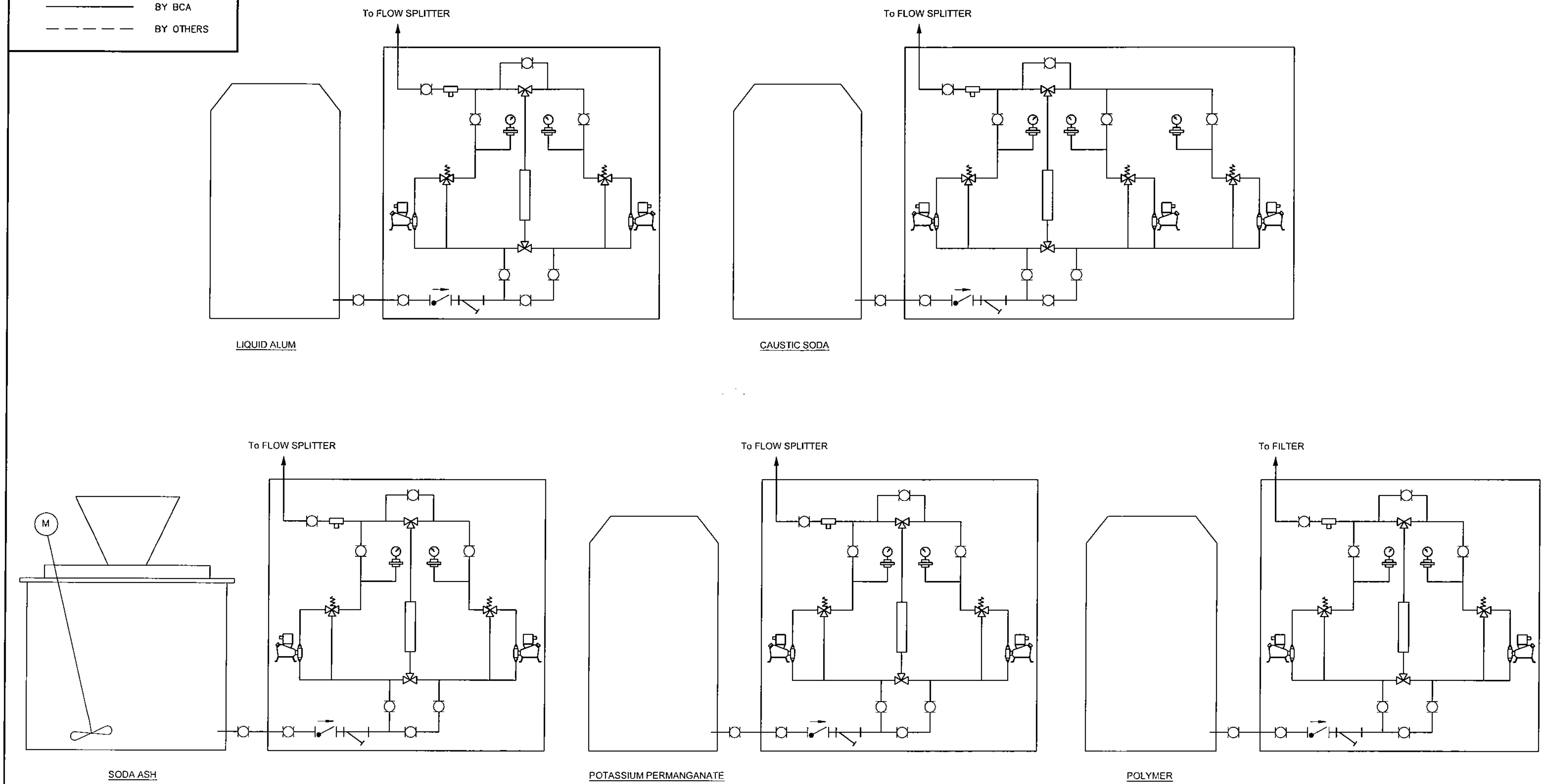
BCA DAF–1520–2 WTP
PROCESS & INSTRUMENTATION DIAGRAM

SH.2 OF 3

DRAWING NO. 058342–02 REV A

NOTE:

———	BY BCA
– – – – –	BY OTHERS



REV	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	Chemical System Added	WW	JB	JY	Jul/19/05

NOTE

THIS DRAWING IS THE PROPERTY OF TERASEN WATER INC., AND CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH MUST NOT BE DUPLICATED, USED OR DISCLOSED OTHER THAN EXPRESSLY AUTHORIZED BY TERASEN WATER INC.

Terasen

DRAWN	WW
DESIGN	JY
CHECKED	JY
APPROVED	JY
DATE	May/30/05
SCALE	N.T.S.

ANTIGONISH WTP (S.O#013459)

BCA DAF-1520-2 WTP
PROCESS & INSTRUMENTATION DIAGRAM

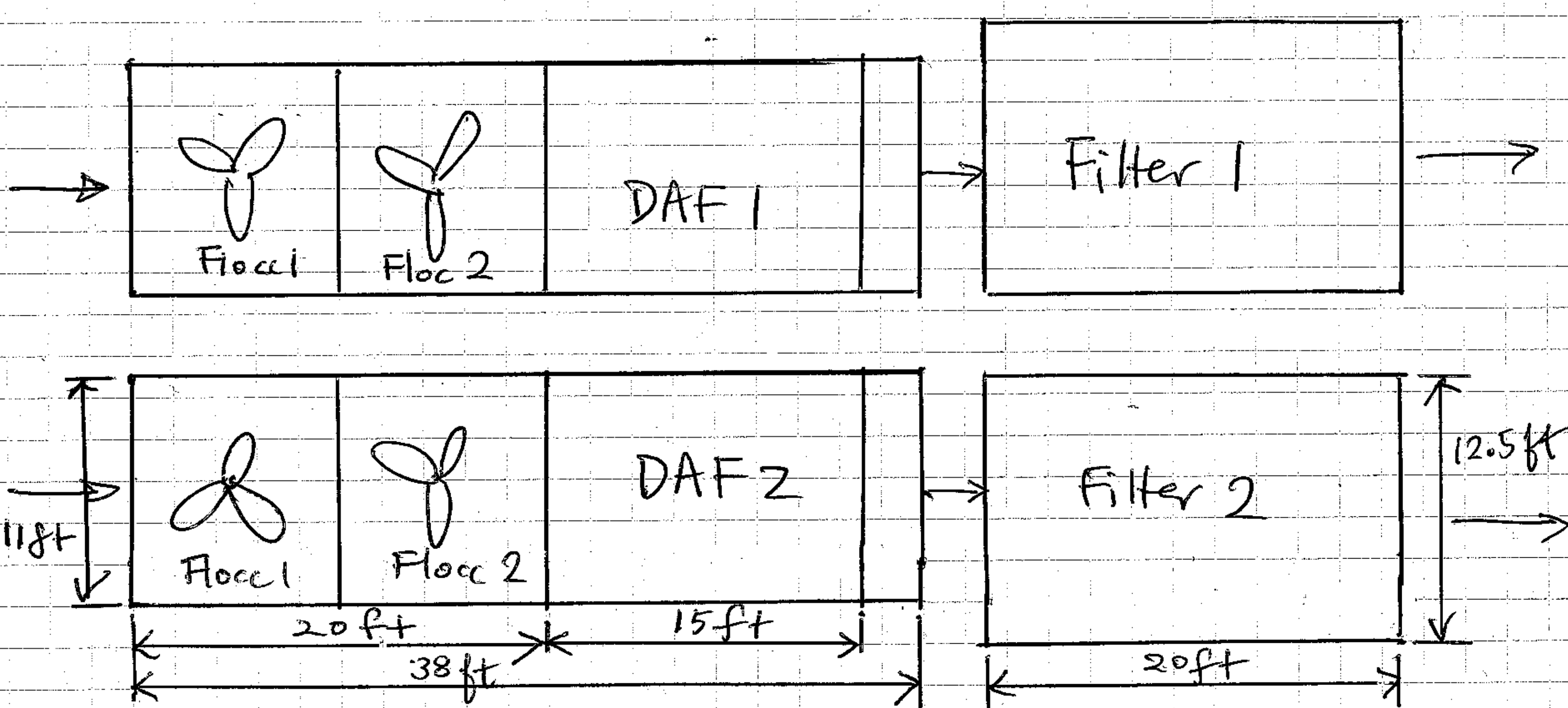
SH.3 OF 3

DRAWING NO. 058342-02 REV A

Wrangell DAF

Design Flow : 1.8 mgd

Flow per Train : 625 gpm



Flocc Time : 25 min

DAF Loading : 3.79 gpm/ft^2

Filter Loading - 2.5 gpm/ft^2

Call: 604-638-0760

AWC Water Solutions offers packaged water treatment plants based on dissolved air flotation (DAF) technology. These plants excel in treating lake and reservoir water containing high levels of color, algae and turbidity, as well as cold waters and high levels of iron and manganese.

Our DAF plants are custom-designed to meet our clients' particular challenges. They can treat capacities up to 1,400 gpm (7,600 m3/d) per train (multiple trains can be combined for higher flows) and reliably achieve less than 0.1 NTU turbidity and 2.5-log, multi-barrier protection against Giardia and Cryptosporidium.

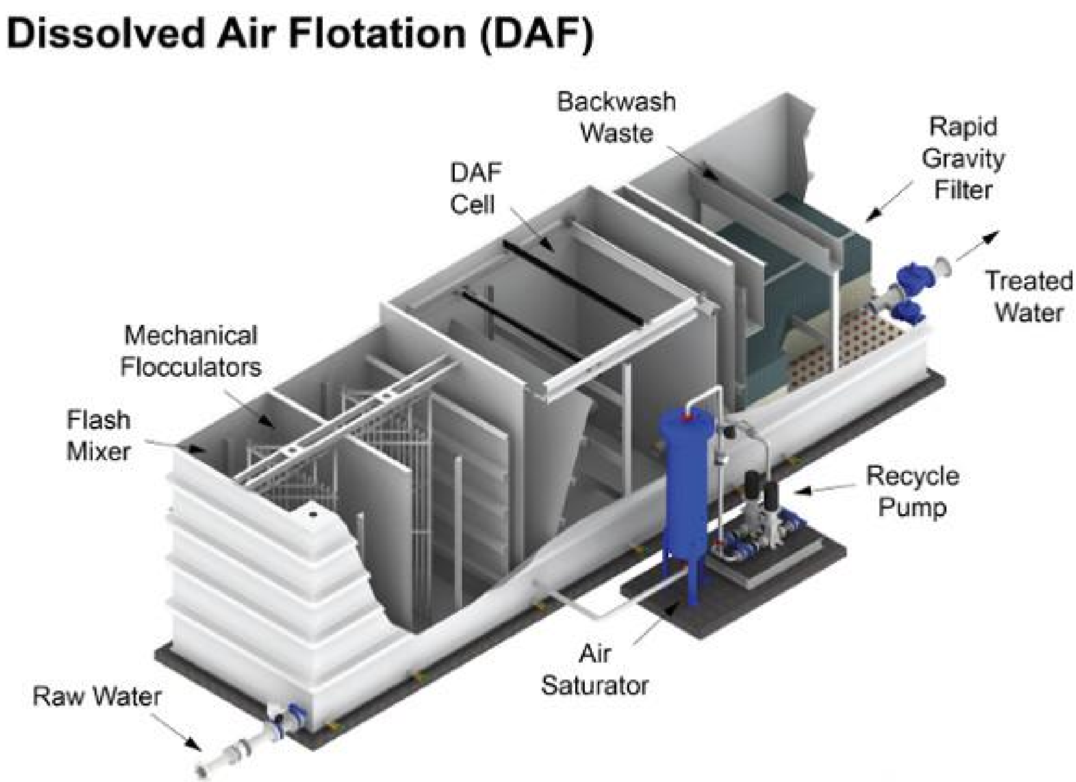
HOW THE DAF PROCESS WORKS

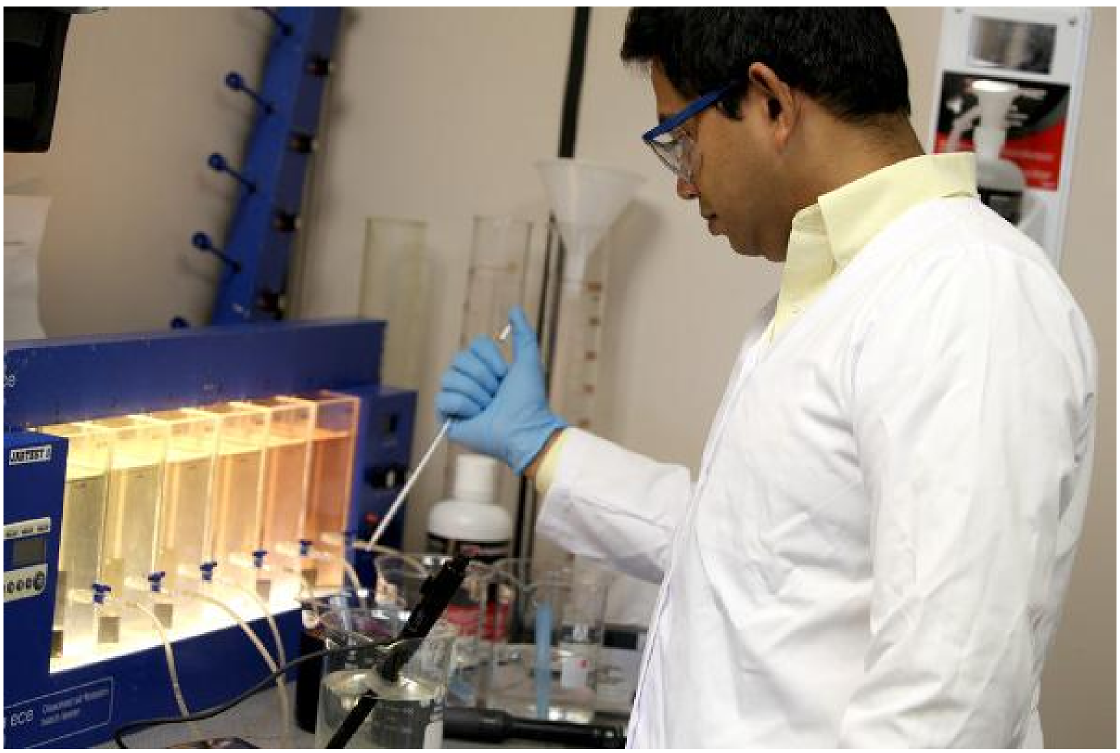
1 Flash Mixing

2 Flocculation

3 Dissolved Air Flotation

4 Filtration





Flash mixing

A coagulant added to the raw water precipitates dissolved contaminants and encourages particles to form "flocs".

- Multi-chemical injection ports for coagulant, polymer, pH adjustment, etc. provides process flexibility

- Static or powered mixers are options

Flocculation

Gentle agitation in the flocculation zone helps these flocs grow before they pass into the flotation zone.

- Multi-stage hydraulic or mechanical flocculation
- Carefully designed to minimize short-circuiting
- Hydraulic flocculation has variable nozzles for site adjustable energy input
- Mechanical flocculators are fitted with variable speed drives

Dissolved air flotation

Once in the flotation zone, microscopic air bubbles are injected. The 50 micron bubbles used for flotation are formed by recycling a small stream of clarified water through an air pressurized, packed tower saturator to specially designed nozzles at the DAF cell inlet. Here, a rapid pressure drop causes the air to come out of the solution and form millions of small bubbles, which are then dispersed through the flocculated raw water. Then, the bubbles rapidly float the flocs to the surface and the accumulated float is skimmed off.

- Inlet/outlet manifolds for even flow distribution
- Mechanical float or hydraulic removal options are available
- "V" hopper bottom for sludge thickening and hydraulic sludge removal option available

Filtration

Clarified water passes to the high-rate filter for final polishing and the filter is periodically cleaned by water or air/water backwashing.

- Mono, dual and multi-media options
- Options for iron, manganese and arsenic removal
- Water backwash with surface wash option
- Air scour/water backwash option for reduced water consumption and improved cleaning
- Nozzle and plenum-type underdrain

Plant Features

Quality tank construction

AWC constructs its tanks out of highly corrosion-resistant marine-grade, 5086 aluminum alloy. This construction eliminates the need for corrosion-protection coatings and prevents premature failures, which can occur with poor surface preparation or coating failures. Sacrificial anodes are used to further increase protection against corrosion. All fasteners in contact with the aluminum are 316 stainless steel to minimize galvanic corrosion. Stainless steel tanks are also available upon request. Our process equipment components can also be supplied for installation into site-constructed concrete tanks or retrofitted into existing tankage. In these circumstances, AWC can provide tank dimensions and other civil criteria.

Electrical systems and control panels

AWC designs, builds, programs and commissions fully integrated automated control and electrical systems. Our systems feature:

- Integrated UL and CSA approved MCC's and control panels

- Fully automatic operation with advanced instruments and controls
- Remote monitoring, control and SCADA options
- Industrial quality PLC's with simple plug-in, pre-programmed modules for reduced training and technical support

Chemical systems

We offer a full range of chemical mixing and dosing systems, including solution tanks, mixers, dosing pumps and safety equipment.

Advantages of AWC DAF Plants

Corrosion-Resistant

Our plants are fabricated with marine-grade aluminum alloys and stainless steel to provide superior resistance to chemicals and corrosion, resulting in longer life.

Cost-Effective

Our packaged DAF plants are pre-assembled and pre-tested in our controlled facility, often saving 50 percent or more over in-situ construction. They can also be integrated into pre-engineered building systems for increased savings and reduced schedule. Their small footprint also reduces building costs.

Simplicity

Our DAF plants are quiet, simple and easy-to-operate with minimal operator input. They are also supplied complete with chemical dosing, water quality instrumentation, automatic controls and monitoring systems customized to meet local needs.

Discover the power of working with the industry's most experienced team.

CONTACT US

#101 19074 22nd Avenue
Surrey, British Columbia
Canada V3Z 3S6

Tel (604) 936-4217

www.adiwater.com

BUDGET QUOTATION

DATE:	December 4, 2015	**TIME:**	1:13 PM
TO:	**Trevor Trasky** **CRW Engineering**	**PHONE:** **FAX:**	**(907) 562-3252**
COPIES:	Mike Morris, ADI	**FAX:**	(360) 886-1396
FROM:	Andrew Stevano P. Eng.	**PHONE:** **FAX:**	(604) 638-0760 x527

Number of pages including this cover 14

Our Ref: **17805**

RE: **Absorption Clarifier (AC) Pre-Treatment with Nano-Filtration (NF) – Budget Quotation for Wrangell AK WTP**

1) ADI-AC-1260-3
2) ADI-NF-1080-3

We are pleased to submit our preliminary ideas and budget pricing for the above plant.

For the NF option, pre-treatment is required. The AC pre-treatment is effective to remove turbidity, Fe and Mn, and organics.

For the reduction of capital costs, we are employing 1 train of the AC plant followed by 2 trains of the NF system. We have adjusted the AC and NF design flows to account for losses for backwashing water and backwashing down time. We are anticipating the use of a common break tank (by others) for flexibility and the continuous operation of the NF.

We are employing Hydranautics' HYDRACoRe membrane that is chlorine resistant and targets organics only, removing very little hardness.

The "AC" plant utilizes chemical coagulation with hydraulic tortuous path flocculation and solids retention clarification within an up-flow roughing filter followed by dual media filtration in a separate down-flow filter.

These plants are factory assembled and tested and delivered complete with all required controls. Only on-site connections for the raw water feed, treated water discharge, wastewater discharge and power are required. Filter media is shipped separately.

The following provides details and budget pricing.

1) Budget Price Proposal for Pre-Packaged Adsorption Clarifier

Plant Type ADI Model AC-1260

1 module, rated at 1260 gpm or 1.8 MGD

The module comprises a static mix system, clarifier and 2 filters. The filters operate simultaneously, but are backwashed separately.

Clarifier surface loading: 9.55 USgpm/ft^2

Filter Loading: 4.77 USgpm/ft^2

Module details.

- Tank dimensions (1):

Width	Height	Length
11 ft	8 ft 6 in	36 ft

- Constructed of marine grade aluminum alloy offering corrosion free service and eliminating the need for protective coatings and tank structure maintenance. (Tankage is approved by the E.P.A. for an approved tank life in excess of 100 years.)
- Inlet basket strainer, flow control valve, and magnetic flow meter,
- Chemical injection spool for addition of coagulant and inline static flash mixer.
- Upflow flocculator/clarifier, each train
  - ◊ Inlet plenum with non-clogg Orthos nozzles
  - ◊ 1070 mm (42") of crushed quartz media
  - ◊ Backflushing by combined air scour/raw water flush
  - ◊ Automatic control valve for air scour and back-flush to waste cycles
  - ◊ Drain for good housekeeping procedures.
- Rapid rate gravity sand Filter, each train
  - ◊ Plenum with non-clogg Orthos nozzles
  - ◊ 450 mm (18") of Anthracite and 450 mm (18") of high silica filter sand media
  - ◊ Backwashing by combined air scour/water
  - ◊ Automatic control valve for effluent, rinse, air scour and backwash
  - ◊ Drain for good housekeeping procedures.

One Air scour blower rated for 396 scfm at 5 psi c/w starter

Backwash pump rated for 2112 usgpm at 40 ft TDH c/w starter, isolation and check valves

Effluent pumping (1), rated for 1260 gpm @ 35' c/w starters, isolation and check valves

Access ladder and walkways as indicated on sample drawing

Chemical Systems

- Storage and dosing systems for the following chemicals. Each system would comprise 2 dosing pumps (duty and Stand by), shelf or stand mounted, injection ports, day tanks with powered mixing if necessary.
  - ◊ (Primary Coagulant)
  - ◊ (Polymer flocculation aid)
  - ◊ Soda Ash for pH and alkalinity elevation

Instrumentation

- One turbidimeter for raw water turbidity
- pH monitor.
- One Turbidimeter for each filter for filtered water turbidity
- Effluent particle counters and chlorine residual monitors are Optional
- Clarifier differential pressure switch
- Filter pressure transmitter
- Filter Level Transmitter
- Inlet magnetic flowmeter and backwash flowmeter

Allen Bradley Compact Logix PLC and Panelview HMI for fully automatic operation (shares with the downstream NF)

Commissioning technician for final commissioning and staff training

O& M manuals: (2 hard copies and 1 CD)

1) Budget Price: $ 395,000.00 excluding all applicable taxes

Delivery can usually be made within 12 weeks following approval of final shop drawings.

2) Packaged Nano-Filtration CWS-NF-1080-2

System comprises 2 trains on 2 skids, 5 micron pre-filtration, vertical inline NF feed pump, NF elements, clean in place (CIP) system and separate chemical dosing systems. It also includes a fully automatic control system.

Basic Design Parameters

Membrane Type:	Hydranautics' HYDRACoRe
# of trains:	2
Design flow, total:	1080 gpm
Design flow each train:	540 gpm
Required Feed Flow, each train:	600 gpm
Permeate production, each train:	540 gpm
Concentrate Recirc, each train:	35 gpm
Recovery:	90% in 1 pass with 2 stages, each train
Overall Flux:	14.6 gfd

System Details

All equipment, other than chemical feed systems and CIP solution tanks are skid mounted on skids constructed of structural aluminum.

- Skid dimensions (2):

Width	Height	Length
8' - 0" (2.45 m)	8' – 6" (2.6 m)	24' - 10" (7.6 m)

- Feed pumping, each train
  - ◊ One 5 Micron pre-filter, sized for 600 GPM @ less than 5 psi head-loss with clean filter.
  - ◊ PVC and 304SS pipework
  - ◊ 1 booster pump, vertical inline, DP 630 gpm @ 200 psi, VFD, line and load reactors.
  - ◊ Check and isolations valves

- RO System Comprises, each train:
  - ◊ Feed water flow meter with panel indication.
  - ◊ Common temperature and pH transmitter.

- ◊ Pressure protection
- ◊ 1 pass membrane array as detailed below, employing HYDRACoRe membranes.
  - Stage 1 – 13 FRP vessels, with 7, 8” x 40” membranes elements
  - Stage 2 – 6 FRP vessels, with 7, 8” x 40” membrane elements
- ◊ Manual throttling valve for concentrate to waste
- ◊ Stage 1 permeate throttling
- ◊ Direct reading rotameter for each concentrate and permeate stream.
- ◊ Permeate discharge check valve.
- ◊ Automatic concentrate purge control and solenoid valve.
- ◊ Permeate flush

- CIP system, one only, skid mounted except for HDPE tanks (overall footprint 15’ x 12’)
  - ◊ CIP chemical preparation tank (1350 gal) with heater
  - ◊ CIP waste collection tank (1350 gal)
  - ◊ CIP pump, VFD, – 288 gpm @65 psi
  - ◊ Flow meter
  - ◊ One 5 micron cartridge filter
  - ◊ Associated piping and valves
- Instrumentation summary
  - ◊ Feed, each train
    - ◊ Pressure, Pressure transducer and indicator
    - ◊ pH, sensor/transmitter, common to both trains
    - ◊ Flow, Magnetic flow meter
    - ◊ Conductivity. Hach Conductivity transmitter, high (optional)
  - ◊ Permeate, each train
    - ◊ Pressure, Pressure transducers and indicators
    - ◊ pH, sensor/transmitter
    - ◊ Flow, direct reading Rotameters
    - ◊ Conductivity. Hach Conductivity transmitter, low range (optional)
  - ◊ Concentrate, each train
    - ◊ Pressure, Pressure indicator
    - ◊ Waste Flow. Magnetic flow meter
  - ◊ Concentrate recirc, each train
    - ◊ Flow, magnetic flow meter
- Chemical Systems, each train

  Storage and dosing systems for the following chemicals. Each system would comprise a solution tank with powered mixer (if necessary), shelf mounted pre-plumbed duplex dosing pumps for 100% redundancy with calibration column and multifunction valve, and injection ports.

- ◊ Anti-scalent (1)
- ◊ Acid for inlet pH balancing (1)
- ◊ NaOH for permeate balancing (1)
- ◊ Sodium hypochlorite for disinfection (1)

- Junction Box
- PLC for fully automatic operation (Allen Bradley CompacLogix with Panelview HMI), in common with AC pre-treatment. Options for MCC Panels, SCADA systems, and Telemetry systems are available upon request.
- 2 trips, 12 days on-site time by trained Corix commissioning technician for final commissioning and staff training…

O& M manuals / As-Built Drawings

Shipping, FOB Wrangell AK

2) **Budget Price: $728,000.00 excluding all applicable taxes**

Delivery can usually be made within 10 weeks following approval of final shop drawings

THIS BUDGET PRICE ESTIMATE DOES NOT INCLUDE:

- Any applicable taxes
- Receiving, unloading and suitable storage of material
- Concrete foundation pads
- Field erection and assembly of treatment plant and equipment, labor and supervision
- Piping connections, influent and effluent piping, rinse and backwash piping, yard piping, drain piping, or other piping outside the plant structure
- Field electrical wiring and conduit
- Plant enclosure or building.
- Base meter, split trough, disconnect switches, transformer, if required, are not included
- Field paint or painting labor
- General cleaning of plant
- Installation of chemical feed systems

ADI Water Solutions and its predecessor companies have engineered over 500 similar plants since 1965 and we value the opportunity to work with engineers and the plant owners and operators to develop concepts and final designs so that the final product provides the most cost effective and efficient solution. For more information on our Company and our range of products and services visit our web site at ***www.adiwater.com.***

I trust this meets your needs and will be pleased to provide any further information you may require.

Regards,

Andrew Stevano P. Eng.
E mail: andrews@adiwater.com

Attachments:

- AC Plant Process Description
- Operating Costs AC-NF Plant

PROCESS DESCRIPTION - "AC" Adsorption Flocculating – Clarifier / Filtration

Inlet Flow Control **-** Raw water enters each plant train through a basket strainer, magnetic flow meter, and Cla-Val hydraulic rate of flow control valve. (Options for electric, pneumatic, or hydraulic valve actuators are available upon request.) A 4-20ma signal from the flow meter is used to modulate the control valve to maintain the desired flow.

Flash Mixing -. Chemicals: typically primary coagulant, polymeric flocculant, and soda ash are injected in an injection spool and the flow passes into a static flash mixer. All chemical rates are paced to flow. (Chemcial oxidizers may be used to precipitate iron and manganese if present.)

Adsorption Clarifier **-** Following mixing the coagulated water flows to the adsorption clarifier that provides both flocculation and solids separation in a common unit. The coagulated water first passes upward through an array of non-clogg Orthos diffusers and then a 42" layer of 2 mm non-buoyant media. The media encourages first flocculation and then traps the formed floc. A pressure switch provides indication that the total head-loss has exceeded a pre-set limit and that flushing is required. This indication is also provided by elapsed run time. The flushing sequence includes an initial air followed by a flushing water flow using the raw water supply. Dirty wastewater flows to waste through the upper wastewater channel. Manual drain valves permit tank draining and cleaning.

Filtration **-** From the clarifier section water flows to the top of the filter section and is filtered through a mixed media comprising:

450 mm	18 inches of 1.0 mm No#1 anthracite coal
450 mm	18 inches of 0.45-0.55 mm high silica filtration sand

The filtered water is collected through an array of slotted PP nozzles. Clayton rate of flow level control valves maintain a constant level in each filter. A pressure switch provides indication that total head-loss has exceeded the maximum acceptable level and that backwashing is required. This indication is also initiated through high filtered water turbidity, which is constantly monitored by an on-line Hach turbidimeter on each filter or by elapsed run time.

The filter utilizes a combined air scour and water back-flush filter cleaning system**.** An initial air scour at 2.5 scfm/ft^2 is followed by a combined air water wash at a wash rate of about 4-6 US gpm/ft^2, (10-15 m/hr), followed by a water only back-flush at 12-16 US gpm/ft^2, (30-40 m/hr). The exact rates are established during start up. A Clayton flow control valve with twin flow pilots modulates the backwash flow for the two separate flow rates. (Other valve configurations are available upon request.)

Dirty backwash water is collected through surface launders and directed to waste. For deeper filters, the launders are normally submerged and equipped with an isolating outlet valve with powered actuator.

Following completion of the backwash cycle the filter is run to waste through a waste line fitted with a Cla-Val control valve. The filter gradually matures and effluent turbidity falls to acceptable levels. After a preset time interval the rinse to waste valve closes, the effluent valve opens and the filter returns to normal service.

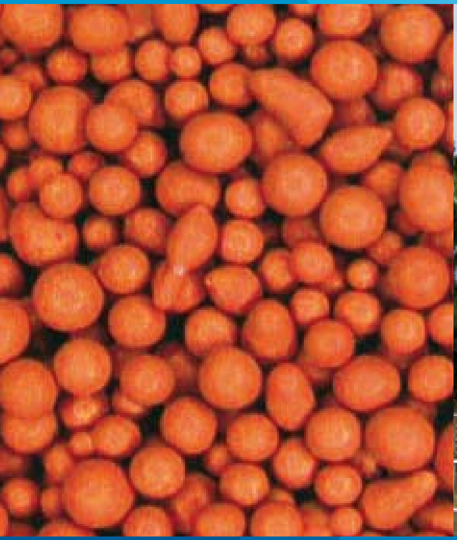
The full backwashing sequence can be both initiated and controlled either manually or automatically. Automatic operation is through a PLC controller with sequence times easily adjustable by the plant operator.

ORICA WATERCARE

MIEX® Treatment Systems

High Rate Configuration

Advanced ion exchange treatment solutions



MIEX®

The MIEX® Treatment Process

The MIEX® Treatment Process is an advanced ion exchange process that uses MIEX® Resin to remove target contaminants from water and wastewater streams.

MIEX® Treatment Systems have small footprints, very low waste volumes and are not subject to chromatographic peaking, allowing ion exchange to be used in a wide variety of applications and throughputs.

MIEX® Resin

The name MIEX® comes from "Magnetic Ion Exchange". The resin beads have a magnetic property that allows them to agglomerate and settle rapidly, or fluidize at high hydraulic loading rates. Because of this unique feature, MIEX® Resin is used in a continuous process with ion exchange occurring in either a mixed tank or a fluidized bed reactor vessel.

Figure 1
Reactor Vessel

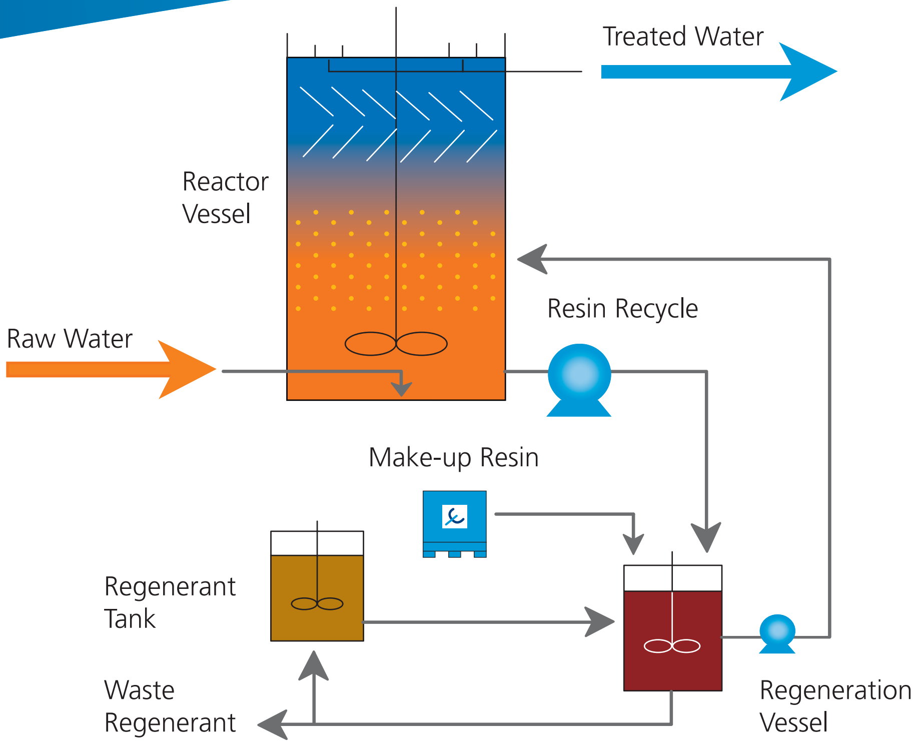


Figure 2
Process Flow Diagram

MIEX® Treatment System: High Rate Configuration

The High Rate configuration refers to a MIEX® System where ion exchange occurs in a fluidized bed reactor *(Figure 2)*.

In this configuration, raw water is fed to the base of the reactor vessel and mixed with the MIEX® Resin. Within the fluidized bed, the magnetic resin beads are attracted to each other to produce large agglomerates that form a uniform resin suspension, allowing design hydraulic loading rates of at least 10 gpm/ft^2.

An agitator operating at low speeds maintains a uniformly mixed resin/water suspension. A small stream of resin is withdrawn from the reactor vessel, regenerated and returned to maintain the ion exchange capacity of the process.

A series of tube settlers (or plates) at the top of the reactor vessel separate the resin from the water. Treated effluent overflows into collection launders to downstream treatment.

Virgin resin is periodically added to the process to make up for minimal quantities of resin that may be carried downstream.

The High Rate configuration can be provided as an open tank gravity flow system or an enclosed pressurized system.

System Sizes

MIEX® Treatment Systems are available as packaged systems up to 2 MGD (MagnaPak™ Systems) and as custom-designed systems for all capacities over 2 MGD.

MIEX®

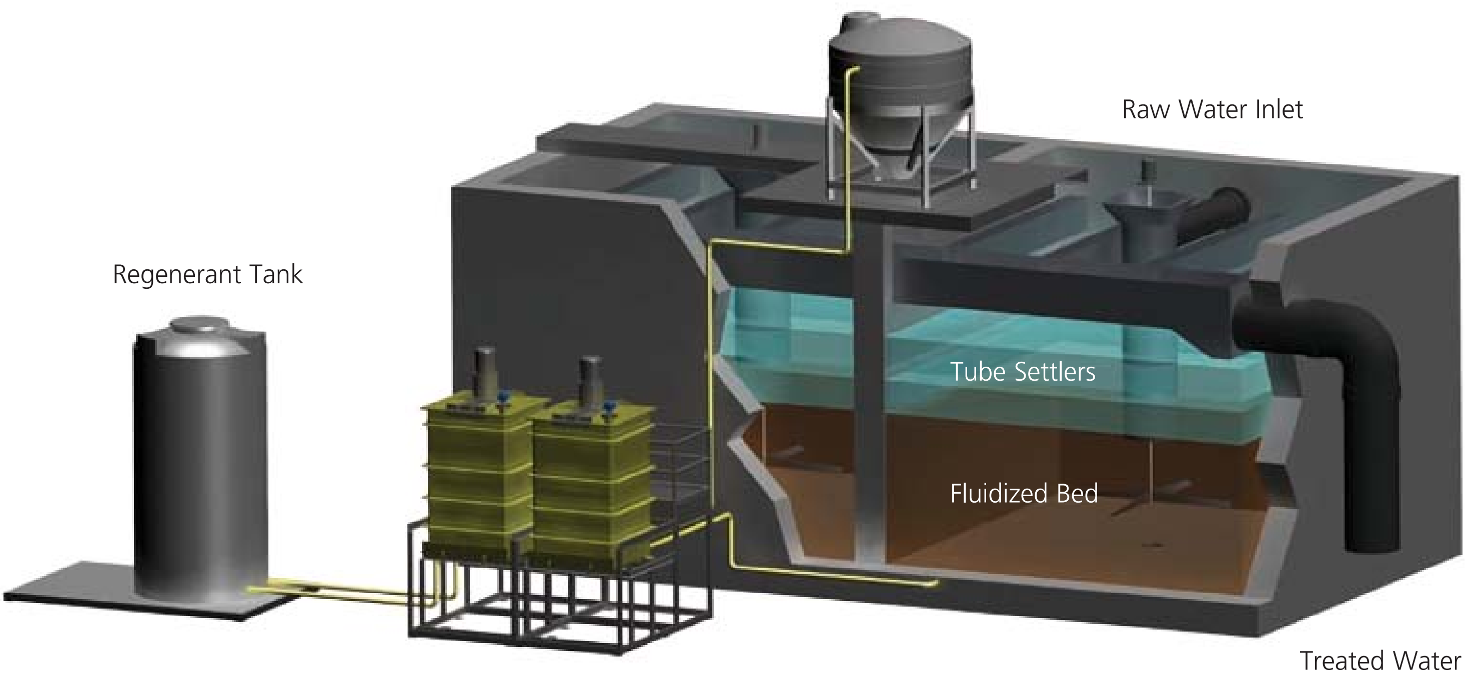


Figure 3
8 MGD MIEX® System

Resin Regeneration Process

The continuous withdrawal of loaded resin and return of fresh regenerated resin ensures a consistent treated water quality which prevents the chromatographic peaking that can occur with conventional ion exchange columns. Regenerant solutions typically consist of sodium chloride but other salts such as potassium chloride, magnesium chloride or sodium bicarbonate can be used if either sodium or chloride is not desired in the waste discharge.

Residuals

The highly efficient regeneration process keeps regenerant use and waste volumes to a minimum. Residual volumes from MIEX® Treatment Systems consist of waste from regeneration and are small, typically 0.02 to 0.06% of the plant throughput. Disposal options include sewer discharge, evaporation or coagulation/recycling of the regenerant solution.

Placement in treatment train

The MIEX® Process can be used as a stand-alone treatment for the removal of contaminants such as nitrate, arsenic or DOC, or in combination with other treatment processes to meet more than one objective.

Since the MIEX® Process is not affected by suspended solids in the source water, it can be placed in a number of locations throughout the treatment train. Typically it is used as a pretreatment step ahead of current processes. When used this way, the efficiency of downstream treatment processes can be greatly improved, resulting in less chemical demand and sludge production, better membrane operability, as well as improved solids separation through DAF and conventional sedimentation/filtration.

The addition of a MIEX® System requires little alteration, if any, to existing treatment systems.

ORICA WATERCARE

Orica Watercare Services

Orica Watercare performs laboratory and pilot evaluations to determine the optimum performance of MIEX® Resin on water and wastewater streams. A design package and budget estimate can be provided based on these feasibility studies. Orica Watercare is also fully equipped to supply equipment and perform system commissioning and optimization upon installation.

Orica Watercare Head Offices

USA
Toll Free 1-877-414-miex
T 303-268-5243
F 303-268-5250

Europe
T 44-1257-256-616
F 44-1257-256-149

Asia Pacific
T 61-3-9665-7111
F 61-3-9665-7937

E miex@orica.com
www.miexresin.com

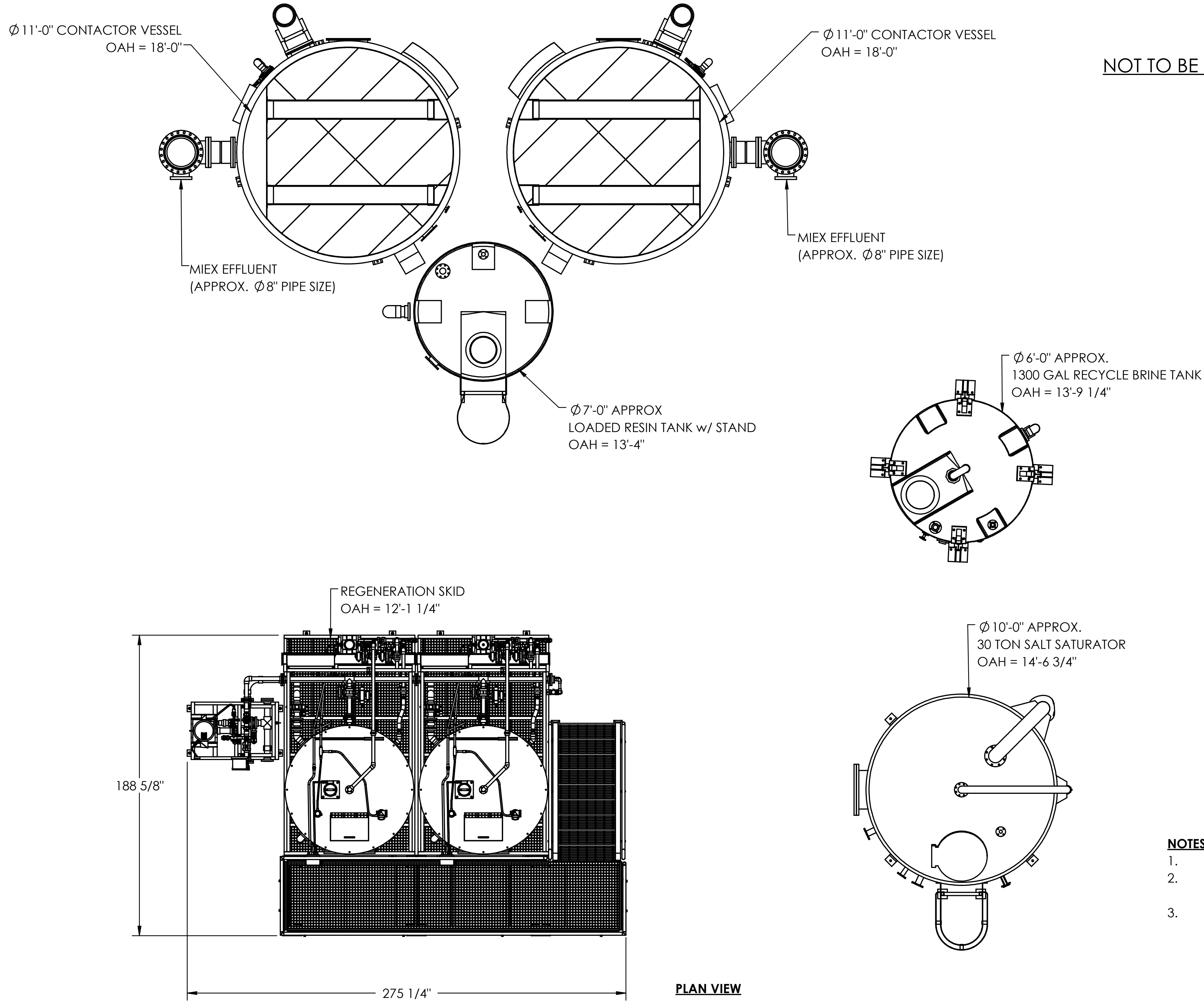
HRC0207

MIEX®

Visit our website at **www.miexresin.com** or contact your nearest Orica Watercare office for more information or to inquire about a specific application.

PRELIMINARY

NOT TO BE USED FOR BUILDING DESIGN OR SCOPE DETERMINATION



PLAN VIEW

NOTES:

1. ALL DIMENSIONS APPROXIMATE
2. EQUIPMENT LOCATIONS SUBJECT TO SITE CONSIDERATION AND NOT GIVEN FOR ANY PARTICULAR ARRANGEMENT.
3. CONTACTOR INFLUENT / EFFLUENT PIPING SHOWN IS GENERIC. ALL REQUIRED PIPING IS BY OTHERS.

REV.	DESCRIPTION	DATE	CHANGED BY	CHECKED BY	ENGINEER

REVISIONS

STAMP

TOLERANCE

FRACTION ± 1/8
DECIMAL: .XX ± 0.03
DECIMAL: .XXX ± 0.010
ANGULAR ± 1°

FINISH 125

	SIGNATURE	DATE
DRAWN BY	S. PADIAS	11/04/15
CHECKED BY	D. GORLOW	11/04/15
ENGINEER	S. MITCHELL	11/03/15
DISCIPLINE ENGR		
CLIENT		
PROJECT NO.		
PROJECT MGR	S. MITCHELL	
FILENAME	NAXXX-05-01-001	

IXOM

(FORMERLY ORICA WATERCARE INC.)

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

PROJECT: CITY OF WRANGELL, AK 2MGD
SERVICE: MIEX® PRE-TREATMENT
TITLE: **MIEX® SYSTEM GENERAL ARRANGEMENT FULL ASSEMBLY PLAN VIEW**

SIZE: B | DWG NO.: **NAXXX-05-01-001** | REV: X
SCALE: 1:72 | SHEET: 1 OF 1

Jon Hermon

From: Trevor Trasky
Sent: Wednesday, December 09, 2015 2:52 PM
To: Will Kemp
Cc: Jon Hermon
Subject: Wrangell - Conventional Train

Will, some ballpark numbers for a conventional system for 2.0 mgd in Wrangell:

Budgetary cost: $1.0 million USD FOB Wrangell
4 trains total to make up a 2.0 MGD plant with a footprint as follows:
3 flocc/clarifier trains approximately 13'Wx51'Lx10'H with 3' walkways in between each
1 filter train perpendicular to these with 4 filter basins (3+1 redundant) approximately 13'Wx40'L total.

Like this:

Flocc+clar 1	4 filt bay
Flocc+clar 2	
Flocc+clar 3	

O&M for this is very similar to the AC treatment for Nano.

Trevor Trasky, PE
Civil and Environmental Engineer

CRW Engineering Group, LLC
3940 Arctic Blvd, Ste. 300
Anchorage AK 99503
Office 907-562-3252 | Direct 907-646-5626
www.crweng.com

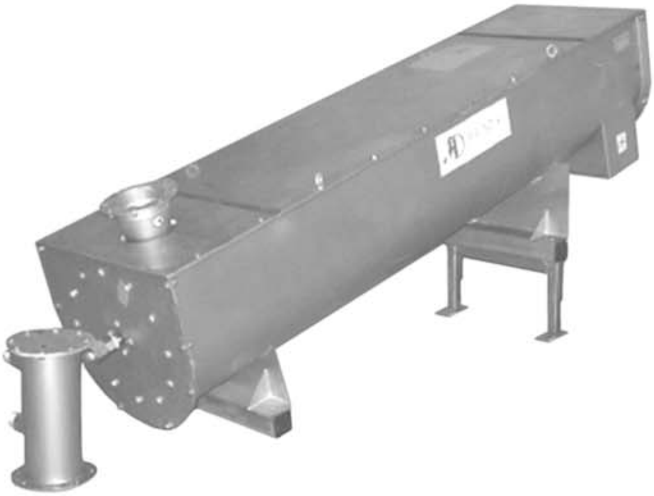
DRYCAKE

Vanderbeken Enterprises Ltd.

1877-DRYCAKE

"DRYCAKE PRESS"

Sludge Thickening & Dewatering



Low Outlay Cost – Low Asset Cost – Low Energy Cost

High Reliability…

DRYCAKE has developed a good reputation with a philosophy of offering high quality at low cost. This has served to provide equipment to smaller industries or applications where previously it was considered unviable and offers a lower purchasing cost for larger applications.

“DRYCAKE PRESS”

DRYCAKE PRESS represents innovation in design and provides an economic solution for either sludge thickening or dewatering at small to medium water, waste water and industrial effluent treatment works in addition to certain larger applications. Low outlay cost, running cost and maintenance costs were fundamental to design objectives and this has culminated with the development of a highly cost-effective process. Sludge export or transportation costs can therefore be significantly reduced with consequential further savings on operational and energy costs.

Sludge thickening up to 15% DS or, sludge dewatering up to 30% DS are attainable. Systems can operate automatically or manually – either continuous, or intermittently for batch processing. Various manufacturers’ flocculants may be used and the system can be supplied with or without preparation plant to suit requirements.

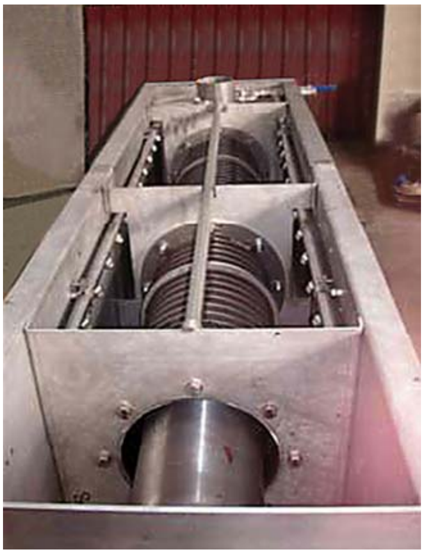
Operation

The patented DRYCAKE PRESS consists of static circular drums with internal screw conveyor. The drums are fabricated in stainless steel using various size special wedge-wire screen profiles with large surface to obtain optimum liquor drainage characteristics. Flocculated sludge enters the inlet chamber into the drum zone where it conveys by spiral movement and is gradually compacted. Liquor continuously drains through the drum wedge-wire screen and gravitates to the filtrate outlet where it can be discharged or returned for treatment. The sludge retained in the drum is subjected to continuous movement and progressive compaction applying the desired effect of releasing more liquor to drain – flocculated sludge is treated gently and flocculent utilization kept low. Spray nozzles provide intermittent wash to the screen sections, however with inlet sludge solids content ≥ 1.5% DS, washing will not be necessary and water consumption is negated. Eventually the solids will pass into the discharge section and to the outlet where it can be collected into a container or conveyed for eventual disposal.

DRYCAKE PRESS sludge thickening and dewatering systems are manufactured with the same philosophy applied to all DRYCAKE equipment comprising of bolted sections to grant far superior inspection and maintenance access which in turn will increase longevity and overall asset life.

Advantages

- Simple mechanized operation
- No rotating synthetic filter cloth requiring periodic attention
- Low speed operation – low energy input
- High solids capture
- Low shear – excellent recovery of all sludge types
- Easy operation and maintenance
- Improved Health & Safety benefits
- High reliability and long asset life
- Non-clogging even with fibrous materials
- Compact, low space requirement



DRYCAKE PRESS with cover removed

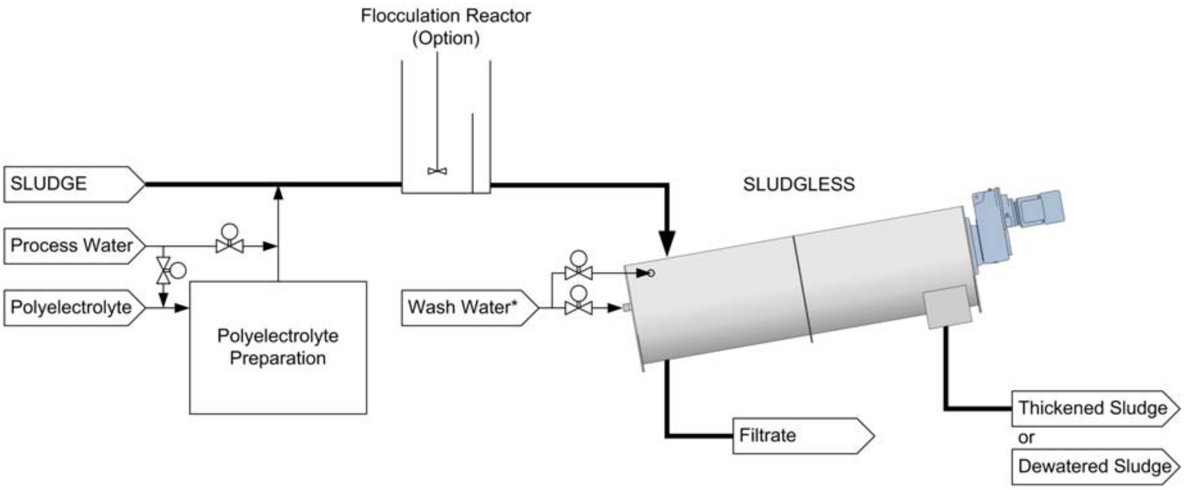
Flocculent

Sludge thickening or dewatering requires initial mixing and flocculation of the incoming sludge using an appropriately selected polymer. Polymer can be supplied as dry solids, beads, emulsions or solutions. Where necessary, other chemicals may be considered such as lime, iron and aluminium salts although, modern polymer solutions generally have superior solid liquid separation and flocculation potential.

Polymer is first activated with water, which depending upon the type of polymer used, may take 5 – 60 minutes to suit process needs. It is then diluted to the required concentration prior to dispersing and mixing with the sludge. Mixing should have sufficient contact time to provide liquid separation and flocculent formation. Typically, adequate flocculation times can range between 30 seconds to 2 minutes.

The quality of treatment will depend upon sludge type, temperature, selected polymer, polymer mixing and adequate flocculation time. Typical polymer usage for waste water sludge varies from 0.3 – 7 kg/ t DS. In general, sludge thickening requires less polyelectrolyte than sludge dewatering. Automated polymer preparation and dosing systems along with the option of a flocculation reactor can be supplied with the DRYCAKE PRESS.

Typical Arrangement



* With inlet sludge solids content ≥ 1.5% DS, intermittent wash water will not be necessary. To reduce potable water usage, wash water may be sourced from the works treated final effluent.

DRYCAKE PRESS is capable of providing automatic sludge thickening or dewatering with continuous 24-hour run time if necessary, without operative attendance being required.

4 DRYCAKE PRESS units positioned in parallel providing sludge dewatering from 1.6% DS to 20% DS

Sludge Dewatering and Thickening

With screw rotation less than 20 rpm, the DRYCAKE PRESS conveys flocculated sludge very gently without high velocity shear, using low energy input and therefore will have an excellent recovery rate for all sludge types. The inlet sludge flow rate, polymer dosing rate, good flocculent formation and inclined angle determines the optimum operating efficiency, the final dry solids concentration and filtrate quality.

Typical Sludge Dewatering Performance

Typical inlet sludge flows to achieve a mean 22% DS discharge

Model	Drum Diameter (mm)	Inlet Sludge Flow 1% DS (gpm)	Inlet Sludge Flow 3% DS (gpm)	Filtrate Quality (mg/l)
XMD 20	200	4.5	3	≤ 400
XMD 40	400	9	6	≤ 400
XMD 70	700	22	15	≤ 400

Sludge Thickening

When applied to sludge thickening, the same DRYCAKE PRESS models are capable of processing increased inlet sludge flows over the above sludge dewatering capacities and higher, determined by the incoming sludge concentration and the final sludge dry solid content requirement.

Wash Water

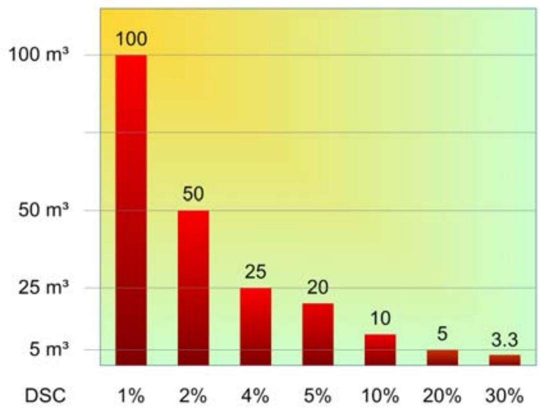
Wash water is standard throughout the DRYCAKE PRESS range; however with inlet sludge concentrations over 1.5% DS, washing will not necessarily be required but may be useful for periodic cleaning purposes.

Model	XMD 20	XMD 40	XMD 70
gph (75 psi)	30	35	55

Dewatered dry solids conveyed into the DRYCAKE PRESS discharge section

XMD 70 DRYCAKE PRESS with TOP 3 Combined Screen, Grit and FOG removal plant installed inside a purpose-built building

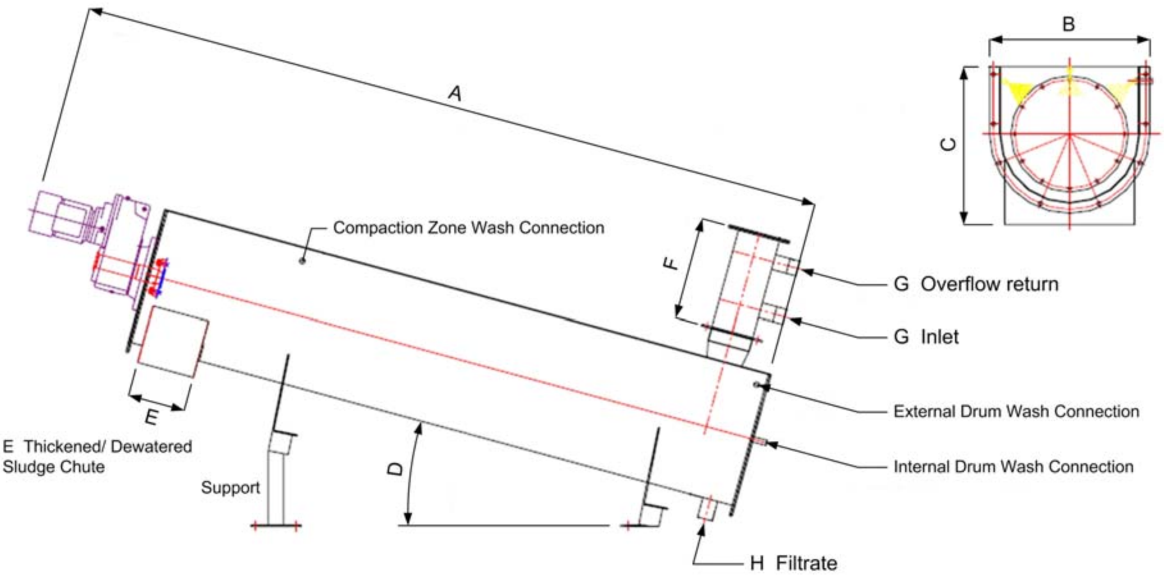
The graph illustrates the significant volume reductions and savings that can be gained by thickening or dewatering 450 gpm of a 1% DS sludge prior to transportation.



DRYCAKE PRESS Nominal Dimensions, Weights and Motor Rating

Dimensions	XMD 20	XMD 40	XMD 70
A	2,320	2,800	3,800
B	400	500	636
C	515	615	640
D	5-15°	5-15°	5-15°
E	230	230	230
F	400	400	400
G	50 DN	50 DN	50 DN
H	60 DN	60 DN	60 DN
Lbs	550	850	1350
HP	1/2	1/2	3/4

Sludge Thickening



The design of the DRYCAKE PRESS facilitates installations to be either inside buildings or outside without any sheltering, allowing direct disposal of thickened or dewatered sludge to a container or holding tank.

Supplementary DRYCAKE products to complement the DRYCAKE PRESS sludge thickening or dewatering systems:

Conveyor Systems

Horizontal

Inclined

Vertical

Appendix G – Water Testing Reports

Wrangell Jar Testing

August 10, 2015 Test

Raw Water Data:

Color: 79 Turbidity: 0.90 pH: 5.40 Temperature: 12.2 deg C Mn = 0.03 mg/L

In 1 Litre of Raw water sample I started with Isopac in order to track chemical dosage, pH adjustment and Flocc formation. Below is the detailed step by step addition of chemicals I added in order to see if flocc is formed. After a short while each step of chemical addition was conducted.

Chemical Added (Isopac)	pH Measurement	Comments
10 mg/L	5.55	No Flocc
20 mg/L	5.24	No Flocc
30 mg/L	4.77	No Flocc
Added 10 mg/L of Caustic	6.36	pH was increased
40 mg/	6.08	No Flocc
50 mg/L	5.80	No Flocc
60 mg/L	5.46	No Flocc
70 mg/L	4.97	No Flocc
Added 15 mg/L of Caustic	8.1	No Flocc
90 mg/L	7.83	Very very very tiny Flocc
110 mg/L	7.24	Very very very tiny Flocc
130 mg/L	5.84	Very tiny Flocc
150 mg/L	4.78	Very tiny Flocc

2nd Test:

1 Litre Jar of Raw Water Sample.

90 mg/L Isopac was added and pH was measured. pH did dropped to 4.5 and then caustic was added to adjust pH. 15 mg/L of caustic was added and pH was raised to 5.67.

No Flocc was seen. No reaction was seen.

Added another 20 mg/L of isopac and also did pH adjustment but still no reaction. pH was about 5.7

No reaction at all.

<u>August 12, 2015 Tests</u>

Raw Water Data:

Color: 81 Turbidity: 0.92 pH: 7.83 Temperature: 12.2 deg C Mn = 0.03 mg/L

Test #1

As per Mike's instructions, raised the pH between 8.5 and 9 and add the coagulant dosage for the flocculation process. (1 Litre JAR only)
100 mg/L of ISOPAC was dosed.
35 mg/L of caustic was added and overtime pH was stable at 8.75.
Medium pin point flocc was observed. Below are the treated water sample results.

Color = 17 Turbidity = 0.28 Mn = 0.005 mg/L pH = 8.5

Test #2
Two Jars of 1 Litre each of raw water samples were used to perform testing.

Jar 1:

100 mg/L of ISOPAC used.

160 mg/L of Soda Ash used. The flocculation timing was regular 20 minutes time 10 minutes for each flocc speed. pH was stabilized at 9.0 during the testing. Below are the results of the treated sample.
Color = 22 Turbidity = 0.4 pH = 8.9 Mn = 0.005 mg/L

Jar 2:

100 mg/L of ISOPAC used.

160 mg/L of Soda Ash used + 1 mg/L of $KMnO_4$ was added as well.

After the addition of $KMnO_4$, sample did turned pink but overtime during flocculation, pink color disappeared. During flocculation pH was stable at 9.1. Flocc size was little bit better than Jar 1. Medium size flocc was seen. Below are the results of the treated water sample.

Color = 17 Turbidity = 0.26 pH = 8.93 Mn = 0.004 mg/L

By: Attinder Dhanoa
August 12, 2015

Date: 9/16/2015
Conducted by: Will Kemp, Andrew Gallagher (CRW Engineering Group, LLC)

Summary Table

		Filtered Water Characteristics			
Polymer	**Dosage**	**UVT**	**Color**	**Turbidity**	**pH**
Nalco 8185	11 mg/L	88	29	0.31	6.88
Nalco 8186	23 mg/L	89	39	0.30	6.89
Nalco 8105	9 mg/L	87	38	0.48	7.09
Nalco 8103	33 mg/L	86	34	0.26	6.87

Laboratory Report

MIEX Resin Test Results

Project Name:	Wrangell Water Treatment Plant		
Site / Location:	Wrangell, Alaska		
Plant Contact:	Unknown		
Contact:	Bill Reilly		
Sample Date:	6/24/2015	**Lab Control ID:**	LC-2015-14
Analysis Subject:	Organics and Color		
Report Date:	9/8/2015	**Document ID:**	LR-2015-14

1. Background / Summary

1.1. Background

Project Background - Wrangell Water Treatment Pilot Study Justification

Based on the TPS Report 54048v1, Wrangell's slow sand and ozone filtration water treatment plant has been in operation for approximately 10 years. In this time, there have been numerous issues that have developed, creating potential health risks and operational/maintenance costs.

Per the TPS report, the current treatment system does not work effectively with Wrangell's surface water supply. Wrangell's water source is surface runoff water that is very high in organics. When these organics are chlorinated, HAA5s and TTHMs levels become high which are known carcinogens. The filtration system attempts to remove organics through ozone and filtration before chlorination; however, not enough of the organics are removed through the existing process. Additional processes are also needed in order to address high levels of lead, copper, and disinfectant byproducts.

Currently, the sand filter screens clog easily, resulting in a failure to supply the necessary filtering or as quickly as customer demands require. The filters have to be scraped or cleaned every 1 to 2 weeks, rather than quarterly as designed. The continual cleaning does not allow the necessary film to build that provides safe filtration.

Based on the aforementioned concerns, Ixom Watercare was commissioned by CRW Engineering Group LLC of Anchorage, Alaska to conduct bench MIEX resin tests to determine its effectiveness for removing dissolved organics and color.

1.2. Summary

Ten (10) gallons of raw water was received from the Wrangell Water Treatment Plant for the removal of dissolved organics and color. The results from the MIEX resin testing showed exceptional removal of the organics and color with minimization of coagulant consumption and pH variation. The MIEX resin results showed the MIEX Gold resin at 800 bed volumes (BV) alone would achieve 78% removal of the DOC (1.7 mg/L DOC) and achieve a color removal of 58% (27 TCU). These results were based on a raw water DOC level of 7.43 mg/L and color of 72 true color units (TCU).

To further reduce the organics and color, coagulant was evaluated as post treatment to the MIEX resin treated water. The results showed additional removal of the DOC and color can be achieved at a minimized coagulant dose and pH variation. The issue regarding pH variation with coagulant addition will be addressed later in this report. Treated raw water with MIEX Gold resin at 800 BV and a coagulant dose of 105 mg/L showed a DOC reduction of 90% (0.71 mg/L) and a color removal of 94% (4 TCU). These are exceptional results for high DOC and color source waters. It should be noted that the organic value varied between the samples (two 5 gallon buckets) collected. For example, Sample A had a raw water DOC value of 7.9 and Sample B had a raw water DOC value of 7.4. Removals will be based on the respective sample raw water quality.

For comparison, enhanced coagulation was conducted on the raw water. The coagulant screen on the raw water helps to identify the coagulant type and dosage. The required coagulant dose and results are compared to MIEX resin treatment. The raw water was treated with ferrous sulfate at a dose of 170 mg/L. The reduction in the DOC using ferrous sulfate (coagulant only) on the raw resulted in a removal of 30% (5.21 mg/L DOC). It was also observed that as the coagulant increased, turbidity increased appreciably. It had been shown that MIEX resin pretreatment followed by coagulation can reduce the coagulant consumption and achieved improved organic and color removal. All results shown in Table 1 below are from Sample B (Sample A was consumed during the coagulant and resin screening tests). Table 1 summarizes the treatment results.

Table 1. Treatment Summary Results

Jar	Units	Raw Water	Raw Water + Coagulant	MIEX Resin (800 BV)	MIEX Pretreat (800 BV) + Coagulant
Coagulant Type		---	**Ferrous Sulfate**	---	**Ferrous Sulfate**
Coagulant Dose	mg/L	0	170	0	105
Initial pH		8.41			
Final Water Quality					
DOC	mg/L	7.43	5.21	1.65	0.71
UVA	1/cm	0.355	0.178	0.111	0.059
True Color	PCU	72	67	30	4
pH		8.41	6.73	7.95	7.31
Copper	mg/L	0.22	--	0.02	0.00
Turbidity	NTU	1.85	229.0	2.7	50.4
% DOC Raw Reduction			30	78	90
% UVA Raw Reduction			50	69	83
% True Color Raw Reduction			7	58	94

1.3. Objective

As instructed by CRW Engineering, our objective was to maximize the reduction in organics and using MIEX resin treatment. In addition, coagulant addition post MIEX resin treatment was evaluated to determine the additional DOC and color removal.

2. Testing and Results

2.1. Sample Characterization

Ten gallons (two 5 gallon buckets) of raw water was received from the Wrangell Water Treatment. The characterization showed that each 5 gallon bucket of raw water to have slightly different characteristics. Typically, other raw water samples received in separate containers are close in characteristic and would not require a separate characterization. The raw water characterization is shown in Table 2. Table 2 below also shows the raw water characteristics from CRW Engineering laboratory analysis report dated August 7, 2015.

Table 2. Raw Water Characterization

Parameter	Units	Sample A	Sample B	CRW Raw Water
DOC	mg/L	7.96	7.43	6.41
UVA	1/cm	0.347	0.355	--
SUVA		4.36	4.78	--
True Color	CU	66	72	60
pH	pH Units	7.13	8.41	6.8
T-Alkalinity	mg/L CaCO3	10	**60**	9.237
T-Hardness	mg/L CaCO3	10	11	8.96
Iron	mg/L	0.57	0.54	0.992
Sulfate	mg/L	0.0	0.0	0.861
Chloride	mg/L	10	15	0.543
Turbidity	NTU	1.59	1.85	--
Conductivity	µS/cm	12.37	**82.1**	22.8
TDS	mg/L	--	--	34
Copper	mg/L	--	0.22	--

Note: There appears to be a discrepancy in the alkalinity and conductivity from Sample B.

2.2. Raw Water Coagulant Screening

Coagulant screening was evaluated on the raw to determine the reduction of the DOC and color. Several iron and aluminum base coagulants were evaluated. In addition, alkalinity was added to facilitate the effectiveness of the coagulant on the organics and color removal with potential for lowering the coagulant dose. The use of alkalinity did not show a reduction in the coagulant; however, the results did show improved floc structure. The use of a coagulant at higher dosages showed the effect on the pH and the DOC and color removal. The results of the coagulant addition at 170 mg/L ferrous sulfate reduced the DOC by 29% and the color by 6.9%. Higher coagulant dose resulted in lower pH and increased turbidity. The raw water turbidity went from 1.85 NTU to 229 NTU after 170 mg/L ferrous sulfate addition. Increased turbidity would require pretreatment like a DAF or a clarifier to remove the bulk solids prior to a mixed media filter or membrane filter.

2.3. MIEX Resin Testing

2.3.1. MIEX Resin Preparation

The MIEX® resin concentration is measured as a volume resin contained in a one liter resin water sample (e.g., milliliters of settled resin per liter of slurry). The MIEX® resin used in jar testing consists of resin that has previously been used and regenerated. Regenerated resin is referred to as fresh resin, whereas; virgin resin is resin that has not been previously used. Fresh resin is representative of what would be used in an on-going full-scale treatment process.

2.3.2. MIEX Resin Multiple Loading Test

The resin multiple loading test (MLT) procedure has been shown to best approximate the full-scale continuous plant operation. Results from the MLT will project the regeneration rate required to achieve a target water quality. Treatment performance at several regeneration rates is determined by contacting a measured volume of resin with increasing volumes of raw water.

The volume of raw water treated divided by the volume of resin used to treat the water determines the bed volumes (BV). The highest BV treatment rate with the largest UVA_{254} reduction is typically selected as the optimal treatment rate.

Jar tests are performed with both the MIEX DOC and GOLD resins. Both resins performed well on various water sources containing dissolved organics and color. The results of the MLT showed the GOLD resin performed satisfactorily on this source water. All resin screening was conducted using Sample A. The results of MIEX DOC resin tests are shown in Table 3 and Figure 1. Results of the MIEX GOLD resin tests are shown in Table 4 and Figure 2.

Table 3. MIEX DOC Jar Test Results

	UVA (cm^{-1})			DOC (mg/L)			True Color (PtCo)		
Bed Volumes	**Raw**	**MIEX**	**Removal (%)**	**Raw**	**MIEX**	**Removal (%)**	**Raw**	**MIEX**	**Removal (%)**
1000	0.347	0.207	40%	7.96	4.50	43%	66	45	32%
800	0.347	0.199	43%	7.96	4.27	46%	66	44	34%
600	0.347	0.188	46%	7.96	4.01	50%	66	42	37%
400	0.347	0.172	50%	7.96	3.59	55%	66	39	42%
200	0.347	0.147	58%	7.96	3.06	62%	66	33	50%

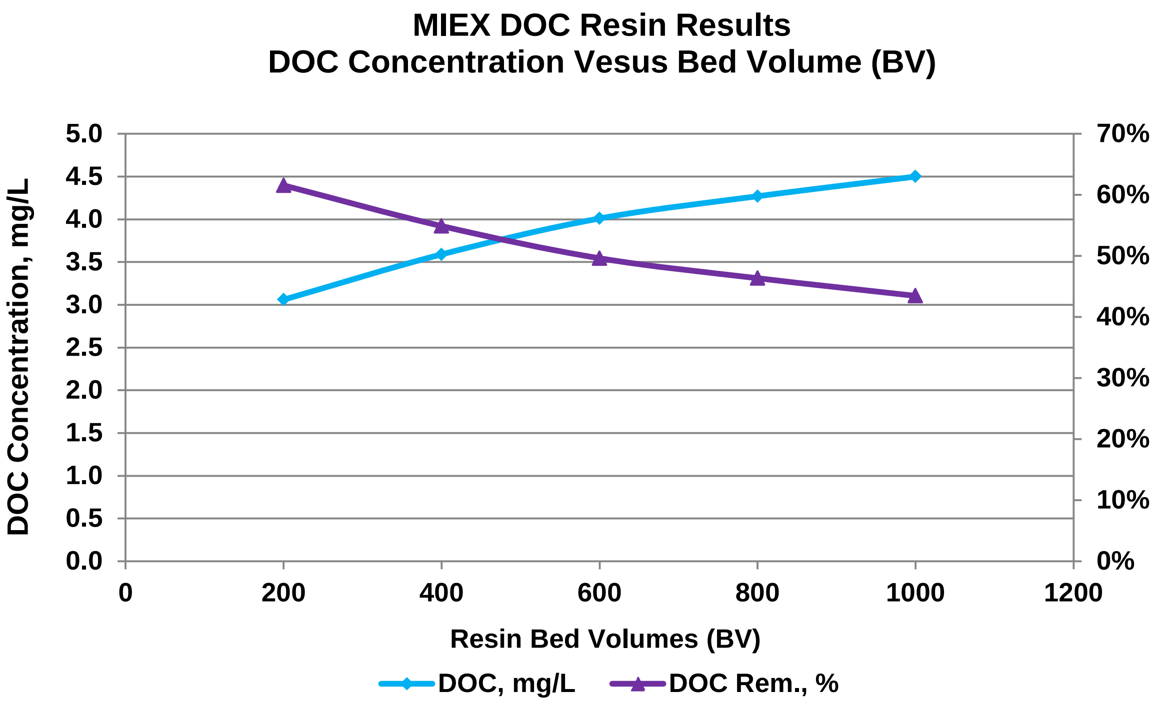


Figure 2: MIEX DOC Jar Test (DOC)

Table 4. MIEX GOLD Jar Test Results

	UVA (cm^{-1})			DOC (mg/L)			True Color (PtCo)		
Bed Volumes	**Raw**	**MIEX**	**Removal (%)**	**Raw**	**MIEX**	**Removal (%)**	**Raw**	**MIEX**	**Removal (%)**
1000	0.347	0.130	63%	7.96	2.87	64%	66	29.6	55%
800	0.347	0.117	66%	7.96	2.57	68%	66	27.0	59%
600	0.347	0.101	71%	7.96	2.19	72%	66	23.7	64%
400	0.347	0.080	77%	7.96	1.76	78%	66	19.0	71%
200	0.347	0.057	84%	7.96	1.34	83%	66	13.0	80%

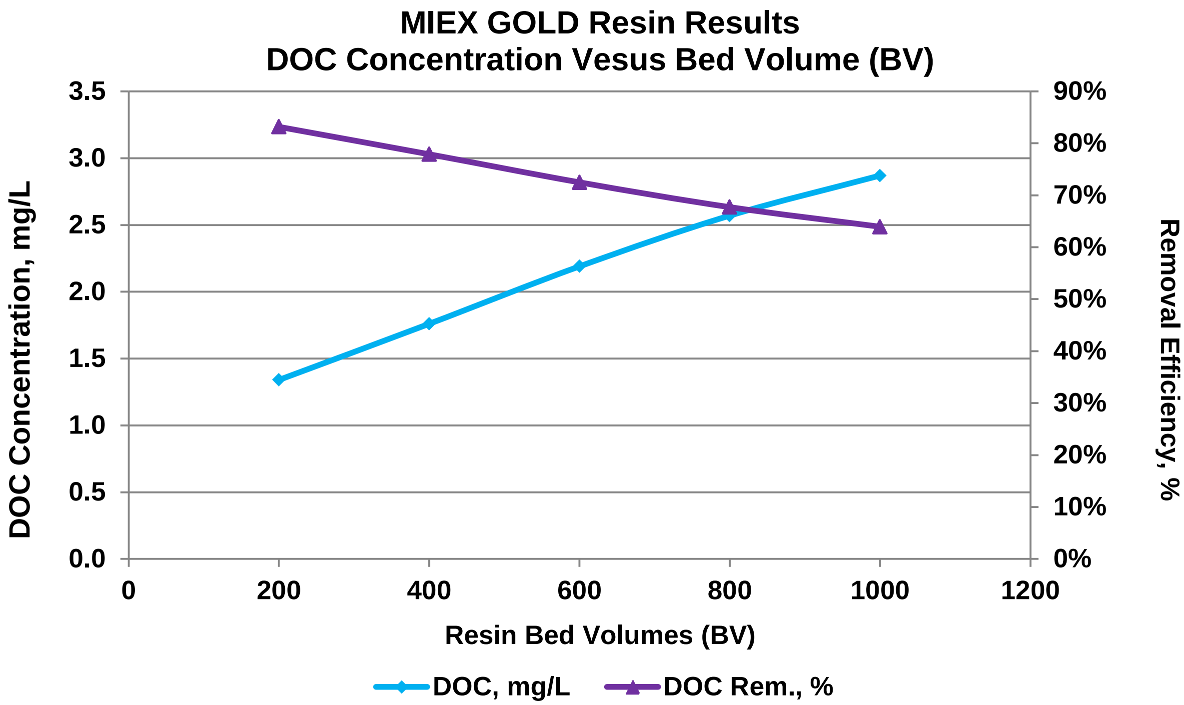


Figure 2. MIEX GOLD Jar Test

2.3.3. MIEX GOLD Post Coagulation Jar Tests

The MIEX GOLD resin treatment was effective at 800 BV. Raw water was treated using MIEX GOLD at 800 BV followed by post coagulant addition. Iron and aluminum coagulants were evaluated based on dose, floc structure, UVA, DOC removal and effluent clarity. Results from the coagulant screen showed the ferrous sulfate performed satisfactorily over the aluminum base coagulants. The ferrous sulfate dose of 105 mg/L was optimal for color and DOC removal.

The MIEX GOLD resin pretreatment can reduce the post coagulant consumption by 38% (compared to the raw water coagulant dosage). Results of water treated at 800 BV of MIEX GOLD resin and ferrous sulfate coagulant additional are presented in Table 5.

Table 5. MIEX GOLD (800 BV) and Coagulant Jar Test Results

Jar	Units	Raw	MIEX Pretreat (800 BV) + Coagulant
Coagulant Type		---	**Ferrous Sulfate**
Coagulant Dose	mg/L	0	105
DOC	mg/L	7.43	0.71
UVA	1/cm	0.355	0.059
True Color	PCU	72	4
pH		8.41	7.31
Copper	mg/L	0.22	0.00
Turbidity	NTU	1.85	50.4
% DOC Raw Reduction			88
% UVA Raw Reduction			82
% True Color Raw Reduction			94

2.4. Ozone Testing

The raw water was treated with the addition of ozonated water at 2 mg/L applied dose, which is a typical dose for many drinking water plants.

The addition of ozone was applied prior to MIEX resin treatment. It may be possible to apply the ozone post-MIEX with the benefit of improved color removal, taste and odor; however, due to the limited raw water available, ozone was applied pre-MIEX. The rationale for evaluating ozone as pre-MIEX was based on the benefit of oxidizing the DOC in the raw water to make it more adsorbable by the MIEX resin. The results showed little benefit on the DOC removal, ; however, there was an immediate reduction in color(70 to 18 PCU).

Ozone addition post-MIEX would be effective in reducing the reducing the color and oxidizing the remaining DOC. If the ozonation is followed by the existing biologically active filter, it would likely result in further reduction of overall DOC. The MIEX treatment would greatly reduce the ozone demand and allow for the application of much less ozone than without MIEX.

3. Conclusions and Recommendations

3.1. Results Summary

The results from this testing clearly shows the MIEX resin process is effective for the removal of organics and color from this source water. The use of MIEX GOLD resins alone removed up to 78% of the dissolved organics. The ozonation showed color reduction from 70 to 18 PCU pre-MIEX® at a dose of 2 mg/L ozone. It would be even more effective at decolorizing the remaining 30 PCU color post-MIEX® due to lower ozone demand from the MIEX® treatment.

Conversely, in order to achieve comparable results to the MIEX resin pretreatment followed by coagulation process, the conventional coagulation system would require a coagulant dose of in excess of 170 mg/L.

Table 6. Treatment Summary Results

Jar	Units	Raw Water	Raw Water + Coagulant	MIEX Resin (800 BV)
Coagulant Type		---	**Ferrous Sulfate**	---
Coagulant Dose	mg/L	0	170	0
Initial pH		8.41		
Final Water Quality				
DOC	mg/L	7.43	5.21	1.65
UVA	1/cm	0.355	0.178	0.111
True Color	PCU	72	67	30
pH		8.41	6.73	7.95
Copper	mg/L	0.22	--	0.02
Turbidity	NTU	1.85	229.0	2.7
% DOC Raw Reduction			30	78
% UVA Raw Reduction			50	69
% True Color Raw Reduction			7	58

3.2. MIEX Resin Advantages

Based on the results of ozonation and MIEX resin treatment, the following MIEX resin advantages can be realized:

- Less pH adjusting chemicals due to no coagulant dosage
- Improved effluent quality of downstream equipment
- Ability to use free chlorine resulting in simpler and more effective disinfection
- Lower DBP potential
- Ease of operation (automated MIEX system)
- Small footprint (high hydraulic loading rate of 8 gpm/ft^2)
- Reduced ozone demand for color reduction

With the exceptional aforementioned results achieve with the MIEX resin process, on-site pilot testing to validate the performance under varying and continuous condition is recommended.

Site / Location:	Wrangell, AK		
Contact:	Trevor Trasky		
Sample Date:	18 October 2015		
Analysis Subject:	MIEX® and Ozone Treatment		
Report Date:	12 November 2015	**Doc ID:**	LR-2015-023

1. Introduction/Background

1.1. Introduction

Ixom Laboratory received a sample of water from Wrangell, Alaska for testing of Disinfection By-Product (DBP) reduction, as measured by Dissolved Organic Carbon (DOC) reduction. The Wrangell water has previously been determined to respond most favorably to the MIEX® Gold Resin and was treated with the same this time. This report is supplemental to the Jar Test Report LR-2015-14, dated September 8, 2015, and includes ozonation results. Table 1 below shows the water quality for this recent sample received on October 19, 2015.

Table 1: As-Received Wastewater Quality

Parameter	Units	Result	Analytical Method*
DOC	mg/L	7.1	Standard Method 5310 C (Filtered with a 0.45 micron filter)
UVA $_{254}$ (nm)	cm^{-1}	0.323	Standard Method 5910 B (Filtered with a 0.45 micron filter)
Specific Ultraviolet Adsorption (SUVA)	L/mg-m	4.55	Calculated
True Color	CU	63	Standard Method 2120 C (Filtered with a 0.45 micron filter)
Apparent Color	CU	6.94	Standard Method 2120 C
pH	-	10	Standard Method 4500 H^+
Total Alkalinity (mg/L $CaCO_3$)	mg/L	11	Standard Method 2320 B
Total Hardness (mg/L $CaCO_3$)	mg/L	0.46	Standard Method 2340 C
Iron	mg/L	< 10	Standard Method 3500- Fe B
Sulfate	mg/L	15	Standard Method 4500-SO_4^{-2} E
Chloride	mg/L	1.55	Standard Method 4500-Cl^- B

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33101 East Quincy Avenue, Watkins, CO 80137
www.ixom.xom www.miexresin.com

Parameter	Units	Result	Analytical Method*
Turbidity	NTU	Not Measured	Standard Method 2130 B
Conductivity	µS/cm	45	Standard Method 2510 B

2. Testing and Results

2.1. MIEX® and Ozone Treatment

The sample was treated up to 1000 Bed Volume (BV) treatment rate as-is and with a pre-treatment with ozone. Also, a liter of Wrangell water treated as-is with MIEX® Gold was post-treated with ozone as well. The applied dose of ozone was 1.44 mg/L in both cases. DOC is analyzed prior to each run and may vary slightly from original characterization.

The Multiple Loading Test with MIEX® Gold is shown below in Table 2.

Table 2: As-Received MIEX® Gold Treatment

	UVA (cm^{-1})			DOC (mg/L)			True Color (PtCo)		
Bed Volumes	Raw	MIEX®	Removal (%)	Raw	MIEX®	% Removal	Raw	MIEX®	% Removal
1000	0.323	0.165	49%	7.10	3.37	53%	63	36	42%
800	0.323	0.157	51%	7.10	3.17	55%	63	35	44%
600	0.323	0.147	54%	7.10	2.94	59%	63	33	48%
400	0.323	0.134	59%	7.10	2.59	64%	63	30	52%
200	0.323	0.119	63%	7.10	2.21	69%	63	26	59%

Table 3 shows a comparison of pre and post ozonation to MIEX® only treatment.

Table 3: Comparison of MIEX® and Ozone Treatment

Parameter	Raw Water	MIEX 1000 BV	Ozone (Pre) + MIEX 1000 BV	MIEX 1000 BV + Ozone Post
DOC	7.1	3.4	2.4	3.6
UVA	0.323	0.165	0.122	0.150
SUVA	4.55	4.95	3.48	3.14
True Color	63	36	18	0

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33101 East Quincy Avenue, Watkins, CO 80137
www.ixom.xom www.miexresin.com

3. Summary

3.1. DOC Removal

The use of ozone prior to MIEX® Gold treatment showed the greatest reduction in DOC, while the use of ozone after MIEX® Gold treatment showed the greatest reduction in color. The color reduction was greater with the use of ozone post-MIEX® because the MIEX® reduced the ozone demand of the water, so the ozone could be used more effectively on the color.

Ozone treatment post-MIEX® would not be expected to show much reduction in DOC, as it is generally recognized that ozone will oxidize Natural Organic Matter (NOM) to smaller molecules, while not necessarily reducing the overall amount of DOC. The ozone is typically paired with biological filtration for a net removal of DOC. It is not generally advised to ozonate water as a final process because of likely reduction in biostability.

The target treatment is the reduction of DBPs and it is clear that MIEX® Gold will accomplish this. As the results showed, further reduction of DBPs can be accomplished with pre ozone treatment to MIEX®.

Ixom Watercare, Inc
33101 East Quincy Avenue, Watkins, CO 80137
www.ixom.xom www.miexresin.com

Appendix H – Cost Estimates

Conceptual Capital Cost Estimate

Alternative No. 1 - Expand Exisitng Slow Sand Filtration System

Project Duration **52** **weeks**

ACTIVITY	NOTES	QUANTITY	UNIT	UNIT COST	TOTAL COST
General					
Per Diem		2912	day	$60	$174,720
Superintendent		52	weeks	$7,200	$374,400
Project Manager	8 hrs/week	52	weeks	$800	$41,600
Expeditor	40 hrs/week	52	weeks	$2,800	$145,600
Roundtrip Air Fare		35	each	$1,000	$35,000
Allowance for Misc Air Freight		1	ls	$100,000	$100,000
Survey		1	ls	$25,000	$25,000
Erosion Control		1	ls	$10,000	$10,000
Equipment Mobilization		1	ls	$50,000	$50,000
Meetings/Coordination					
Project Meetings		104	hours		$10,400
Project Schedule		13	months	$200	$2,600
Shop Drawings		208	hours		$20,800
Equipment					
Pickup (2 each)	Rental/Ownership Cost	52	weeks	$300	$15,600
Flatbed Truck	Rental/Ownership Cost	52	weeks	$500	$26,000
Note: Heavy Equipment Cost Included in Unit Costs for WTP Upgrades					
Other					
Project Office	Office + equipment	13	months	$750	$9,750
Safety Equipment		1	ls	$5,000	$5,000
Temporary Power	Generators for Tools	13	months	$500	$6,500
Hand tools, consumables, signage, porta cans, etc.		1	ls	$35,000	$35,000
Fuel, oil and gas for equipment		12	months	$1,500	$18,000
Housing					
Housing		12	months	$10,000	$120,000
Utilities		12	months	$1,500	$18,000
Insurance					
Certified Payroll Fee		1	ls	$5,000	$5,000
Water Treatment Plant Modifications					
Clearing and Grubbing		0.5	ACRE	$10,000	$5,000
Fill		3000	CY	$35	$105,000
Site Grading and Drainage		1	LS	$125,000	$125,000
Cleaning Existing Filter Sand		1920	CY	$50	$96,000
Addition of (3) Slow Sand Filters					
Bedrock Blasting and Removal		1600	CY	$80	$128,000
Concrete Filter Beds		690	CY	$1,300	$897,000
Filter Piping		800	LF	$120	$96,000
Filter Valves, Fittings, Etc.		1	LS	$72,000	$72,000
Connection to Existing System		1	LS	$30,000	$30,000
Media for Filters		12800	CF	$7	$89,600

Freight for Media		810	TONS	$700	$567,000
Metal Building Over Filters		3176	SF	$250	$794,063
Addition of (2) Roughing Filter					
Bedrock Blasting and Removal		1000	CY	$80	$80,000
Concrete Filter Beds		180	CY	$1,300	$234,000
Filter Piping		500	LF	$120	$60,000
Filter Valves, Fittings, Etc.		1	LS	$45,000	$45,000
Connection to Existing System		1	LS	$20,000	$20,000
Media for Filters		4320	CF	$7	$30,240
1 ft GAC Cap		2160	CF	$35	$75,600
20 hp Backwash Pumps		2	EA	$35,000	$70,000
Freight for Media		270	TONS	$700	$189,000
Metal Building Over Filters		1080	SF	$250	$270,000
Chemical Feed System		1	ea	$35,000	$35,000
Replace Onsite Chlorine Generation System		1	LS	$115,000	$115,000
Caustic Feed System Improvements		1	ea	$30,000	$30,000
Air Scour System		1	LS	$150,000	$150,000
Oxygen Generator		1	EA	$210,000	$210,000
Ozone Destructor		1	EA	$50,000	$50,000
Expansion of Ozone Contactor by 50%					
Bedrock Blasting and Removal		300	CY	$80	$24,000
Concrete Contact Filter		20	CY	$1,300	$26,000
Connection to Existing System		1	LS	$15,000	$15,000
60 hp Booster Pumps		2	ea	$20,000	$40,000
150,000-gal Recaptured Water Storage Tank		150000	gal	$2.50	$375,000
150,000-gal Tank Insulation Package		150000	gal	$0.50	$75,000
10 hp Transfer Pumps		2	ea	$10,000	$20,000
Recapture Water Piping		200	LF	$120	$24,000
Sand Removal System		1	LS	$200,000	$200,000
Sand Cleaning System		1	LS	$400,000	$400,000
Standby Generator		1	LS	$150,000	$150,000
Fuel System		1	LS	$24,000	$24,000
Control Panels		1	LS	$200,000	$200,000
System Startup, Operator Training and O&M Manuals		1	ls	$50,000	$50,000
Project Closeout					
Punchlist Items		1	ls	$25,000	$25,000
Asbuilts of System		1	ls	$15,000	$15,000
Site Cleanup		1	ls	$25,000	$25,000
Demobilization		1	ls	$50,000	$50,000

		Subtotal	$7,655,000
General Contractor Overhead and Profit	15.0%		$1,149,000
General Contractor Bond & Insurance	3.0%		$230,000
Estimating Contingency	15.0%		$1,149,000
Inflation	3.5%		$268,000
		Construction Subt	$10,451,000
Design	9.0%		$941,000

Construction Administration	9.0%	$941,000
City Administration	2.0%	$210,000
Estimated Total Cost (Alternative No. 1)		**$12,543,000**

Conceptual Capital Cost Estimate

3/27/2017

Alternative No. 2 - MIEX Process with Multimedia Filtration

Project Duration **40** **weeks**

ACTIVITY	NOTES	QUANTITY	UNIT	UNIT COST	TOTAL COST
General					
Meals and lodging		2240	day	$60	$134,400
Superintendent		40	weeks	$7,200	$288,000
Project Manager	8 hrs/week	40	weeks	$800	$32,000
Expeditor	40 hrs/week	40	weeks	$2,800	$112,000
Roundtrip Air Fare		27	each	$1,000	$27,000
Allowance for Misc Air Freight		1	ls	$75,000	$75,000
Equipment Mobilization		1	ls	$50,000	$50,000
Meetings/Coordination					
Project Meetings		80	hours	$100	$8,000
Project Schedule		10	months	$200	$2,000
Shop Drawings		160	hours	$100	$16,000
Equipment					
Pickup (2 each)	Rental/Ownership Cost	40	weeks	$300	$12,000
Flatbed Truck	Rental/Ownership Cost	40	weeks	$500	$20,000
Other					
Project Office	Office + equipment	10	months	$750	$7,500
Safety Equipment		1	ls	$5,000	$5,000
Temporary Power	Generators for Tools	10	months	$500	$5,000
Hand tools, consumables, signage, porta cans, etc.		1	ls	$30,000	$30,000
Fuel, oil and gas for equipment		10	months	$1,500	$15,000
Housing					
Housing		10	months	$10,000	$100,000
Utilities		10	months	$1,500	$15,000
Insurance					
Certified Payroll Fee		1	ls	$5,000	$5,000
Water Treatment Plant					
Bedrock Blasting and Removal		6000	CY	$80	$480,000
Site Grading and Drainage		1	LS	$25,000	$25,000
Demolish Roughing Filter Building		1600	SF	$20	$32,000
Demolish Ozone Generation System		1	LS	$10,000	$10,000
New Treatment Building		7500	SF	$325	$2,437,500
MIEX Treatment System		1	LS	$1,326,000	$1,326,000
Multimedia Filter System		1	LS	$1,000,000	$1,000,000
Conversion of Filters to Clearwells		4	ea	$25,000	$100,000
Process Piping and Instrumentation		1	LS	$350,000	$350,000
Connection to Existing WTP Piping		1	LS	$50,000	$50,000
Chemical Feed Systems		1	ea	$35,000	$35,000
Replace Onsite Chlorine Generation System		1	LS	$115,000	$115,000
Caustic Feed System Improvements		1	ea	$30,000	$30,000
10 hp Transfer Pumpst to Treatment System		2	ea	$12,000	$24,000

60 hp Booster Pumps to WST		2	ea	$20,000	$40,000
Control Panels		1	LS	$150,000	$150,000
Standby Generator		1	LS	$150,000	$150,000
Fuel System		1	LS	$24,000	$24,000
Temporary Water Treatment Facilities		1	ls	$300,000	$300,000
System Startup, Operator Training and O&M Manuals		1	ls	$50,000	$50,000
Project Closeout					
Punchlist Items		1	ls	$25,000	$25,000
Asbuilts of System		1	ls	$15,000	$15,000
Site Cleanup		1	ls	$25,000	$25,000
Demobilization		1	ls	$50,000	$50,000

Subtotal		$7,802,000
General Contractor Overhead and Profit	15.0%	$1,171,000
General Contractor Bond & Insurance	3.0%	$235,000
Estimating Contingency	15.0%	$1,171,000
Inflation	3.5%	$274,000
Construction Subtotal		$10,653,000
Design	9.0%	$703,000
Construction Administration	9.0%	$703,000
City Administration	2.0%	$157,000
Estimated Total Cost (Alternative No. 2)		**$12,216,000**

Conceptual Capital Cost Estimate

Alternative No. 3 - Ozonation with MIEX and Biological Filtration

Project Duration **40** **weeks**

ACTIVITY	NOTES	QUANTITY	UNIT	UNIT COST	TOTAL COST
General					
Meals and lodging		2240	day	$60	$134,400
Superintendent		40	weeks	$7,200	$288,000
Project Manager	8 hrs/week	40	weeks	$800	$32,000
Expeditor	40 hrs/week	40	weeks	$2,800	$112,000
Roundtrip Air Fare		27	each	$1,000	$27,000
Allowance for Misc Air Freight		1	ls	$75,000	$75,000
Equipment Mobilization		1	ls	$50,000	$50,000
Meetings/Coordination					
Project Meetings		80	hours	$100	$8,000
Project Schedule		10	months	$200	$2,000
Shop Drawings		160	hours	$100	$16,000
Equipment					
Pickup (2 each)	Rental/Ownership Cost	40	weeks	$300	$12,000
Flatbed Truck	Rental/Ownership Cost	40	weeks	$500	$20,000
Other					
Project Office	Office + equipment	10	months	$750	$7,500
Safety Equipment		1	ls	$5,000	$5,000
Temporary Power	Generators for Tools	10	months	$500	$5,000
Hand tools, consumables, signage, porta cans, etc.		1	ls	$30,000	$30,000
Fuel, oil and gas for equipment		10	months	$1,500	$15,000
Housing					
Housing		10	months	$10,000	$100,000
Utilities		10	months	$1,500	$15,000
Insurance					
Certified Payroll Fee		1	ls	$5,000	$5,000
Water Treatment Plant Modifications					
Bedrock Blasting and Removal		6000	CY	$80	$480,000
Site Grading and Drainage		1	LS	$25,000	$25,000
Demolish Roughing Filter Building		1600	SF	$20	$32,000
New Treatment Building		7475	SF	$325	$2,429,375
MIEX Treatment System		1	LS	$1,326,000	$1,326,000
Bio-media Filter System		1	LS	$1,300,000	$1,300,000
Conversion of Filters to Clearwells		4	ea	$25,000	$100,000
Process Piping and Instrumentation		1	LS	$350,000	$350,000
Connection to Existing WTP Piping		1	LS	$50,000	$50,000
Caustic Feed System Improvements		1	ea	$30,000	$30,000
Replace Onsite Chlorine Generation System		1	LS	$115,000	$115,000
Oxygen Generator		1	EA	$210,000	$210,000
Ozone Destructor		1	EA	$50,000	$50,000
Expansion of Ozone Contactor by 50%					

Bedrock Blasting and Removal		300	CY	$40	$12,000
Rock Removal		300	CY	$20	$6,000
Concrete Contact Filter		20	CY	$1,300	$26,000
Connection to Existing System		1	LS	$15,000	$15,000
10 hp Transfer Pumpst to Treatment System		2	ea	$12,000	$24,000
60 hp Booster Pumps		2	ea	$20,000	$40,000
Control Panels		1	LS	$150,000	$150,000
Standby Generator		1	LS	$150,000	$150,000
Fuel System		1	LS	$24,000	$24,000
Temporary Water Treatment Facilities		1	ls	$300,000	$300,000
System Startup, Operator Training and O&M Manuals		1	ls	$50,000	$50,000
Project Closeout					
Punchlist Items		1	ls	$25,000	$25,000
Asbuilts of System		1	ls	$15,000	$15,000
Site Cleanup		1	ls	$25,000	$25,000
Demobilization		1	ls	$50,000	$50,000

Subtotal		$8,368,000
General Contractor Overhead and Profit	15.0%	$1,256,000
General Contractor Bond & Insurance	3.0%	$252,000
Estimating Contingency	15.0%	$1,256,000
Inflation	3.5%	$293,000
Construction Subtotal		$11,425,000
Design	9.0%	$1,029,000
Construction Administration	9.0%	$1,029,000
City Administration	2.0%	$229,000
Estimated Total Cost (Alternative No. 3)		**$13,712,000**

Alternative No. 4 - Dissolved Air Flotation with Multimedia Filtration

Project Duration **40** **weeks**

ACTIVITY	NOTES	QUANTITY	UNIT	UNIT COST	TOTAL COST
General					
Meals and lodging		2240	day	$60	$134,400
Superintendent		40	weeks	$7,200	$288,000
Project Manager	8 hrs/week	40	weeks	$800	$32,000
Expeditor	40 hrs/week	40	weeks	$2,800	$112,000
Roundtrip Air Fare		27	each	$1,000	$27,000
Allowance for Misc Air Freight		1	ls	$75,000	$75,000
Equipment Mobilization		1	ls	$50,000	$50,000
Meetings/Coordination					
Project Meetings		80	hours	$100	$8,000
Project Schedule		10	months	$200	$2,000
Shop Drawings		160	hours	$100	$16,000
Equipment					
Pickup (2 each)	Rental/Ownership Cost	40	weeks	$300	$12,000
Flatbed Truck	Rental/Ownership Cost	40	weeks	$500	$20,000
Other					
Project Office	Office + equipment	10	months	$750	$7,500
Safety Equipment		1	ls	$5,000	$5,000
Temporary Power	Generators for Tools	10	months	$500	$5,000
Hand tools, consumables, signage, porta cans, etc.		1	ls	$30,000	$30,000
Fuel, oil and gas for equipment		10	months	$1,500	$15,000
Housing					
Housing		10	months	$10,000	$100,000
Utilities		10	months	$1,500	$15,000
Insurance					
Certified Payroll Fee		1	ls	$5,000	$5,000
Water Treatment Plant Modifications					
Bedrock Blasting and Removal		1400	CY	$80	$112,000
Site Grading and Drainage		1	LS	$25,000	$25,000
Remodel Roughing Filter Bldg		1936	SF	$50	$96,800
Demolish Ozone Generation System		1	LS	$10,000	$10,000
Expand Roughing Filter Bldg		2640	SF	$325	$858,000
DAF Treatment System		1	LS	$1,360,000	$1,360,000
Streaming Current Detector		1	ea	$25,000	$25,000
Conversion of Filters to Clearwells		4	ea	$25,000	$100,000
Connection to Existing WTP Piping		1	LS	$50,000	$50,000
Process Piping and Instrumentation		1	LS	$350,000	$350,000
Chemical Feed Systems		1	LS	$35,000	$35,000
Replace Onsite Chlorine Generation System		1	LS	$115,000	$115,000
Caustic Feed System Improvements		1	ea	$30,000	$30,000
10 hp Transfer Pumpst to Treatment System		2	ea	$12,000	$24,000

60 hp Booster Pumps		2	ea	$20,000	$40,000
Control Panels		1	LS	$150,000	$150,000
Remodel Part of Control Bldg for Chemical Storage		400	SF	$50	$20,000
Standby Generator		1	LS	$150,000	$150,000
Fuel System		1	LS	$24,000	$24,000
Temporary Water Treatment Facilities		1	ls	$300,000	$300,000
System Startup, Operator Training and O&M Manuals		1	ls	$50,000	$50,000
Project Closeout					
Punchlist Items		1	ls	$25,000	$25,000
Asbuilts of System		1	ls	$15,000	$15,000
Site Cleanup		1	ls	$25,000	$25,000
Demobilization		1	ls	$50,000	$50,000

Subtotal		$4,999,000
General Contractor Overhead and Profit	15.0%	$750,000
General Contractor Bond & Insurance	3.0%	$150,000
Estimating Contingency	15.0%	$750,000
Inflation	3.5%	$175,000
Construction Subtotal		$6,824,000
Design	9.0%	$615,000
Construction Administration	9.0%	$615,000
City Administration	2.0%	$137,000
Estimated Total Cost (Alternative No. 4)		**$8,191,000**

Conceptual Capital Cost Estimate

Alternative No. 5 - Nanofiltration with Multimedia Filtration

Project Duration **40** **weeks**

ACTIVITY	NOTES	QUANTITY	UNIT	UNIT COST	TOTAL COST
General					
Meals and lodging		2240	day	$60	$134,400
Superintendent		40	weeks	$7,200	$288,000
Project Manager	8 hrs/week	40	weeks	$800	$32,000
Expeditor	40 hrs/week	40	weeks	$2,800	$112,000
Roundtrip Air Fare		27	each	$1,000	$27,000
Allowance for Misc Air Freight		1	ls	$75,000	$75,000
Equipment Mobilization		1	ls	$50,000	$50,000
Meetings/Coordination					
Project Meetings		80	hours	$100	$8,000
Project Schedule		10	months	$200	$2,000
Shop Drawings		160	hours	$100	$16,000
Equipment					
Pickup (2 each)	Rental/Ownership Cost	40	weeks	$300	$12,000
Flatbed Truck	Rental/Ownership Cost	40	weeks	$500	$20,000
Other					
Project Office	Office + equipment	10	months	$750	$7,500
Safety Equipment		1	ls	$5,000	$5,000
Temporary Power	Generators for Tools	10	months	$500	$5,000
Hand tools, consumables, signage, porta cans, etc.		1	ls	$30,000	$30,000
Fuel, oil and gas for equipment		10	months	$1,500	$15,000
Housing					
Housing		10	months	$10,000	$100,000
Utilities		10	months	$1,500	$15,000
Insurance					
Certified Payroll Fee		1	ls	$5,000	$5,000
Water Treatment Plant Modifications					
Bedrock Blasting and Removal		1400	CY	$80	$112,000
Site Grading and Drainage		1	LS	$25,000	$25,000
Remodel Roughing Filter Bldg		1936	SF	$25	$48,400
Demolish Ozone Generation System		1	LS	$10,000	$10,000
Expand Roughing Filter Bldg		2640	SF	$325	$858,000
Adsorption Clarifier Treatment System		1	LS	$455,000	$455,000
Nanofiltration System		1	ea	$950,000	$950,000
Filtration Booster Pumps		2	ea	$10,000	$20,000
Streaming Current Detector		1	ea	$25,000	$25,000
Conversion of Filters to Clearwells		4	ea	$25,000	$100,000
Process Piping and Instrumentation		1	LS	$350,000	$350,000
Connection to Existing WTP Piping		1	LS	$50,000	$50,000
Chemical Feed Systems		1	ea	$35,000	$35,000
Replace Onsite Chlorine Generation System		1	LS	$115,000	$115,000

Caustic Feed System Improvements		1	ea	$30,000	$30,000
10 hp Transfer Pumpst to Treatment System		2	ea	$12,000	$24,000
60 hp Booster Pumps		2	ea	$20,000	$40,000
Control Panels		1	LS	$150,000	$150,000
Standby Generator		1	LS	$150,000	$150,000
Fuel System		1	LS	$24,000	$24,000
Temporary Water Treatment Facilities		1	ls	$300,000	$300,000
System Startup, Operator Training and O&M Manuals		1	ls	$50,000	$50,000
Project Closeout					
Punchlist Items		1	ls	$25,000	$25,000
Asbuilts of System		1	ls	$15,000	$15,000
Site Cleanup		1	ls	$25,000	$25,000
Demobilization		1	ls	$50,000	$50,000

Subtotal		$4,995,000
General Contractor Overhead and Profit	15.0%	$750,000
General Contractor Bond & Insurance	3.0%	$150,000
Estimating Contingency	15.0%	$750,000
Inflation	3.5%	$175,000
Construction Subtotal		$6,820,000
Design	9.0%	$614,000
Construction Administration	9.0%	$614,000
City Administration	2.0%	$137,000
Estimated Total Cost (Alternative No. 5)		**$8,185,000**

Conceptual Capital Cost Estimate

Alternative No. A1 - Extend Sewer Service to Wastewater Treatment Plant (Buried Pipeline)

Project Duration **4** **weeks**

ACTIVITY	NOTES	QUANTITY	UNIT	UNIT COST	TOTAL COST
General					
Per Diem		224	day	$60	$13,440
Superintendent		4	weeks	$7,200	$28,800
Project Manager	8 hrs/week	4	weeks	$800	$3,200
Expeditor	40 hrs/week	4	weeks	$2,800	$11,200
Roundtrip Air Fare		3	each	$1,000	$3,000
Allowance for Misc Air Freight		1	ls	$10,000	$10,000
Allowance for Misc Barge Freight		1	ls	$15,000	$15,000
Survey		1	ls	$20,000	$20,000
Erosion Control		1	ls	$25,000	$25,000
Equipment Mobilization		1	ls	$50,000	$50,000
Meetings/Coordination					
Project Meetings		8	hours		$800
Project Schedule		1	months	$200	$200
Shop Drawings		16	hours		$1,600
Equipment					
Pickup (2 each)	Rental/Ownership Cost	4	weeks	$300	$1,200
Four Wheelers (4 each)	Rental/Ownership Cost	4	weeks	$200	$800
Flatbed Truck	Rental/Ownership Cost	4	weeks	$500	$2,000
Note: Heavy Equipment Cost Included in Unit Costs for Sewer Service Extension					
Other					
Project Office	Office + equipment	1	months	$750	$750
Safety Equipment		1	ls	$5,000	$5,000
Temporary Power	Generators for Tools	1	months	$500	$500
Housing					
Housing		1	months	$10,000	$10,000
Utilities		1	months	$1,500	$1,500
Insurance					
Certified Payroll Fee		1	ls	$5,000	$5,000
Clarifier Tank					
30,000-gal Backwash Water Storage Tank		30,000	gal	$2.50	$75,000
30,000-gal Tank Insulation Package		30,000	gal	$0.50	$15,000
Tank Add Heat System		1	ls	$10,000	$10,000
Connection Piping to WTP		150	LF	$120	$18,000
Fill for Tank Base		100	CY	$30	$3,000
Sludge Dewatering and Disposal Equipment					
Sludge Dewatering System		1	ea	$275,000	$275,000
Containers for Secondary Sludge Dewatering		1	ls	$30,000	$30,000

Conceptual Capital Cost Estimate

Sewer Service Extension					
Clearing and Grubbing		1	ACRE	$40,000	$40,000
Excavation (non-bedrock)		1,450	CY	$30	$43,500
Bedrock Blasting and Removal	Assume 50% of excavation	1,450	CY	$40	$58,000
Rock Removal	requires blasting	1,450	CY	$20	$29,000
Backfill and Bedding		1,450	CY	$35	$50,750
Sanitary Sewer Pipe		1,300	LF	$80	$104,000
Sanitary Sewer Manholes		4	EA	$7,500	$30,000
Connection to Wastewater Treatment Plant		1	LS	$5,000	$5,000
Seeding		1	ACRE	$15,000	$15,000

Subtotal		$1,010,000
General Contractor Profit (fee)	15.0%	$152,000
General Contractor Bond & Insurance	3.0%	$31,000
Estimating Contingency	15.0%	$152,000
Inflation	3.5%	$36,000
Construction Subtotal		$1,381,000
Design	9.0%	$125,000
Construction Administration	9.0%	$125,000
City Administration	2.0%	$28,000
Estimated Total Cost (Alternative No. A)		**$1,659,000**

Conceptual Capital Cost Estimate

Alternative No. A2 - Extend Sewer Service to Wastewater Treatment Plant (Above Grade Pipeline)

Project Duration **4** **weeks**

ACTIVITY	NOTES	QUANTITY	UNIT	UNIT COST	TOTAL COST
General					
Per Diem		224	day	$60	$13,440
Superintendent		4	weeks	$7,200	$28,800
Project Manager	8 hrs/week	4	weeks	$800	$3,200
Expeditor	40 hrs/week	4	weeks	$2,800	$11,200
Roundtrip Air Fare		3	each	$1,000	$3,000
Allowance for Misc Air Freight		1	ls	$10,000	$10,000
Allowance for Misc Barge Freight		1	ls	$15,000	$15,000
Survey		1	ls	$20,000	$20,000
Erosion Control		1	ls	$25,000	$25,000
Equipment Mobilization		1	ls	$50,000	$50,000
Meetings/Coordination					
Project Meetings		8	hours		$800
Project Schedule		1	months	$200	$200
Shop Drawings		16	hours		$1,600
Equipment					
Pickup (2 each)	Rental/Ownership Cost	4	weeks	$300	$1,200
Four Wheelers (4 each)	Rental/Ownership Cost	4	weeks	$200	$800
Flatbed Truck	Rental/Ownership Cost	4	weeks	$500	$2,000
Note: Heavy Equipment Cost Included in Unit Costs for Sewer Service Extension					
Other					
Project Office	Office + equipment	1	months	$750	$750
Safety Equipment		1	ls	$5,000	$5,000
Temporary Power	Generators for Tools	1	months	$500	$500
Housing					
Housing		1	months	$10,000	$10,000
Utilities		1	months	$1,500	$1,500
Insurance					
Certified Payroll Fee		1	ls	$5,000	$5,000
Clarifier Tank					
30,000-gal Backwash Water Storage Tank		30,000	gal	$2.50	$75,000
30,000-gal Tank Insulation Package		30,000	gal	$0.50	$15,000
Tank Add Heat System		1	ls	$10,000	$10,000
Connection Piping to WTP		150	LF	$120	$18,000
Fill for Tank Base		100	CY	$30	$3,000
Sludge Dewatering and Disposal Equipment					
Sludge Dewatering System		1	ea	$275,000	$275,000
Containers for Secondary Sludge Dewatering		1	ls	$30,000	$30,000

Sewer Service Extension					
Clearing and Grubbing		1	ACRE	$40,000	$40,000
Sanitary Sewer Pipe, Insulated w/ Aluminum Spir-l-ok Jacket		1,300	LF	$105	$136,500
Heat Trace		1,300	LF	$20	$26,000
Heat Trace Controls and Power Distribution		1	LS	$30,000	$30,000
Timber Pipe Supports w/ Duckbill Anchors and Pipe Strap		65	EA	$300	$19,500
Timber Pipe Supports w/ Drilled Epoxy Anchors and Pipe Strap		65	EA	$350	$22,750
Sanitary Sewer Manholes/Cleanouts		4	EA	$7,500	$30,000
Connection to Wastewater Treatment Plant		1	LS	$5,000	$5,000
Seeding		1	ACRE	$15,000	$15,000

		Subtotal	$960,000
General Contractor Profit (fee)	15.0%		$144,000
General Contractor Bond & Insurance	3.0%		$29,000
Estimating Contingency	15.0%		$144,000
Inflation	3.5%		$34,000
		Construction Subtotal	$1,311,000
Design	9.0%		$118,000
Construction Administration	9.0%		$118,000
City Administration	2.0%		$27,000
Estimated Total Cost (Alternative No. A)			**$1,574,000**

Conceptual Capital Cost Estimate

Alternative No. B - Extend Sewer Service along Wood Street

Project Duration **5 weeks**

ACTIVITY	NOTES	QUANTITY	UNIT	UNIT COST	TOTAL COST
General					
Per Diem		280	day	$60	$16,800
Superintendent		5	weeks	$7,200	$36,000
Project Manager	8 hrs/week	5	weeks	$800	$4,000
Expeditor	40 hrs/week	5	weeks	$2,800	$14,000
Roundtrip Air Fare		4	each	$1,000	$4,000
Allowance for Misc Air Freight		1	ls	$10,000	$10,000
Allowance for Misc Barge Freight		1	ls	$15,000	$15,000
Survey		1	ls	$25,000	$25,000
Erosion Control		1	ls	$30,000	$30,000
Equipment Mobilization		1	ls	$75,000	$75,000
Meetings/Coordination					
Project Meetings		10	hours		$1,000
Project Schedule		2	months	$200	$400
Shop Drawings		20	hours		$2,000
Equipment					
Pickup (2 each)	Rental/Ownership Cost	5	weeks	$300	$1,500
Four Wheelers (4 each)	Rental/Ownership Cost	5	weeks	$200	$1,000
Flatbed Truck	Rental/Ownership Cost	5	weeks	$500	$2,500
Note: Heavy Equipment Cost Included in Unit Costs for Sewer Service Extension					
Other					
Project Office	Office + equipment	2	months	$750	$1,500
Safety Equipment		1	ls	$5,000	$5,000
Temporary Power	Generators for Tools	2	months	$500	$1,000
Housing					
Housing		2	months	$10,000	$20,000
Utilities		2	months	$1,500	$3,000
Insurance					
Certified Payroll Fee		1	ls	$5,000	$5,000
Clarifier Tank					
30,000-gal Backwash Water Storage Tank		30,000	gal	$2.50	$75,000
30,000-gal Tank Insulation Package		30,000	gal	$0.50	$15,000
Tank Add Heat System		1	ls	$10,000	$10,000
Connection Piping to WTP		150	LF	$120	$18,000
Fill for Tank Base		100	CY	$30	$3,000
Sludge Dewatering and Disposal Equipment					
Sludge Dewatering System		1	ea	$275,000	$275,000
Containers for Secondary Sludge Dewatering		1	ls	$30,000	$30,000

Sewer Service Extension					
Excavation (non-bedrock)		3,450	CY	$30	$103,500
Bedrock Blasting and Removal	Assume 50% of excavation	3,450	CY	$40	$138,000
Rock Removal	requires blasting	3,450	CY	$20	$69,000
Backfill and Bedding		3,450	CY	$35	$120,750
Sanitary Sewer Pipe		3,100	LF	$80	$248,000
Sanitary Sewer Manhole		7	EA	$7,500	$52,500
D1 Surfacing		600	CY	$55	$33,000
Connection to Sanitary Sewer System		1	LS	$5,000	$5,000

		Subtotal	$1,469,000
General Contractor Profit (fee)	15.0%		$221,000
General Contractor Bond & Insurance	3.0%		$45,000
Estimating Contingency	15.0%		$221,000
Inflation	3.5%		$52,000
		Construction Subtotal	$2,008,000
Design	9.0%		$181,000
Construction Administration	9.0%		$181,000
City Administration	2.0%		$41,000
Estimated Total Cost (Alternative No. B)			**$2,411,000**

Conceptual Capital Cost Estimate

Alternative No. C - Marine Outfall

Project Duration **6 weeks**

ACTIVITY	NOTES	QUANTITY	UNIT	UNIT COST	TOTAL COST
General					
Per Diem		336	day	$60	$20,160
Superintendent		6	weeks	$7,200	$43,200
Project Manager	8 hrs/week	6	weeks	$800	$4,800
Expeditor	40 hrs/week	6	weeks	$2,800	$16,800
Roundtrip Air Fare		4	each	$1,000	$4,000
Allowance for Misc Air Freight		1	ls	$10,000	$10,000
Allowance for Misc Barge Freight		1	ls	$15,000	$15,000
Survey		1	ls	$15,000	$15,000
Erosion Control		1	ls	$25,000	$25,000
Equipment Mobilization		1	ls	$50,000	$50,000
Meetings/Coordination					
Project Meetings		12	hours		$1,200
Project Schedule		2	months	$200	$400
Shop Drawings		24	hours		$2,400
Equipment					
Pickup (2 each)	Rental/Ownership Cost	6	weeks	$300	$1,800
Four Wheelers (4 each)	Rental/Ownership Cost	6	weeks	$200	$1,200
Flatbed Truck	Rental/Ownership Cost	6	weeks	$500	$3,000
Note: Heavy Equipment Cost Included in Unit Costs for Clarifier					
Other					
Project Office	Office + equipment	2	months	$750	$1,500
Safety Equipment		1	ls	$5,000	$5,000
Temporary Power	Generators for Tools	2	months	$500	$1,000
Housing					
Housing		2	months	$10,000	$20,000
Utilities		2	months	$1,500	$3,000
Insurance					
Certified Payroll Fee		1	ls	$5,000	$5,000
Clarifier Tank					
30,000-gal Backwash Water Storage Tank		30,000	gal	$2.50	$75,000
30,000-gal Tank Insulation Package		30,000	gal	$0.50	$15,000
Tank Add Heat System		1	ls	$10,000	$10,000
Connection Piping to WTP		150	LF	$120	$18,000
Fill for Tank Base		100	CY	$30	$3,000
Sludge Dewatering and Disposal Equipment					
Sludge Dewatering System		1	ea	$275,000	$275,000
Containers for Secondary Sludge Dewatering		1	ls	$30,000	$30,000
Sewer Outfall					

Excavation (non-bedrock)		2,250	CY	$30	$67,500
Bedrock Blasting and Removal	Assume 50% of excavation	2,250	CY	$40	$90,000
Rock Removal	requires blasting	2,250	CY	$20	$45,000
Backfill and Bedding		2,250	CY	$35	$78,750
Sanitary Sewer Pipe		2,000	LF	$80	$160,000
Sanitary Sewer Manhole		5	EA	$7,500	$37,500
Marine Outfall		1	LS	$25,000	$25,000

Subtotal		$1,179,000
General Contractor Profit (fee)	15.0%	$177,000
General Contractor Bond & Insurance	3.0%	$36,000
Estimating Contingency	15.0%	$177,000
Inflation	3.5%	$42,000
Construction Subtotal		$1,611,000
Design	9.0%	$145,000
Construction Administration	9.0%	$145,000
City Administration	2.0%	$33,000
Estimated Total Cost (Alternative No. C)		**$1,934,000**

Conceptual Capital Cost Estimate

4/13/2017

Alternative No. D - Recycle of Backwash Water to Process

Project Duration **4** **weeks**

ACTIVITY	NOTES	QUANTITY	UNIT	UNIT COST	TOTAL COST
General					
Per Diem		112	day	$60	$6,720
Superintendent		4	weeks	$7,200	$28,800
Project Manager	8 hrs/week	4	weeks	$800	$3,200
Expeditor	40 hrs/week	4	weeks	$2,800	$11,200
Roundtrip Air Fare		3	each	$1,000	$3,000
Allowance for Misc Air Freight		1	ls	$1,500	$1,500
Allowance for Misc Barge Freight		1	ls	$1,000	$1,000
Equipment Mobilization		1	ls	$5,000	$5,000
Meetings/Coordination					
Project Meetings		8	hours		$800
Project Schedule		0.93	months	$200	$186
Shop Drawings		16	hours		$1,600
Equipment					
Pickup (2 each)	Rental/Ownership Cost	4	weeks	$300	$1,200
Four Wheelers (4 each)	Rental/Ownership Cost	4	weeks	$200	$800
Flatbed Truck	Rental/Ownership Cost	4	weeks	$500	$2,000
Note: Heavy Equipment Cost Included in Unit Costs for Clarifier					
Other					
Project Office	Office + equipment	1	months	$750	$750
Safety Equipment		1	ls	$250	$250
Temporary Power	Generators for Tools	1	months	$500	$500
Housing					
Housing		1	months	$10,000	$10,000
Utilities		1	months	$1,500	$1,500
Insurance					
Certified Payroll Fee		1	ls	$1,000	$1,000
Clarifier Tank					
30,000-gal Backwash Water Storage Tank		30,000	gal	$2.50	$75,000
30,000-gal Tank Insulation Package		30,000	gal	$0.50	$15,000
Tank Add Heat System		1	ls	$10,000	$10,000
Connection Piping to WTP		150	LF	$120	$18,000
Fill for Tank Base		100	CY	$30	$3,000
Sludge Dewatering and Disposal Equipment					
Sludge Dewatering System		1	ea	$275,000	$275,000
Containers for Secondary Sludge Dewatering		1	ls	$30,000	$30,000
Backwash Recycle					
Recycle Pump		1	ea	$2,500	$2,500
Recycle Piping		100	LF	$120	$12,000

		Subtotal	$522,000
General Contractor Profit (fee)	15.0%		$79,000
General Contractor Bond & Insurance	3.0%		$16,000
Estimating Contingency	15.0%		$79,000
Inflation	3.5%		$19,000
		Construction Subtotal	$715,000
Design	9.0%		$65,000
Construction Administration	9.0%		$65,000
City Administration	2.0%		$15,000
Estimated Total Cost (Alternative No. D)			**$860,000**

WATER TREATMENT - O & M COST SUMMARY

ANNUAL SYSTEM COSTS						
	Existing (Current Flow)	Option 1 Upgraded Slow Sand	Option 2 Miex and Conventional	Option 3 Ozone, Miex, and Biofiltration	Option 4 DAF	Option 5 AC and Nanofiltration
Building Addition O&M						
Building	$5,000	$5,900	$11,700	$11,700	$10,700	$10,700
Pre-Treatment Processes						
Ozone	$62,917	$79,182	-	$47,416	-	-
Miex	-	-	$125,751	$125,751	-	-
Treatment/Filtration Processes						
DAF	-	-	-	-	$305,903	-
Slow Sand Filtration	$118,154	$216,002	-	-	-	-
Conventional Filtration	-	-	$250,000	-	-	-
Biomedia Filtration	-	-	-	$263,724	-	-
Adsorption Clarifier and Nanofiltration	-	-	-	-	-	$507,952
TOTAL COST	$186,071	$301,084	$387,450	$448,591	$316,603	$518,652

ANNUAL SYSTEM COSTS						
	Existing (Current Flow)	Option 1 Upgraded Slow Sand	Option 2 Miex and Conventional	Option 3 Ozone, Miex, and Biofiltration	Option 4 DAF	Option 5 AC and Nanofiltration
Power	$55,856	$67,027	$55,849	$101,538	$42,192	$117,940
Labor	$31,200	$73,440	$19,710	$14,115	$29,193	$29,193
Chemicals/Salt/Sludge Disposal	$29,552	$39,668	$210,313	$209,666	$197,367	$213,145
Equipment/Material Replacement	$2,704	$74,611	$54,139	$65,988	$10,162	$46,101
Building	$5,000	$5,900	$11,700	$11,700	$10,700	$10,700
SUBTOTAL COST	$124,312	$260,646	$351,711	$403,007	$289,614	$417,079
Sand Cleaner Maintenance	-	$5,000	-	-	-	-
Backwash/Non-salable Water	$61,760	$35,438	$35,740	$45,584	$26,989	$101,573
TOTAL COST	$186,071	$301,084	$387,450	$448,591	$316,603	$518,652

Water Treatment Plant Ozone Costs - Existing Flow (monthly/yearly)

Daily Water Consumption	**900,000**	**gpd**
Monthly Water Consumption	**27,000,000**	**gal/month**
Yearly Water Consumption	**328,500,000**	**gal/year**

11.3	kWh/lb ozone	
$0.1145	/kwh	Electricity
$1.29	$/lb of ozone	

Ozone

	10	mg/l ozone dose required
$	2,246	lb ozone use per month
	$1.29	ozone cost per pound
$	2,906	ozone cost per month
$	2,337	cooling water cost per month
$	5,243	Total monthly ozonation cost

Power Cost per year	$	34,877
wasted water cost per year	$	28,040
Annual Ozonation Cost	$	62,917

Water Treatment Plant Ozone Costs - New Flow (monthly/yearly)

Daily Water Consumption	1,000,000	gpd
Monthly Water Consumption	30,000,000	gal/month
Yearly Water Consumption	365,000,000	gal/year

11.3	kWh/lb ozone	
$0.1145	/kwh	Electricity
$1.29	$/lb of ozone	

Ozone

10	mg/l ozone dose required
$2,496	lb ozone use per month
$1.29	ozone cost per pound
$3,229	ozone cost per month
$2,337	cooling water cost per month
$5,566	Total monthly ozonation cost

$66,792.44	Annual Ozonation Cost

GAC Cap on Roughing Filter (Option 1 only)

1	foot media depth
30	feet length
16	feet wide
2	each
960	ft3 media volume
$32,108	cost of media replacement
3	year service life
5.00	inflation

$12,390	cost per year

Power Cost per year	$38,752
wasted water cost per year	$28,040
material cost per year	$12,390

Total Annual Cost	**$79,182**

Water Treatment Plant Ozone Costs - New Flow (monthly/yearly)

Daily Water Consumption	1,000,000	gpd
Monthly Water Consumption	30,000,000	gal/month
Yearly Water Consumption	365,000,000	gal/year

11.3	kWh/lb ozone	
$0.1145	/kwh	Electricity
$1.29	$/lb of ozone	

Ozone

	5	mg/l ozone dose required
$	1,248	lb ozone use per month
	$1.29	ozone cost per pound
$	1,615	ozone cost per month
$	2,337	cooling water cost per month
$	3,951	Total monthly ozonation cost

Power Cost per year	$	19,376
wasted water cost per year	$	28,040
Annual Ozonation Cost	$	47,416

Water Treatment Plant Miex Costs (monthly/yearly)

Daily Water Consumption	1,000,000	**gpd**
Monthly Water Consumption	30,000,000	**gal/month**
Yearly Water Consumption	365,000,000	**gal/year**

Resin Treatment Rate

600 Bed Volumes

1.67 gallons resin per every 1,000 gallons treated

1. Salt Use

500 lbs / MG of plant throughput

365 MGD/year

500 lbs salt / day

182,500 lbs Salt / year

182,500 lbs annual salt consumption

salt cost $ 0.15 PER WAYNE

$0.22 $/lb including shipping

$ 40,597 Annual salt cost

2. Resin Use

From Ixom

1.3 to 1.5 gallons of resin per 1 MGD water treated

resin is $ 78.12 $/gallon per Ixom

547.5 gallons of resin

10 55-gallon drums or 2.3 totes

$42,771 resin cost

3. Electrical

Assume 25 kw total connected load

(20-25 average, 35 max)

Electricity Service Charge $13.50 /mo

Electricity $0.1145 /kwh

Electrical per month $ 2,095

Electrical per year	$ 25,076

4. Labor

assume	0.25	hour per day	$60.00	/hr
=	$5,475.00	$/year in labor		

Labor per year	$	5,475

5. Waste Brine

Volume of each vessel		1,711	ft3
# of vessels		2	each
Regenerations per year		104	per year
Volume of water used	$	5,322,831	gallons/year
Cost of water used	$	11,832	$/year

Waste Brine per year	$	11,832

6. Summary

Annual salt cost	$	40,597
resin cost	$	42,771
Electrical per year	$	25,076
Labor	$	5,475
Brine Waste	$	11,832

Total Miex Annual Cost	$125,751

(Bldg O&M Cost is Calculated Separately)

Water Treatment Plant DAF Costs (monthly/yearly)

Daily Water Consumption	1,000,000	**gpd**
Monthly Water Consumption	30,000,000	**gal/month**
Yearly Water Consumption	365,000,000	**gal/year**

User Data:

Design Flow	1	MGD
Design Flow	694.4444444	gpm
Storage Volume	848,000	gallons
Time to Fill Tanks	0.8	days
Annual Water Production	365,000,000	gallons

Operational Costs:

Electricity Service Charge	$13.50	/mo
Electricity	$0.1145	/kwh
Burdened labor rate for an Operator	$60	/hr

Description	Number	Phase	Voltage	kW	Total Connected load kW	Total kWh	Run Time per day Hours
Control Panel							
Rapid mixer	1	3	460	1.5	1.5	36	24
Flocculators	4	3	460	0.56	2.24	53.76	24
Recycle Pumps	1	3	460	7.46	7.46	179.04	24
Air Compressor	1	1	120	3.73	3.73	14.92	4
Instrumentation etc	1	1	240	1	1	24	24
				Sub Total (kW)	15.93		
Backwash pump	1	3	460	29.8	29.8	7.945872	0.26664
Sludge pump	n/a						
Airscour blower	1	3	460	11.2	11.2	1.344	0.12
Mixers							
Alum mixer	1	1	110	0.25	0.37	0.37	1
Soda Ash mixer	1	1	110	0.56	0.37	0.37	1
Polymer mixer	1	1	110	0.25	0.25	0.25	1
Potassium Perm. Mixer	1	1	110	0.37	0.37	0.74	2
				Sub Total (kW)	1.36		
Clearwell Booster Pumps	1	3	460	44.742	44.742	621.4166667	13.88888889
Dosing Pumps							
Chemical dosing pumps	4	1	110	0.03	0.12	2.88	24
				Sub Total (kW)	0.12		

Total load for 1.8 MGD plant (KWH) 943
w/ some reduction for 1.0 MGD usage

Power Cost:	$0.1145	per kwh
Daily Power Cost	$107.98	
Daily Production	1,000,000	gallons
Power cost per 1000 gallons	$ 0.108	
Yearly Power Cost	$39,411.85	

Chemical Cost

Estimated Chemical Dosages:	Typical Dosages (ppm)	
Polymer - PAX XL-19	35	
Alum	0	
Soda Ash (Sodium Carbonate)	5.0	(typ. 50% of alum)
Sodium Hypochlorite	4	
Potassium Permangante	2	

Flowrate in usgpm	694.44	(not used)
Plant Run Hours	24	
Total Galls per Day	1,000,000	

Total Pounds of Chemicals Used Per Day				
	#/day	#/month	$/#	Cost/day
Polymer:	291.98	8905.347594	$1.00	$ 291.98
Alum	-	0	$0.41	$ -
Soda Ash:	41.71	1272.192513	$0.30	$ 12
Sodium Hypochlorite	33.37	1017.754011	$2.25	$ 75
Potassium Permanganate	16.68	508.88	$2.18	$ 36.41
			total	$ 416

Chemical cost /1000 gall. =	0.416
Yearly chemical cost	$ 151,811

Total Operating Cost

Power	$ 0.108	
Chemicals	$ 0.42	
	$ 0.52	per 1000 gal

Chemical cost of soda ash $ 27,420

Sludge Dewatering and Disposal

Plant Flowrate	3.785	MLpd	
Raw Water DOC	7	mg/L	
Solids Content After Dewatering	40%		
Sludge Volume	464	kg/day	kg -> lb
Sludge Volume	1022	lb/day	2.2046
Sludge Volume	187	ton/year	

Backwash Volume

backwash flow rate	1386	gpm		
backwash frequency	0.83	days	per Andrew Stevano - every 20 hours	
backwash duration per filter bed	10	minutes		
# of filter beds	2			0.033264
backwash volume per year	12,141,360	gallons		
cost of water	0.0022	$/gallon		
cost of backwash per year	$ 26,989	$/year		

Capital Equipment Replacement	Cost	Expected Equipment Life	Annual Cost
Chemical Systems	$10,000	7 yr	$2,010
Backwash Pump	$8,000	10 yr	$1,303
Air Scour Blower	$10,000	10 yr	$1,629
Booster Pumps	$20,000	10 yr	$3,258
Sludge Centrifuge Parts	$3,560	2 yr	$1,962
Inflation		5 %	

Operator Labor

labor Requirement:

average hours/day of operation for chemical preperation, monitoring and adjustment.			1 hrs	
average hours/day for minor maintenance of treatment equipment			0.333 hrs	
labor rate per hour			$60	
labor cost/day for operation of treament equipment				$60
labor cost/year for operation of treament equipment	cost per	365 days		$21,900
labor cost/day for minor maintenance of treatment equipment				$20
labor cost/year for minor maintenance of treatment equipment		365 days		$7,293

Total Yearly Labor $ 29,192.70

Estimated Annual Water Treatment O&M Cost

Yearly Power Cost	$ 39,412
Yearly chemical cost	$ 151,811
cost of backwash per year	$ 26,989
Capital Equipment Replacement:	$ 10,162
Operator Labor	$ 29,193

Estimated Annual Sludge Dewatering & Disposal O&M Cost (see separate estimate)

Sludge Centrifuge Power Cost $ 2,780

Sludge Chemical Cost	$	15,556
Sludge Disposal	$	30,000

Total Yearly Treatment Operating Cost	**$305,903**

(Bldg O&M Cost is Calculated Separately)

EXISTING WATER TREATMENT SYSTEM
SURFACE WATER TREATMENT w/ SLOW SAND FILTRATION

User Data:		
Design Flow	0.9	MGD
Design Flow	625	gpm
Storage Volume	848,000	gallons
Time to Fill Tanks	0.9	days
Annual Water Production	328,500,000	gallons

Operational Costs:		
Electricity Service Charge	$13.50	/mo
Electricity	$0.1145	/kwh
Burdened labor rate for an Operator	$60	/hr
Labor - Operator	43	hr/mo specific to slow san

Capital Equipment Replacement:	Cost	Expected Equipment Life		Annual Cost
Chemical Systems	$3,500	7	yr	$704
Booster Pumps	$20,000	10	yr	$2,000
Inflation		5	%	

Estimated Yearly Electrical Demand

Equipment			Usage (hrs/year)	Yearly Demand (kwh)	Annual Cost
Chlorine Pump	20	watts	8760	175	$20
Booster Pumps	40	hp	6083	181,454	$20,776
Mixers	0.33	hp	365	181	$21

Drawdown Volume		
water wasted per filter cleaning	145,860	gallons
Filter Cleanings per year	104	
water wasted per year	15,169,440	gallons
cost of wasted water	$ 33,720	

Chemical Feed

Caustic Soda

3	mg/l casutic soda dose required
683.26	lb caustic soda use per month
$0.45	caustic soda cost per pound FOB Wrangell
$ 309	**caustic soda cost per month**
$ 3,710	**COST PER YEAR**

Sodium Hypochlorite

4.2	mg/l sodium hypo dose required
957	lb sodium hypo use per month
$ 2.25	chlorine cost per equivalent pound
$ 2,154	**sodium hypo cost per month**
$ 25,842	**COST PER YEAR**

Estimated Annual Water Treatment O&M Cost

Operator Labor	$31,200
Electricity	$20,979
Equipment Replacement	$2,704
Wasted Water	$33,720
Chemical Feed	$29,552
Total Annual Treatment Cost	**$118,154**

(Bldg O&M Cost is Calculated Separately)

PROPOSED WATER TREATMENT SYSTEM
SURFACE WATER TREATMENT w/ SLOW SAND FILTRATION

User Data:

Design Flow	1	MGD
Design Flow	694	gpm
Storage Volume	848,000	gallons
Time to Fill Tanks	0.8	days
Annual Water Production	365,000,000	gallons

Operational Costs:

Electricity Service Charge	$13.50	/mo
Electricity	$0.1145	/kwh
Burdened labor rate for an Operator	$60	/hr
Labor	1176	hours yearly
Labor - Operator	98	hr/mo specific to slow sand
Labor - Operator	4	hr/mo specific to recapture tank cleaning

Capital Equipment Replacement:	Cost	Expected Equipment Life		Annual Cost
Chemical Systems	$10,000	7	yr	$2,010
Backwash Pump	$10,000	10	yr	$1,629
Air Scour Blower	$30,000	10	yr	$4,887
Booster Pumps	$20,000	10	yr	$3,258
Sludge Centrifuge Parts	$3,560	10	yr	$580
Inflation		5	%	

Estimated Yearly Electrical Demand

Equipment			Usage (hrs/year)	Yearly Demand (kwh)	Annual Cost
Chlorine Pump	20	watts	8760	175	$20
Backwash pump	20	hp	17	517	$59
Air Scour Blower	100	hp	5	776	$89
Booster Pumps	60	hp	5069	226,817	$25,971
Recapture Tank Pump	10	hp	1787	13,324	$1,526
Mixers	0.33	hp	365	272	$31

Drawdown Volume

water wasted per filter cleaning	145,860	gallons
Filter Cleanings per year	147	
water wasted per year	21,441,420	gallons
cost of wasted water	$ 47,661	$

****This cost is not added to the total, as it is assumed a recapture tank will be used*

Sand Cleaning

Equipment Maintenance cost	$	5,000	$/year
Total yearly sand cleaning cost	$	5,000	

Sand Replacement

Sand Replacement		3,500	ft3/year
	$	49,858	$/year
Total yearly sand replacement cost	$	49,858	

Backwash of Roughing Filter

Roughing Filter		400	SF
Backwash unit flow rate		8	gpm/sf
Backwash flow rate		3,200	gpm
Air scour unit flow rate		7	scfm/sf
Air Scour flow rate		2,800	SCFM
backwash per filter cleaning		32,000	gallons
Filter Cleanings per year		104	
backwash per year		3,328,000	gallons
cost of backwash water	$	7,398	$

Chemical Feed

Caustic Soda

	3	mg/l casutic soda dose required
	759	lb caustic soda use per month
	$0.45	caustic soda cost per pound FOB Wrangell
$	**343**	**caustic soda cost per month**
$	**4,122**	**COST PER YEAR**

Sodium Hypochlorite

	4.2	mg/l sodium hypo dose required
	1063	lb sodium hypo use per month
$	2.25	chlorine cost per equivalent pound
$	**2,393**	**sodium hypo cost per month**
$	**28,713**	**COST PER YEAR**

Sludge Dewatering and Disposal

Polymer Cost	$14,544	per year	
Centrifuge Electrical Cost	$2,780	per year	
Plant Flowrate	3.785	MLpd	
Raw Water DOC	7	mg/L	
Solids Content After Dewatering	40%		
Sludge Volume	95	kg/day	kg -> lb
Sludge Volume	209	lb/day	2.2046
Sludge Volume	38	ton/year	
Disposal Cost	$120	per ton	
Disposal Cost	$4,569.05	per year	

Estimated Annual Water Treatment O&M Cost

Operator Labor	$73,440
Electricity	$27,857
Equipment Replacement	$62,222
Wasted Water Cost	$0
Sand Cleaning	$5,000
Backwash	$7,398
Chemical Feed	$32,835

Estimated Annual Sludge Dewatering & Disposal O&M Cost (see separate estimate)

Sludge Centrifuge Power Cost	$	417
Sludge Chemical Cost	$	2,333
Sludge Disposal	$	4,500

Total Annual Treatment Cost	**$216,002**

(Bldg O&M Cost is Calculated Separately)

WATER TREATMENT SYSTEM
SURFACE WATER TREATMENT w/ BIOMEDIA FILTRATION

User Data:

Design Flow	1	MGD
Design Flow	3.8	MLD
Design Flow	694.4444444	gpm
Storage Volume	848,000	gallons
Time to Fill Tanks	0.8	days
Annual Water Production	365,000,000	gallons

Operational Costs:

Electricity Service Charge	$13.50	/mo
Electricity	$0.1145	/kwh
Burdened labor rate for an Operator	$60	/hr
Labor - Operator	12	hr/mo specific to biomedia

Capital Equipment Replacement:	Cost	Expected Equipment Life		Annual Cost
Chemical Systems	$10,000	7	yr	$2,010
Backwash Pump	$10,000	10	yr	$1,629
GAC Media Replacement	$52,176	5	yr	$13,318
Booster Pumps	$20,000	10	yr	$3,258
Air Blower	$10,000	10	yr	$1,629
Sludge Centrifuge Parts	$3,560	3	yr	$1,374
Inflation		5	%	

Estimated Yearly Electrical Demand

Equipment			Usage (hrs/year)	Yearly Demand (kwh)	Annual Cost
Chlorine Pump	20	watts	8760	175	$20
Mixers	0.33	hp	365	272	$31
Backwash Pump	25	hp	81	1,512	$173
Air Blower	50	hp	24.3	907	$104
Booster Pumps	60	hp	5069	226,817	$25,971

Backwash Volume

Filter surface area (each)	130	sf
Backwash unit flow rate	24	gpm/sf
Backwash flow rate	3,120	gpm
Air scour unit flow rate	6	scfm/sf
Air Scour flow rate	780	SCFM
backwash flow rate	3,120	gpm
backwash frequency	3	days
backwash duration per filter vessel	10	minutes
# of filter beds	4	
backwash volume per year	15184000	gallons
cost of water	0.002222862	$/gallon
cost of backwash per year	$ 33,751.94	$/year

Chemical Feed

Alum

57.5	mg/l alum dose required
14551	lb alum use per month
$0.41	alum cost per pound FOB Wrangell
$ 6,002	**alum cost per month**
$ 72,019	**COST PER YEAR**

Soda Ash

28.75	mg/l soda ash dose required
7275	lb soda ash use per month
$0.30	soda ash cost per pound FOB Wrangell
$ 2,164	**soda ash cost per month**
$ 25,969	**COST PER YEAR**

Sodium Hypochlorite

4.2	mg/l sodium hypo dose required
1063	lb sodium hypo use per month
$ 2.25	chlorine cost per equivalent pound
$ 2,393	**sodium hypo cost per month**
$ 28,713	**COST PER YEAR**

Flowrate	3.785	MLpd	
Raw Water DOC	7	mg/L	
Solids Content After Dewatering	40%		
Sludge Volume	578	kg/day	kg -> lb
Sludge Volume	1274	lb/day	2.2046
Sludge Volume	232	ton/year	

Estimated Annual Water Treatment O&M Cost

Operator Labor	$8,640
Electricity	$26,461
Equipment Replacement	$23,218
Backwash Water	$33,752
Chemical Feed	$126,701

Estimated Annual Sludge Dewatering & Disposal O&M Cost (see separate estimate)

Sludge Centrifuge Power Cost	$ 2,585
Sludge Chemical Cost	$ 14,467
Sludge Disposal	$ 27,900

Total Annual Treatment Cost	**$263,724**

(Bldg O&M Cost is Calculated Separately)

Water Treatment Conventional Packaged Plant Costs (monthly/yearly)

3.8754
gal->liters

Daily Water Consumption	1,000,000	gpd
Daily Water Consumption	3,875,400	Lpd
Monthly Water Consumption	30,000,000	gal/month
Yearly Water Consumption	365,000,000	gal/year

User Data:

Design MDD Flow	1.8	MGD
Design MDD Flow	1250	gpm
Storage Volume	848,000	gallons
Time to Fill Tanks	0.5	days
Annual Water Production	365,000,000	gallons

Operational Costs:

Electricity Service Charge	$13.50	/mo
Electricity	$0.1145	/kwh
Burdened labor rate for an Operator	$60	/hr

Description	Number	Phase	Voltage	kW	Total Connected load kW	Amps	Total kWh	Run Time per day Hours
Instrumentation etc	1	1	110	1	1	10	24	24
Backwash pump	1	3	460	29.8	29.8		5.066	0.17
Air scour blower	1	3	460	11.2	11.2		0.93296	0.0833
Flocculators	4	3	460	0.19	0.75		18	24
AC Chem. Mixers								
Alum mixer	1	1	110	0.37	0.37		0.74	2
Soda ash mixer	1	1	110	0.37	0.37		0.74	2
Polymer mixer	1	1	110	0.25	0.25		0.125	0.5
Clearwell Booster Pumps	1	3	460	44.74	44.74		621.42	13.88889
AC Dosing pumps								
chem pumps,.	3	1	110	0.03	0.09	3	2.115	23.5
Sub Total (kW)					**88.572**			
Total load for plant (KWH)							**673.135627**	
Total amps						**13**		

Power Cost:	$0.1145	$/kWh
Daily Power Cost	$77.07	
Daily Production	1,000,000	gallons
Cost per 1000 gallons	$ 0.08	
Yearly Power cost	$28,132.02	

Estimated Chemical Dosages AC Plant:

	Typical Dosages ppm		
Polymer	0.1	(1	max)
Alum	57.5	(60-300)	
Soda Ash (Sodium Carbonate)	28.75	(typ. 50% of alum)	
Sodium Hypochlorite	4		
Flowrate in usgpm	1050		net daily average
Plant Run Hours	24		
Total Galls per Day production		1,000,000	net daily average

Total Pounds of Chemicals Used Per Day				
	#/day	#/month	$/#	Cost/day
Polymer	1	25	$ 2.51	$ 2.10
Alum	480	14630	$0.41	$ 197.84
Soda Ash	240	7315	$0.30	$ 71.34
Sodium Hypochlorite	33	1018	$ 2.25	$ 75.12

Flowrate	3.875	MLpd	
Raw Water DOC	7	mg/L	
Alum	57.5	mg/L	
Soda Ash	28.75	mg/L	
Polymer	0.1	mg/L	
Solids Content After Dewatering	40%		
Sludge Volume	592	kg/day	kg -> lb
Sludge Volume	1306	lb/day	2.2046
Sludge Volume	238	ton/year	
chemical cost of soda ash	$ 26,039		
Daily typical operations total	$ 346.41		
Chemical cost per	365	days	$126,438

Total yearly chemical cost	$126,438

labor Cost

labor Requirement:					
average hours/day of operation for chemical preperation, monitoring and adjustment.					0.5 hrs
average hours/day for minor maintenance of treatment equipment					0.15 hrs
labor rate per hour					$60
labor cost/day for operation of treament equipment				$	30
labor cost/year for operation of treament equipment	cost per		365 days	$	10,950
labor cost/day for minor maintenance of treatment equipment				$	9.00
labor cost/year for minor maintenance of treatment equipment			365 days	$	3,285

Total Yearly Labor Cost	$	14,235

Backwash Volume

backwash flow rate		2210	gpm	2.0 gpm/SF for conventional
backwash frequency		3	days	
backwash duration per filter bed		10	minutes	
# of filter beds		4		
backwash volume per year		10755333	gallons	
cost of water		0.0022	$/gallon	
cost of backwash per year	$	23,908	$/year	

Capital Equipment Replacement:	Cost	Expected Equipment Life	Annual Cost
Chemical Systems	$10,000	7 yr	$2,010
Backwash Pump	$10,000	10 yr	$1,629
Air Scour Blower	$20,000	10 yr	$3,258
Booster Pumps	$20,000	10 yr	$3,258
Sludge Centrifuge Parts	$3,560	3 yr	$1,214
Inflation		5 %	

Water Treatment Cost		
Yearly Power cost	$	28,132
Total yearly chemical cost	$	126,438
Total Yearly Labor Cost	$	14,235
Capital Equipment Replacement	$	11,368
cost of backwash per year	$	23,908
Estimated Annual Sludge Dewatering & Disposal O&M Cost (see separate estimate)		
Sludge Centrifuge Power Cost	$	2,641
Sludge Chemical Cost	$	14,778
Sludge Disposal	$	28,500

Total yearly operating cost for Conventional treatment package	**$**	**250,000**

(Bldg O&M Cost is Calculated Separately)

Water Treatment Plant Adsorption Clarifier and Nanofiltration Costs (monthly/yearly)

Daily Water Consumption	1,000,000	**gpd**
Monthly Water Consumption	30,000,000	**gal/month**
Yearly Water Consumption	365,000,000	**gal/year**

User Data:

Design Flow	1.8	MGD
Design Flow	1250	gpm
Storage Volume	848,000	gallons
Time to Fill Tanks	0.5	days
Annual Water Production	365,000,000	gallons

Operational Costs:

Electricity Service Charge	$13.50	/mo
Electricity	$0.1145	/kwh
Burdened labor rate for an Operator	$60	/hr

Description	**Number**	**Phase**	**Voltage**	**kW**	**Total Connected load kW**	**Amps**	**Total kWh**	**Run Time per day Hours**
Instrumentation etc	1	1	110	1	1	10	24.00	24
Backwash pump	1	3	460	29.8	29.8		5.07	0.17
Air scour blower	1	3	460	11.2	11.2		0.93	0.0833
AC Chem. Mixers								
Alum mixer	1	1	110	0.37	0.37		0.74	2
Soda ash mixer	1	1	110	0.37	0.37		0.74	2
Polymer mixer	1	1	110	0.25	0.25		0.13	0.5
AC Dosing pumps								
chem pumps,.	3	1	110	0.03	0.09	3	2.12	23.5
Clearwell booster pumps	1	3	460	44.742	44.742		621.42	13.88889
NF Booster pumps	2	3	460	44	88		2112.00	24
CIP Pump	1	3	460	14.9	14.9	3.9	0.09	0.006
CIP Heater	1	3	460	18	18	4.9	0.11	0.006
NF Chemical dosing pumps	3	1	110	0.03	0.09	3	2.16	24
Sub Total (kW)					**208.812**			
Total load for plant (KWH)							**2769.493027**	
Total amps						**24.8**		

Power Cost:	$0.1145	$/kWh
Daily Power Cost	$317.11	
Daily Production	1,000,000	gallons
Cost per 1000 gallons	$ 0.32	
Yearly Power cost	$115,744	

Estimated Chemical Dosages AC Plant:

Chemical	Typical Dosages (ppm)	
Polymer	0.1	(1 max)
Alum	40	(20-50)
Soda Ash (Sodium Carbonate)	25	(typ. 50% of alum)
Potassium Permangante	2	

Flowrate	3.785	MLpd	
Raw Water DOC	7	mg/L	
Solids Content After Dewatering	40%		
Sludge Volume	489	kg/day	kg -> lb
Sludge Volume	1079	lb/day	2.2046
Sludge Volume	197	ton/year	

Backwash Water

backwash flow rate	2112	gpm
backwash frequency	3	days
backwash duration per filter bed	10	minutes
# of filter beds	2	
backwash volume per year	5139200	gallons
cost of water	0.0022	$/gallon

cost of backwash per year	$ 11,424	$/year

Estimated Chemical Dosages NF/finished water:

NF recovery	90%		
Acid NF feed	0		
Sodium Hypochlorite	4		
Anti Scalant	2		
Soda Ash Finished	25		
Flowrate in usgpm	1050		net daily average both trains
Plant Run Hours	24		
Total Galls per Day NF production		1,000,000	net daily average both trains

Total Pounds of Chemicals Used Per Day				
	#/day	#/month	$/#	Cost/day
Polymer	0.83	25.44	$ 2.51	$ 2.10
Alum	333.69	10177.54	$0.41	$ 137.63
Soda Ash	208.56	6360.96	$0.30	$ 62.04
Potassium Permanganate	16.68	508.88	$2.18	$ 36.41
Anti-Scalant	16.68	508.88	$ 4.21	$ 70.24
Acid NF feed	0.00	0.00	$ 0.58	$ -
Hypochlorite	33.37	1017.75	$ 2.25	$ 75.12
Soda ash Finished	208.56	6360.96	$ 0.30	$ 62.04

chemical cost of soda ash alone	$ 45,286		
Daily chemical operations total	$ 446		
Chemical cost per year	365	days	$162,635

Water Volume Summary & Waste Summary

Total daily NF waste:	111,111	gals
Cost of wasted water	$ 247	$/day
Cost of wasted water	$ 90,149	$/year

Offline Cleaning once every 90 days

NF System CIP Cleaning	# required	$/#	Cost/occurance
High pH clean Avista RoClean P111	350	4.83	$ 1,691
Low pH clean Avista RoClean P303	350	5.4	$ 1,890
per CIP occurance total			$ 3,581
daily cost assuming occurance every	90	days	$ 40
cost per	365	days	$ 14,521

Total yearly chemical cost	$177,156

labor Cost

labor Requirement:					
average hours/day of operation for chemical preperation, monitoring and adjustment.				1 hrs	
average hours/day for minor maintenance of treatment equipment				0.333 hrs	
labor rate per hour				$60	
labor cost/day for operation of treament equipment		$	60.00		
labor cost/year for operation of treament equipment	cost per		365 days		$ 21,900
labor cost/day for minor maintenance of treatment equipment					$ 20
labor cost/year for minor maintenance of treatment equipment			365 days		$ 7,293

Total Yearly Labor Cost	$	29,193

Capital Equipment/Membrane Replacement Costs

NF membranes	216 membranes, cost to replace today (freight extra)		$ 185,000
NF membranes because of good pre-treatment assume		8 years	
inflaton		5 %	
Cost/year for membrane replacement	$34,166		

Capital Equipment Replacement:	Cost	Expected Equipment Life	Annual Cost
Chemical Systems	$10,000	7 yr	$2,010
Backwash Pump	$10,000	10 yr	$1,629
Air Scour Blower	$20,000	10 yr	$3,258
Booster Pumps	$20,000	10 yr	$3,258
Sludge Centrifuge Parts	$3,560	2 yr	$1,780
Inflation		5 %	

Total Yearly Capital Equipment/Membrane Replacement Costs	$46,101

Estimated Annual Water Treatment O&M Cost

Yearly Power cost	$115,744
cost of backwash per year	$11,424
Cost of wasted water	$90,149
Total yearly chemical cost	$177,156
Total Yearly Labor Cost	$29,193
Capital Equipment and Membrane Replacement	$46,101

Estimated Annual Sludge Dewatering & Disposal O&M Cost (see separate estimate)

Sludge Centrifuge Power Cost	$	2,196
Sludge Chemical Cost	$	12,289
Sludge Disposal	$	23,700

Total yearly operating cost for AC and nano membrane treatment	**$**	**507,952**

(Bldg O&M Cost is Calculated Separately)

WTP BUILDING - EXISTING BUILDINGS

System Data:

Existing Roughing Filter Building	1,936	ft^2
Control Building	1,936	ft^2

Operational Costs:

Burdened labor rate for an Operator	$60	/hr
Labor - Operation and maintenance of building	1	hr/wk
Misc Materials and Supplies	$500	/yr
Floor Resurfacing	$300	/yr
Electricity	$0.11	/kwh

Capital Costs:	Cost	Expected Equipment Life	Annual Cost
Unit Heaters (2 total)	$2,000	15 yr	$300
Inflation	5 %		

Electrical Demand:

Equipment	Power	Usage (hr/day)	Yearly Demand (kwh)	Annual Cost
Building Unit Heater	1,500 watts	9	3,696	$423
Building Lights	0.4 watts/ft2	6	3,392	$388
Misc. Building Power	1,500 kwh/yr		1,500	$172

Estimated Annual Building O & M Cost

Labor		$3,200
Materials (Routine O&M and repairs)		$500
Electricity		$990
Equipment Replacement Cost		$300
	Total	$5,000

WTP BUILDING EXPANSION
OPTION 1

System Data:		
Existing Roughing Filter Building	1936	
Additional Roughing Filter Building Area	1936	ft^2
Control Building	1,936	ft^2
Total Building Area	5,808	ft^2

Operational Costs:		
Burdened labor rate for an Operator	$60	/hr
Labor - Operation and maintenance of building	1	hr/wk
Misc Materials and Supplies	$500	/yr
Floor Resurfacing	$300	/yr
Electricity	$0.11	/kwh

Capital Costs:	Cost		Expected Equipment Life	Annual Cost
Unit Heaters (3 total)	$3,000		15 yr	$500
Inflation		5 %		

Electrical Demand:

Equipment	Power	Usage (hr/day)	Yearly Demand (kwh)	Annual Cost
Building Unit Heater	3,000 watts	9	7,391	$846
Building Lights	0.4 watts/ft2	6	5,088	$583
Misc. Building Power	1,500 kwh/yr		1,500	$172

Estimated Annual Building O & M Cost

Labor		$3,200
Materials (Routine O&M and repairs)		$500
Electricity		$1,610
Equipment Replacement Cost		$500
	Total	$5,900

NEW WTP BUILDING
OPTIONS 2-3

System Data:

Total Building Area	11,736	ft^2
(New Treatment Bldg + Control Building)		

Operational Costs:

Burdened labor rate for an Operator	$60	/hr
Labor - Operation and maintenance of building	2	hr/wk
Misc Materials and Supplies	$500	/yr
Floor Resurfacing	$300	/yr
Electricity	$0.11	/kwh

Capital Costs:	Cost		Expected Equipment Life	Annual Cost
Unit Heaters (6 total)	$6,000		15 yr	$900
Inflation		5 %		

Electrical Demand:

Equipment	Power	Usage (hr/day)	Yearly Demand (kwh)	Annual Cost
Building Unit Heater	9,000 watts	9	22,174	$2,539
Building Lights	0.4 watts/ft2	6	10,281	$1,177
Misc. Building Power	2,000 kwh/yr		2,000	$229

Estimated Annual Building O & M Cost

Labor		$6,300
Materials (Routine O&M and repairs)		$500
Electricity		$3,950
Equipment Replacement Cost		$900
	Total	$11,700

NEW WTP BUILDING
OPTIONS 4-5

System Data:

Total Building Area	8,236	ft^2
(New Treatment Bldg + Control Building)		

Operational Costs:

Burdened labor rate for an Operator	$60	/hr
Labor - Operation and maintenance of building	2	hr/wk
Misc Materials and Supplies	$500	/yr
Floor Resurfacing	$300	/yr
Electricity	$0.11	/kwh

Capital Costs:	Cost	Expected Equipment Life	Annual Cost
Unit Heaters (5 total)	$5,000	15 yr	$700
Inflation	5 %		

Electrical Demand:

Equipment	Power	Usage (hr/day)	Yearly Demand (kwh)	Annual Cost
Building Unit Heater	7,500 watts	9	18,478	$2,116
Building Lights	0.4 watts/ft2	6	7,215	$826
Misc. Building Power	1,750 kwh/yr		1,750	$200

Estimated Annual Building O & M Cost

Labor		$6,300
Materials (Routine O&M and repairs)		$500
Electricity		$3,150
Equipment Replacement Cost		$700
	Total	$10,700

BACKWASH DISPOSAL - ALTERNATIVE A-1
SEWER SERVICE EXTENSION TO WWTP (BELOW GROUND)

Operational Costs:

Burdened labor rate for an Operator	$60	/hr
Equipment Operating Cost	$50	/hr
Backwash Clarifier Tank Cleaning	40	hr/year
Inspection and cleaning sewer collection system		
Labor - Operator	10	hr/year

Estimated Annual Operation & Maintenance Cost

Operator Labor	
Sewer Collection System	$600
Tank Cleaning	$2,400
Equipment	
Sewer Collection System	$500
Total	**$3,500**

BACKWASH DISPOSAL - ALTERNATIVE A-2
SEWER SERVICE EXTENSION TO WWTP (ABOVE GROUND)

Operational Costs:

Burdened labor rate for an Operator	$60	/hr
Equipment Operating Cost	$50	/hr
Backwash Clarifier Tank Cleaning	40	hr/year
Electrical Heat Trace		
Sewer Line Length	1,300	feet
Days Per Year Heat Trace Operational	60	days
Electricity Service Charge	$13.50	/mo
Electricity	$0.1145	/kwh
Inspection and cleaning sewer collection system		
Labor - Operator	10	hr/year

Estimated Yearly Electrical Demand

Equipment			Usage (hrs/year)	Yearly Demand (kwh)	Annual Cost
Heat Trace	10	watts/foot	1440	18,720	$2,143

Estimated Annual Operation & Maintenance Cost

Operator Labor	
Sewer Collection System	$600
Tank Cleaning	$2,400
Heat Trace Electricity	$2,305
Equipment	
Sewer Collection System	$500
Total	**$5,805**

BACKWASH DISPOSAL - ALTERNATIVE B
SEWER SERVICE EXTENSION ALONG WOOD ST

Operational Costs:

Burdened labor rate for an Operator	$60	/hr
Vacuum Truck Operating Cost	$50	/hr
Inspection and cleaning sewer collection system		
Labor - Operator	20	hr/year
Backwash Clarifier Tank Cleaning	40	hr/year

Estimated Annual Operation & Maintenance Cost

Operator Labor	
Sewer Collection System	$1,200
Tank Cleaning	$2,400
Equipment	
Sewer Collection System	$1,000
Total	**$4,600**

BACKWASH DISPOSAL - ALTERNATIVE C
MARINE OUTFALL

Operational Costs:

Burdened labor rate for an Operator	$60	/hr
Vacuum Truck Operating Cost	$50	/hr
Inspection and cleaning sewer collection system	20	hr/year
Backwash Clarifier Tank Cleaning	40	hr/year

Estimated Annual Operation & Maintenance Cost

Operator Labor	
Sewer Collection System	$1,200
Tank Cleaning	$2,400
Equipment	
Sewer Collection System	$1,000
Total	**$3,600**

BACKWASH DISPOSAL - ALTERNATIVE D
BACKWASH RECYCLE

Operational Costs:		
Burdened labor rate for an Operator	$60	/hr
Electricity	$0.1145	/kwh
Backwash Clarifier Tank Cleaning	40	hrs per year
Backwash Volume	11,500	gallons per day
Backwash Recycle Pumps		
Power	1	hp
Power	0.75	kW
Flow	100	gpm
Pump run time	115	minutes
Energy Consumption	1.4	kWh per day
Capital Cost	$1,500	
Expected Equipment Life	7	yr
Inflation	5%	

Estimated Annual Operation & Maintenance Cost	
Capital Replacement (Recycle Pump)	$302
Labor	$2,400
Electricity (Recycle Pump)	$60
Total	**$2,761**

Date	**March 23rd 2017**
Offer	**17060-E1701**
Revision	**00**

Throughput Data

2.00	m3/h
2.0%	%DSw/w
20,000	DS ppm
40.00	kg/h solids
60	kg/day solids
15,000	kg/year solids

	HIGH	LOW
Capture rate	98%	98%
Centrate TSS ppm	400	400
Solids Discharge	50%	40%
Dry Cake kg/hr	80	100
Dry Cake tons/year	30	38
Landfill $/ton	$ 120	$ 120
YEARLY DISPOSAL COST	$ 3,600	$ 4,500

Operation

1.5	hour/day
5	days/week
50	week/year
375	hour/year
750,000	litres/year

10	years
3,750	hours operation

Polymer consumption

low consumption	high comsumption	
8	10	kg poly/dry ton solids
0.320	0.400	kg/hour 100% active
45%	45%	% Polymer Activity
0.71	0.89	kg/hour neat emulsion polymer
1.07	1.33	kg/day
267	333	kg/year neat emulsion polymer
$ 7.00	$ 7.00	CAD Price neat polymer per kg
$ 1,867	$ 2,333	POLYMER PRICE

Date	March 23rd 2017
Offer	17060-E1701
Revision	00

Decanter Replacement Interval Normal Conditions

S: Suggested replacement; C: Integrity and functionality check of the part and replacement if necessary.

YEAR	14	30	46	62
hour per replacement	5,000	11,000	17,000	23,000
BEARINGS AND SEALS	S	S	S	S
JOINT FLANGE FOR HYDRAULIC PUMP	C	C	C	C
FIFTH WHEEL OF SLUDGE SCRAPER	S	S	S	S
TRANSMISSION BELTS	C	C	C	C
CYCLOIDAL GEARBOX SEALS	C	C	C	C
SCREW	C	C	C	C
BOWL	C	C	C	C
SLUDGE SCRAPER BLADE	C	C	C	C
SENSORS OPERATION	C	C	C	C
INTEGRITY OF MACHINE COMPONENTS	C	C	C	C
ELECTRIC BOARD OPERATION	C	C	C	C
INTEGRITY OF ELECTRIC BOARD COMPONENTS	C	C	C	C

DR250E Start-up Spare Parts Kit

Decanter Startup Toolbox

Items	Part #	QTY	Kit Price USD
Wrench set	-	1	Free of Charge
Weir plate puller	-	1	
Bowl and Scroll Speed Sensor	-	1	
Bearing Grease Gun (1 cartridge)	-	1	
Gearbox Grease gun (1 cartridge)	-	1	
Washing Solenoid Valve (internal wash)	-	1	
Washing Solenoid Valve (external wash)	-	1	
Intake Oil Filter	M1120023	1	
Return Oil Filter	M1120024	1	
Sludge Feed Pump Stator (w/pump purchase)		1	
Polymer Feed Pump Stator (w/pump purchase)		0	

Decanter Recommended On Hand Spare Parts

Items	Part #	QTY	Kit Price USD
Bowl Belt kit (3 belts)	M1040078	1	$ 445
Scroll Belt	M1040006	1	$ 200
Cover and Gasket Kit	C1010045	1	$ 350
	-	-	-
		KIT PRICE	$ 995

Decanter Parts and Consumables Kit (2 years)

Items	Part #	QTY	Unit Price USD
Bearing Grease Cartridge	M1170002	15	$ 510
Gearbox Gear Cartridge	M1170001	8	$ 50
			-
2 year package			$ 3,000
Bowl Bearing supply side	M1060017	1	-
Bowl Bearing gear side	M1060016	1	-
Scroll Bearing supply side	M1060014	1	-
Scroll Bearing gear side	M1060015	1	-
Scraper bearing front	M1060007	1	-
Sludge Feed Pump Stator		1	-
Polymer Feed Pump Stator		1	-
		KIT PRICE	$ 3,560

DRYCAKE
Vanderbeken Enterprises Ltd.

Date	**March 23rd 2017**
Offer	**17060-E1701**
Revision	**00**

Wash Water Consumption

Decanter Wash water

1000	L/h	Washing consumption DR250E
5	min	Shut down Time
83	L	Shutdown Water Consumption per Shutdown
83	L	Shutdown Water Consumption Daily
0.417	m3	Shutdown Water Consumption Weekly
20.8	m3	Shutdown Water Consumption Yearly

Internal and External Washing	
Quality:	Reuse Water
Pressure:	30-50PSI

Polymer Makeup Water

low consumption	**high comsumption**	
267	333	Neat Polymer Consumption per year kg
0.25%	0.25%	Dilution Ratio
0.13	0.16	m3/year Water for Polymer Makeup

Dewatering System Electric Power

Equipment	Component	kW	HP	Voltage	Amp
DR250E	Main Motor	11	15	575	19.13
DR250E	Scroll Motor	0	0.00	24	0.00
DR250E	Scraper	0.37	0.50	575	0.64
DR250E	Solenoid Valve External Wash	0.010	0.013	24	0.42
DR250E	Solenoid Valve Internal Wash	0.010	0.013	24	0.42
SFP	Sludge Feed Pump	1.5	2	575	2.61
PFP	Polymer Feed Pump	0.55	0.74	575	0.96
CONV	Conveyor	1.5	2.01	575	2.61
	Total	14.9	20		27
Average Consumed Power		9.7	Kw/h		17.4
Yearly number of operation		375	hours		
Electricity Price		0.1145	$/kW		
ELECTRICITY PRICE		$ 417	$/year		

DRYCAKE
Vanderbeken Enterprises Ltd.

Date	**March 23rd 2017**
Offer	**17060-E1701**
Revision	**00**

Throughput Data

2.00	m3/h
2.0%	%DSw/w
20,000	DS ppm
40.00	kg/h solids
316	kg/day solids
79,000	kg/year solids

	HIGH	LOW
Capture rate	98%	98%
Centrate TSS ppm	400	400

Solids Discharge	50%	40%
Dry Cake kg/hr	80	100
Dry Cake tons/year	158	198
Landfill $/ton	$ 120	$ 120
YEARLY DISPOSAL COST	$ 18,960	$ 23,700

Operation

8	hour/day
5	days/week
50	week/year
1,975	hour/year
3,950,000	litres/year

10	years
19,750	hours operation

Polymer consumption

low consumption	high comsumption	
8	10	kg poly/dry ton solids
0.320	0.400	kg/hour 100% active
45%	45%	% Polymer Activity
0.71	0.89	kg/hour neat emulsion polymer
5.62	7.02	kg/day
1,404	1,756	kg/year neat emulsion polymer
$ 7.00	$ 7.00	CAD Price neat polymer per kg
$ 9,831	$ 12,289	POLYMER PRICE

DRYCAKE
Vanderbeken Enterprises Ltd.

Date	March 23rd 2017
Offer	17060-E1701
Revision	00

Decanter Replacement Interval Normal Conditions

S: Suggested replacement; C: Integrity and functionality check of the part and replacement if necessary.

YEAR	3	6	9	12
hour per replacement	5,000	11,000	17,000	23,000
BEARINGS AND SEALS	S	S	S	S
JOINT FLANGE FOR HYDRAULIC PUMP	C	C	C	C
FIFTH WHEEL OF SLUDGE SCRAPER	S	S	S	S
TRANSMISSION BELTS	C	C	C	C
CYCLOIDAL GEARBOX SEALS	C	C	C	C
SCREW	C	C	C	C
BOWL	C	C	C	C
SLUDGE SCRAPER BLADE	C	C	C	C
SENSORS OPERATION	C	C	C	C
INTEGRITY OF MACHINE COMPONENTS	C	C	C	C
ELECTRIC BOARD OPERATION	C	C	C	C
INTEGRITY OF ELECTRIC BOARD COMPONENTS	C	C	C	C

DR250E Start-up Spare Parts Kit

Decanter Startup Toolbox

Items	Part #	QTY	Kit Price USD
Wrench set	-	1	Free of Charge
Weir plate puller	-	1	
Bowl and Scroll Speed Sensor	-	1	
Bearing Grease Gun (1 cartridge)	-	1	
Gearbox Grease gun (1 cartridge)	-	1	
Washing Solenoid Valve (internal wash)	-	1	
Washing Solenoid Valve (external wash)	-	1	
Intake Oil Filter	M1120023	1	
Return Oil Filter	M1120024	1	
Sludge Feed Pump Stator (w/pump purchase)		1	
Polymer Feed Pump Stator (w/pump purchase)		0	

Decanter Recommended On Hand Spare Parts

Items	Part #	QTY	Kit Price USD
Bowl Belt kit (3 belts)	M1040078	1	$ 445
Scroll Belt	M1040006	1	$ 200
Cover and Gasket Kit	C1010045	1	$ 350
	-	-	-
		KIT PRICE	$ 995

Decanter Parts and Consumables Kit (2 years)

Items	Part #	QTY	Unit Price USD
Bearing Grease Cartridge	M1170002	15	$ 510
Gearbox Gear Cartridge	M1170001	8	$ 50
			-
2 year package			$ 3,000
Bowl Bearing supply side	M1060017	1	-
Bowl Bearing gear side	M1060016	1	-
Scroll Bearing supply side	M1060014	1	-
Scroll Bearing gear side	M1060015	1	-
Scraper bearing front	M1060007	1	-
Sludge Feed Pump Stator		1	-
Polymer Feed Pump Stator		1	-
		KIT PRICE	$ 3,560

DRYCAKE
Vanderbeken Enterprises Ltd.

Date	**March 23rd 2017**
Offer	**17060-E1701**
Revision	**00**

Wash Water Consumption

Decanter Wash water

1000	L/h	Washing consumption DR250E
5	min	Shut down Time
83	L	Shutdown Water Consumption per Shutdown
83	L	Shutdown Water Consumption Daily
0.417	m3	Shutdown Water Consumption Weekly
20.8	m3	Shutdown Water Consumption Yearly

Internal and External Washing	
Quality:	Reuse Water
Pressure:	30-50PSI

Polymer Makeup Water

low consumption	**high comsumption**	
1,404	1,756	Neat Polymer Consumption per year kg
0.25%	0.25%	Dilution Ratio
0.13	0.16	m3/year Water for Polymer Makeup

Dewatering System Electric Power

Equipment	Component	kW	HP	Voltage	Amp
DR250E	Main Motor	11	15	575	19.13
DR250E	Scroll Motor	0	0.00	24	0.00
DR250E	Scraper	0.37	0.50	575	0.64
DR250E	Solenoid Valve External Wash	0.010	0.013	24	0.42
DR250E	Solenoid Valve Internal Wash	0.010	0.013	24	0.42
SFP	Sludge Feed Pump	1.5	2	575	2.61
PFP	Polymer Feed Pump	0.55	0.74	575	0.96
CONV	Conveyor	1.5	2.01	575	2.61
	Total	14.9	20		27
Average Consumed Power		9.7	Kw/h		17.4
Yearly number of operation		1,975	hours		
Electricity Price		0.1145	$/kW		
ELECTRICITY PRICE		$ 2,196	$/year		

DRYCAKE
Vanderbeken Enterprises Ltd.

Date	March 23rd 2017
Offer	17060-E1701
Revision	00

Throughput Data

2.00	m3/h
1.9%	%DSw/w
18,700	DS ppm
37.40	kg/h solids
374	kg/day solids
93,500	kg/year solids

	HIGH	LOW
Capture rate	98%	98%
Centrate TSS ppm	374	374

Solids Discharge	50%	20%
Dry Cake kg/hr	75	187
Dry Cake tons/year	187	468
Landfill $/ton	$ 120	$ 120
YEARLY DISPOSAL COST	$ 22,440	$ 56,100

Operation

10	hour/day
5	days/week
50	week/year
2,500	hour/year
5,000,000	litres/year

10	years
25,000	hours operation

Polymer consumption

low consumption	high comsumption	
8	10	kg poly/dry ton solids
0.299	0.374	kg/hour 100% active
45%	45%	% Polymer Activity
0.66	0.83	kg/hour neat emulsion polymer
6.65	8.31	kg/day
1,662	2,078	kg/year neat emulsion polymer
$ 7.00	$ 7.00	CAD Price neat polymer per kg
$ 11,636	$ 14,544	POLYMER PRICE

DRYCAKE
Vanderbeken Enterprises Ltd.

Date	March 23rd 2017
Offer	17060-E1701
Revision	00

Decanter Replacement Interval Normal Conditions

S: Suggested replacement; C: Integrity and functionality check of the part and replacement if necessary.

YEAR	2	5	7	10
hour per replacement	5,000	11,000	17,000	23,000
BEARINGS AND SEALS	S	S	S	S
JOINT FLANGE FOR HYDRAULIC PUMP	C	C	C	C
FIFTH WHEEL OF SLUDGE SCRAPER	S	S	S	S
TRANSMISSION BELTS	C	C	C	C
CYCLOIDAL GEARBOX SEALS	C	C	C	C
SCREW	C	C	C	C
BOWL	C	C	C	C
SLUDGE SCRAPER BLADE	C	C	C	C
SENSORS OPERATION	C	C	C	C
INTEGRITY OF MACHINE COMPONENTS	C	C	C	C
ELECTRIC BOARD OPERATION	C	C	C	C
INTEGRITY OF ELECTRIC BOARD COMPONENTS	C	C	C	C

DR250E Start-up Spare Parts Kit

Decanter Startup Toolbox

Items	Part #	QTY	Kit Price USD
Wrench set	-	1	Free of Charge
Weir plate puller	-	1	
Bowl and Scroll Speed Sensor	-	1	
Bearing Grease Gun (1 cartridge)	-	1	
Gearbox Grease gun (1 cartridge)	-	1	
Washing Solenoid Valve (internal wash)	-	1	
Washing Solenoid Valve (external wash)	-	1	
Intake Oil Filter	M1120023	1	
Return Oil Filter	M1120024	1	
Sludge Feed Pump Stator (w/pump purchase)		1	
Polymer Feed Pump Stator (w/pump purchase)		0	

Decanter Recommended On Hand Spare Parts

Items	Part #	QTY	Kit Price USD
Bowl Belt kit (3 belts)	M1040078	1	$ 445
Scroll Belt	M1040006	1	$ 200
Cover and Gasket Kit	C1010045	1	$ 350
	-	-	-
		KIT PRICE	$ 995

Decanter Parts and Consumables Kit (2 years)

Items	Part #	QTY	Unit Price USD
Bearing Grease Cartridge	M1170002	15	$ 510
Gearbox Gear Cartridge	M1170001	8	$ 50
			-
2 year package			$ 3,000
Bowl Bearing supply side	M1060017	1	-
Bowl Bearing gear side	M1060016	1	-
Scroll Bearing supply side	M1060014	1	-
Scroll Bearing gear side	M1060015	1	-
Scraper bearing front	M1060007	1	-
Sludge Feed Pump Stator		1	-
Polymer Feed Pump Stator		1	-
		KIT PRICE	$ 3,560

DRYCAKE
Vanderbeken Enterprises Ltd.

Date	**March 23rd 2017**
Offer	**17060-E1701**
Revision	**00**

Wash Water Consumption

Decanter Wash water

1000	L/h	Washing consumption DR250E
5	min	Shut down Time
83	L	Shutdown Water Consumption per Shutdown
83	L	Shutdown Water Consumption Daily
0.417	m3	Shutdown Water Consumption Weekly
20.8	m3	Shutdown Water Consumption Yearly

Internal and External Washing	
Quality:	Reuse Water
Pressure:	30-50PSI

Polymer Makeup Water

low consumption	**high comsumption**	
1,662	2,078	Neat Polymer Consumption per year kg
0.25%	0.25%	Dilution Ratio
0.12	0.15	m3/year Water for Polymer Makeup

Dewatering System Electric Power

Equipment	Component	kW	HP	Voltage	Amp
DR250E	Main Motor	11	15	575	19.13
DR250E	Scroll Motor	0	0.00	24	0.00
DR250E	Scraper	0.37	0.50	575	0.64
DR250E	Solenoid Valve External Wash	0.010	0.013	24	0.42
DR250E	Solenoid Valve Internal Wash	0.010	0.013	24	0.42
SFP	Sludge Feed Pump	1.5	2	575	2.61
PFP	Polymer Feed Pump	0.55	0.74	575	0.96
CONV	Conveyor	1.5	2.01	575	2.61
	Total	14.9	20		27
Average Consumed Power		9.7	Kw/h		17.4
Yearly number of operation		2,500	hours		
Electricity Price		0.1145	$/kW		
ELECTRICITY PRICE		$ 2,780	$/year		

DRYCAKE
Vanderbeken Enterprises Ltd.

Date	**March 23rd 2017**
Offer	**17060-E1701**
Revision	**00**

Throughput Data

2.00	m3/h
2.0%	%DSw/w
20,000	DS ppm
40.00	kg/h solids
380	kg/day solids
95,000	kg/year solids

	HIGH	**LOW**
Capture rate	98%	98%
Centrate TSS ppm	400	400

Solids Discharge	50%	40%
Dry Cake kg/hr	80	100
Dry Cake tons/year	190	238
Landfill $/ton	$ 120	$ 120
YEARLY DISPOSAL COST	$ 22,800	$ 28,500

Operation

9.5	hour/day
5	days/week
50	week/year
2,375	hour/year
4,750,000	litres/year

10	years
23,750	hours operation

Polymer consumption

low consumption	high comsumption	
8	10	kg poly/dry ton solids
0.320	0.400	kg/hour 100% active
45%	45%	% Polymer Activity
0.71	0.89	kg/hour neat emulsion polymer
6.76	8.44	kg/day
1,689	2,111	kg/year neat emulsion polymer
$ 7.00	$ 7.00	CAD Price neat polymer per kg
$ 11,822	$ 14,778	POLYMER PRICE

DRYCAKE
Vanderbeken Enterprises Ltd.

Date	March 23rd 2017
Offer	17060-E1701
Revision	00

Decanter Replacement Interval Normal Conditions

S: Suggested replacement; C: Integrity and functionality check of the part and replacement if necessary.

YEAR	3	5	8	10
hour per replacement	5,000	11,000	17,000	23,000
BEARINGS AND SEALS	S	S	S	S
JOINT FLANGE FOR HYDRAULIC PUMP	C	C	C	C
FIFTH WHEEL OF SLUDGE SCRAPER	S	S	S	S
TRANSMISSION BELTS	C	C	C	C
CYCLOIDAL GEARBOX SEALS	C	C	C	C
SCREW	C	C	C	C
BOWL	C	C	C	C
SLUDGE SCRAPER BLADE	C	C	C	C
SENSORS OPERATION	C	C	C	C
INTEGRITY OF MACHINE COMPONENTS	C	C	C	C
ELECTRIC BOARD OPERATION	C	C	C	C
INTEGRITY OF ELECTRIC BOARD COMPONENTS	C	C	C	C

DR250E Start-up Spare Parts Kit

Decanter Startup Toolbox

Items	Part #	QTY	Kit Price USD
Wrench set	-	1	Free of Charge
Weir plate puller	-	1	
Bowl and Scroll Speed Sensor	-	1	
Bearing Grease Gun (1 cartridge)	-	1	
Gearbox Grease gun (1 cartridge)	-	1	
Washing Solenoid Valve (internal wash)	-	1	
Washing Solenoid Valve (external wash)	-	1	
Intake Oil Filter	M1120023	1	
Return Oil Filter	M1120024	1	
Sludge Feed Pump Stator (w/pump purchase)		1	
Polymer Feed Pump Stator (w/pump purchase)		0	

Decanter Recommended On Hand Spare Parts

Items	Part #	QTY	Kit Price USD
Bowl Belt kit (3 belts)	M1040078	1	$ 445
Scroll Belt	M1040006	1	$ 200
Cover and Gasket Kit	C1010045	1	$ 350
	-	-	-
		KIT PRICE	$ 995

Decanter Parts and Consumables Kit (2 years)

Items	Part #	QTY	Unit Price USD
Bearing Grease Cartridge	M1170002	15	$ 510
Gearbox Gear Cartridge	M1170001	8	$ 50
			-
2 year package			$ 3,000
Bowl Bearing supply side	M1060017	1	-
Bowl Bearing gear side	M1060016	1	-
Scroll Bearing supply side	M1060014	1	-
Scroll Bearing gear side	M1060015	1	-
Scraper bearing front	M1060007	1	-
Sludge Feed Pump Stator		1	-
Polymer Feed Pump Stator		1	-
		KIT PRICE	$ 3,560

DRYCAKE
Vanderbeken Enterprises Ltd.

Date	**March 23rd 2017**
Offer	**17060-E1701**
Revision	**00**

Wash Water Consumption

Decanter Wash water

1000	L/h	Washing consumption DR250E
5	min	Shut down Time
83	L	Shutdown Water Consumption per Shutdown
83	L	Shutdown Water Consumption Daily
0.417	m3	Shutdown Water Consumption Weekly
20.8	m3	Shutdown Water Consumption Yearly

Internal and External Washing	
Quality:	Reuse Water
Pressure:	30-50PSI

Polymer Makeup Water

low consumption	**high comsumption**	
1,689	2,111	Neat Polymer Consumption per year kg
0.25%	0.25%	Dilution Ratio
0.13	0.16	m3/year Water for Polymer Makeup

Dewatering System Electric Power

Equipment	Component	kW	HP	Voltage	Amp
DR250E	Main Motor	11	15	575	19.13
DR250E	Scroll Motor	0	0.00	24	0.00
DR250E	Scraper	0.37	0.50	575	0.64
DR250E	Solenoid Valve External Wash	0.010	0.013	24	0.42
DR250E	Solenoid Valve Internal Wash	0.010	0.013	24	0.42
SFP	Sludge Feed Pump	1.5	2	575	2.61
PFP	Polymer Feed Pump	0.55	0.74	575	0.96
CONV	Conveyor	1.5	2.01	575	2.61
	Total	14.9	20		27
Average Consumed Power		9.7	Kw/h		17.4
Yearly number of operation		2,375	hours		
Electricity Price		0.1145	$/kW		
ELECTRICITY PRICE		$ 2,641	$/year		

DRYCAKE
Vanderbeken Enterprises Ltd.

Date	March 23rd 2017
Offer	17060-E1701
Revision	00

Throughput Data

2.00	m3/h
2.0%	%DSw/w
20,000	DS ppm
40.00	kg/h solids
372	kg/day solids
93,000	kg/year solids

	HIGH	LOW
Capture rate	98%	98%
Centrate TSS ppm	400	400

Solids Discharge	50%	40%
Dry Cake kg/hr	80	100
Dry Cake tons/year	186	233
Landfill $/ton	$ 120	$ 120
YEARLY DISPOSAL COST	$ 22,320	$ 27,900

Operation

9.3	hour/day
5	days/week
50	week/year
2,325	hour/year
4,650,000	litres/year

10	years
23,250	hours operation

Polymer consumption

low consumption	high comsumption	
8	10	kg poly/dry ton solids
0.320	0.400	kg/hour 100% active
45%	45%	% Polymer Activity
0.71	0.89	kg/hour neat emulsion polymer
6.61	8.27	kg/day
1,653	2,067	kg/year neat emulsion polymer
$ 7.00	$ 7.00	CAD Price neat polymer per kg
$ 11,573	$ 14,467	POLYMER PRICE

DRYCAKE
Vanderbeken Enterprises Ltd.

Date	March 23rd 2017
Offer	17060-E1701
Revision	00

Decanter Replacement Interval Normal Conditions

S: Suggested replacement; C: Integrity and functionality check of the part and replacement if necessary.

YEAR	3	5	8	10
hour per replacement	5,000	11,000	17,000	23,000
BEARINGS AND SEALS	S	S	S	S
JOINT FLANGE FOR HYDRAULIC PUMP	C	C	C	C
FIFTH WHEEL OF SLUDGE SCRAPER	S	S	S	S
TRANSMISSION BELTS	C	C	C	C
CYCLOIDAL GEARBOX SEALS	C	C	C	C
SCREW	C	C	C	C
BOWL	C	C	C	C
SLUDGE SCRAPER BLADE	C	C	C	C
SENSORS OPERATION	C	C	C	C
INTEGRITY OF MACHINE COMPONENTS	C	C	C	C
ELECTRIC BOARD OPERATION	C	C	C	C
INTEGRITY OF ELECTRIC BOARD COMPONENTS	C	C	C	C

DR250E Start-up Spare Parts Kit

Decanter Startup Toolbox

Items	Part #	QTY	Kit Price USD
Wrench set	-	1	Free of Charge
Weir plate puller	-	1	
Bowl and Scroll Speed Sensor	-	1	
Bearing Grease Gun (1 cartridge)	-	1	
Gearbox Grease gun (1 cartridge)	-	1	
Washing Solenoid Valve (internal wash)	-	1	
Washing Solenoid Valve (external wash)	-	1	
Intake Oil Filter	M1120023	1	
Return Oil Filter	M1120024	1	
Sludge Feed Pump Stator (w/pump purchase)		1	
Polymer Feed Pump Stator (w/pump purchase)		0	

Decanter Recommended On Hand Spare Parts

Items	Part #	QTY	Kit Price USD
Bowl Belt kit (3 belts)	M1040078	1	$ 445
Scroll Belt	M1040006	1	$ 200
Cover and Gasket Kit	C1010045	1	$ 350
	-	-	-
		KIT PRICE	$ 995

Decanter Parts and Consumables Kit (2 years)

Items	Part #	QTY	Unit Price USD
Bearing Grease Cartridge	M1170002	15	$ 510
Gearbox Gear Cartridge	M1170001	8	$ 50
			-
2 year package			$ 3,000
Bowl Bearing supply side	M1060017	1	-
Bowl Bearing gear side	M1060016	1	-
Scroll Bearing supply side	M1060014	1	-
Scroll Bearing gear side	M1060015	1	-
Scraper bearing front	M1060007	1	-
Sludge Feed Pump Stator		1	-
Polymer Feed Pump Stator		1	-
		KIT PRICE	$ 3,560

DRYCAKE
Vanderbeken Enterprises Ltd.

Date	**March 23rd 2017**
Offer	**17060-E1701**
Revision	**00**

Wash Water Consumption

Decanter Wash water

1000	L/h	Washing consumption DR250E
5	min	Shut down Time
83	L	Shutdown Water Consumption per Shutdown
83	L	Shutdown Water Consumption Daily
0.417	m3	Shutdown Water Consumption Weekly
20.8	m3	Shutdown Water Consumption Yearly

Internal and External Washing	
Quality:	Reuse Water
Pressure:	30-50PSI

Polymer Makeup Water

low consumption	**high comsumption**	
1,653	2,067	Neat Polymer Consumption per year kg
0.25%	0.25%	Dilution Ratio
0.13	0.16	m3/year Water for Polymer Makeup

Dewatering System Electric Power

Equipment	Component	kW	HP	Voltage	Amp
DR250E	Main Motor	11	15	575	19.13
DR250E	Scroll Motor	0	0.00	24	0.00
DR250E	Scraper	0.37	0.50	575	0.64
DR250E	Solenoid Valve External Wash	0.010	0.013	24	0.42
DR250E	Solenoid Valve Internal Wash	0.010	0.013	24	0.42
SFP	Sludge Feed Pump	1.5	2	575	2.61
PFP	Polymer Feed Pump	0.55	0.74	575	0.96
CONV	Conveyor	1.5	2.01	575	2.61
	Total	14.9	20		27
Average Consumed Power		9.7	Kw/h		17.4
Yearly number of operation		2,325	hours		
Electricity Price		0.1145	$/kW		
ELECTRICITY PRICE		$ 2,585	$/year		

Appendix I – Community Resolutions

CITY AND BOROUGH OF WRANGELL, ALASKA

RESOLUTION NO. 08-14-1299

A RESOLUTION OF THE ASSEMBLY OF THE CITY AND BOROUGH OF WRANGELL, ALASKA, TO ACCEPT A LOAN IN THE AMOUNT OF UP TO $542,249 FROM THE STATE OF ALASKA, DEPARTMENT OF ENVIRONMENTAL CONSERVATION

WHEREAS, the City and Borough of Wrangell has determined that several of Wrangell's water mains are corroding and starting to fail; and

WHEREAS, the costs to maintain sections of the water mains continue to escalate, and replacement of these corroding mains would result in lower operating and maintenance costs; and

WHEREAS, the City and Borough of Wrangell seeks to obtain the necessary financial assistance to replace water mains and make water system improvements; and

WHEREAS, the State of Alaska, Department of Environmental Conservation is able to offer loan funding through the Alaska Drinking Water Fund; and

WHEREAS, the City and Borough of Wrangell applied for and received priority funding in the State's FY15 Intended Use Plan to apply for loan term that would be 20 years at 1.5% interest; and

WHEREAS, the City and Borough of Wrangell is authorized under WMC Chapter 6.3 to borrow money when authorized by the Assembly for use by a utility or enterprise of the borough and that repayment of the loan including interest comes exclusively from said utility.

NOW, THEREFORE, BE IT RESOLVED BY THE ASSEMBLY OF THE CITY AND BOROUGH OF WRANGELL, ALASKA:

The Assembly hereby authorizes and directs the Borough Manager to make, accept, and execute a loan agreement up to $542,249 for funding in the form of a loan through the State of Alaska Department of Environmental Conservation Drinking Water Fund for the replacement of water mains and water system improvements.

ADOPTED: August 26, 2014

David Jack, Mayor

ATTEST: Kim Lane

Kim Lane, Borough Clerk

City & Borough of Wrangell
Incorporated Borough May 30, 2008
Incorporated City June 15, 1903
Alaska

CITY AND BOROUGH OF WRANGELL, ALASKA

RESOLUTION NO. 01-17-1359

A RESOLUTION OF THE ASSEMBLY OF THE CITY AND BOROUGH OF WRANGELL, ALASKA, TO ACCEPT A LOAN IN THE AMOUNT OF UP TO $322,650 FROM THE STATE OF ALASKA, DEPARTMENT OF ENVIRONMENTAL CONSERVATION

WHEREAS, the City and Borough of Wrangell has determined that the last of Wrangell's two original ozone generators is failing and is at the end of its useful life; and

WHEREAS, the current equipment is obsolete, costs to keep the generator operating continue to escalate, parts are no longer available and replacement of the generator would result in lower operating and maintenance costs; and

WHEREAS, the City and Borough of Wrangell seeks to obtain the necessary financial assistance to replace the obsolete ozone generator; and

WHEREAS, the State of Alaska, Department of Environmental Conservation is able to offer loan funding through the Alaska Drinking Water Fund Program; and

WHEREAS, the City and Borough of Wrangell applied for and received priority funding in the State's FY 2016 Intended Use Plan; and the term of the loan would be twenty years at 1.5 percent interest; and

WHEREAS, the City and Borough of Wrangell is authorized under Wrangell Charter 6-3 to borrow money when authorized by the assembly for use by a utility or enterprise of the borough and that repayment of the loan including interest comes exclusively from the said utility.

NOW, THEREFORE, BE IT RESOLVED BY THE ASSEMBLY OF THE CITY AND BOROUGH OF WRANGELL, ALASKA:

The Assembly hereby authorizes and directs the Borough Manager to make, accept and execute a loan agreement up to $322,650 for funding in the form of a loan through the State of Alaska Department of Environmental Conservation Clean Water Fund Wastewater Loan Program for the purpose of acquiring and installing a new ozone generator at the water treatment plant.

ADOPTED: January 24, 2017

David Jack, Mayor

ATTEST: Kim Lane, Borough Clerk

City & Borough of Wrangell
Incorporated Borough May 30, 2008
Incorporated City June 15, 1903
Alaska

Appendix J – Short Lived Assets

SHORT LIVED ASSET SCHEDULE, LISTING & REPLACEMENT COST

CITY OF WRANGELL, ALASKA **7-Jul-15**

FIVE YEAR REPLACEMENT ASSETS

Equipment	Unit	Quantity	Unit Cost	Total Cost
- Mechanical Blowers	each	3	$3,000	$9,000
- Gen-Eye Camera System	each	1	$15,200.00	$15,200
- Lift Station Submersible 7.6HP Pumps Start Kits	each	20	$550	$11,000
- SCADA Radios	each	5	$1,200	$6,000
Management				
- Computers & Software	each	1	$4,000	$4,000
- Copier/Printer	each	1	$1,000	$1,000
Total five year replacement budget				**$46,200**
Annual contribution				**$9,240**

TEN YEAR REPLACEMENT ASSETS

Equipment	Unit	Quantity	Unit Cost	Total Cost
- Building Interior Painting	ft2	2500	$2.50	$6,250
- Building Heater	each	1	$8,000.00	$8,000
- Crane on Pick-Up Truck	each	1	$6,200.00	$6,200
- Weather Tight Sampler	each	2	$6,500.00	$13,000
- CAT Excavator	each	1	$46,800.00	$46,800
- Sewer Dept. Utility Service Truck	each	1	$60,000	$60,000
- Sewer Dept. Truck	each	1	$32,000	$32,000
- Lift Station Submersible Pumps, 7.6 HP	each	10	$6,000	$60,000
- Duplex Grinder Pumps, 2 HP, Explosion Proof	each	2	$24,000	$48,000
- Simplex Grinder Pumps, 2HP	each	23	$2,100	$48,300
Total ten year replacement budget				**$328,550**
Annual contribution				**$32,855**

FIFTEEN YEAR REPLACEMENT ASSETS

Equipment	Unit	Quantity	Unit Cost	Total Cost
- Lift Stations' Pumps, 2 HP	each	2	$2,000	$4,000
- Lift Stations' Pumps, 3.5 HP	each	4	$2,500	$10,000
- Lift Stations' Pumps, 5 HP	each	6	$3,500	$21,000
- Lift Stations' Pumps, 25 HP	each	2	$6,500	$13,000
- 16' Mechanical Screen	each	1	$10,000	$10,000
Total fifteen year replacement budget				**$58,000**
Annual contribution				**$3,867**

TOTAL ANNUAL CONTRIBUTION, 5, 10 & 15 Yr Needs **$45,962**

SHORT LIVED ASSET SCHEDULE, LISTING & REPLACEMENT COST

CITY OF WRANGELL, ALASKA
WATER SYSTEM
FIVE YEAR REPLACEMENT ASSETS

Equipment				
Copier/Printer	each	1	$450	$450
Total five year replacement budget				**$450**
Annual contribution				**$90**

TEN YEAR REPLACEMENT ASSETS

Equipment	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Chlorine Cell	each	3	$12,000	$36,000
Transformer	each	1	$2,500	$2,500
Water Softening System	each	1	$500	$500
Valve repair parts	each	1	$250	$250
Flow Meter	each	1	$5,000	$5,000
Clearwell Pump Contactor	each	1	$1,500	$1,500
Turbidimeter	each	1	$2,900	$2,900
Computers and Software	each	2	$1,500	$3,000
Chemical Systems	ls	1	$10,000	$10,000
Backwash Pump	each	1	$8,000	$8,000
Air Scour Blower	each	1	$10,000	$10,000
Booster Pumps	each	2	$10,000	$20,000
Total ten year replacement budget				**$63,650**
Annual contribution				**$6,365**

FIFTEEN YEAR REPLACEMENT ASSETS

Equipment	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Water Dept. Utility Service Truck	each	1	$60,000	$60,000
Water Dept. Truck	each	1	$30,000	$30,000
Laboratory Equipment	ls	1	$10,000	$10,000
Total fifteen year replacement budget				**$100,000**
Annual contribution				**$6,667**

TOTAL ANNUAL CONTRIBUTION, 5, 10 & 15 Yr Needs	**$13,122**

City and Borough of Wrangell
Water Treatment Plant Upgrades Project
USDA Environmental Report

Prepared for:
City and Borough of Wrangell

Prepared by:
Solstice Alaska Consulting, Inc.
2607 Fairbanks St., Suite B
Anchorage, AK 99503

March 2017

Table of Contents

List of Attachments

1.0 Purpose and Need

1.1 Project Description

USDA, Rural Development is a mission area that includes three federal agencies – Rural Business-Cooperative Service, Rural Housing Service, and Rural Utilities Service. The agencies have in excess of 50 programs that provide financial assistance and a variety of technical and educational assistance to eligible rural and tribal populations, eligible communities, individuals, cooperatives, and other entities with a goal of improving the quality of life, sustainability, infrastructure, economic opportunity, development, and security in rural America. Financial assistance can include direct loans, guaranteed loans, and grants in order to accomplish program objectives.

The City and Borough of Wrangell (CBW) is seeking U.S. Department of Agriculture (USDA) Rural Development Program funding to upgrade Wrangell's water treatment plant (WTP) in order to increase capacity and improve treatment for a design life of 20 years. Wrangell is located on Wrangell Island, approximately 200 miles south of Juneau and 100 miles northwest of Ketchikan. The WTP is located about 1 mile south of downtown Wrangell (Copper River Meridian; Township 62; Range 84; Section 31; Exhibit A Figure 1).

Currently, raw (untreated) water from two mountain lake reservoirs is routed to the existing WTP via an intake at the lower reservoir and 1,500 linear feet of 12-inch diameter pipeline (Exhibit A Figure 2). The existing WTP, comprised of the roughing filters building, control building, and slow sand filter building, treats raw water through the following process:

1) pH is adjusted through the injection of sodium hydroxide.
2) Ozone is injected to initiate oxidation.
3) Suspended solids are reduced by passing the water through roughing filters.
4) Particulates are removed and dissolved solids are biologically treated by conveying the water through slow sand filters.
5) Chlorine is added to disinfect the water and provide residual disinfection so that the water stays potable throughout the distribution system.
6) Water is collected in a central clearwell, which acts as a temporary storage tank.
7) After being treated, clean drinking water is pumped from the WTP to two water storage tanks with a capacity of 850,000-gallons via a 12-inch diameter pipeline.
8) Water is provided to the public through the existing distribution system.
9) A separate pipeline connects water from the storage tanks directly to clean out the roughing filter. The "backwash" water flows downward through the roughing filters and to a drainage sump that discharges to an outside ditch.

The CBW is proposing to upgrade the WTP by replacing the existing slow-sand filtration system with a dissolved air flotation (DAF) and multimedia filtration system (Exhibit A Figure 3). The new DAF system would include the following processes:

1) pH would be adjusted using soda ash.
1) A pre-filtering process would occur using DAF—a process that uses minute air bubbles to suspend and facilitate the removal of low-density solids.
2) Contaminants would be removed using multimedia filtration.
3) Chlorine would be added to disinfect the water and provide residual disinfection so that the water stays potable throughout the distribution system.
4) Water would be stored in new clearwells.
5) Filter backwash waste water from cleaning out the multimedia filtration filters would be treated through a clarifying tank and secondary dewatering and recycled through the WTP.
6) Sludge from the backwash would be hauled to the barge dock and transported via barge to a landfill in Washington for final disposal.

The upgrades would require the following changes to the existing WTP facility.

Roughing Filter Building Expansion/Conversion to Treatment Building

The roughing filter building would be expanded to approximately 44 feet by 104 feet and converted to house two parallel DAF plants which would integrate both DAF and multimedia filtration. Chemical feed tanks and associated pumps and control systems would also be located in the treatment building.

The building would be within the existing site, and no additional land acquisition will be required. Approximately 1,600 square feet (40 feet by 40 feet) will need to be cleared and drilling and blasting of approximately 1,400 cubic yards of bedrock south of the site would likely be required to accommodate the expansion.

Slow Sand Filter Building Conversion

The existing slow sand filters would be converted into clearwells to provide CBW with additional water storage. All building materials removed during the building renovation would be disposed of properly. No ground disturbing activities outside the existing building pad would occur.

Other Upgrades Installation

A standby electric generator and an aboveground bulk fuel tank would be installed. The bulk fuel tank would provide for any building or process heating needs (as well as powering the emergency generator). The generator would provide emergency power during a power outage.

Backwash Waste Disposal System Installation
An insulated above-ground 30,000 bolted steel clarifier tank (20-foot diameter) would be installed adjacent to treatment building. Backwash waste water from the WTP would be piped to the tank where polymer would be injected into the backwash waste water to improve settling of solids. Supernatant from the clarifier would be routed to the water treatment process upstream of the filters and raw water chemical injection. The backwash water would be recycled at the WTP by blending with influent raw water before undergoing treatment. The sludge would be transferred to bins or shipping containers and transported to a landfill in Washington for final disposal.

1.2 Purpose and Need of the Proposal

The purpose of this project is to upgrade the existing WTP in order to provide an adequate amount of treated water to the community of Wrangell's residents, medical facilities, and seafood processing plants and the ability to respond to local fires for next 20 years.

The WTP upgrades are needed because the current water treatment process does not provide sufficient treatment capacity to meet distribution system demands. In July 2016, the CBW passed a Disaster Declaration with a Request for State Assistance because of inadequacy of the filtration system to provide sufficient flow to meet the community water consumption. At that time, the CBW asked the public to ration their water use by 30 to 50 percent. With this project, the CBW will be able to provide clean, treated water to a growing population and industry demand for a 20-year design life.

2.0 Alternatives Evaluated Including Proposed Action

2.1 Proposed Action

Under the Proposed Action (Alternative 4—DAF with Multimedia Filtration and Backwash Waste Disposal Alternative D), the existing roughing filter building would be expanded to house two parallel DAF plants installed downstream of the pH adjustment system (Exhibit A Figure 3). The two package plants would integrate DAF and multimedia filtration. Alum would be used as the coagulant and rapid-mixed with the raw water. Under this alternative, a lower dosage of alum would be used due to the efficiencies of DAF. This alternative would include reusing the existing disinfection system and converting the existing slow sand filters to a serpentine clearwell for storing treated water. A backwash clarifying tank and sludge storage area and secondary dewatering system would be installed onsite to treat backwash wastewater.
This water treatment alternative is the Proposed Action because it has the lowest life cycle cost and the highest treatment efficiency. This alternative provides good organics removal and excellent color removal. In addition, it is a robust process that can accommodate significant variability in raw water quality without substantial adjustments in the treatment process.

The Proposed Action includes recycling backwash water through the water treatment system. The water removed during dewatering would also be piped back to the WTP. The dewatered backwash sludge would be transported to landfill in Washington for disposal. This backwash waste disposal alternative was selected as the Proposed Action because it had the lowest life cycle cost compared to other alternatives. This alternative was also selected because it uses the existing WWTP to treat the backwash wastewater, making it more sustainable than other alternatives.

2.2 Other Alternatives

A number of initial water treatment alternatives and backwash waste disposal alternatives were considered for this project but were eliminated from further detailed review, as explained below.

2.2.1 Alternative 1 – Improvements Made to the Existing Water Treatment Process

Under this alternative, the existing slow sand filter treatment process would be upgraded; therefore, improvements would be made to all of the existing components: pH adjustment, ozonation, roughing filtration, and slow sand filtration (Exhibit A Figure 4). The disinfection process, which works well currently, would not be upgraded. A backwash clarifying tank (20-foot diameter) and sludge storage area and secondary dewatering system would be installed for backwash water disposal.

This alternative was dismissed from further consideration because it had high capital costs, would have continued issues with a lack of water storage during the summer, and because it had the potential for continued difficulties with post-treatment high chlorine demands and disinfection by-products, since slow sand filtration has limited organic removal capabilities.

2.2.2 Alternative 2 – MIEX Process with Multimedia Filtration

This alternative would have a MIEX (a proprietary ion exchange process) system installed downstream of the pH adjustment system, using soda ash to increase the raw water's alkalinity (instead of caustic soda). The ozonation system would not be used under this alternative. Alum, rapid-mixed with the raw water, would be used as the coagulant. The use of MIEX would allow a lower dosage of alum to be optimized more for turbidity removal and less for organics removal. Under this alternative, the roughing filter building would be demolished, and a new treatment building would be constructed to house a conventional filtration system comprised of three parallel flocculation/sedimentation/filtration trains with a redundant fourth filter for backwashing purposes (Exhibit A Figure 5). The existing disinfection system would be reused, and the existing slow sand filters would be converted to a serpentine clearwell for storing disinfected water after filtration. A backwash clarifying tank and sludge storage area and secondary dewatering system would be installed for backwash water disposal.

This alternative was dismissed from further consideration because it had the higher annual operation and maintenance (O&M) cost than other alternatives due to chemical and MIEX resin replacement needs. In addition, without substantial amounts of coagulant, Alternative 2 would not remove color as well as other alternatives.

2.2.3 Alternative 3 – Ozonation with MIEX and Biological Filtration

This alternative, a variation of Alternate 2, assumes that a MIEX would be installed between the pH adjustment and the ozone systems. Alum is would be used as the coagulant and rapid-mixed with the raw water. The use of MIEX and ozonation would allow a lower dosage of alum to be optimized more for turbidity removal and less for organics removal. Under this alternative, the roughing filter building would be demolished, and a new treatment building would be constructed to house biological filters in a similar configuration as for Alternative 2 (Exhibit A Figure 6). The existing disinfection system would be reused, and the existing slow sand filters would be converted to a serpentine clearwell for storing disinfected water after filtration. A backwash clarifying tank and sludge storage area and secondary dewatering system would be installed for backwash water disposal.

Alternative 3 was dismissed from further consideration because its annual O&M costs would be very high due to considerable power needs for ozone and high costs of chemical and MIEX resin replacements. This alternative would be more complex than other conventional filtration processes, which would require a higher WTP operator certification (Level IV). In addition, the MIEX process would not accommodate major variabilities in raw water characteristics and could lead to variable finished water quality.

2.2.4 Alternative 5 – Nanofiltration and Multimedia Filtration

Under this alternative, a new treatment building would house a nanofiltration system installed downstream of multimedia filtration. A pH adjustment system using soda ash and potassium permanganate oxidations step would precede the filtration process. The soda ash would provide sufficient alkalinity for the coagulation process, which would employ alum. The existing disinfection system would be reused, and the existing slow sand filters would be converted to a serpentine clearwell for storing disinfected water after filtration (Exhibit A Figure 7). A second pH adjustment step featuring soda ash would be downstream of the clearwell for increasing alkalinity in the water of the distribution system. A backwash clarifying tank and sludge storage area and secondary dewatering system would be installed for backwash water disposal.

This alternative was dismissed from further consideration because it had the highest annual O&M costs and lowest sustainability of any alternative due to chemicals and filter membrane replacement needs. In addition, it was the most complex of the alternatives and required higher WTP operator certification (Level IV)

2.2.5 Backwash Waste Disposal Alternative A1 – Extend Sewer Service from WWTP (Buried Pipeline)

This alternative would include construction of a gravity sewer pipeline to transport backwash water from secondary dewatering area to the wastewater treatment plant (WWTP). The new 1,300 linear feet 20-inch outside diameter (approximately) insulated pipeline would be constructed below ground (Exhibit A Figure 8). Construction of the sewer line would require clearing a 30 feet wide corridor or 39,000 square feet (0.93 acres) through forested areas. In addition, some blasting at the road crossing could be required in order to place the pipeline. The gravity sewer main would connect to the WWTP where clarified backwash wastewater would be treated.

After much analysis, this alternative was dismissed from further consideration because it had a higher capital cost (about $800,000 higher than the proposed action) and annual O&M costs (about $800 higher than proposed action) and would require forest clearing and blasting along the pipeline route and construction could be difficult due to the steep terrain between the WTP and the WWTP.

2.2.6 Backwash Waste Disposal Alternative A2 – Extend Sewer Service from WWTP (Above Ground Pipeline)

Under this alternative, an aboveground gravity sewer pipeline would be installed to transport backwash water from the new treatment building to the WWTP where clarified backwash wastewater would be treated (Exhibit A Figure 8). The pipeline would be supported by timber sleepers and secured with duckbill or drilled epoxy anchors (depending on depth of bedrock). The pipeline would be insulated and have electric heat trace to provide freeze protection.

This alternative was dismissed from further consideration because it had a higher capital cost (about $700,000 higher than the proposed action); had higher annual O&M costs (about $3,100 higher than proposed action); would require heat trace and insulation to maintain the pipeline during the winter; would require forest clearing along the pipeline route; and because construction could be difficult due to the steep terrain between the WTP and the WWTP.

2.2.7 Backwash Waste Disposal Alternative B – Wood Street Sewer Extension

Under this alternative, sewer service would be extended from the Zimovia Highway, along Wood Street to the water treatment plant. This alternative would require construction of an above ground clarifier tank and approximately 3,100 linear feet of gravity sewer main. The pipeline alignment would be routed inside the existing road corridor (Exhibit A Figure 8).

This alternative was dismissed from further consideration because it had higher capital costs (about $1.5 million higher than the proposed action) and annual O&M costs (about $1,900 higher than proposed action).

2.2.8 Backwash Waste Disposal Alternative C – Marine Outfall

Under this alternative, backwash waste from the WTP would be piped to an above-ground clarifier tank. The clarifier would allow solids to settle between backwash cycles. Supernatant from the clarifier would then be routed through a 2,000 linear foot gravity sewer main for discharge at a marine outfall (Exhibit A Figure 9).

This alternative was dismissed from further consideration because it had much higher capital costs (about $1 million higher) and annual O&M costs (about $1,000 higher) than the proposed action.

2.3 No Action Alternative

As required by guidance, the No Action Alternative was considered for this project. Under this alternative CBW would make no improvements to the WTP, and the facility would continue to operate in its current condition. There would not be sufficient water treatment capacity to meet existing distribution system demands, and the No Action Alternative would likely result in future Disaster Declarations and public water rationing due to the inadequacy of the filtration system to provide sufficient flow to meet community water consumption. Future population growth and increased commercial water usage would not be accommodated.

The No Action Alternative was dismissed from further consideration because it would result in health and safety issues and would limit economic development and because it does not meet Wrangell's need for long term, reliable, safe water treatment facilities.

3.0 Affected Environment/Environmental Consequences

A summary of affected environments, environmental consequences, and any necessary mitigation activities are provided below.

3.1 Land Use

3.1.1 Affected Environment

General Land Use

The proposed project falls within CBW boundaries. The CBW is located on the northwest tip of Wrangell Island, 155 miles south of Juneau and 89 miles northwest of Ketchikan. It is near the mouth of the Stikine River, a historic trade route to the Canadian Interior (ADCCED 2016a). The existing WTP is located approximately one mile south of downtown Wrangell.

The project would involve approximately 1 acre of impacts to previously disturbed land adjacent to the WTP, undisturbed forested land, and previously disturbed land adjacent to an existing rock quarry and the WWTP. The land is flat near the WTP and sloped between the WTP and the WWTP. According to the CBW Comprehensive Plan, the project would be located on land owned by the CBW and zoned light industrial/industrial. Most of the land adjacent to the proposed project area is owned by the CBW and is zoned light industrial/industrial. A portion of the project area is bounded by quarry, which is zoned industrial. The northern area of the quarry is privately owned, and the southern area is owned by the CBW (CBW 2010).

Important Farmland

There are no prime farmlands in Alaska since soil temperatures do not meet the threshold established by Congress, and no unique farmlands have been designated in Alaska (NRCS 2014).

Formally Classified Lands

The project would not be located within formally-classified lands, including refuges, parks, or lands administered by the U.S. Government. The Tongass National Forest, managed by the U.S. Forest Service (USFS), is located about 0.5 miles from the proposed project and includes most of Wrangell Island (USFS 2016).

3.1.2 Environmental Consequences and Mitigation

General Land Use

There are no anticipated adverse impacts from this project on general land use or zoning. The WTP expansion and backwash water recycling are compatible land uses since they would be directly adjacent to the existing WTP and within industrial-zoned lands.

Important Farmland

No unique farmlands have been designated in Alaska.

Formally Classified Lands

There are no anticipated impacts to formally-classified lands, since the project will take place on CBW-owned land.

3.2 Floodplains

3.2.1 Affected Environment

The project would not be located in a 100- or 500-year floodplain because the proposed project areas are outside of the Flood Insurance Rate Map (FIRM) established by the Federal Emergency Management Agency (FEMA 1982). The WTP is above 200 feet above sea level, and the WWTP is about 90 feet above sea level and under no risk of marine flooding.

3.2.2 Environmental Consequences and Mitigation

There would be no negative impacts to floodplains as a result of this project. The project area is located outside of the FIRM, and the project area is not within a coastal flooding or erosion area.

3.3 Wetlands

3.3.1 Affected Environment

The U.S. Army Corps of Engineers (USACE) found that the project area does not contain waters of the United States, including wetlands, under their jurisdiction. The USACE's finding letter is included in Exhibit B.

3.3.2 Environmental Consequences and Mitigation

Since there are no wetlands on the site, no wetlands impacts would be expected by the proposed project.

3.4 Water Resources

3.4.1 Affected Environment

CBW's drinking water comes from a surface water source is comprised of two mountain lakes—an upper and a lower reservoir. These lakes are located east of and above the WTP, the lower reservoir is about a quarter mile away, via gravel road. The upper reservoir is located about a half mile from the lower reservoir, and is fed by a forested watershed formed by an elevated valley between two mountain peaks. The upper reservoir is dammed and, through a submerged intake, flows into a small creek that feeds the lower reservoir (CRW 2016).

No other freshwater bodies are near with the project area. There are no wild or scenic rivers near the project area. The Stikine River was recommended for designation as wild and scenic but was not designated later (USFS 2007).

Wrangell has a public wastewater treatment system that includes a Class 1 aerated lagoon treatment system and a class 2 collection system. After treatment, wastewater is discharged to Zimovia Strait. Wastewater discharge from the WWTP is permitted under Alaska Department of Environmental Conservation (ADEC) General Permit No. 2003-DB0096.

There are no impaired waterbodies near the community Wrangell (ADEC 2010).

3.4.2 Environmental Consequences and Mitigation

Over the 20-year design life of the proposed project, the raw water taken from the reservoirs would increase from about 850,000 gallons per day to about 1 million gallons per day. Most of the demand would be during a short time in the summer when seafood processing plants are operating and cruise ships are docked in the community. According to CBW staff, the reservoirs have continuously supplied water to the community with no drought-related interruptions. Therefore, the reservoirs are anticipated to continue to provide sufficient water for the anticipated increase in water use for the 20-year design life of the WTP upgrades.

Since the backwash water would be recycled through the WTP and the sludge would be disposed of at the permitted landfill no impacts to marine or freshwater are expected. There are no anticipated water degradation issues from temporary construction activities. Activities will be conducted away and downhill from freshwater bodies, and no waterbody would be crossed.

A SWPPP would be developed for the project area to manage the materials, equipment, and runoff, including construction impacts, because the project would disturb more than one acre. The CBW and/or contractor will implement BMPs for erosion and sediment control and will maintain a spill clean-up kit on site at all times.

3.5 Coastal Resources

3.5.1 Affected Environment

The project is not within the boundaries of a coastal zone management area because the Alaska Coastal Management Program sunset on July 1, 2011 per Alaska Statute 44.66.030.

3.5.2 Environmental Consequences and Mitigation

No adverse environmental consequences have been projected. This project will not be located within coastal zone management land, and no mitigation efforts would be necessary.

3.6 Biological Resources

3.6.1 Affected Environment

General Fish, Wildlife, and Vegetation Resources

No anadromous fish streams intersect with the project area. The nearest anadromous fish streams are Playground Creek (AWC Code: 108-40-10282) and an unnamed creek (AWC Code: 108-40-10278) located 0.3 miles southwest and 1.9 miles north west of the project, respectively (ADFG 2015).

The community of Wrangell is surrounded by the Tongass National Forest, a coastal temperate rain forest comprised of thick stands of Sitka spruce, yellow-cedar, red cedar, and western and mountain hemlock. The project area includes dense forest with Sitka spruce and mountain hemlock. There is considerable deadfall in the area which supports various mosses and lichen species. Deciduous trees and shrubs, including alders and devil's club, are found in areas where light penetrates the forest cover. Some of the project area is previously cleared and is unvegetated.

Common wildlife in the area includes Sitka black-tailed deer, black bear, coastal brown (grizzly) bear, moose, fox, and porcupine are common throughout the forest (ADF&G 2016; USFS 2016). Marine mammals, including sea otters, seals, sea lions, porpoises and whales, are abundant in adjacent Zimovia Strait (USFS 2016).

ESA-Listed Threatened and Endangered Species

According to the USFWS Information for Planning and Conservation (IPaC) website, the proposed project would not impact any endangered species, and there is no designated critical habitat of any Endangered Species Act (ESA)-listed species under the jurisdiction of the USFWS within the project area (USFWS 2016; Exhibit C). According to the National Marine Fisheries Service's Marine Mammal Species Range and Critical Habitat Mapper, endangered Steller sea lion (western distinct population segment [DPS]) and the endangered humpback whale (Western North Pacific DPS) are found in the ocean near the project area (NMFS 2016).

Migratory Bird Treaty Act

A report generated through the USFWS' IPaC website indicated that nine migratory birds could be located within the project area (USFWS 2016). The species, which are birds of conservation concern with the highest priority for conservation, include Black Oystercatcher, Fox Sparrow, Lesser Yellowlegs, Marbled Murrelet, Pelagic Cormorant, Pink-footed Shearwater, Rufous Hummingbird, and Short-eared Owl.

Invasive Species

A total of 58 non-native species were documented in 2006, and 46 non-native species were documented in 2010 on Wrangell Island. Of these, five are classified as high priority invasive plant species by the Tongass National Forest: reed canarygrass, orange hawkweed, oxeye daisy, meadow hawkweed, and common hawkweed. Several high priority invasive plants are within the city limits of Wrangell but not found in the rest on the National Forest, including the common tansy, tansy ragwort, Japanese knotweed, bull thistle, Canada thistle, and yellow sweetclover (de Montigny 2016).

3.6.2 Environmental Consequences and Mitigation

General Fish, Wildlife, and Vegetation Resources

Fish and anadromous fish streams would be avoided and not be impacted by the project. Further, minimal impacts to wildlife would be expected because wildlife habitat is not limited on Wrangell Island and animals would be expected to move away from the construction area.

Although improvements and expansion of the WTP would occur on previously disturbed land and on an existing pad, about 600 square feet would be cleared and about 400 cubic yards of material would be blasted for the expanded building, backwash clarifier tank, and shipping container area.

Threatened and Endangered Species

Marine areas will be avoided; the WTP improvements would be located approximately 0.3 miles from the coastline. Because all ESA-listed species inhabit the marine environment, and the project will not be located in a marine area, no ESA-listed species nor habitat would be impacted.

Migratory Bird Treaty Act

Where migratory bird habitat is impacted, birds would likely find other areas to nest, since undisturbed open space is not limited. To avoid impacts to migratory birds and comply with the Migratory Bird Treaty Act, no vegetation clearing would occur between April 15-July 15, as recommended by USFWS for forests and woodlands in Southeast Alaska (USFWS 2007).

Invasive Species

According to the USFS (de Montigny 2016), invasive species could be transported onto National Forest System by humans or vehicles travelling from the community of Wrangell to forest lands and could have direct or indirect impacts on native habitats.

To minimize the risk of introducing or spreading invasive species, the project will comply with all federal, state, and local laws, including Executive Order 13112, by ensuring that ground disturbing activities are minimized, and disturbed areas are re-vegetated with native species in accordance with the Alaska Department of Natural Resources re-vegetation manual.

3.7 Historic and Cultural Properties

3.7.1 Affected Environment

Wrangell is one of the oldest non-Native settlements in Alaska. In 1811, the Russians began fur trading with area Tlingits and built a stockade named Redoubt St. Dionysius in 1834. In the late 1800's the community served as an outpost for gold prospectors. The city was incorporated in 1903. In the early 1900's fishing and forest products were the primary industries. Recently, tourism and growth in the seafood processing and marine services industries have become important economic activities (ADCCED 2016a).

A cultural resources literature review was completed on October 17, 2016 by Cultural Resource Consultants, LLC (CRC 2016; Exhibit D). According to CRC's literature review preliminary findings, there are no known sites within the project limits listed in the Alaska Heritage Resource Survey (AHRS). West of the general project area, the closest known sites are a reported petroglyph (PET-00033), the Redmen's Cemetery and Native Cemetery (PET-00099), Eli Urho Kanerva Boat Shed and Warehouse (PET-00330), and Fremin Midden (PET-00483). To the east are two Wrangell water supply dams—PET-00571 and PET-00572.

Among other criteria, Appendix D of the 2010 programmatic agreement[1] between the USDA USFS, Advisory Council on Historic Preservation, and Alaska State Historic Preservation Officer defines areas of high archaeological sensitivity as "all land between mean lower low water and 100 ft. of elevation above mean high water, with no consideration of slope;" "lake and stream systems containing, or known to have contained, anadromous fish runs; including a focus on barrier falls locations in such systems;" and "elevated/fossil marine, river, and lake terrace systems." The project area is generally above the 100-ft contour, is not near the mouth of any creeks, and the topography of the area is too steep to be considered a marine terrace.

According to CRC, the location does not appear to have been archaeologically surveyed; however, because the proposed project is in an area where there is low probability for undiscovered historic and archaeological sites, CRC did not recommend an archaeological field survey (CRC 2016).

3.7.2 Environmental Consequences and Mitigation

No historic properties would be disturbed by the proposed Water Treatment Upgrades Project because there are no reported historic or cultural sites within the APE, and the probability that there are historic properties within the APE is low. On December 15, 2016, the State Historic Preservation Officer (SHPO) concurred with the finding that no historic properties would be affected by the project (Exhibit D). If historic resources are discovered during construction, all work will halt, and the SHPO will be contacted immediately.

[1]*Third Amended Programmatic Agreement Among the USDA Forest Service, Alaska Region, the Advisory Council on Historic Preservation, and the Alaska State Historic Preservation Officer Regarding Heritage Resource Management on National Forests in the State of Alaska.*

3.8 Aesthetics

3.8.1 Affected Environment
The nearest development (residential) and a visually-sensitive area (city park) are located approximately 0.15 and 0.21 mile from the proposed project area, respectively.

3.8.2 Environmental Consequences and Mitigation
Topography of the area would provide a natural barrier to block the WTP expansion from view of the residential development and the city park.

3.9. Air Quality

3.9.1 Affected Environment
This project is neither located in nor adjacent to a nonattainment or maintenance area (USEPA 2016). The community of Wrangell is also not within the Dust Complaint in Rural Alaska area (ADEC 2016b).

3.9.2 Environmental Consequences and Mitigation
The WTP improvements would not likely to result in any permanent air quality impacts, as it will not result in additional air emissions. Some air emissions would be the result of construction equipment; however, these would be minor and temporary in nature. Further, most disturbed areas will be permanently stabilized after project completion to keep dust from becoming an air quality issue.

3.10 Socio-Economic Impact Assessment/Environmental Justice

3.10.1 Affected Environment

Environmental Justice
The project is in compliance with Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations, issued in 1994. The ethnicity and poverty status in the Wrangell was compared to data for the State of Alaska Census Area population to determine if minority or low-income communities exist in the area that could be disproportionately affected by the proposed actions.

The demographics of the Wrangell are generally reflective of the wealth distribution and ethnic diversity of the State of Alaska. Approximately 40.5% of the total population of the State of Alaska is a minority (non-white). Most community members identify as Biracial, Alaska Native, and White. The Wrangell community has a racial makeup similar to its census area, with minorities making up 31.6% of the total population. Wrangell has a slightly higher percentage of low-income residents than the State of Alaska census area. Approximately 10.3% of the State of Alaska Census Area population lives below the poverty level while 11.9% of the Wrangell population lives below the poverty level (U.S. Census Bureau 2013).

Socio-Economic Issues

Wrangell's economy depends heavily upon tourism and marine industries (CBW 2015). Wrangell receives about 50 (mainly small) cruise ships each summer, and the visitor-related industry supports about 75 monthly jobs. Many residents have commercial fishing permits, and the millions of pounds coming into port each year support seafood processing jobs, which make up the majority of manufacturing employment in Wrangell. About 38% of the workforce is employed by the local, state, or federal government (Bell 2014).

Some residents use a subsistence lifestyle to supplement cash incomes. In 2000, the average Wrangell household harvested 43,060 pounds of usable wild foods consisting of 15% salmon, 20% other fish, 23% land mammals, 36% marine invertebrates, 9% birds and eggs, and 5% wild plants (ADFG 2000).

3.10.2 Environmental Consequences and Mitigation

Environmental Justice

Environmental justice populations would not be adversely impacted by the project; rather, the proposed improvements to the WTP would benefit all residents by providing adequate and sustainable drinking water for future populations.

Socio-Economic Issues

No land or marine areas that provides economic opportunities for the community would be negatively impacted by this project. The seafood industry especially would benefit from the WTP improvements, since more water would be available for fish and seafood processing.

3.11 Miscellaneous Issues

3.11.1 Affected Environment

Noise

The noise generated by this project would be minimal during the brief construction phase and negligible post-construction. Further, this project would not take place near any noise-sensitive facilities (Google Earth 2013). The project would take place about 1 mile from the nearest school (1.11 miles to Evergreen Elementary and 1.01 miles to Stikine Middle School and Wrangell High School), 0.78 miles southeast of the nearest church (Bible Baptist Church), and 0.48 miles southeast of the nearest medical clinic (AICS Medical Clinic).

Transportation

Wrangell is accessible by air and water. There is a state-owned paved, lighted runway on the north side of the community. A seaplane base is adjacent to the runway, with another airplane float located in the Inner Harbor. Charter air taxi services are also available. The marine facilities include three harbors with 710 slips for recreational and commercial vessels; a deep draft dock which just completed upgrades and renovations; a state ferry terminal; and three boat launches. Freight arrives by barge, ship, ferry, and cargo plane. Front Street was reconstructed as part of a larger downtown revitalization in 2014 (ADCCED 2016a).

A coastal community, Wrangell is located on Zimovia Strait which is a part of the Inside Passage. The Inside Passage is a coastal route for cruise ships, freighters, fishing vessels, and ferries along a network of ocean passages along the Pacific coast from southeastern Alaska to north-western Washington.

The WTP is located about 0.5 miles up Wood Road (WTP Access Road) east of the Zimovia Highway. The WWTP is located on the Zimovia Highway.

3.11.2 Environmental Consequences and Mitigation

Noise

Following construction, the project would have minimal noise generation. In addition, the project will be located away sensitive noise receptors, including schools, churches, and health care facilities.

Transportation

There would be no expected impacts to transportation. The improvements to the WTP would occur at the facility and would not block or impact the road to the facility. Although sludge could be transported to the barge dock every week, it isn't expected to impact local traffic.

3.12 Human Health and Safety

3.12.1 Affected Environment

Electromagnetic Fields and Interference

The closest electromagnetic fields from broadcasting, cellular and other communication transmitters and radar systems (or other sources) is from the closest Federal Communications Commission-registered cell phone tower is located about 350 feet uphill (east) of the WTP. Another FCC cell phone tower is located about 2,000 downhill (southwest) of the WTP.

Environmental Risk Management

There are two active contaminated sites located near the project area identified by the ADEC Contaminated Sites Program (ADEC 2016a). The Wrangell City Shop site (file number: 1529.26.009), about 0.25 miles from the WTP, has contaminated soils from a leaky 500-gallon used oil underground storage tank. The Wrangell Power Plant site (file number 1529.38.021), approximately 0.35 miles from the WTP, has contaminated soils from a 300,000-gallon aboveground fuel storage tank. In 2016, contaminated soils from both sites were taken to the landfill for remediation.

3.12.2 Environmental Consequences and Mitigation

Electromagnetic Fields and Interference

Electromagnetic interference from narrowband transmissions, such as radio or cell phones, or broadband transmissions, such as electric power transmission lines, would not occur as a result of this project. The WTP upgrades would not produce electromagnetic fields or impact existing cell phone transmissions because the improvements would be near the ground.

Environmental Risk Management

Although there are two nearby contaminated sites, they are not expected to be impacted or impact because of their distances away from the proposed project.

3.13 Corridor Analysis

This project is not a linear infrastructure project where a routing analysis is needed.

4.0 Cumulative Effects

Cumulative effects focus on past, present, and reasonably foreseeable future actions regardless of which entity – private or governmental – is affecting those resources. For this project the geographic scope includes the community of Wrangell. The timeframe for the cumulative effects analysis includes 10 years into the past and 20 years into the future.

4.1 Affected Environment

Recent past actions in Wrangell over the past 10 years have included (CBW 2015 and ADCCED 2016b):

- Development of a new harbor
- Construction of a new harbor house
- Upgrades and expansion to the water and wastewater systems
- Upgrades to city streets and sidewalks
- Upgrades to the power house and power system
- Upgrades to the health clinic
- Improvements to the City dock
- Upgrades to the boat haulout pier
- Upgrades to Industrial Park subdivision
- Upgrades to public buildings
- Upgrades to the Eastern Channel Paddle Craft Trail
- Upgrades to the Marine Service Center
- Construction of a commercial passenger vessel facility
- Construction of a hospital and nursing home

Currently, the City is replacing sewer pumps, paving the barge ramp, and making improvements to Wood Street (CBW 2015).

4.2 Environmental Consequences

Cumulative impacts to be considered are based on the following criteria: 1) effects occur but are not localized to the same general area; 2) effects to a resource are similar in nature; and 3) effects are long-term rather than short-term in nature. Cumulative effects can result from several individually minor impacts, which may be collectively substantial over time. Other developments in Wrangell have been proposed could contribute to cumulative effects on resources; however, the cumulative impacts would not be substantial.

In general, the proposed water treatment plant expansion would be a part of a pattern of growth and development in a community that was founded around 1811. The sections below consider the cumulative effects of the project when combined with past, present, and reasonably foreseeable future projects.

4.1.1 Land Use and Zoning

Land use is not expected to change with cumulative development. The CBW maintains zoning restrictions and requires land use permits which maintain established and desired land uses and zoning.

4.2.2 Floodplains

This project would not impact floodplains, and therefore would not contribute to the cumulative loss of floodplains.

4.2.3 Wetlands

This project would not impact wetlands, and therefore would not contribute cumulatively to loss of wetlands in Wrangell.

4.2.4 Water Resources

Previous, current, and future projects together with the proposed project are not expected to cumulatively impact Wrangell's drinking water source because they will not lead to substantial additional water use, and it is expected the reservoirs will continue to supply water demand as the population grows and the economy expands.

4.2.5 Coastal Resources

This project would not impact coastal resources, and therefore would not contribute to the cumulative loss of floodplains.

4.2.6 Biological Resources

This project would not contribute to the cumulatively loss of wildlife habitat. Most future projects would occur on land within the City boundaries; therefore, ESA-listed species would be minimally impacted. Less migratory bird habitat would be available as development increases in the area; however, because Wrangell is surrounded by the Tongass National Forest, the area for birds to inhabit is not limited. Cumulatively, projects could lead to the spread of invasive plant species; however, mitigation measures should help to minimize their distribution. For these reasons, cumulative effects on biological resources would be negligible.

4.2.7 Historical and Cultural Properties

This project would not impact historical or cultural resources, and therefore would not contribute to the cumulative loss of those properties.

4.2.8 Aesthetics

This project would add to the cumulative impacts to visual resources, since all improvements would be at the WTP site away from the community view.

4.2.9 Air Quality

Cumulative impacts to air quality in Wrangell is expected to be low, since the project would not have measurable air quality impacts and air quality in the community is good.

4.2.10 Socio-Economic/Environmental Justice

Reasonably foreseeable future projects in Wrangell would have minimal adverse effects to minority and low-income populations. The proposed WTP improvements would not have disproportionately high and adverse impacts to minority or low-income populations and therefore is not a part of cumulative impacts of other projects. In fact, these projects together are expected to benefit the low income and minority populations in Wrangell.

4.2.11 Miscellaneous: Noise and Transportation

The WTP upgrades are not anticipated to have any effect on noise-sensitive land uses. Additional noise from planned projects not associated with this project would be minimal; therefore, the cumulative impact of the project is not substantial.

Transportation should not be cumulatively impacted by this project because this project only involves weekly transport of sludge to the barge dock.

4.2.12 Human Health and Safety

The proposed project would have no impacts or interference to electromagnetic fields and therefore would not contribute to the cumulative impacts to electromagnetic fields near Wrangell.

5.0 Summary of Mitigation

The following table summarizes mitigation efforts for each of the affected environments discussed in section 3 of this report.

Affected Environment	Mitigation Measures
Land Use	Not required, project is consistent with planning and zoning.
Floodplains	Not required, project does not impact floodplains.
Wetlands	Not required, project does not impact wetlands.
Water Resources	Water quality impacts mitigation: During construction, a SWPPP would be developed, erosion and sediment control BMPs will be implemented, and a spill clean-up kit will be maintained on site.
Coastal Resources	Not required, project does not impact coastal resources.
Biological Resources	Migratory bird impacts mitigation: No vegetation clearing would occur between April 15-July 15. Invasive species impacts mitigation: Disturbing activities would be minimized and disturbed areas would be re-vegetated with native species.
Historic and Cultural Properties	If historic resources are discovered during construction, all work would halt, and the SHPO would be contacted immediately.
Aesthetics	Not required, project does not impact visual resources
Air Quality	Most disturbed areas would be permanently stabilized after project completion to help suppress dust.
Socio-Economic Issues/ Environmental Justice	Not required, project does not have disproportionately high or adverse impacts to minority or low-income populations
Miscellaneous Issues	Not required, project does not impact noise and involves only minor impacts to transportation
Human Health and Safety	Not required, project does not impact electromagnetic fields

6.0 Coordination, Correspondence, and Coordination

On November 11, 2016, CBW's consultant emailed the USACE to request a jurisdictional determination (JD) for the project area (Exhibit B).

On November 14, 2016, a JD request form was submitted by email to USACE (Exhibit B).

On November 15, 2016, the CBW initiated consultation under the Section 106 of the National Historic Preservation Act by letters to the SHPO, Wrangell Cooperative Association, Central Council of the Tlingit and Haida Indian Tribes of Alaska, and Sealaska Corporation (Exhibit D).

On November 21, 2016, the USACE responded to the CBW request for a JD that the project area did not contain waters of the United States under the jurisdiction of the USACE (Exhibit B).

On November 29, 2016, an archeologist from the SHPO emailed that there were no immediate concerns regarding the cultural and historic sites information provided. The SHPO representative recommended the APE include all project-related components, including access roads, staging areas, and material sites. The representative did not have additional information and agreed with the consulting parties (Exhibit D).

On December 8, 2016, the USDA Rural Development's sent a letter to the SHPO requesting concurrence on a finding of no historic properties affected by the project (Exhibit D).

On December 15, 2016, the SHPO sent a letter concurring with USDA Rural Development's finding that no historic properties would be affected by the project (Exhibit D).

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8.0. List of Preparers

This report was prepared by Solstice Alaska Consulting, Inc. with assistance from CRW Engineering Group, LLC on behalf of the CBW. The individuals that contributed to compiling the report included the following:

Robin Reich, President, Solstice Alaska Consulting, Inc.
Areas of Input: Senior review, research, document writing

Olivia Cohn, Environmental Planner, Solstice Alaska Consulting, Inc.
Areas of Input: Research, document writing

Will Kemp, P.E., Civil Engineer, CRW Engineering Group, LLC
Areas of Input: Review

Emerald Hagy, College Intern, Solstice Alaska Consulting, Inc.
Area of Input: Research, document writing

Exhibit A

Project Figures

FILE NAME: J:\Jobsdata\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\01 Working Set\01 Civil\20901.00 Vicinity Map.dwg

CRW ENGINEERING GROUP, LLC

Project:

STATUS: DRAFT

CITY AND BOROUGH OF WRANGELL

PRELIMINARY ENGINEERING REPORT

Figure 1

VICINITY MAP

Project No:	20901.00
Drawn By:	WMK
Scale:	NTS
Date:	10/5/2016

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

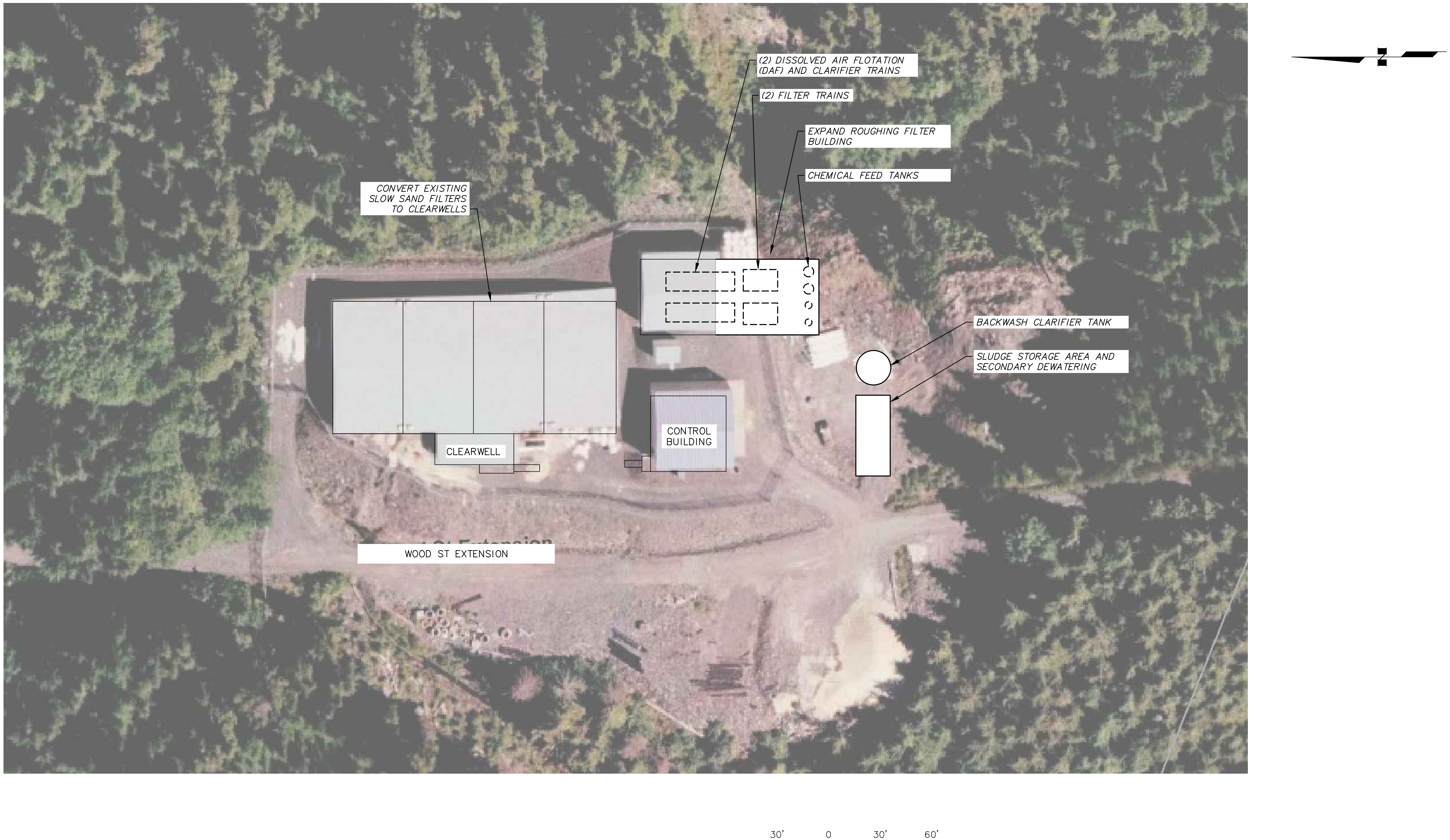
PROJECT: 20901.00
STATUS: DRAFT

Figure 2

EXISTING AREA MAP

DATE 10/4/16
SCALE GRAPHIC

File: J:\Jobsdata\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\02 Figures\05 PER\20901.00 Site Plan - Existing Conditions.dwg



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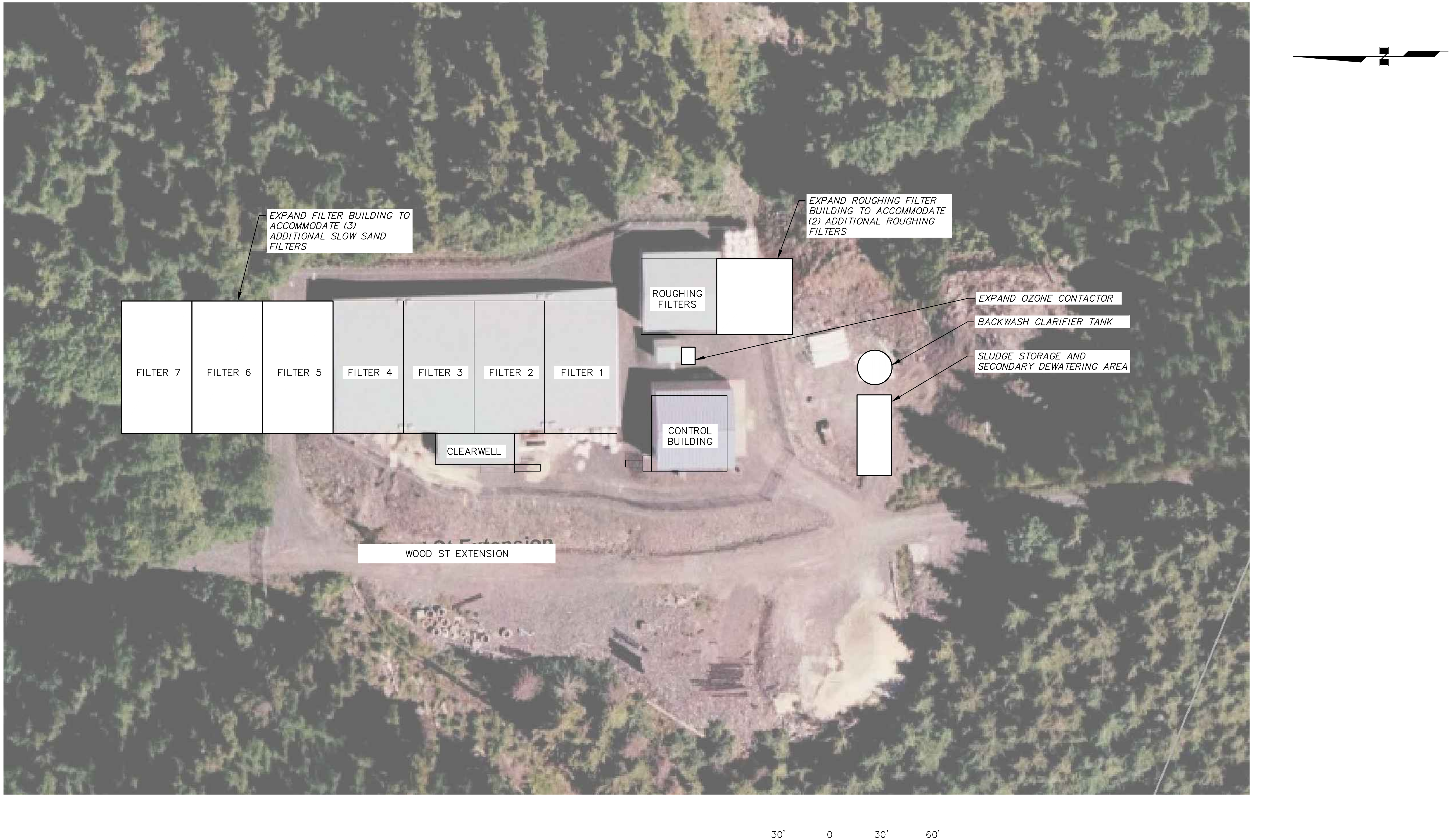
PROJECT: 20901.00
STATUS: FINAL

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

Figure 3
PREFERRED ALTERNATIVE

DATE 3/27/17
SCALE GRAPHIC



PROJECT: 20901.00
STATUS: FINAL

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD., SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

Figure 4

SITE PLAN – ALTERNATIVE 1
EXPAND SLOW SAND FILTERS

DATE 3/27/17
SCALE GRAPHIC

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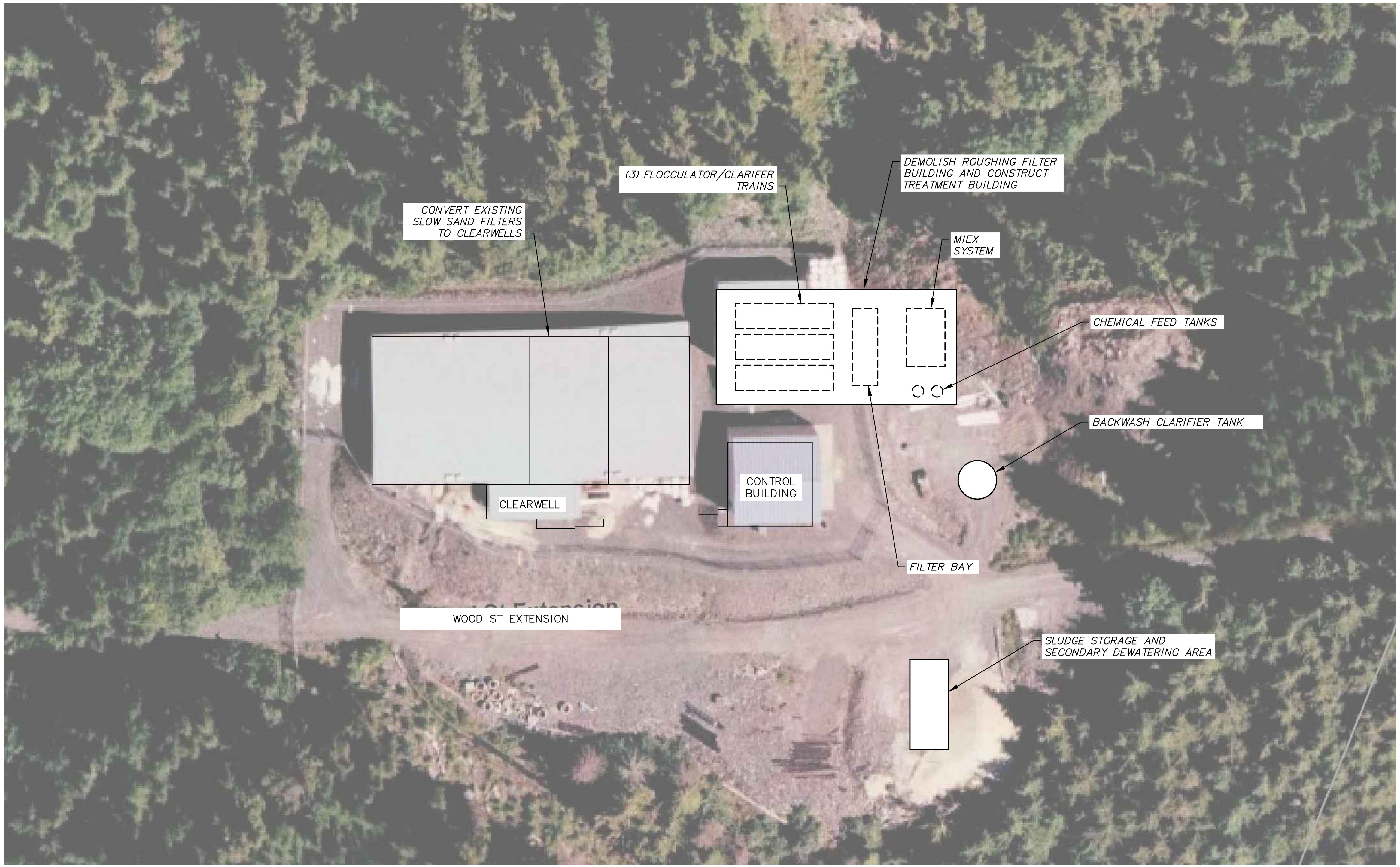

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PROJECT: 20901.00
STATUS: FINAL

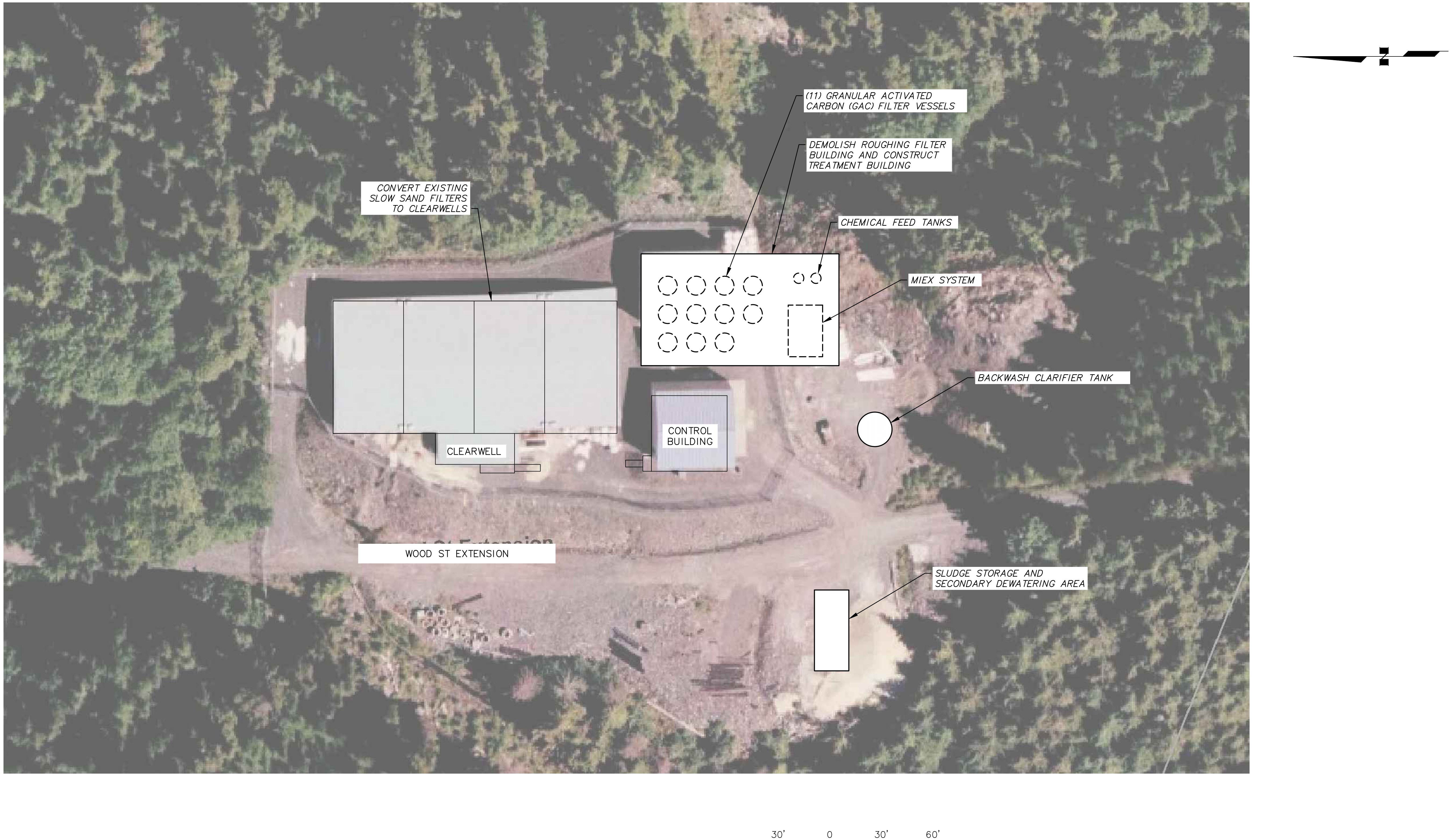
CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD, SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

Figure 5

SITE PLAN – ALTERNATIVE 2
MIEX AND MULTIMEDIA FILTRATION

DATE
3/27/17
SCALE
GRAPHIC

File: J:\JobsData\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\02 Figures\05 PER\20901.00 ALT 2 Miex + Direct.dwg



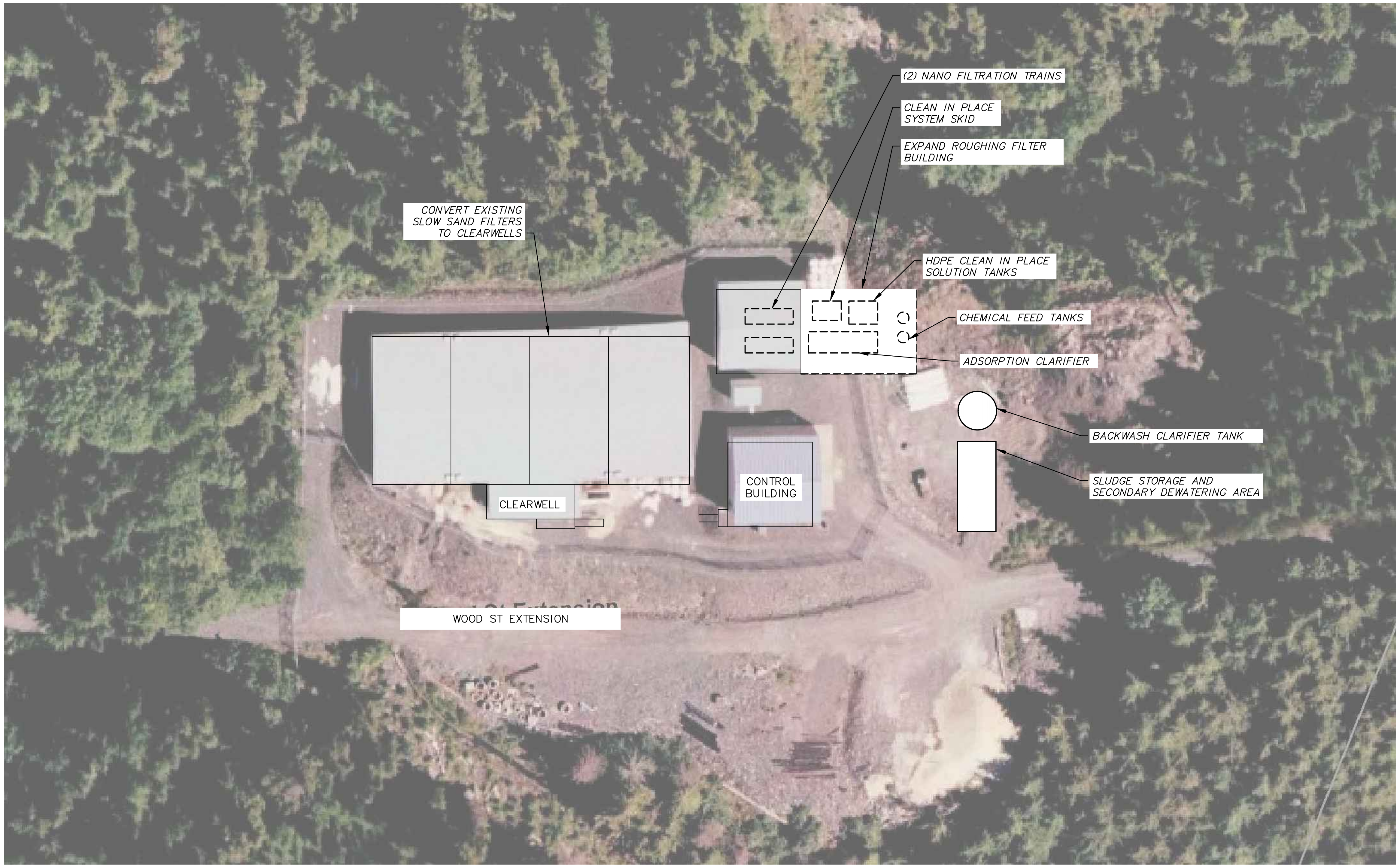
PROJECT: 20901.00
STATUS: FINAL

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD, SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

Figure 6

SITE PLAN – ALTERNATIVE 3
MIEX AND BIOLOGICAL FILTRATION

DATE 3/27/17
SCALE GRAPHIC



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PROJECT: 20901.00

STATUS: FINAL

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

Figure 7

SITE PLAN – ALTERNATIVE 5
NANO FILTRATION WITH MULTIMEDIA FILTRATION

DATE 3/27/17

SCALE GRAPHIC

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PROJECT:

STATUS: FINAL

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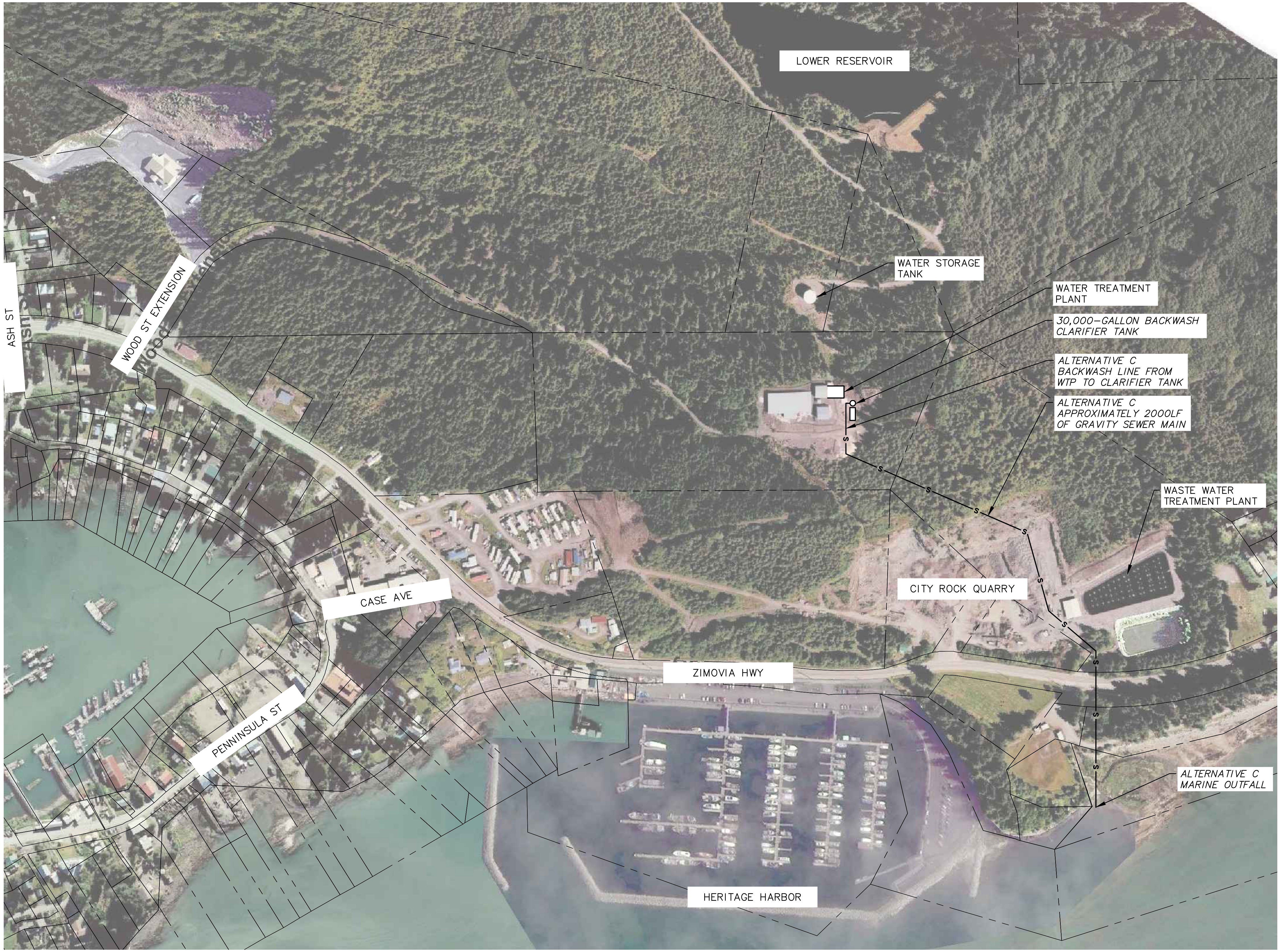
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

Figure 8
BACKWASH WASTE DISPOSAL
ALTERNATIVES A1, A2, AND B

DATE 3/27/17

SCALE GRAPHIC



200' 0 200' 400'

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

PROJECT:

STATUS: FINAL

Figure 9

BACKWASH WASTE DISPOSAL
ALTERNATIVE C

DATE
3/27/17

SCALE
GRAPHIC

File: J:\JobsData\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\02 Figures\05 PER\20901.00 Sewer Disposal Alternatives.dwg

Exhibit B

Wetlands Information and Coordination

DEPARTMENT OF THE ARMY
ALASKA DISTRICT, U.S. ARMY CORPS OF ENGINEERS
REGULATORY DIVISION
P.O. BOX 6898
JBER, AK 99506-0898

November 21, 2016

Regulatory Division
POA-2016-535

City and Borough of Wrangell
Attn: Ms. Amber Al-Haddad
Post Office Box 531
Wrangell, Alaska 99929

Dear Ms. Al-Haddad:

This letter responds to your November 14, 2016, request for a Department of the Army (DA) jurisdictional determination for your proposed upgrade to the water treatment plant. It has been assigned number POA-2016-535, Zimovia Straits, which should be referred to in all correspondence with us. The project site is located within Section 36, T. 62 S., R. 83 E., Seward Meridian; USGS Quad Map AK-Petersburg B-2; Latitude 56.4561º N., Longitude 132.3770º W.; Wrangell-Petersburg Borough; in Wrangell, Alaska.

Based on our review of the information you provided, we have determined the subject property does not contain waters of the United States (U.S.) under Corps jurisdiction. Therefore, a DA permit is not required. A copy of the Approved Jurisdictional Determination form is available at: www.poa.usace.army.mil/Missions/Regulatory/JurisdictionalDeterminations.aspx under the above file number. Please contact us if you decide to alter the method, scope, or location of your proposed activity.

This approved jurisdictional determination is valid for a period of five (5) years from the date of this letter, unless new information supporting a revision is provided to us before the expiration date.

Enclosed is a Notification of Administrative Appeal Options and Process and Request for Appeal form regarding this approved jurisdictional determination (see section labeled “Approved Jurisdictional Determination”).

Nothing in this letter excuses you from compliance with other Federal, State, or local statutes, ordinances, or regulations.

Please contact me via email at michael.r.gala@usace.army.mil, by mail at the address above, by phone at (907) 753-2821, or toll free from within Alaska at (800) 478-2712, if you have questions. For more information about the Regulatory Program, please visit our website at http://www.poa.usace.army.mil/Missions/Regulatory.aspx.

Sincerely,

Michael R. Gala
Regulatory Specialist

Request for a Jurisdictional Determination from the Regulatory Division of the U.S. Army Corps of Engineers

Instructions: Provide the information on this sheet along with a map of the property and send it to one of the Corps offices listed on the back of this form.

City and Borough of Wrangell, Alaska
NAME

(907) 874-3904
PHONE - HOME

Amber Al-Haddad
Director of Public Works and Capital Projects
MAILING ADDRESS 1

(907) 874-3904
PHONE - WORK

P.O. Box 531
MAILING ADDRESS 2

FAX

Wrangell — AK — 99929
CITY — STATE — ZIP

aal-haddad@wrangell.com
E-MAIL

Property Location:

Section 31 Township 62S Range 84D Meridian Copper River Nearest City Wrangell

Lot: _____ Block: _____ Tract: _____ Subdivision Name: ____________________

Parcel Number: ____________________ Borough: City and Borough of Wrangell

Physical Address (if any): ______________________________

Directions to the property: From the Wrangell Airport, take Airport Loop Road east to Bennett Street to Zimovia Highway. Turn left (east) off Zimovia Highway to Wood Street (the Water Treatment Plant access road). The project area can be accessed from the WTP parking area.

How are the boundaries of the property identified? ______________________________

Do you own the land? Yes or No

If "Yes", do we have your permission to visit the property? Yes or No

If you do not own the property and in the event a site visit is necessary, provide a written statement from the landowner allowing the Corps of Engineers to enter the site.

To expedite our response to you, you may request a preliminary jurisdictional determination (PJD). If you need to obtain a permit for your project, it may be possible to evaluate your permit application using a PJD, depending on the specific project. Note that a PJD is not definitive and therefore not appealable. More information regarding JDs can be found at http://www.usace.army.mil/Portals/2/docs/civilworks/RGLS/rgl08-02.pdf.

Please indicate if you desire a preliminary jurisdictional determination (PJD). YES or NO

Signature Amber Al-Haddad
Public Works Director

Date: November 14, 2016

Submit this form and map to the Corps office responsible for the geographic area that encompasses the Property Location. (See back)

From:	Robin Reich <robin@solsticeak.com>
Sent:	Friday, November 11, 2016 2:04 PM
To:	'Speerstra, Linda POA'
Cc:	''Olivia Cohn''
Subject:	FW: Wrangell Wetlands Water Treatment Plant Project

Hi Linda-
Here is information to follow up on the voicemail message I left you this morning. I will send along a JD request form, if you need it?

The City & Borough of Wrangell is currently proposing improvements to its water treatment processes that consist of constructing a backwash waste disposal pipe and an expansion and remodel of its water treatment plant (WTP). We are assisting the City with environmental permitting for this effort.

The project would be located in Wrangell, Alaska north of Zimovia Highway near Township 62 South, Range 84 East, Section 31 of the Copper River Meridian, USGS quadrangle Petersburg B-2 NE. The WTP is located at approximately latitude 56.4565028112, longitude -132.376624775 (Figure 1). WTP improvements would occur primarily within the footprint of the existing WTP to expand capacity of existing infrastructure. The preferred option for the backwash waste disposal pipe would be a 1,350 linear feet pipe that would be constructed to run downhill from the WTP, that is located near the 400-feet (ft) contour, to connect to the existing wastewater treatment facility (WWTF), that is located just under the 100-ft contour. See the included U.S. Geological Survey topographical map image for a depiction of the elevations (Figure 2). See the included photographs of the proposed project area for the WTP and backwash waste disposal pipe, which were taken on October 19, 2016 traveling downhill from the WTP to the WWTF, for a depiction of the proposed project area (Images 1 through 13).

National Wetlands Inventory (NWI) and Other Information
According to the NWI, wetlands do not exist in the project area (Figure 3). There is little other wetlands data available in the proposed project area. Land appraisals, the 2003 wetlands assessment (which does not include the proposed project area), a City & Borough of Wrangell Land Prospectus, the Wrangell Institute Master Plan, the Tongass National Forest website, the Southeast Alaska Land Trust's Wetland Ecosystem Services Protocol for Southeast Alaska, and additional resources were reviewed.

The grade along the vegetated hillside area along the proposed backwash disposal pipe route from the WTP to the WWTF is approximately 25% (a 25 ft elevation difference per 100 ft). It appears that the area contains forested vegetation (see images). According to the 2003 Wetlands and Watershed Management Plan for the City of Wrangell and Alaska Mental Health Trust Land Office, hydric soils were mapped almost a mile from the proposed project area, (for the Institute Study Area). According to the 2014 City and Borough of Wrangell, Alaska 134 Acre Land Prospectus, which includes the proposed project area, the land is described as mostly forested wetlands (The prospectus states: "Mostly forested wetlands occur throughout the property with several large creeks and smaller drainages.")

Given the information in this email, we are requesting a jurisdictional determination. Please see attached.

Figure 1. Water treatment project general project Area, Wrangell, Alaska

Figure 2. U.S. Geological Survey topographical map of the water treatment improvement proposed project area, Wrangell, Alaska. *The red diamond indicates the location of the WTP at 56.4565028112, -132.376624775.*


topoView
1880
2010
Shoemaker Bay Zimovia Hwy
Wood St
MAP RECORDS: 8
Leaflet © Mapbox © OpenStreetMap

Figure 3. NWI mapping near general project area, Wrangell, Alaska

Site photographs

These photographs were taken on October 19, 2016 and follow the proposed project area traveling downhill from the WTP to the WWTF.


Image 1.


Image 2.


Image 3.


Image 4.

These photographs were taken on October 19, 2016 and follow the proposed project area traveling downhill from the WTP to the WWTF.


Image 5.


Image 6.


Image 7.


Image 8.

These photographs were taken on October 19, 2016 and follow the proposed project area traveling downhill from the WTP to the WWTF.


Image 9. Image 10.

These photographs were taken on October 19, 2016 and follow the proposed project area traveling downhill from the WTP to the WWTF. The WWTF can be seen in these photographs.


Image 11. Image 12.


Image 13.

Thank you.

Robin Reich, President
Environmental Planner

Solstice Alaska Consulting, Inc.
2607 Fairbanks St. #B
Anchorage, AK 99503
907.929.5960
Cell: 907.903.0597

www.solsticeak.com

Exhibit C

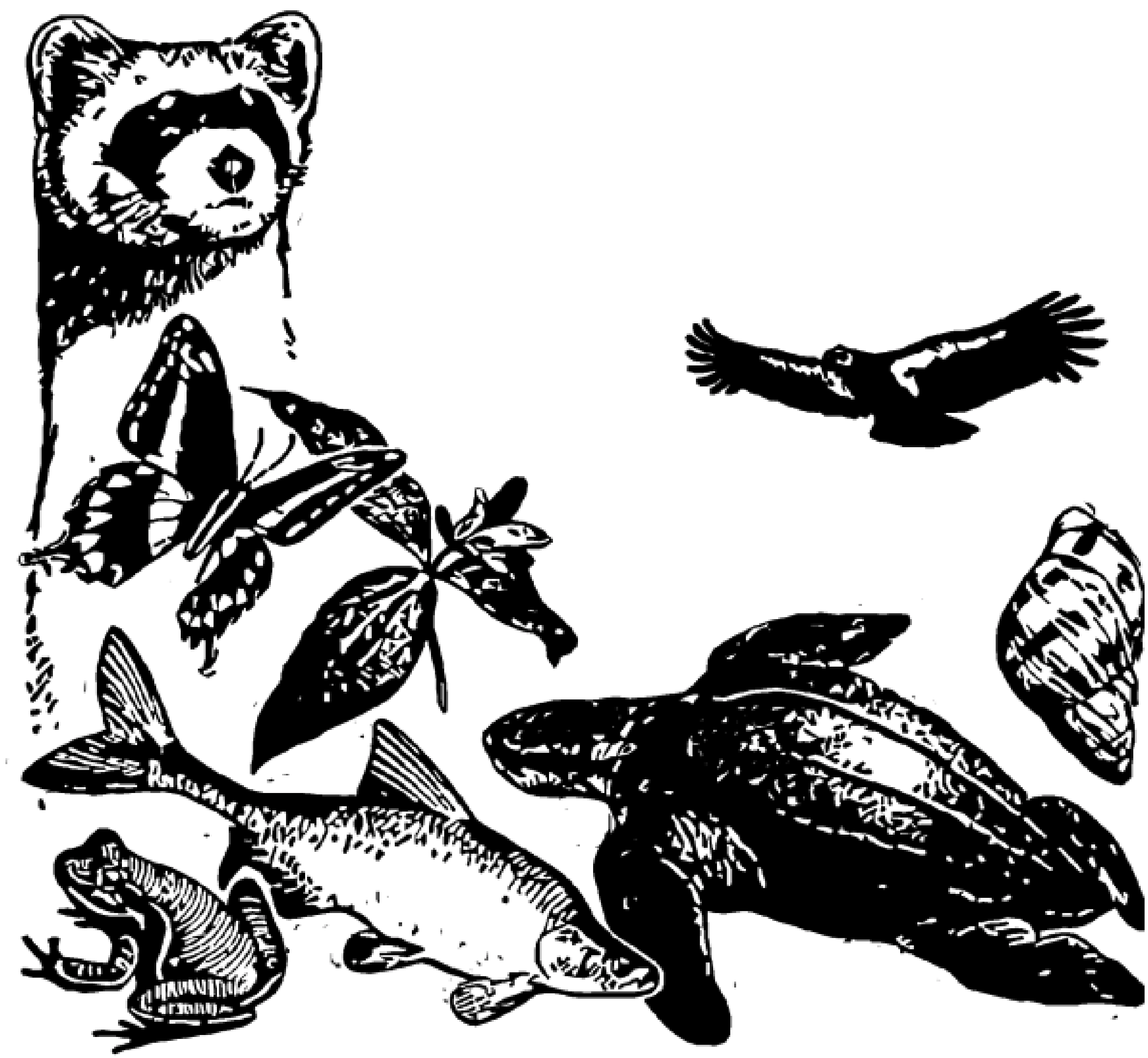
U.S. Fish and Wildlife Service Information for Planning and Conservation Report

U.S. Fish & Wildlife Service

IPaC Trust Resources Report

Generated October 05, 2016 04:25 PM MDT, IPaC v3.0.9

This report is for informational purposes only and should not be used for planning or analyzing project level impacts. For project reviews that require U.S. Fish & Wildlife Service review or concurrence, please return to the IPaC website and request an official species list from the Regulatory Documents page.



IPaC - Information for Planning and Conservation (https://ecos.fws.gov/ipac/): A project planning tool to help streamline the U.S. Fish & Wildlife Service environmental review process.

Table of Contents

U.S. Fish & Wildlife Service

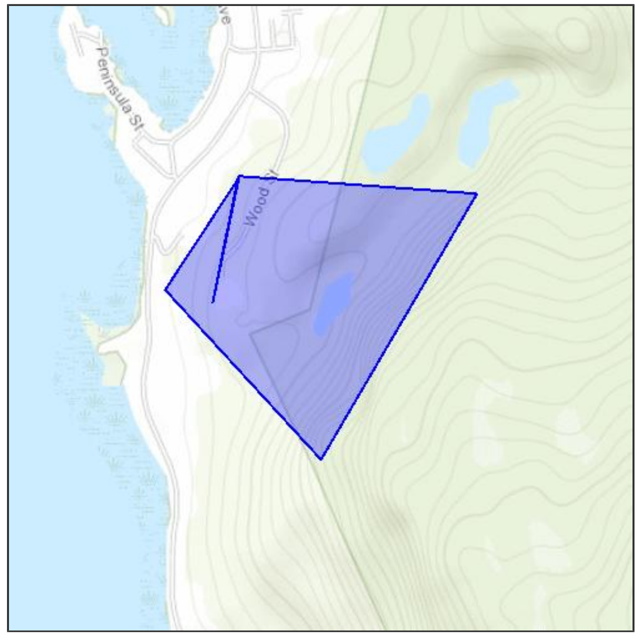
IPaC Trust Resources Report

LOCATION

Wrangell County, Alaska

IPAC LINK

https://ecos.fws.gov/ipac/project/QVBER-SQCNF-BANCV-EPW42-FDSH7A



U.S. Fish & Wildlife Service Contact Information

Trust resources in this location are managed by:

Anchorage Fish And Wildlife Field Office
4700 Blm Road
Anchorage, AK 99507
(907) 271-2888

Endangered Species

Proposed, candidate, threatened, and endangered species are managed by the Endangered Species Program of the U.S. Fish & Wildlife Service.

This USFWS trust resource report is for informational purposes only and should not be used for planning or analyzing project level impacts.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list from the Regulatory Documents section.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency.

A letter from the local office and a species list which fulfills this requirement can only be obtained by requesting an official species list either from the Regulatory Documents section in IPaC or from the local field office directly.

There are no endangered species in this location

Critical Habitats

There are no critical habitats in this location

Migratory Birds

Birds are protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Any activity that results in the take of migratory birds or eagles is prohibited unless authorized by the U.S. Fish & Wildlife Service.[1] There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

---

1. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern
  http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds
  http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data
  http://www.birdscanada.org/birdmon/default/datasummaries.jsp

The following species of migratory birds could potentially be affected by activities in this location:

Black Oystercatcher Haematopus bachmani — Bird of conservation concern
Season: Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0KJ

Fox Sparrow Passerella iliaca — Bird of conservation concern
Season: Breeding

Lesser Yellowlegs Tringa flavipes — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0MD

Marbled Murrelet Brachyramphus marmoratus — Bird of conservation concern
Season: Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B08C

Pelagic Cormorant Phalacrocorax pelagicus pelagicus — Bird of conservation concern
Season: Wintering

Pink-footed Shearwater Puffinus creatopus — Bird of conservation concern

Season: Year-round

Queen Charlotte Goshawk Accipiter gentilis laingi — Bird of conservation concern

Season: Year-round

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0AE

Rufous Hummingbird selasphorus rufus — Bird of conservation concern

Season: Breeding

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0E1

Short-eared Owl Asio flammeus — Bird of conservation concern

Season: Breeding

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HD

Wildlife refuges and fish hatcheries

There are no refuges or fish hatcheries in this location

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

DATA LIMITATIONS

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

DATA EXCLUSIONS

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

DATA PRECAUTIONS

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Wetland data is unavailable at this time.

Exhibit D

Cultural and Historic Resources Information and Coordination

THE STATE of ALASKA
GOVERNOR BILL WALKER

Department of Natural Resources
DIVISION OF PARKS & OUTDOOR RECREATION
Office of History & Archaeology
550 West 7th Ave., Suite 1310
Anchorage, Alaska 99501-3565
Main: 907.269.8721
http://dnr.alaska.gov/parks/oha

December 15th, 2016

File No.: 3130-1R USDA-RD
2016-01463

Robert Chambers
USDA – Rural Development
Alaska State Office
800 W. Evergreen, Suite 201
Palmer, AK 99645

SUBJECT: Finding of No Historic Properties Affected, City and Borough of Wrangell Water Treatment Plant Improvements

Dear Mr. Chambers:

The Alaska State Historic Preservation Office (AKSHPO) received your correspondence on December 8th, 2016. Upon review of the documentation provided, we concur that a finding of **no historic properties affected** is appropriate for the subject undertaking.

As a reminder, should previously unidentified archaeological resources be discovered in the course of the project, work must be interrupted until the resources have been evaluated in terms of the National Register of Historic Places eligibility criteria (36 CFR 60.4) in consultation with our office.

Thank you for the opportunity to review and comment. Please contact Mckenzie Johnson at 269-8726 or mckenzie.johnson@alaska.gov if you have any questions or if we can be of further assistance.

Sincerely,

Judith E. Bittner

Judith E. Bittner
State Historic Preservation Officer

JEB: msj

From: Amber Al-Haddad <aal-haddad@wrangell.com>
Sent: Monday, December 12, 2016 4:42 PM
To: 'Johnson, McKenzie S (DNR)'
Cc: tasha.deardorff@ak.usda.gov; 'Jon Hermon'; 'Will Kemp'; 'Robin Reich'
Subject: Wrangell Drinking Water Treatment Plant Project--Initiation of Section 106, AKSHPO Comments

Hello McKenzie,

Thank you for AKSHPO's review for Wrangell's proposed Water Treatment Plant Improvements project, indicating that there are no immediate concerns with the described Area of Potential Effect (APE) or with the current assessment of potential effects. We appreciate your recommendation to maintain project staging areas within the APE, and we will share any information received from other consulting parties upon receipt. Thank you again for your prompt review of our request.

Best,
Amber Al-Haddad
Director of Public Works and Capital Projects
City and Borough of Wrangell
P.O. Box 531, Wrangell, Alaska 99929
Telephone 907.874-3904
Email: aal-haddad@wrangell.com
www.wrangell.com

From: Johnson, McKenzie S (DNR) [mailto:mckenzie.johnson@alaska.gov]
Sent: Tuesday, November 29, 2016 12:45 PM
To: aal-haddad@wrangell.com
Cc: tasha.deardorff@ak.usda.gov
Subject: Wrangell Drinking Water Treatment Plant Project--Initiation of Section 106, AKSHPO Comments

File No.: 3130-1R USDA-RD
2016-01463

Ms. Al-Haddad,

The Alaska State Historic Preservation Office (AKSHPO) received your correspondence initiating consultation under Section 106 on behalf of Rural Development (USDA-RD) on November 21st, 2016 (dated November 15th, 2016). Upon review of the information provided for the project we do not have any immediate concerns with the described Area of Potential Effect (APE), or the current assessment of potential effects. We recommend ensuring all access roads for construction equipment, staging areas, and potential material sources-- if necessary-- are captured within the APE boundaries. We have no additional information regarding known or potential historic properties that was not already addressed in the documentation, and appropriate contacts for consulting parties appear to have been made. We look forward to receiving the final determination of effect from USDA-RD. If other consulting parties offer new information, or have concerns, we would appreciate a copy of those comments for our review. Please let me know if we can assist further, and thank you for the opportunity to comment.

Mckenzie S. Johnson
Archaeologist I, Review and Compliance

WRANGELL
GATEWAY TO THE STIKINE
ADOPTED AUGUST 1972

CITY & BOROUGH OF WRANGELL
INCORPORATED JUNE 15, 1903

Dept. of Public Works & Capital Projects

PO Box 531
Wrangell, AK 99929

Phone (907)-874-3904
Fax (907)-874-2699

November 15, 2016

Judith Bittner, State Historic Preservation Officer
Alaska Office of History and Archeology and State Historic Preservation Office
Alaska Department of Natural Resources
550 West 7th Avenue, Suite 1260
Anchorage, AK 99501-3557

Subject: Initiation of Section 106 Review Process

The City and Borough of Wrangell has applied to the USDA Rural Development for federal financial assistance, and we have been authorized by that agency to initiate the consultation process required under Section 106 of the National Historic Preservation Act (NHPA) (see attached authorization). Section 106 of the NHPA requires federal agencies to consider the effects of their undertakings on historic properties.

You have been identified as a possible consulting party under 36 CFR Part 800, Section 800.2(c). Therefore, we provide you with the attached information regarding our proposed project and respectfully request your comments with regards to the potential for the project to impact historic properties. Specifically, we would appreciate any comments you may have on the following issues:

- The proposed project;
- The described area of potential effects (APE);
- The potential effects of the undertaking on any historic property we have thus far identified;
- Information on other historic properties which might be present and could be effected by the proposed project, including properties which have religious or cultural significance to one or more Indian Tribes;
- Any additional parties with who we should consider consulting; and
- Any other comments or information related to historic preservation which you believe is relevant to the Section 106 review.

Please be as specific as you can with any comments or information. Since this review is time sensitive and must adhere to the provisions in 36 CFR Part 800, we request that you submit comments within 30 days from receipt of this letter.

If you have any questions regarding this letter please contact me at 907-874-3904 or P.O. Box 531, Wrangell, AK 99929, or you may contact Rural Development directly by contacting Tasha Deardorff at 907-271-2424 ext. 118 or 510 L Street, Suite 410, Anchorage, AK 99501.

Sincerely,

Amber Al-Haddad

Amber Al-Haddad
Director of Public Works and Capital Projects
City and Borough of Wrangell
P.O. Box 531
Wrangell, AK 99929

Attachments: Section 106 Consultation Supporting Documentation

Copy: Tasha Deardorff, USDA, WEP/RAVG Program
Jon Hermon, CRW Engineering Group

CITY & BOROUGH OF WRANGELL
INCORPORATED JUNE 15, 1903

Dept. of Public Works & Capital Projects

PO Box 531
Wrangell, AK 99929

Phone (907)-874-3904
Fax (907)-874-2699

November 15, 2016

Richard Oliver, President
Wrangell Cooperative Association
P.O. Box 2021
Wrangell, AK 99929

Subject: Initiation of Section 106 Review Process

The City and Borough of Wrangell has applied to the USDA Rural Development for federal financial assistance, and we have been authorized by that agency to initiate the consultation process required under Section 106 of the National Historic Preservation Act (NHPA) (see attached authorization). Section 106 of the NHPA requires federal agencies to consider the effects of their undertakings on historic properties.

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Sincerely,

Amber Al-Haddad

Amber Al-Haddad
Director of Public Works and Capital Projects
City and Borough of Wrangell
P.O. Box 531
Wrangell, AK 99929

Attachments: Section 106 Consultation Supporting Documentation

Copy: Tasha Deardorff, USDA, WEP/RAVG Program
Jon Hermon, CRW Engineering Group

CITY & BOROUGH OF WRANGELL

INCORPORATED JUNE 15, 1903

Dept. of Public Works & Capital Projects

PO Box 531
Wrangell, AK 99929

Phone (907)-874-3904
Fax (907)-874-2699

November 15, 2016

Richard J. Peterson, President
Central Council of the Tlingit and Haida Indian Tribes of Alaska
320 West Wiloughby Avenue, Suite 300
Juneau, AK 99801

Subject: Initiation of Section 106 Review Process

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Please be as specific as you can with any comments or information. Since this review is time sensitive and must adhere to the provisions in 36 CFR Part 800, we request that you submit comments within 30 days from receipt of this letter.

If you have any questions regarding this letter please contact me at 907-874-3904 or P.O. Box 531, Wrangell, AK 99929, or you may contact Rural Development directly by contacting Tasha Deardorff at 907-271-2424 ext. 118 or 510 L Street, Suite 410, Anchorage, AK 99501.

Sincerely,

Amber Al-Haddad

Amber Al-Haddad
Director of Public Works and Capital Projects
City and Borough of Wrangell
P.O. Box 531
Wrangell, AK 99929

Attachments: Section 106 Consultation Supporting Documentation

Copy: Tasha Deardorff, USDA, WEP/RAVG Program
Jon Hermon, CRW Engineering Group

CITY & BOROUGH OF WRANGELL
INCORPORATED JUNE 15, 1903

Dept. of Public Works & Capital Projects

PO Box 531
Wrangell, AK 99929

Phone (907)-874-3904
Fax (907)-874-2699

November 15, 2016

Anthony Mallott, President and CEO
Sealaska Corporation
One Sealaska Plaza, Suite 400
Juneau, AK 99801-1276

Subject: Initiation of Section 106 Review Process

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- Any other comments or information related to historic preservation which you believe is relevant to the Section 106 review.

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If you have any questions regarding this letter please contact me at 907-874-3904 or P.O. Box 531, Wrangell, AK 99929, or you may contact Rural Development directly by contacting Tasha Deardorff at 907-271-2424 ext. 118 or 510 L Street, Suite 410, Anchorage, AK 99501.

Sincerely,

Amber Al-Haddad

Amber Al-Haddad
Director of Public Works and Capital Projects
City and Borough of Wrangell
P.O. Box 531
Wrangell, AK 99929

Attachments: Section 106 Consultation Supporting Documentation

Copy: Tasha Deardorff, USDA, WEP/RAVG Program
Jon Hermon, CRW Engineering Group

Wrangell Drinking Water Treatment Plant Pilot Study Project
Section 106 Consultation Supporting Documentation

November 2016

Authorization/Instructions to Applicant

For reference, the National Historic Preservation Act (NHPA) Section 106 Consultation Authorization and Instructions to Applicant are attached to this document (Attachment A). The document gives written authorization to the City and Borough of Wrangell (CBW), CRW Engineering Group, LLC (CRW), and Solstice Alaska Consulting, Inc. (SolsticeAK) to initiate consultation under the Section 106 process on behalf of the U.S. Department of Agriculture (USDA) Rural Development.

Project Description

To meet the community of Wrangell's current water demand, the CBW is proposing to upgrade Wrangell's water treatment plant (WTP). Presently, Wrangell's primary water source is a water treatment system that includes an existing WTP, water storage tank, and a lower reservoir wastewater treatment plant (WWTP). The proposed project will upgrade and expand Wrangell's water treatment system.

The water treatment processes would be improved through remodeling, upgrading, and expanding the existing WTP and installing a gravity sewer line pipe for backwash wastewater disposal to the nearby existing WWTP.

WTP Upgrades and Expansion

A new treatment building would be constructed adjacent to the existing WTP to house two parallel Dissolved Air Flotation (DAF) plants and multimedia filtration to ensure that water meets drinking water standards. The treatment building would also house chemical feed tanks and associated pumps and control systems. The existing slow sand filters at the WTP facility would be converted into clearwells to slightly more than double the current capacity of the facility to about 850,000 gallons. A dedicated chemical storage building would be constructed adjacent to the new treatment building.

Gravity Sewer Line

A gravity sewer line would be installed to carry backwash wastewater from the WTP to the WWTP. The gravity sewer main would be approximately 1,350 linear feet long and would run underground to the WWTP, where the water would be treated. Sewer line construction would require clearing, drilling, and blasting along the proposed alignment.

Figures showing the proposed project are found in Attachment B.

Federal and State Project Involvement

The CBW is interested in obtaining funds from USDA Rural Development for upgrades to the WTP. In order to obtain federal funding, the project must meet the requirements of the National Environmental Policy Act.

Further, the project is expected to require the following permits and authorizations:

- NHPA Section 106 compliance through concurrence from the Alaska Office of History and Archaeology and State Historic Preservation Office (SHPO)
- State of Alaska Department of Environmental Conservation (ADEC) Drinking Water Plan Review, including a Construction Approval and Operations Approval
- ADEC Wastewater Plan Review, including a Construction Approval and Operations Approval
- ADEC General Construction Permit

Project Site Details

The project would occur in Wrangell, Alaska, which is located on the northwest tip of Wrangell Island, 155 miles south of Juneau and 89 miles northwest of Ketchikan (Figure 1). Within Wrangell, the project would be located north of Zimovia Highway (Township 62 South, Range 84 East, Section 31 of the Copper River Meridian, USGS quadrangle Petersburg B-2 NE). The WTP is located at approximately north latitude 56.4565028112, west longitude -132.376624775 (Attachment B; Figure 1).

Land Use

The project would be located on land owned by the CBW and zoned light industrial/industrial. The project would involve approximately 1 acre of impacts to previously disturbed land adjacent to the WTP, undisturbed forested land, and previously disturbed land adjacent to an existing rock quarry and the WWTP. The land is flat near the WTP and sloped between the WTP and the WWTP.

Adjacent Land Use

Most of the land adjacent to the proposed project area is owned by the CBW and is zoned light industrial/industrial. A portion of the project area is bounded by quarry, which is zoned industrial. The northern area of the quarry is privately owned, and the southern area is owned by the CBW.

U.S. Geological Survey (USGS) Quadrangle Map

The USGS 7.5 quadrangle map, Petersburg B-2 NE, is found in Attachment C.

Site Photographs

See the included photographs of the proposed project area for the WTP and gravity sewer line pipe for backwash wastewater disposal, which were taken on October 19, 2016, traveling downhill from the WTP to the WWTP (Attachment D; Images 1 through 13).

Area of Potential Effects

The project's area of potential effects (APE) is the existing WTP, an area around the WTP, and a 50-ft wide corridor between the WTP and the WWTP. See the provided APE map (Attachment E).

Efforts to Determine Cultural and Historic Resources in the APE

A cultural resources literature review was completed on October 17, 2016 by Cultural Resource Consultants, LLC (CRC; Attachment F).

Results of Efforts to Determine Cultural and Historic Resources in the APE

According to CRC's literature review preliminary findings, there are no known sites within the project limits listed in the Alaska Heritage Resource Survey (AHRS). West of the general project area, the closest known sites are a reported petroglyph (PET-00033), the Redmen's Cemetery and Native Cemetery (PET-00099), Eli Urho Kanerva Boat Shed and Warehouse (PET-00330), and Fremin Midden (PET-00483). To the east are two Wrangell water supply dams—PET-00571 and PET-00572.

Among other criteria, Appendix D of the 2010 programmatic agreement[1] between the USDA Forest Service, Advisory Council on Historic Preservation, and Alaska State Historic Preservation Officer defines areas of high archaeological sensitivity as "all land between mean lower low water and 100 ft. of elevation above mean high water, with no consideration of slope;" "lake and stream systems containing, or known to have contained, anadromous fish runs; including a focus on barrier falls locations in such systems;" and "elevated/fossil marine, river, and lake terrace systems." The project area is generally above the 100-ft contour, is not near the mouth of any creeks, and the topography of the area is too steep to be considered a marine terrace.

According to CRC, the location does not appear to have been archaeologically surveyed; however, because the proposed project is in an area where there is low probability for undiscovered historic and archaeological sites, CRC does not recommend an archaeological field survey.

Preliminary Findings and Determination

There are no reported historic or cultural sites within the APE, and the probability that there are historic properties within the APE is low. Based on the information above, CBW, CRW, and SolsticeAK contend that no historic properties will be affected by the project.

---

[1] *Third Amended Programmatic Agreement Among the USDA Forest Service, Alaska Region, the Advisory Council on Historic Preservation, and the Alaska State Historic Preservation Officer Regarding Heritage Resource Management on National Forests in the State of Alaska.*

Parties Consulted

The parties that are being consulted on this issue include the following entities:

- Wrangell Cooperative Association (local federally-recognized tribe)
- Central Council of the Tlingit and Haida Indian Tribes of Alaska (native non-profit regional organization)
- Sealaska Corporation (ANCSA regional corporation)

Wrangell was not recognized under section 16 of ANCSA and does not have a village corporation.

Attachments

Attachment A
NHPA Section 106 Consultation Authorization and Instructions to Applicant

Attachment B
Figure 1. Vicinity Map
Figure 2. Proposed WTP Upgrades and Expansion
Figure 3. Proposed Gravity Sewer Line Location

Attachment C
USGS Map Petersburg B-2 SE

Attachment D
Site Photographs: Images 1-13

Attachment E
Area of Potential Effect Figure

Attachment F
Cultural Resources Literature Review Memorandum
Prepared by Cultural Resources Consultants, LLC. October 17, 2016

Attachment A

NHPA Section 106 Consultation Authorization and Instructions to Applicant

USDA

United States Department of Agriculture

Rural Development

510 L Street,
Suite 410
Anchorage, AK
99501

Voice 907.271-2424

Section 106 Consultation Authorization and Instructions to Applicant

DATE: 10/17/2016

TO: City of Wrangell
Wrangell, Alaska

CRW Engineers/Solstice Alaska Consulting
Anchorage, AK

FROM: USDA Rural Development
510 L Street, Suite 410
Anchorage, AK

SUBJECT: Initiating Consultations under the Section 106 Process

In order for Rural Development to make a decision on the Wrangell application, an environmental review must first be completed. Among other items, this environmental review includes an analysis of the potential for your proposed project to impact sites that are listed or eligible for listing on the National Register of Historic Places. This analysis is required by Section 106 of the National Historic Preservation Act (NHPA) and its implementing regulations located at 36 CFR Part 800. NHPA requires Rural Development to work closely with the State Historic Preservation Office (SHPO), Tribes, and other consulting parties to take into account the effects of your project on historic properties and to attempt to find ways to avoid, minimize, or mitigate adverse effects, to the extent practicable.

Receipt of this letter from Rural Development authorizes you to initiate consultation under the Section 106 process. Please proceed as follows:

1. Review the attached letter (Attachment 1) and the required supporting documentation (Attachment 2).

2. Your Rural Development representative will:

- Answer any questions you have about completing the letter and the supporting documentation;
- Assist you in a preliminary description of the area of potential effects* (APE);
- Assist you in developing a preliminary list of the consulting parties.

Please completed the following:

1. Send the completed letter (Attachment 1) and the supporting documentation (contained in Attachment 2) to each of the consulting parties on the list (retain a dated copy of each letter for your records).
2. Include a copy of this Authorization/Instructions document with your letter to the SHPO and/or THPO.
3. Allow 30 days for receipt of comments. Incorporate any comments received into the environmental information/report (depending on Rural Development program) being prepared as part of your application to Rural Development, and attach copies of each letter you sent out and comments received to the environmental information/report.

The initiation of consultation is the first step in the Section 106 process. This authorization permits you, as an applicant (or, by proxy, the applicant's consultant), to initiate this consultation process and to assist Rural Development in collecting and evaluating information to facilitate timely compliance with Section 106 requirements. Rural Development remains legally responsible for making all formal determinations and findings under the Section 106 process.

Please be aware that some proposals require the services of a professional consultant. For example, an archeological survey may be needed before the Section 106 process can be concluded. Your Rural Development representative can provide you further guidance, if there is a need for such services. As an applicant, you are still responsible for the requirements of this letter, even though you have hired a consultant to assist you.

This authorization to initiate consultation under the Section 106 process does **not** constitute Rural Development approval of your request for financial assistance. All costs incurred by the applicant in compliance with the Section 106 process are incurred at the applicant's risk.

Note: Do **not** take any actions which might have an adverse effect on historic property or cultural resources until the Section 106 review process is completed. Section 110(k) of the National Historic Preservation Act **may prohibit** federal agencies from providing federal financial assistance to any applicant who "... with intent to avoid the requirements of Section 106, has intentionally significantly adversely affected a historic property..."

Please contact your Rural Development representative Tasha Deardorff at 907-271-2424 ext 118 or at tasha.deadorff@ak.usda.gov, should you have any questions.

Attachments: Attachments 1 and 2

* The area of potential effects (APE) is defined by 36 CFR Part 800, Section 800.16(d) as follows: "Area of potential effects means the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking."

Attachment B
Figure 1. Vicinity Map
Figure 2. Proposed WTP Upgrades and Expansion
Figure 3. Proposed Gravity Sewer Line Location

Project:

STATUS: DRAFT

Wrangell WTP Upgrades Project
Figure 1. Vicinity Map

Project No:	20901.00
Drawn By:	WMK
Scale:	NTS
Date:	10/5/2016

CRW ENGINEERING GROUP, LLC

FILE NAME: J:\Jobsdata\20901.00 Wrangell Water Treatment Pilot Stud\00 CADD\01 Working Set\01 Civil\20901.00 Vicinity Map.dwg

PROJECT: 20901.00 STATUS: DRAFT	CRW ENGINEERING GROUP, LLC 3940 ARCTIC BLVD, SUITE 300 ANCHORAGE, ALASKA 99503 PHONE (907) 562-3252 #AECL882-AK	Wrangell WTP Upgrades Project Figure 2. Proposed WTP Upgrades and Expansion	DATE 10/13/16 SCALE GRAPHIC

File: J:\Jobsdata\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\02 Figures\05 PER\20901.00 ALT 4 DAF.dwg

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD, SUITE 300
ANCHORAGE, ALASKA 99503
PHONE (907) 562-3252
#AECL882-AK

Wrangell WTP Upgrades Project
Figure 3. Proposed Gravity Sewer Line Location

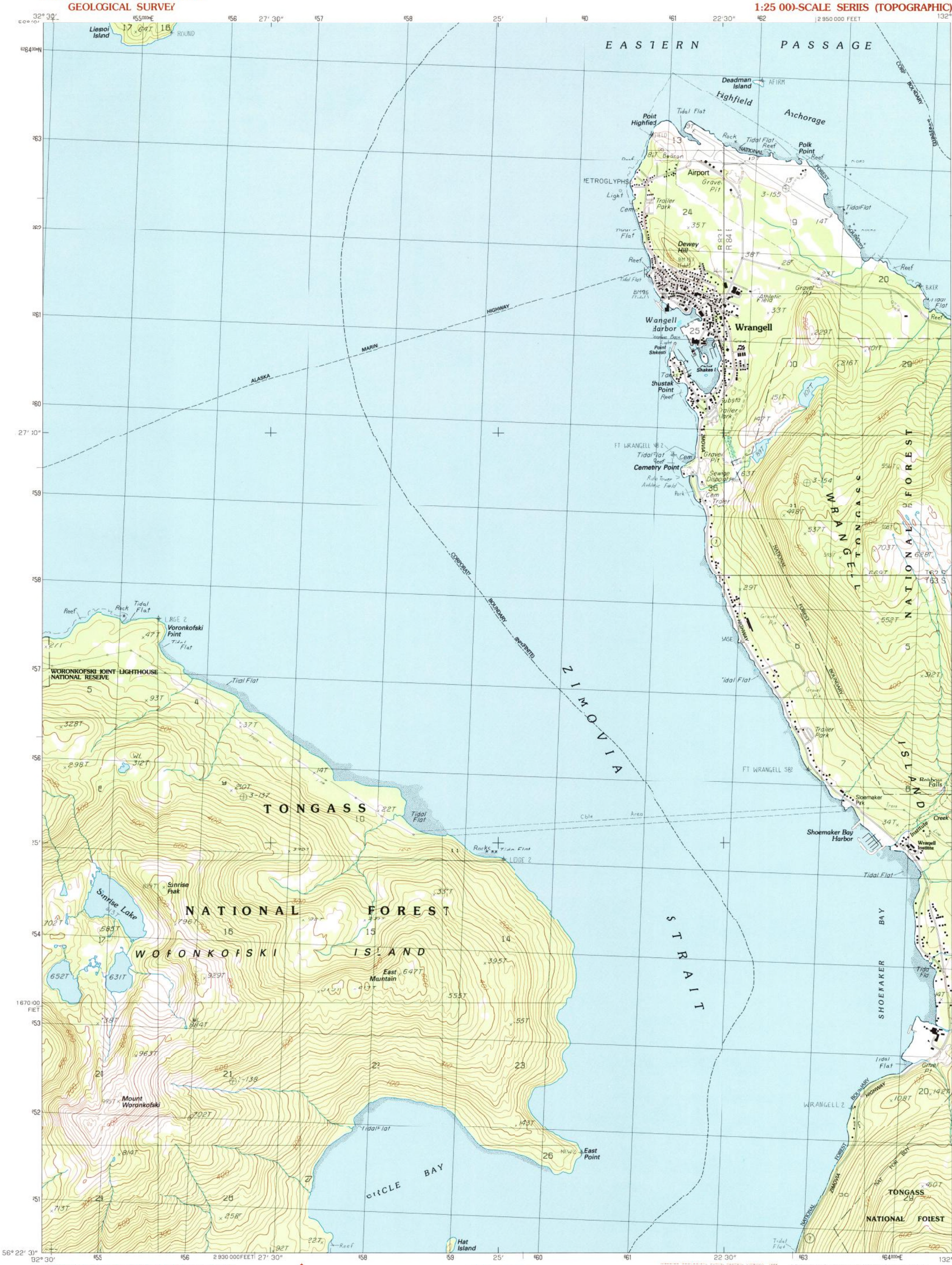
DATE	10/5/16
SCALE	GRAPHIC
PROJECT:	
STATUS:	DRAFT

File: J:\Jobsdata\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\02 Figures\05 PER\20901.00 Sewer Disposal Alternatives.dwg

Attachment C
USGS Map Petersburg B-2 SE

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PETERSBURG (B-2) NE QUADRANGLE
ALASKA
1:25 000-SCALE SERIES (TOPOGRAPHIC)



PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY
CONTROL BY .... USGS, NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1982
FIELD CHECKED .... 1986. MAP EDITED 1992
PROJECTION .... UNIVERSAL TRANSVERSE MERCATOR
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR .... ZONE 8
10,000 FOOT STATE GRID TICKS .... ALASKA, ZONE 1
UTM GRID DECLINATION .... 2°09' EAST
1992 MAGNETIC NORTH DECLINATION .... 26°30' EAST
VERTICAL DATUM .... NATIONAL GEODETIC VERTICAL DATUM OF 1929

The difference between NAD 27 and North American Datum of 1983 (NAD 83) for 7.5 minute intersections is given in USGS Bulletin 1875. The NAD 83 is shown by dashed corner ticks

Land lines represent unsurveyed and unmarked locations predetermined by the Bureau of Land Management, Folio CR-15 Copper River Meridan

There may be private inholdings within the boundaries of any Federal and State Reservations shown on this map

National Interest Lands Conservation Act PL 96-487, Dec. 2 1980, are shown as compiled by the adminstering agencies

NORTH

PROVISIONAL MAP
Produced from original manuscript drawings, Information shown as of date of photography. 1

SCALE 1:25000

KILOMETERS · METERS · MILES · FEET

CONTOUR INTERVAL 10 METERS
THE MEAN RANGE OF TIDE IS APPROXIMATELY 4.1 METERS
CONTROL ELEVATIONS SHOWN TO THE NEAREST 0.1 METER
OTHER ELEVATIONS SHOWN TO THE NEAREST METER

To convert meters to feet multiply by 3.2808
To convert feet to meters multiply by .3048

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, FAIRBANKS, ALASKA 99701
DENVER, COLORADO 80225 OR RESTON, VIRGINIA 22092

ALASKA
QUADRANGLE LOCATION

1	2	3	1 Petersburg (C-2) SW 2 Petersburg (C-2) SE 3 Petersburg (C-1) SW 4 Petersburg (B-2) NW 5 Petersburg (B-1) NW 6 Petersburg (B-2) SW 7 Petersburg (B-2) SE 8 Petersburg (B-1) SW
4		5	
6	7	8	

ADJOINING 7.5' QUADRANGLE NAMES

CONTOURS AND ELEVATIONS IN METERS

ROAD LEGEND

Improved Road ....
Unimproved Road ....
Trail ....
State Route

PETERSBURG (B-2) NE, ALASKA
PROVISIONAL EDITION 1992

OCT 1992

Attachment D

Site Photographs: Images 1-13

These photographs were taken on October 19, 2016 and follow the proposed project area traveling downhill from the WTP to the wastewater treatment facility.

Image 1.

Image 2.

Image 3.

Image 4.

These photographs were taken on October 19, 2016 and follow the proposed project area traveling downhill from the WTP to the wastewater treatment facility.


Image 5.


Image 6.


Image 7.


Image 8.

These photographs were taken on October 19, 2016 and follow the proposed project area traveling downhill from the WTP to the wastewater treatment facility.

Image 9.

Image 10.

These photographs were taken on October 19, 2016 and follow the proposed project area traveling downhill from the WTP to the wastewater treatment facility. The wastewater treatment facility treatment facility can be seen in these photographs.


Image 11.


Image 12.

Image 13.

Attachment E

Area of Potential Effect Figure

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD, SUITE 300
ANCHORAGE, ALASKA 99503
PHONE (907) 562-3252
#AECL882-AK

Wrangell WTP Upgrades Project
Area of Potential Effect

DATE 10/5/16
SCALE GRAPHIC
PROJECT:
STATUS: DRAFT

File: J:\Jobsdata\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\02 Figures\05 PER\20901.00 Sewer Disposal Alternatives.dwg

Attachment F

Cultural Resources Literature Review Memorandum

Prepared by Cultural Resources Consultants, LLC. October 17, 2016

CRC

CULTURAL RESOURCE CONSULTANTS LLC

3504 East 67th Avenue
Anchorage, Alaska 99507
(907) 349-3445

October 17, 2016

Wrangell Drinking Water Treatment Plant Pilot Study Project

Introduction

The following briefly summarizes the results of a cultural resources literature review for the Wrangell Drinking Water Treatment Plant Pilot Study Project. The project would be located in Wrangell, Alaska, east of Zimovia Highway near Township 62 South, Range 84 East, Sections 30 and 31; and Township 63 South, Range 84 East, Section 6 of the Copper River Meridian, USGS quadrangle Petersburg B-2 NE. The middle of project is at about 56.4591642766 N, -132.377090082 E.

Project Description

The City & Borough of Wrangell proposes improvements to its water treatment plant consisting of construction of a wastewater pipe and an expansion and remodel of the treatment plant buildings (Figure 1). The wastewater pipe would be either above or below ground, depending on alternatives selected. For one alternative, the gravity sewer main pipe would be approximately 1,350 linear feet (LF) in length and would run downhill from the existing water treatment plant to connect to the existing wastewater treatment plant. For the other alternative, the gravity sewer main pipe would be approximately 2,900 LF and would be constructed along the existing road to connect to the existing gravity sewer main. Various alternatives are being considered for the water treatment plant, but all options involve expansion and construction of new best technology facilities (e.g., a backwash clarifier and multimedia treatment system or additional roughing and sand filters).

Known Sites in the General Project Area

There are no known sites within the project limits listed in the Alaska Heritage Resource Survey (AHRS). West of the general project area, the closest known sites are a reported petroglyph (PET-00033), the Redmen's Cemetery and Native Cemetery (PET-00099), Eli Urho Kanerva Boat Shed and Warehouse (PET-00330), and Fremin Midden (PET-00483). To the east are two Wrangell water supply dams, PET-00571 and PET-00572.

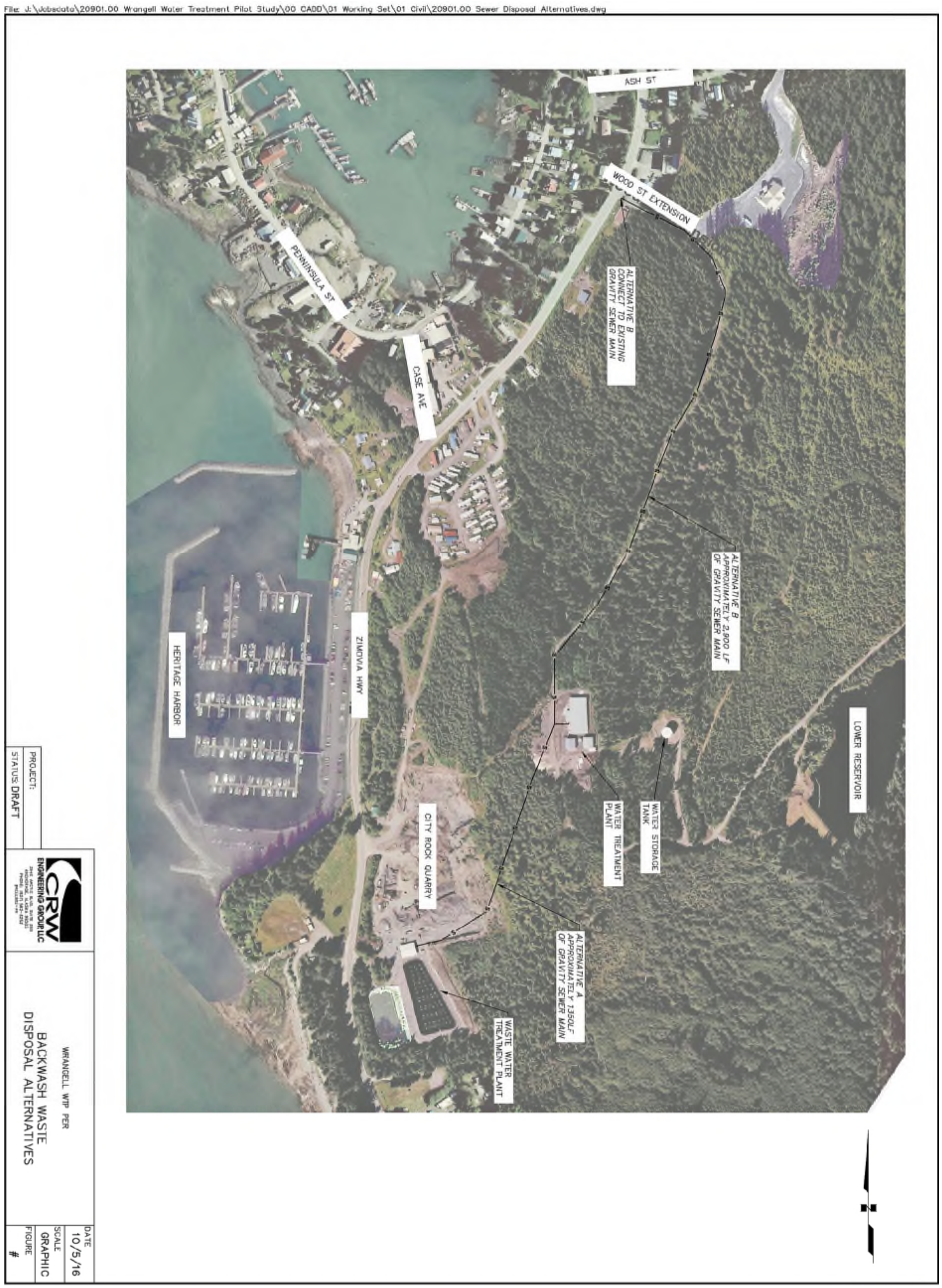


Figure 1. Project location.

Recommendations

There are no known cultural resources within the footprint of the proposed project, although this specific locale does not appear to have been archaeologically surveyed. However, because the proposed project is in an area where there is a low probability for undiscovered historic and archaeological sites, Cultural Resource Consultants LLC does not recommend an archaeological field survey. Among other criteria, Appendix D of the 2010 programmatic agreement[1] between the USDA Forest Service, Advisory Council on Historic Preservation, and Alaska State Historic Preservation Officer, defines areas of high archaeological sensitivity as “all land between mean lower low water and 100 ft. of elevation above mean high water, with no consideration of slope;” “lake and stream systems containing, or known to have contained, anadromous fish runs; including a focus on barrier falls locations in such systems;” and “elevated/fossil marine, river, and lake terrace systems.” The project area generally is above the 100-foot contour, it is not near the mouth of any creeks, and the topography of the area too steep to be considered a marine terrace.

[1] *Third Amended Programmatic Agreement Among the USDA Forest Service, Alaska Region, the Advisory Council on Historic Preservation, and the Alaska State Historic Preservation Officer Regarding Heritage Resource Management on National Forests in the State of Alaska.*

2895 Rat (Funny)

CITY OF WRANGELL

Al Jordan

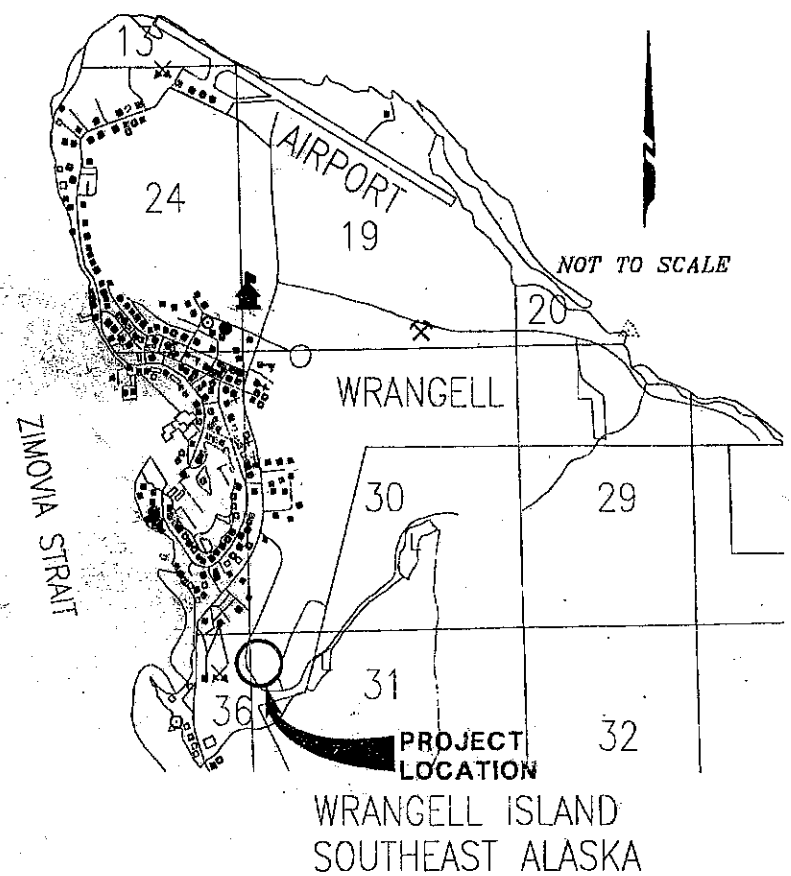
PHASE 2 WATER SYSTEM IMPROVEMENTS

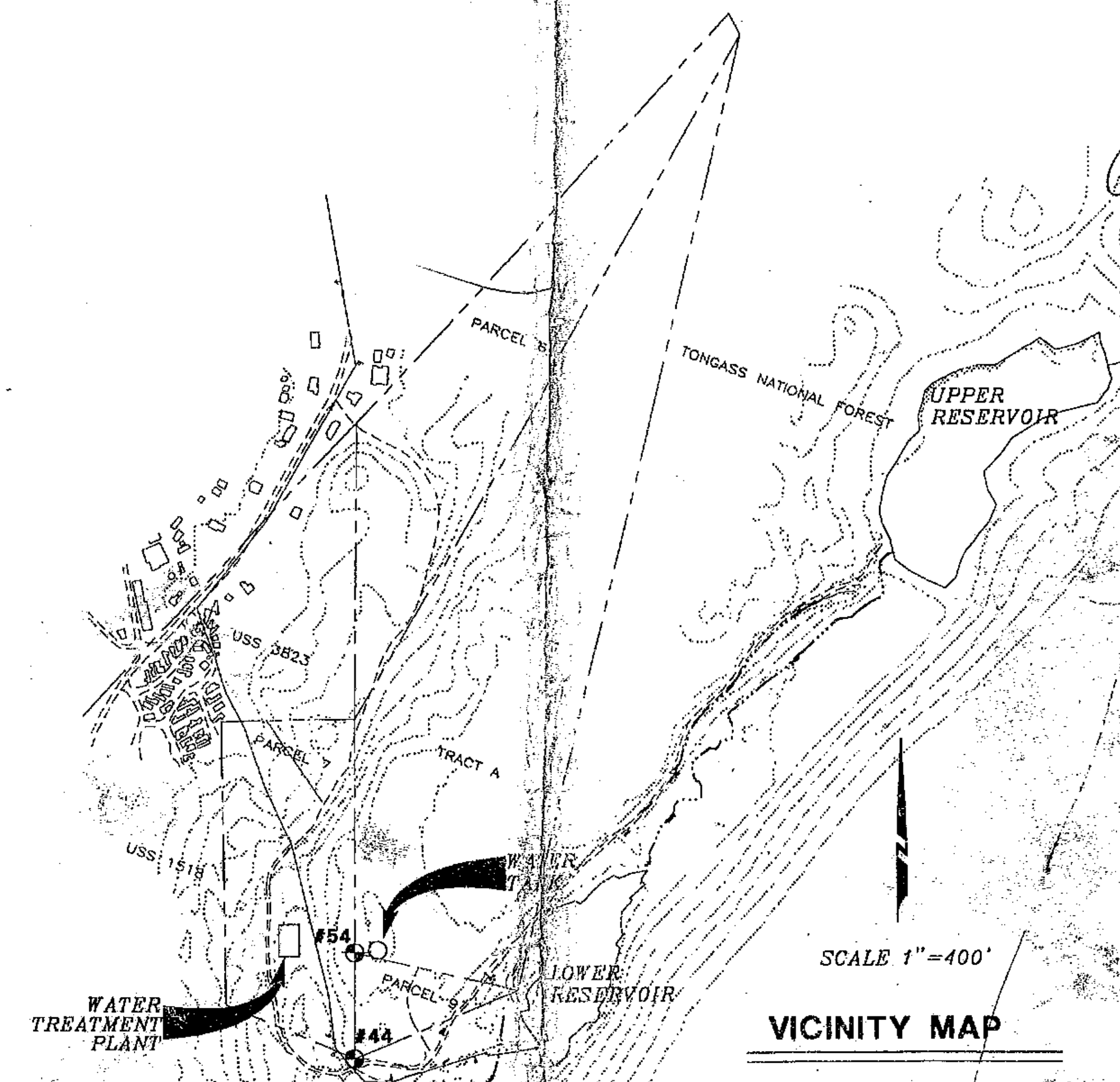
WRANGELL, ALASKA

STATE OF ALASKA
49TH
JAMES E. WILSON
No. CE6668
REGISTERED PROFESSIONAL ENGINEER

3/12/98

LOCATION MAP





VICINITY MAP

PROJECT DATUM

ELEVATION DATUM
USC & GS TIDAL BENCH MARK 6, 1954, ELEV 39.27' – M.L.L.W.

BASIS OF BEARING
LINE OF SIGHT BETWEEN ORIGINAL CENTERLINE ANGLE POINT MONUMENTS FOR FRONT STREET ADJACENT TO LOT NO. 7, BLOCK NO. 4 AND LOT NO. 10, BLOCK NO. 5, WRANGELL TOWNSITE. THE RECORD BEARING IS S 51°29'00" E.

DENOTES PROJECT BENCHMARK

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
44	7127.83	9950.14	276.31	ALUM POST WITH 2-1/2" ALUM CAP
54	7593.62	9962.38	306.01	ALUM POST WITH 2-1/2" ALUM CAP

DETAIL NOTATIONS

1 — DETAIL NUMBER
C9 — SHEET NUMBER ON WHICH DETAIL APPEARS

INDEX TO DRAWINGS

CIVIL
- C01 VICINITY MAP, INDEX TO DRAWING
- C02 HYDRAULIC PROFILE & PROCESS SCHEMATIC
- C03 SITE PIPING PLAN
- C04 SITE GRADING & DRAINAGE PLAN
- C05 EXISTING SITE CONDITIONS
- C06 SITE DIMENSIONAL PLAN
- C07 SITE CROSS SECTIONS
- C08 SITE CROSS SECTIONS
- C09 CIVIL DETAILS

WATER STORAGE TANK
- R01 WATER STORAGE TANK PLAN & PIPING

ARCHITECTURAL
- A01 CONTROL BUILDING FLOOR PLAN
- A02 CONTROL BUILDING ELEVATIONS
- A03 CONTROL BUILDING SECTIONS
- A04 ROUGHING FILTER BUILDING PLAN & ELEVATIONS
- A05 PIPE GALLERY BUILDING PLAN & ELEVATIONS
- A06 SLOW SAND FILTER ROOFING PLAN

STRUCTURAL
- S01 GENERAL STRUCTURAL NOTES & REFERENCE PLAN
- S02 CONTROL BUILDING PLAN, SECTIONS & DETAILS
- S03 ROUGHING FILTER BUILDING PLAN, SECTIONS, & DETAILS
- S04 OZONE CONTACTOR VAULT PLAN, SECTIONS & DETAILS
- CLEARWELL PLAN, SECTIONS, & DETAILS
- S05 SLOW SAND FILTER 1/2: PLAN, SECTIONS & DETAILS
- S06 SLOW SAND FILTER 2/2: PLAN, SECTIONS & DETAILS
- S07 DETAILS, SECTIONS, & SCHEDULES

MECHANICAL
- M01 CONTROL BUILDING PIPING
- M02 OZONE CONTACTOR
- M03 ROUGHING FILTER/FLOW SPLITTER PLAN
- M04 ROUGHING FILTER/FLOW SPLITTER SECTIONS
- M05 SLOW SAND FILTER CELL PIPING
- M06 PIPE GALLERY PLAN & SECTIONS
- M07 PIPE GALLERY ISOMETRIC
- M08 SLOW SAND FILTER DETAILS

ELECTRICAL
- E01 ELECTRICAL SYMBOLS
- E02 ONE LINE DIAGRAM & MISC. DETAILS
- E03 SITE ELECTRICAL PLAN
- E04 CONTROL BLDG & FACILITY POWER PLAN
- E05 PROCESS POWER / INSTRUMENTATION PLAN
- E06 CIRCUIT SCHEDULE & CONTROL DIAGRAMS

INSTRUMENTATION
- I01 INSTRUMENTATION SYMBOLS
- I02 PID SCHEMATIC NO. 1
- I03 PID SCHEMATIC NO. 2 & MISC DETAILS

Mac Curtis

REDUCED PLANS!

HALF SCALE PLANS

NO.	REVISIONS	BY	DATE

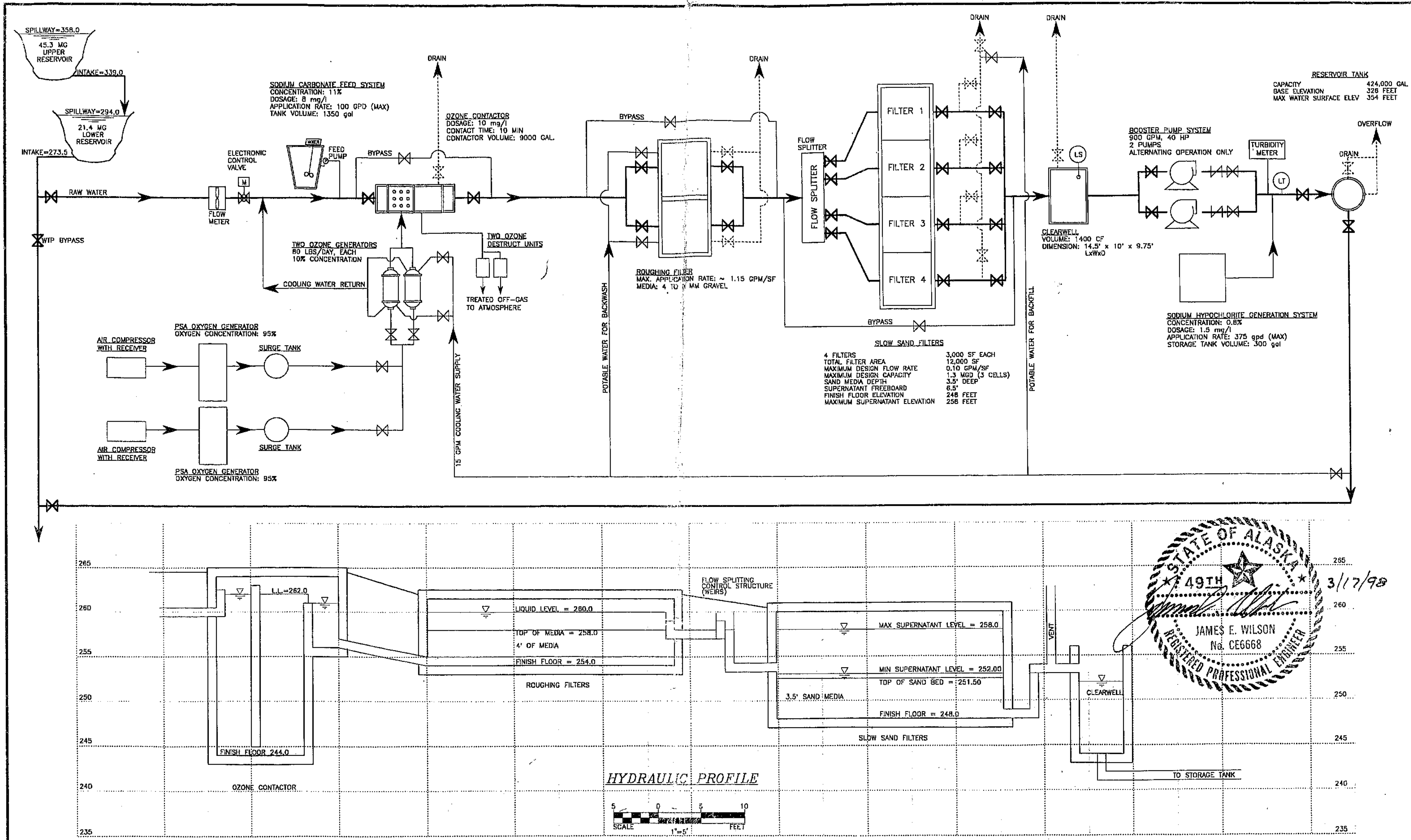
Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX (360) 647-9061

DESIGNED BY: MAC
DRAWN BY: WAH
CHECKED BY: JEW

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
VICINITY MAP, INDEX TO DRAWINGS

DATE 3/11/98
SCALE AS SHOWN
JOB NUMBER 97070
SHEET C01 OF C09

C:\PROJECT\97070\DWG\97070C01 Wed Mar 11 17:01:24 1998 WAH



NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

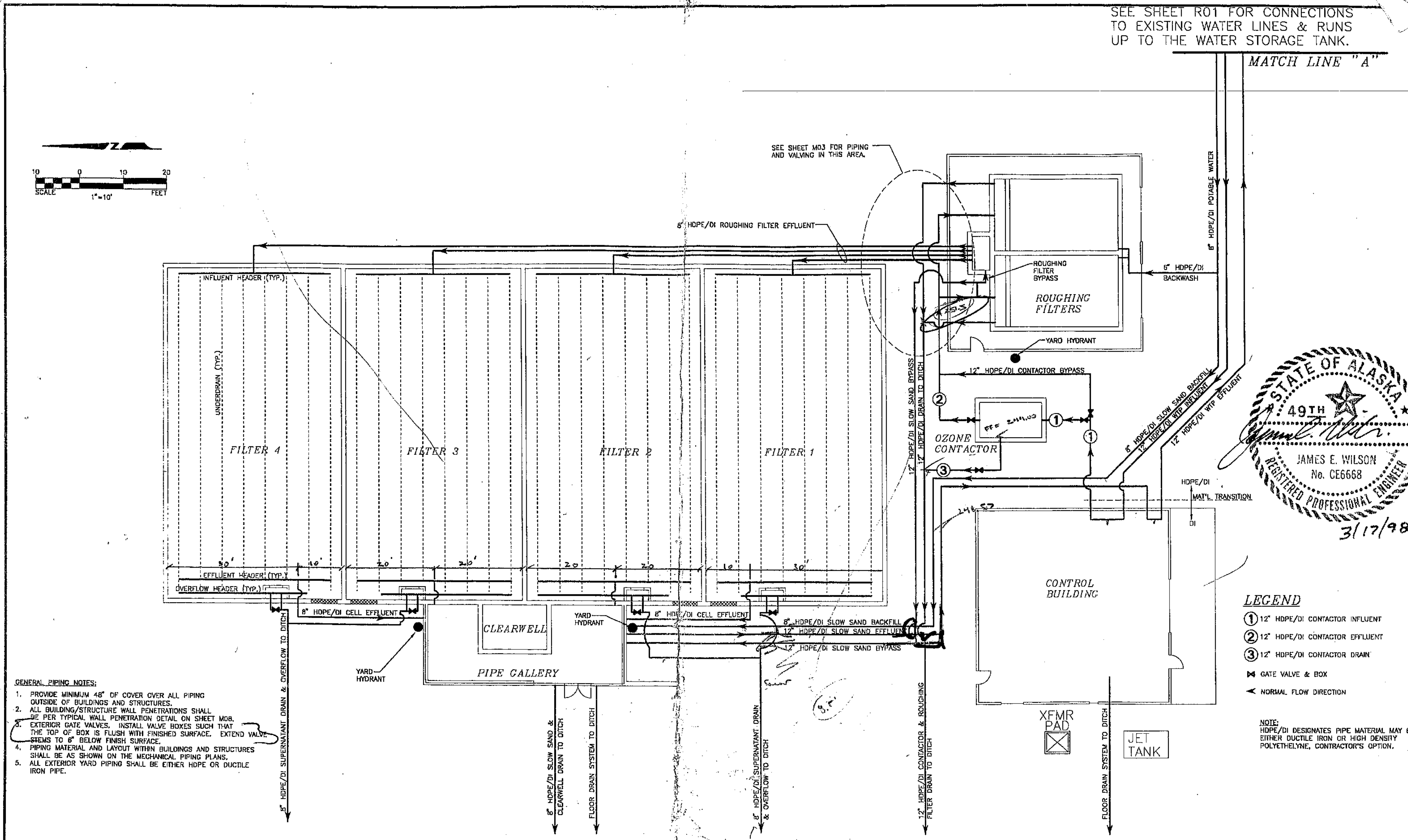
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: MAC
DRAWN BY: WAH
CHECKED BY: MAC

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
HYDRAULIC PROFILE & PROCESS SCHEMATIC

DATE 3/12/98
SCALE AS SHOWN
JOB NUMBER 97070
SHEET C02 OF C09

CT\97070\DWG\97070C02 Thu Mar 12 16:59:31 1998 WAH



GENERAL PIPING NOTES:

1. PROVIDE MINIMUM 48" OF COVER OVER ALL PIPING OUTSIDE OF BUILDINGS AND STRUCTURES.
2. ALL BUILDING/STRUCTURE WALL PENETRATIONS SHALL BE PER TYPICAL WALL PENETRATION DETAIL ON SHEET M08.
3. EXTERIOR GATE VALVES. INSTALL VALVE BOXES SUCH THAT THE TOP OF BOX IS FLUSH WITH FINISHED SURFACE. EXTEND VALVE STEMS TO 6" BELOW FINISH SURFACE.
4. PIPING MATERIAL AND LAYOUT WITHIN BUILDINGS AND STRUCTURES SHALL BE AS SHOWN ON THE MECHANICAL PIPING PLANS.
5. ALL EXTERIOR YARD PIPING SHALL BE EITHER HDPE OR DUCTILE IRON PIPE.

LEGEND

1. 12" HDPE/DI CONTACTOR INFLUENT
2. 12" HDPE/DI CONTACTOR EFFLUENT
3. 12" HDPE/DI CONTACTOR DRAIN

GATE VALVE & BOX

NORMAL FLOW DIRECTION

NOTE: HDPE/DI DESIGNATES PIPE MATERIAL MAY BE EITHER DUCTILE IRON OR HIGH DENSITY POLYETHELYNE, CONTRACTOR'S OPTION.

C:\PROJECT\97070\DWG\97070C03 Thu Mar 12 15:56:37 1998 WAH

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

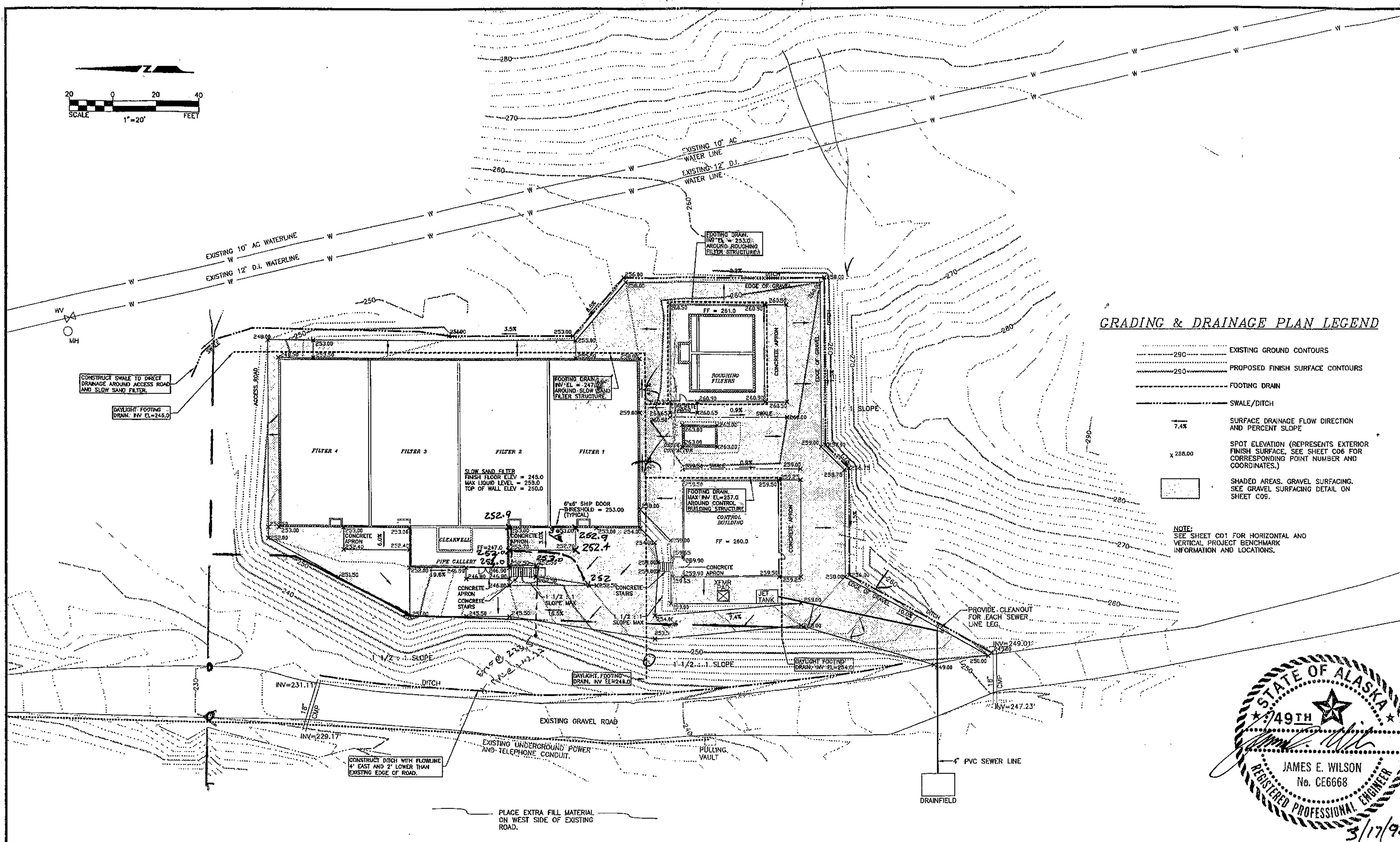
DESIGNED BY: MAC
DRAWN BY: WAH
CHECKED BY:

CITY OF WRANGELL

WRANGELL ISLAND ALASKA

PHASE 2 WATER SYSTEM IMPROVEMENTS
SITE PIPING PLAN

DATE 3/11/98
SCALE AS SHOWN
JOB NUMBER 97070
SHEET C03 OF C09



C:\PROJECT\97070\DWG\97070C04 Tue Mar 17 08:04:45 1998 WAH

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY:	DRAWN BY:	CHECKED BY:
MAC	WAH	

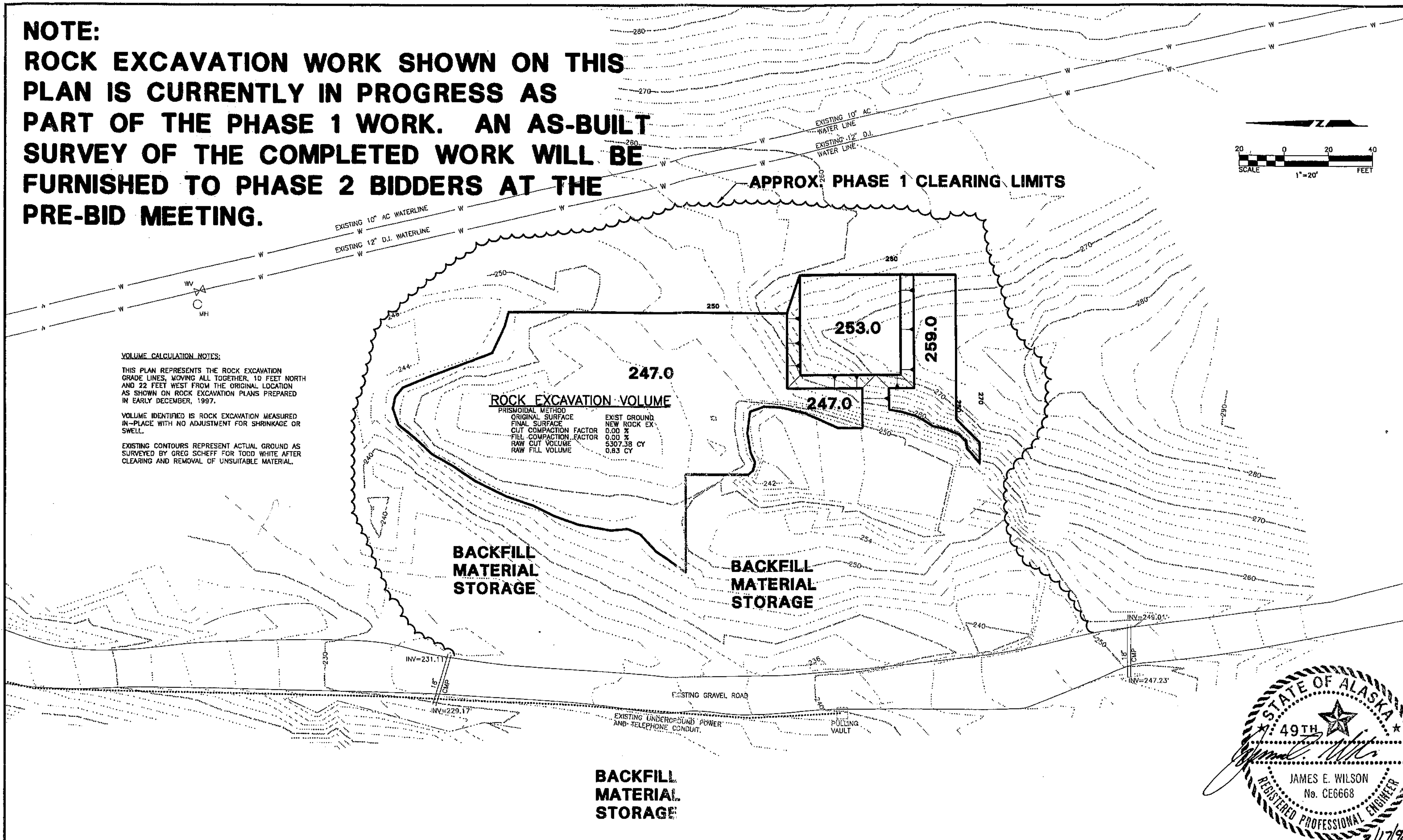
CITY OF WRANGELL

WRANGELL ISLAND — ALASKA

PHASE 2 WATER SYSTEM IMPROVEMENTS
SITE GRADING & DRAINAGE PLAN

DATE	SHEET
3/17/98	C04
SCALE AS SHOWN	OF
JOB NUMBER 97070	C09

NOTE:
ROCK EXCAVATION WORK SHOWN ON THIS PLAN IS CURRENTLY IN PROGRESS AS PART OF THE PHASE 1 WORK. AN AS-BUILT SURVEY OF THE COMPLETED WORK WILL BE FURNISHED TO PHASE 2 BIDDERS AT THE PRE-BID MEETING.



VOLUME CALCULATION NOTES:

THIS PLAN REPRESENTS THE ROCK EXCAVATION GRADE LINES, MOVING ALL TOGETHER, 10 FEET NORTH AND 22 FEET WEST FROM THE ORIGINAL LOCATION AS SHOWN ON ROCK EXCAVATION PLANS PREPARED IN EARLY DECEMBER, 1997.

VOLUME IDENTIFIED IS ROCK EXCAVATION MEASURED IN-PLACE WITH NO ADJUSTMENT FOR SHRINKAGE OR SWELL.

EXISTING CONTOURS REPRESENT ACTUAL GROUND AS SURVEYED BY GREG SCHEFF FOR TODD WHITE AFTER CLEARING AND REMOVAL OF UNSUITABLE MATERIAL.

STATE OF ALASKA
49TH
JAMES E. WILSON
No. CE6668
REGISTERED PROFESSIONAL ENGINEER
3/17/98

NO.	REVISIONS	BY	DATE

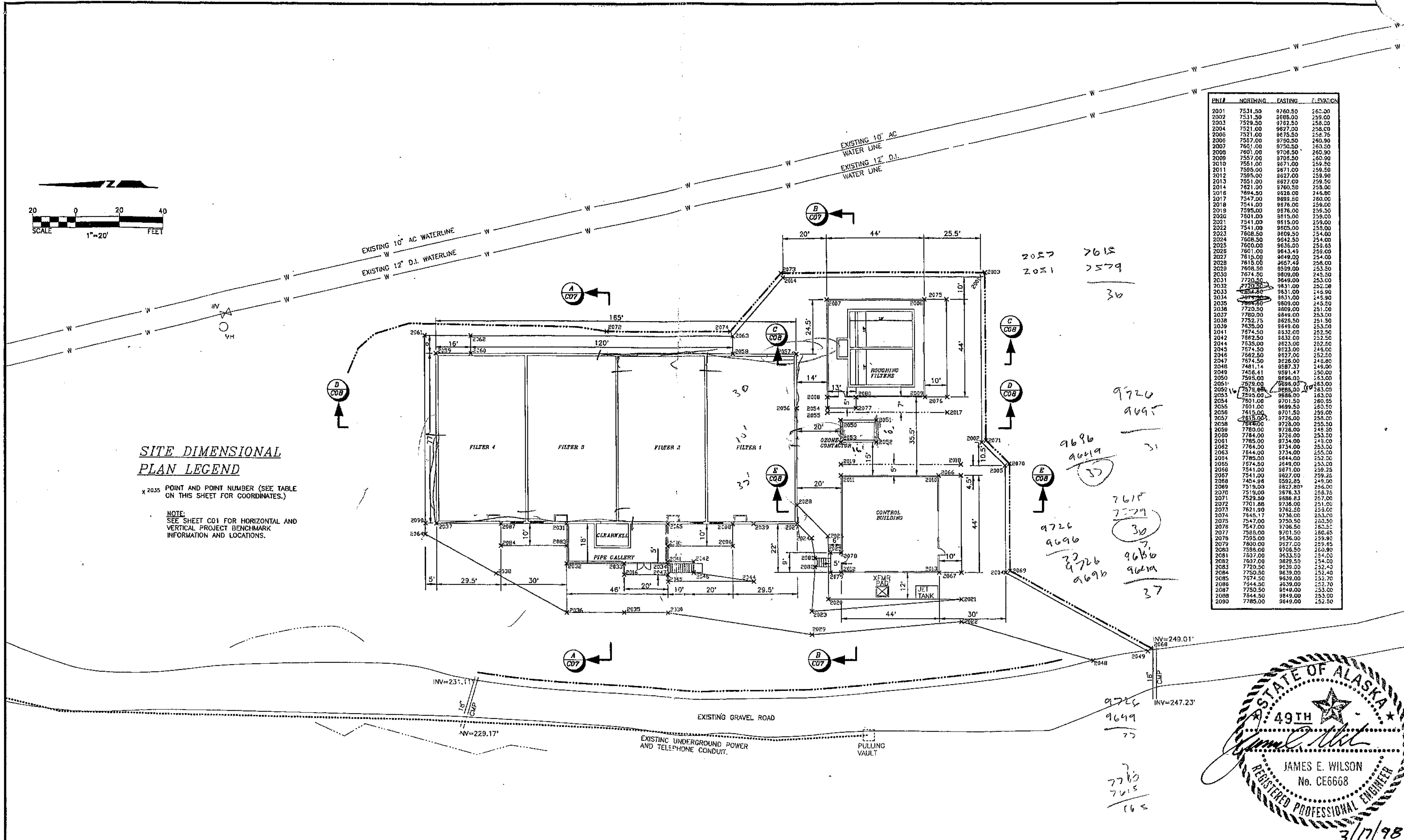
Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: MAC
DRAWN BY: WAH
CHECKED BY:

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
EXISTING SITE CONDITIONS

DATE 3/12/98
SCALE AS SHOWN
JOB NUMBER 97070
SHEET C05 OF C09

C:\PROJECT\97070\DWG\97070C05 Thu Mar 12 15:57:39 1998 WAH



SITE DIMENSIONAL PLAN LEGEND

x 2035 POINT AND POINT NUMBER (SEE TABLE ON THIS SHEET FOR COORDINATES.)

NOTE:
SEE SHEET C01 FOR HORIZONTAL AND VERTICAL PROJECT BENCHMARK INFORMATION AND LOCATIONS.

PNT#	NORTHING	EASTING	ELEVATION
2001	7531.50	9760.50	260.00
2002	7531.50	9686.00	259.00
2003	7529.50	9762.50	258.00
2004	7521.00	9627.00	258.00
2005	7521.00	9675.50	258.75
2006	7557.00	9750.50	260.90
2007	7601.00	9750.50	260.50
2008	7601.00	9706.50	260.90
2009	7557.00	9706.50	260.90
2010	7551.00	9671.00	259.50
2011	7595.00	9671.00	259.50
2012	7595.00	9627.00	259.90
2013	7551.00	9627.00	259.50
2014	7621.00	9760.50	258.00
2016	7694.50	9626.00	246.80
2017	7547.00	9699.50	260.00
2018	7541.00	9676.00	259.00
2019	7595.00	9676.00	259.50
2020	7601.00	9615.00	259.00
2021	7541.00	9615.00	259.00
2022	7541.00	9605.00	258.00
2023	7608.50	9609.50	254.00
2024	7608.50	9642.50	254.00
2025	7600.00	9636.00	259.65
2026	7601.00	9643.49	259.00
2027	7615.00	9649.00	254.00
2028	7615.00	9657.49	258.00
2029	7608.50	9599.00	253.50
2030	7674.50	9809.00	245.50
2031	7720.50	9649.00	253.00
2032	7720.50	9631.00	252.00
2033	7694.50	9631.00	246.90
2034	7674.50	9631.00	245.90
2035	7694.50	9609.00	245.50
2036	7720.50	9609.00	251.00
2037	7780.00	9649.00	253.00
2038	7752.75	9626.50	251.50
2039	7635.00	9649.00	253.00
2041	7674.50	9632.00	252.50
2042	7662.50	9632.00	252.50
2044	7635.00	9623.00	252.50
2045	7674.50	9623.00	245.00
2046	7662.50	9627.00	252.50
2047	7674.50	9626.00	246.80
2048	7481.14	9587.37	249.00
2049	7456.41	9591.47	250.00
2050	7595.00	9696.00	253.00
2051	7579.00	9696.00	263.00
2052	7579.00	9686.00	263.00
2053	7595.00	9686.00	263.00
2054	7601.00	9701.50	260.55
2055	7601.00	9699.50	260.50
2056	7615.00	9701.50	259.00
2057	7615.00	9726.00	258.00
2058	7644.00	9728.00	255.50
2059	7780.00	9726.00	248.50
2060	7784.00	9726.00	253.50
2061	7785.00	9734.00	248.00
2062	7764.00	9734.00	253.00
2063	7644.00	9734.00	255.00
2064	7785.00	9644.00	252.00
2065	7674.50	9649.00	253.00
2066	7541.00	9671.00	259.25
2067	7541.00	9627.00	259.25
2068	7454.96	9592.85	249.00
2069	7519.00	9627.80	256.00
2070	7519.00	9676.33	258.75
2071	7529.50	9686.83	257.00
2072	7701.88	9736.00	251.00
2073	7621.90	9762.50	258.00
2074	7545.17	9736.00	253.00
2075	7547.00	9750.50	260.50
2076	7547.00	9706.50	260.50
2077	7588.00	9701.50	260.65
2078	7595.00	9636.00	259.90
2079	7600.00	9627.00	259.65
2080	7588.00	9706.50	260.90
2081	7607.00	9633.50	254.00
2082	7607.00	9629.50	254.00
2083	7720.50	9639.00	252.40
2084	7750.50	9639.00	252.40
2085	7674.50	9639.00	252.70
2086	7644.50	9639.00	252.70
2087	7750.50	9649.00	253.00
2088	7644.50	9649.00	253.00
2090	7785.00	9649.00	252.50

2057 7615
2051 2579
36

9726
9695

9696
9649
35

31

7615
2579
36

9726
9696
9726
9696

9686
9649
37

9726
9649
77

7785
7615
165

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NO.	REVISIONS	BY	DATE

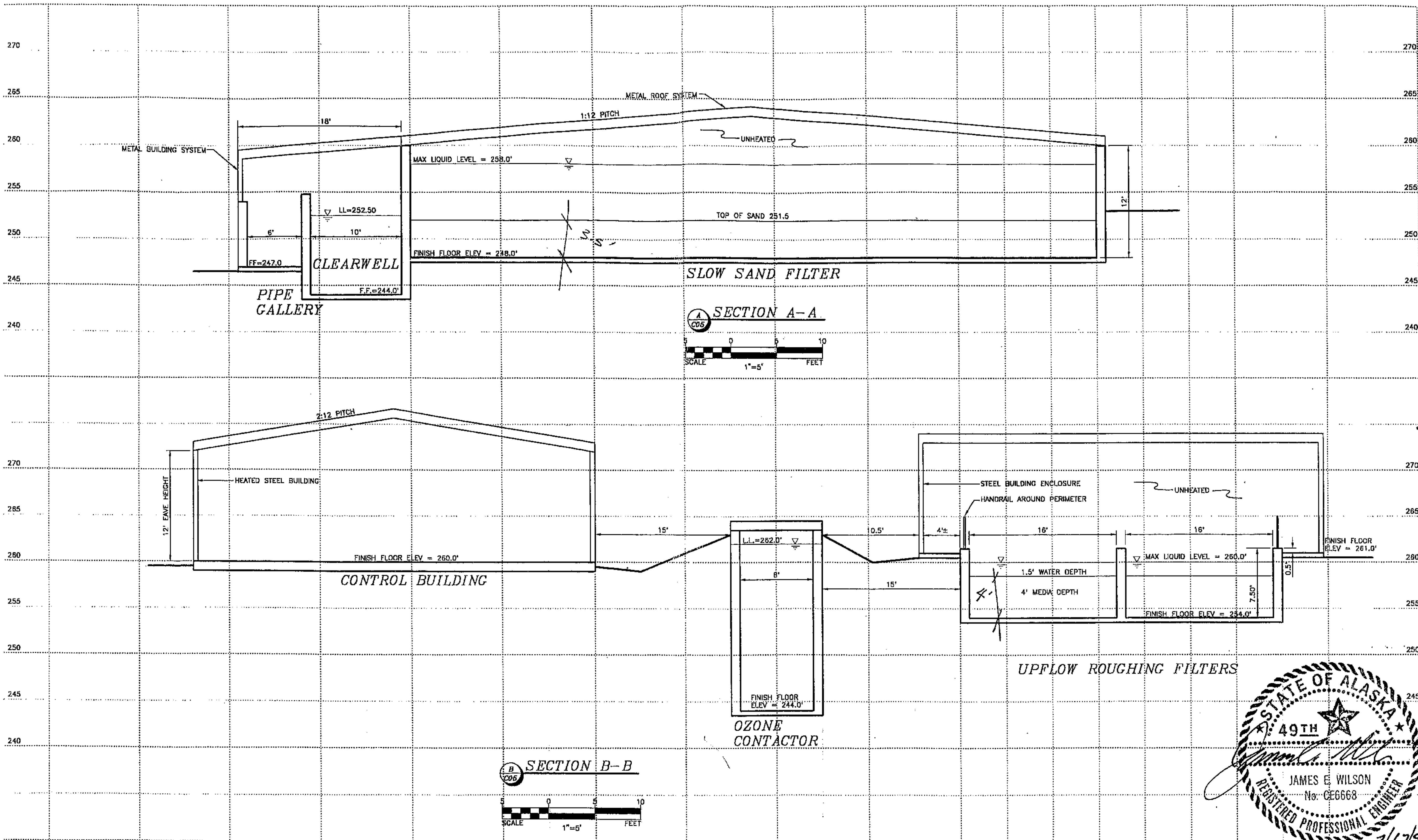
Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: MAC
DRAWN BY: WAH
CHECKED BY:

CITY OF WRANGELL
WRANGELL ISLAND — ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
SITE DIMENSIONAL PLAN

DATE 3/11/98
SCALE AS SHOWN
JOB NUMBER 97070
SHEET C06 OF C09



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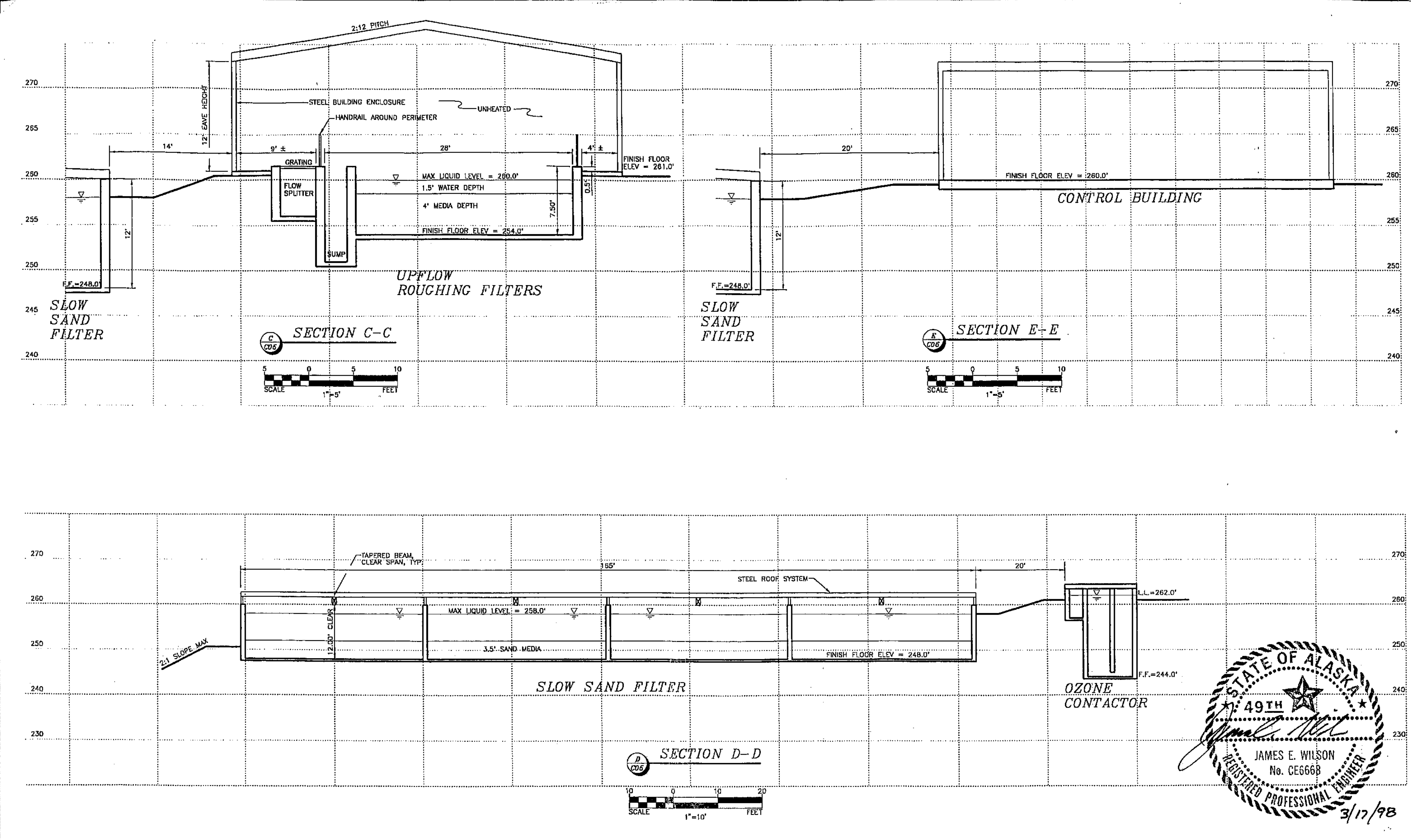
Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX (360) 647-9061

DESIGNED BY: —
DRAWN BY: —
CHECKED BY:

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
SITE CROSS SECTIONS

DATE	SHEET
3/11/98	C07
SCALE AS SHOWN	OF
JOB NUMBER 97070	C09



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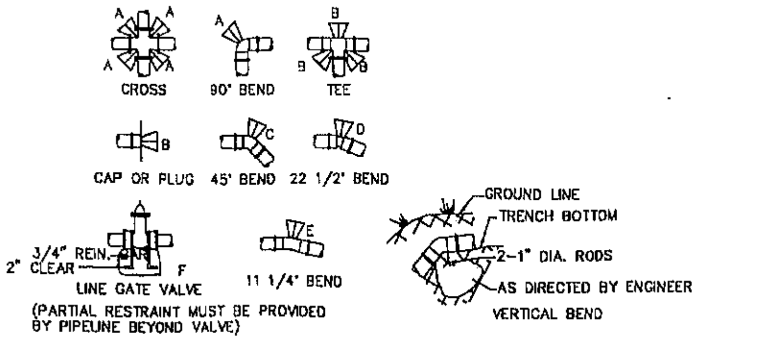
Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY:
DRAWN BY:
CHECKED BY:

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
SITE CROSS SECTIONS

DATE	SHEET
3/4/98	C08
SCALE AS SHOWN	OF
JOB NUMBER 97070	C09



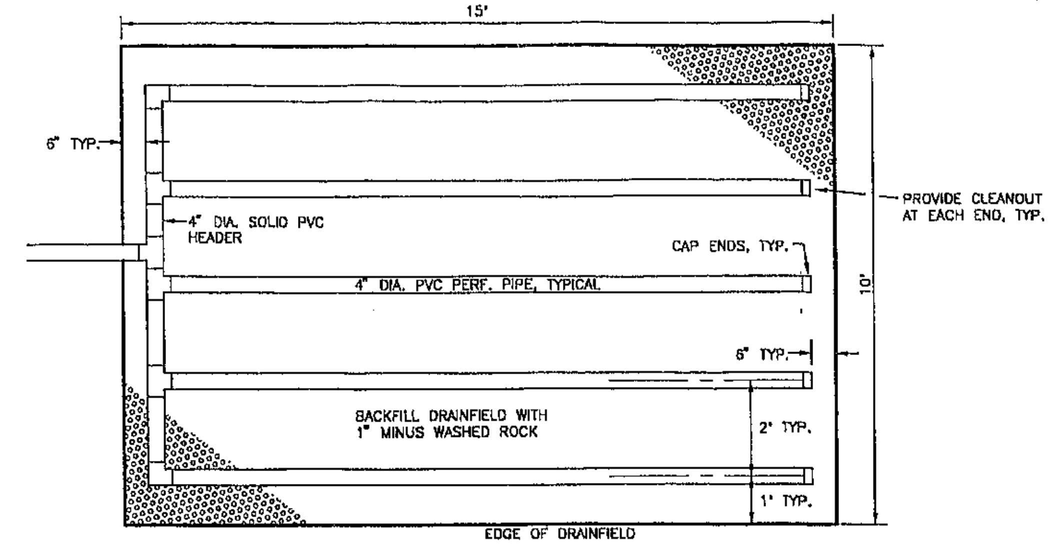
NOTES

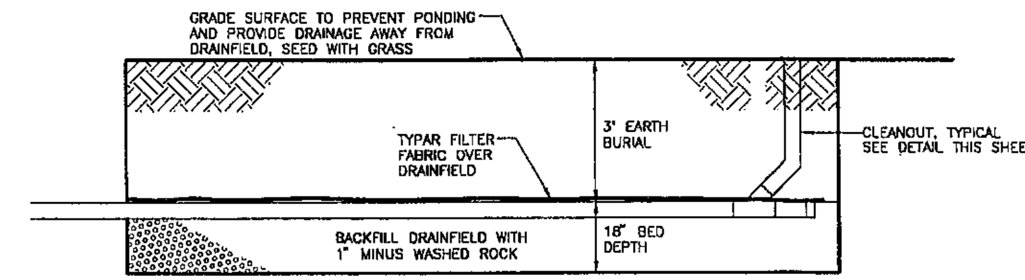
1. SQUARE FEET OF CONCRETE THRUST BLOCK AREA IS BASED ON 200 P.S.I. INTERNAL PRESSURE, A SOIL SAFE BEARING OF 3000 POUNDS PER SQUARE FOOT AND A FACTOR OF SAFETY OF 1.5.
2. BEARING AREA MUST BE ADJUSTED FOR INTERNAL PRESSURES AND LOWER SOIL BEARING VALUES.
3. CONCRETE BLOCKING SHALL BE CAST IN PLACE AND HAVE A MINIMUM OF 1/4 SQUARE FOOT BEARING AGAINST THE FITTING.
4. BLOCK SHALL BEAR AGAINST FITTINGS ONLY AND SHALL BE CLEAR OF JOINTS TO PERMIT TAKING UP OR DISMANTLING JOINT.
5. THE CONTRACTOR SHALL INSTALL BLOCKING WHICH IS ADEQUATE TO WITHSTAND FULL TEST PRESSURE AS WELL AS TO CONTINUOUSLY WITHSTAND OPERATING PRESSURE UNDER ALL CONDITIONS OF SERVICE.
6. CONTRACTOR MAY USE RESTRAINED JOINTS AS APPROVED BY THE CITY AS AN ALTERNATIVE TO THRUST BLOCKING.

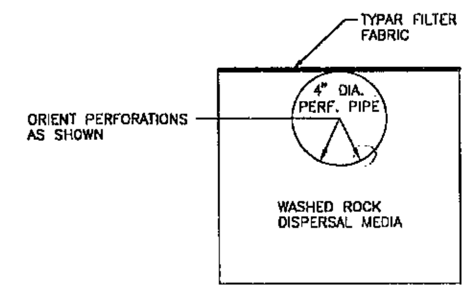
THRUST BLOCK TABLE

PIPE SIZE	MIN. BEARING AREA AGAINST UNDISTURBED SOIL SQUARE FEET					
	A	B	C	D	E	F
4"	2	2	2	2	2	NONE
6"	4	3	2	2	2	NONE
8"	7	5	4	2	2	3
10"	11	8	6	3	2	4
12"	16	12	9	5	3	6
22	16	16	12	6	3	9
29	20	20	16	8	4	13

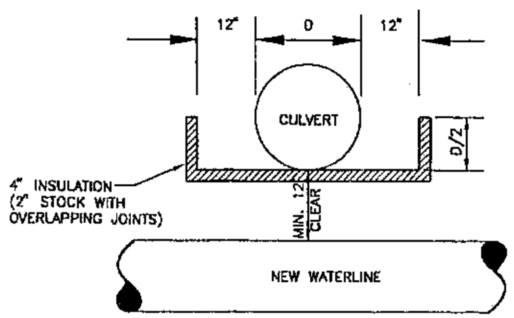
1 THRUST BLOCK SCHEDULE
NOT TO SCALE



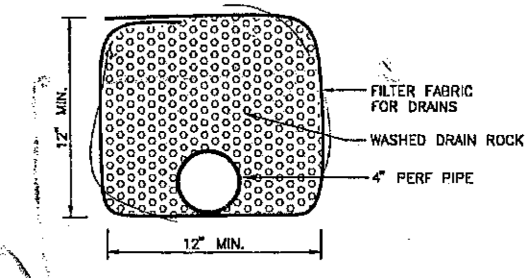




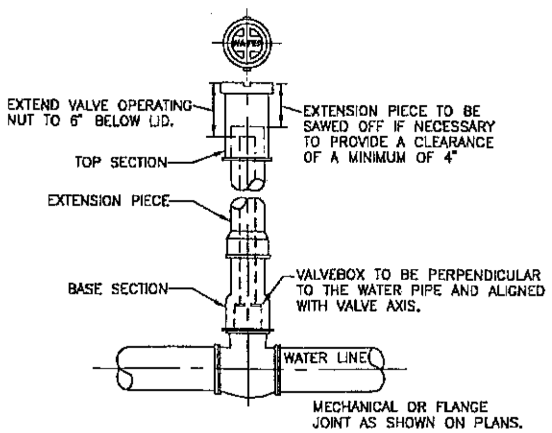
5 DRAINFIELD DETAIL
NOT TO SCALE



2 CULVERT CROSSING
NOT TO SCALE

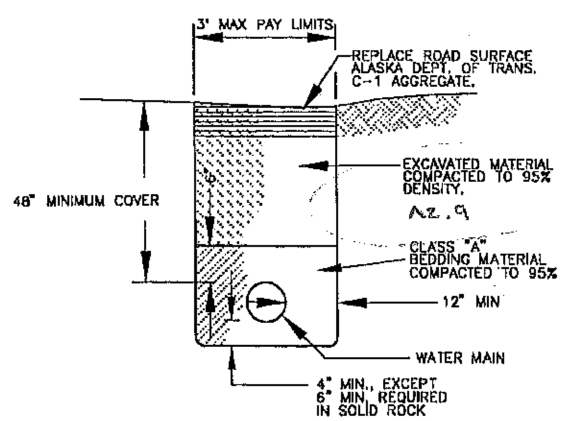


4 FOOTING DRAIN
NOT TO SCALE

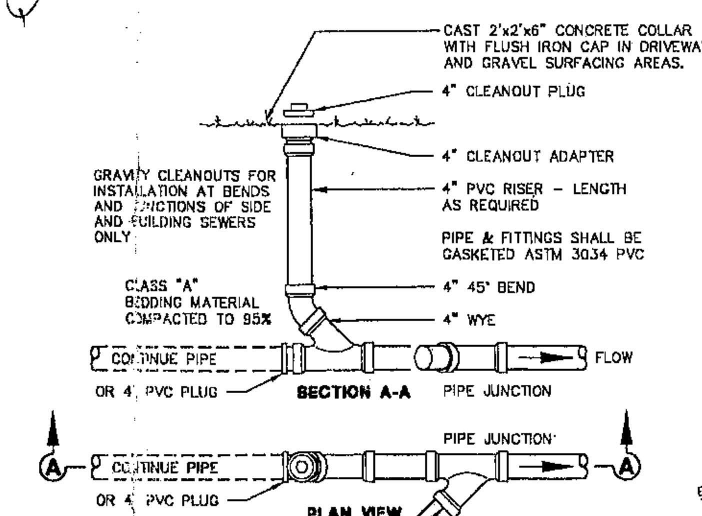


NOTE:
VALVE BOX SHALL BE CAST IRON AND SHALL HAVE A MINIMUM INSIDE DIAMTER OF 4-1/2"

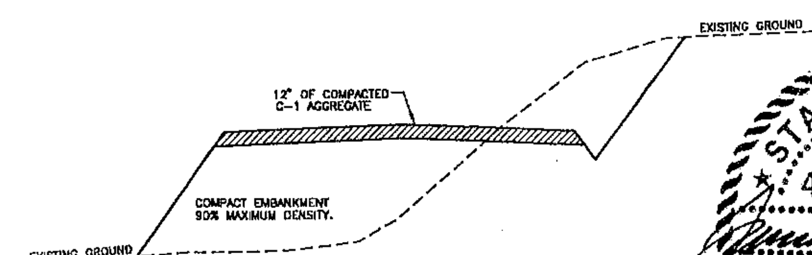
7 VALVE BOX
NOT TO SCALE



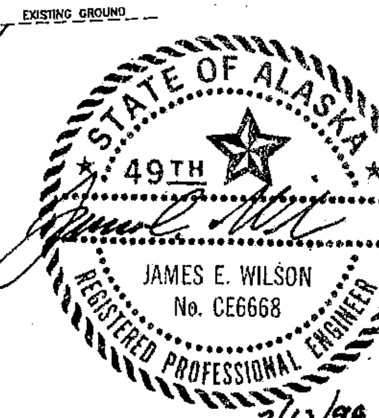
3 WATER LINE TRENCH
NOT TO SCALE



GRAVITY SEWER CLEANOUT
NOT TO SCALE



6 GRAVEL SURFACING DETAIL
NOT TO SCALE



C:\PROJECT\97070\DWG\97070C09 Tue Mar 17 09:30:21 1998 WAH

NO.	REVISIONS	BY	DATE

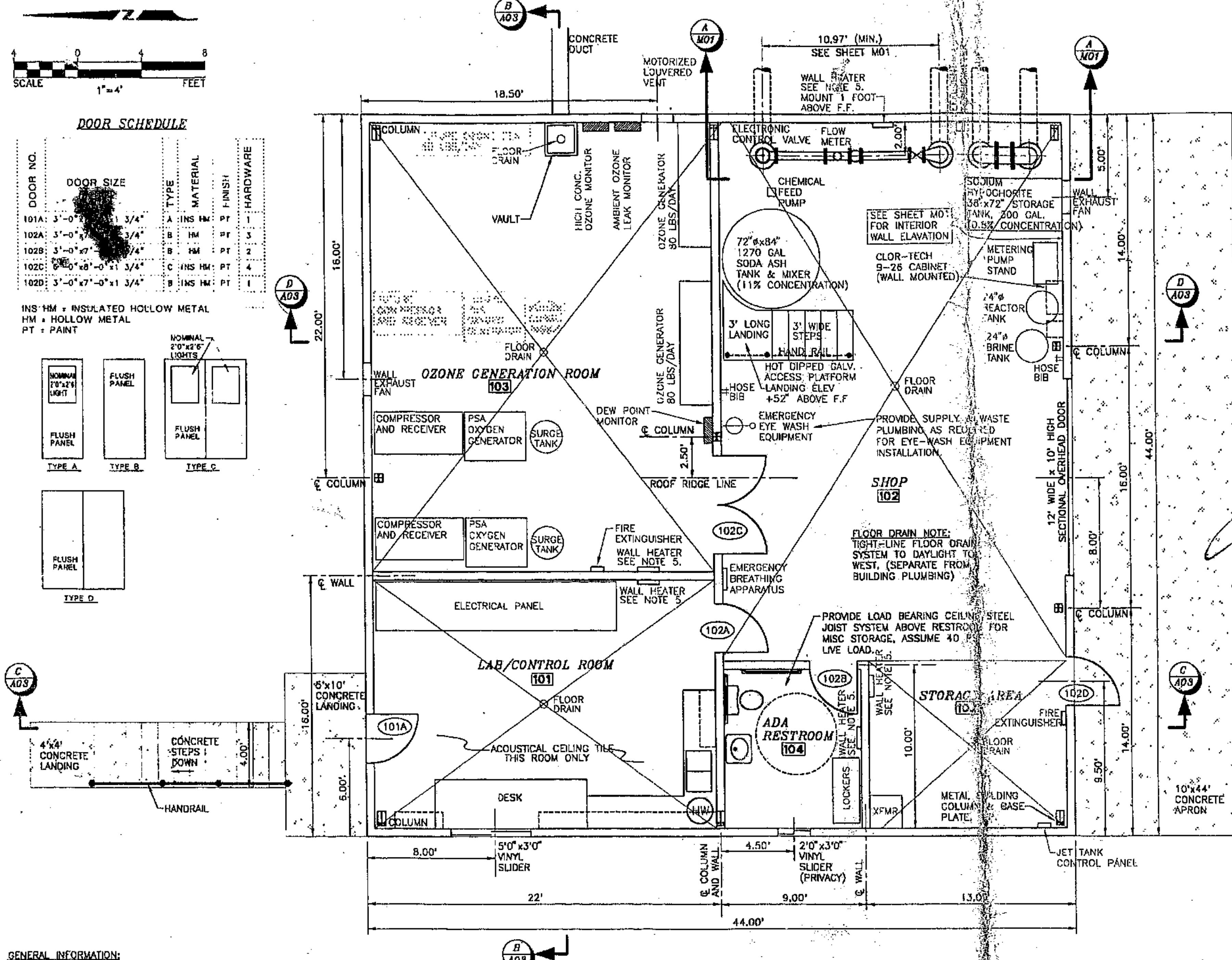
Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

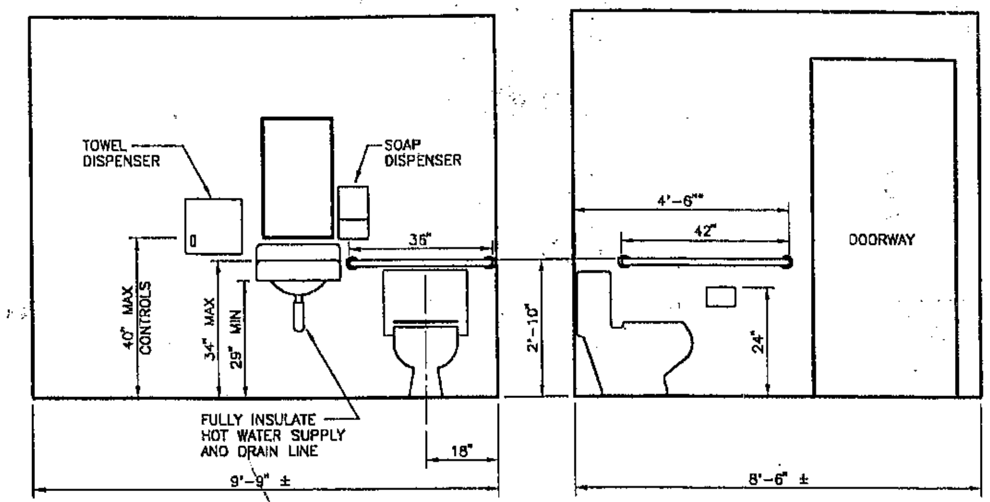
DESIGNED BY: MAC
DRAWN BY: JGC
CHECKED BY:

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
CIVIL DETAILS

DATE 3/17/98
SCALE AS NOTED
JOB NUMBER 97070
SHEET C09 OF C09

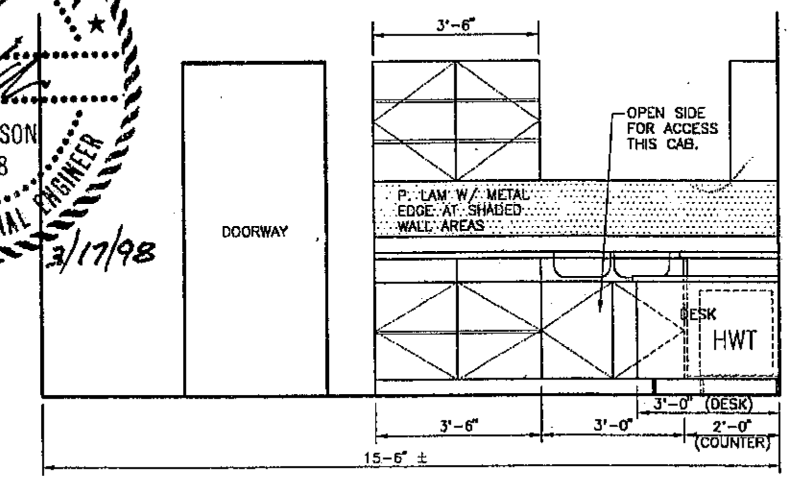


STATE OF ALASKA
49TH
JAMES E. WILSON
No. CE6668
REGISTERED PROFESSIONAL ENGINEER
3/17/98



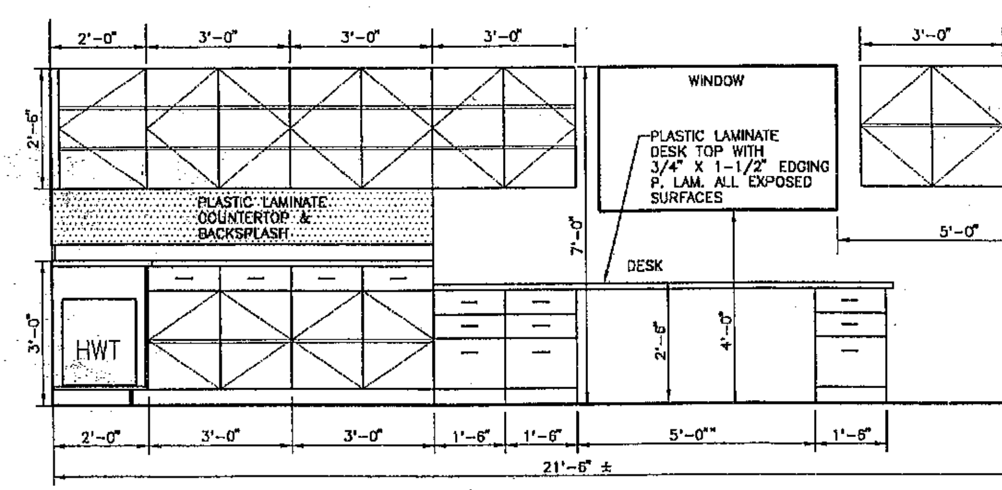
RESTROOM ELEVATIONS

SCALE: 1"=2'



SOUTH LAB/CONTROL ROOM ELEVATION

SCALE: 1"=2'



WEST LAB/CONTROL ROOM ELEVATION

SCALE: 1"=2'

CONTROL BUILDING FLOOR PLAN

GENERAL INFORMATION:

1. ALL WORK SHALL CONFORM TO ALL APPLICABLE CODES AND ORDINANCES, THE MORE STRINGENT TO GOVERN, DISCREPANCIES BETWEEN CONTRACT DOCUMENTS AND CODES SHALL BE BROUGHT TO THE ENGINEER'S ATTENTION PROMPTLY AND RESOLUTION OBTAINED BEFORE PROCEEDING.
2. BUILDING SHALL BE A RIGID STEEL FRAME, BOLTED FLANGE, PRE-MANUFACTURED BUILDING GENERALLY USING GALVANIZED COLD FORMED SECONDARY STRUCTURAL MEMBERS BOLTED TO WELDED CLIPS WITH PROFILED AND PRE-COATED METAL ROOFING AND SIDING SCREW ATTACHED. BUILDING SHALL BE ENGINEERED, MANUFACTURED AND ERECTED CONSISTENT WITH BOTH AISC (AMERICAN INSTITUTE OF STEEL CONSTRUCTION) AND MBMA (METAL BUILDING MANUFACTURER'S ASSOCIATION).
3. UNIFORM BUILDING CODE CLASSIFICATOINS (1994)
   CONSTRUCTION TYPE: TYPE II-N
   BUILDING OCCUPANCY: F2
4. BUILDING SQUARE FOOTAGE: 1936 SQUARE FEET.
5. 1500 WATT, 5120 BTU, 120 V, 12.5 AMP, CHROME WALL HEATER, GRAINGER #2E434. RECESS MOUNT WITH 2' CLEARANCE FROM FINISH FLOOR, UNLESS NOTED OTHERWISE ON PLAN.

FINISH SCHEDULE

ABBREVIATIONS
SUS CEIL Suspended Ceiling Tile
RES FLR Resilient Flooring
FACT Factory
GWB Gypsum Wall Board
R.B. Rubber Base
EXP STR Exposed Structure

ROOM NAME	ROOM NO.	FLOOR		BASE	WALL		CEILING		
		MAT'L	FINISH	MAT'L	MAT'L	FINISH	MAT'L	FINISH	HEIGHT
LAB/CONTROL ROOM	101	RES. FLR.	FACT.	6" R.B.	GWB	PAINT	SUS CEIL	FACT	10'-0"
SHOP & STORAGE AREA	102	CONCRETE	SEALER	6" R.B.	GWB	PAINT	EXP STR	NONE	–
OZONE GENERATION ROOM	103	CONCRETE	SEALER	6" R.B.	GWB	PAINT	EXP STR	NONE	–
ADA RESTROOM	104	RES. FLR.	FACT.	4" R.B.	GWB	PAINT	GWB	PAINT	8'-0"

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX (360) 647-9061

DESIGNED BY: MAC
DRAWN BY: WAH
CHECKED BY:

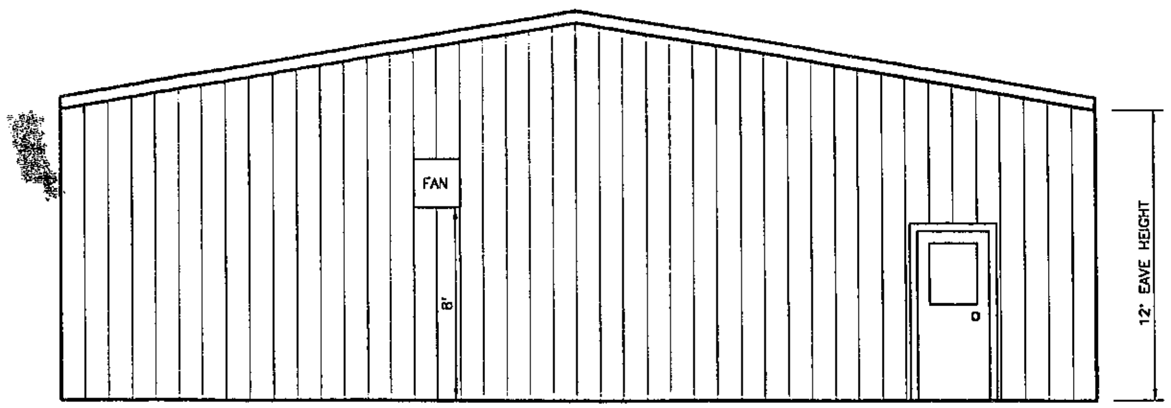
CITY OF WRANGELL

WRANGELL ISLAND ALASKA

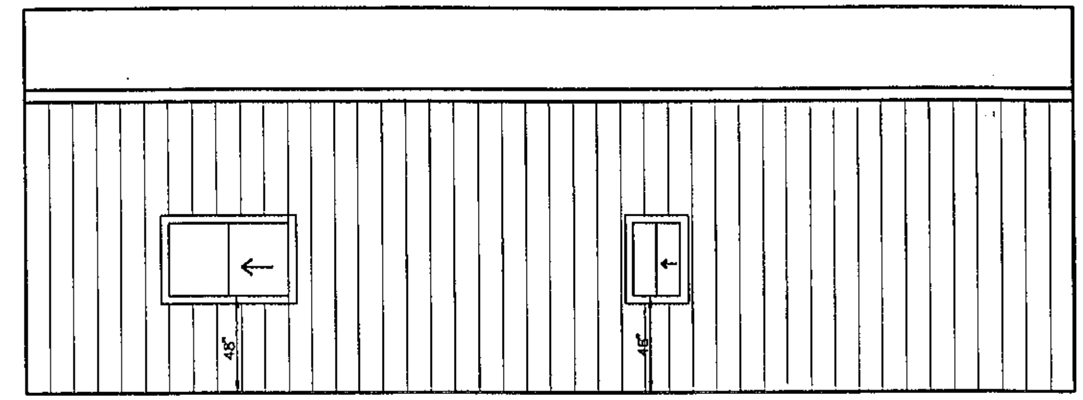
PHASE 2 WATER SYSTEM IMPROVEMENTS
CONTROL BUILDING FLOOR PLAN

DATE 3/13/98
SCALE AS SHOWN
JOB NUMBER 97070
SHEET A01 OF A06

C:\PROJECT\97070\DWG\97070A01 Fri Mar 13 16:45:56 1998 WAH



NORTH ELEVATION
SCALE: 1"=4'



WEST ELEVATION
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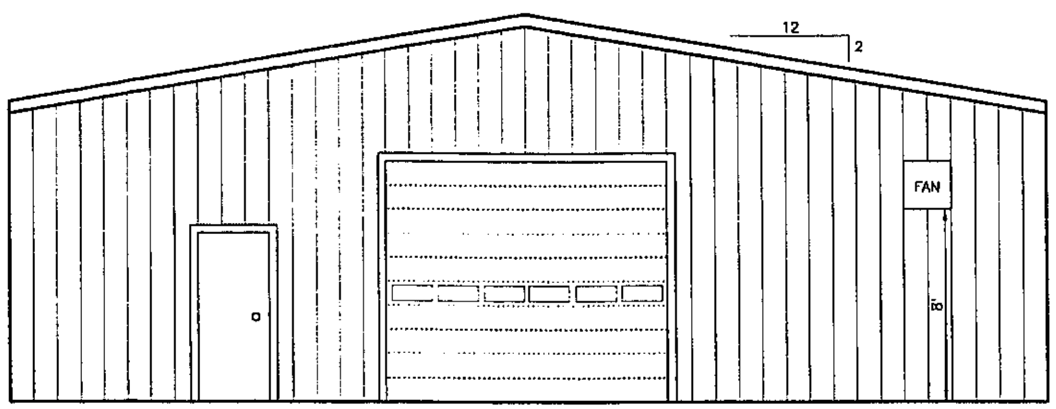

SOUTH ELEVATION
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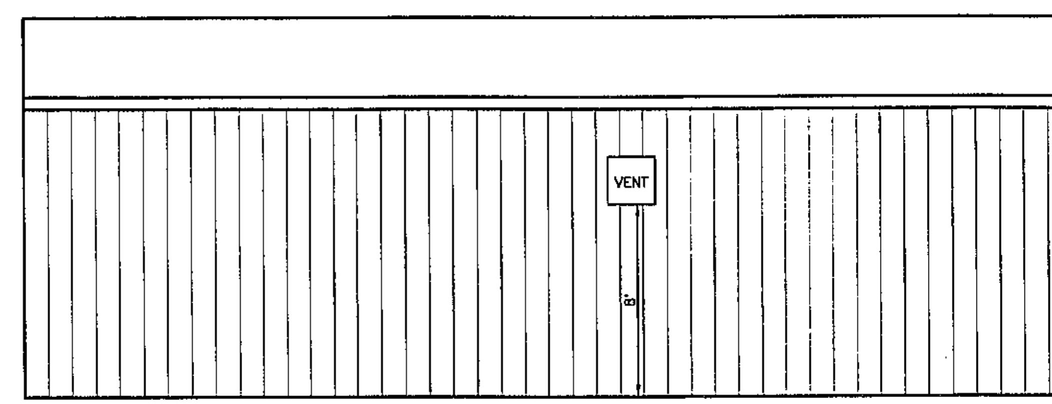


EAST ELEVATION
SCALE: 1"=4'

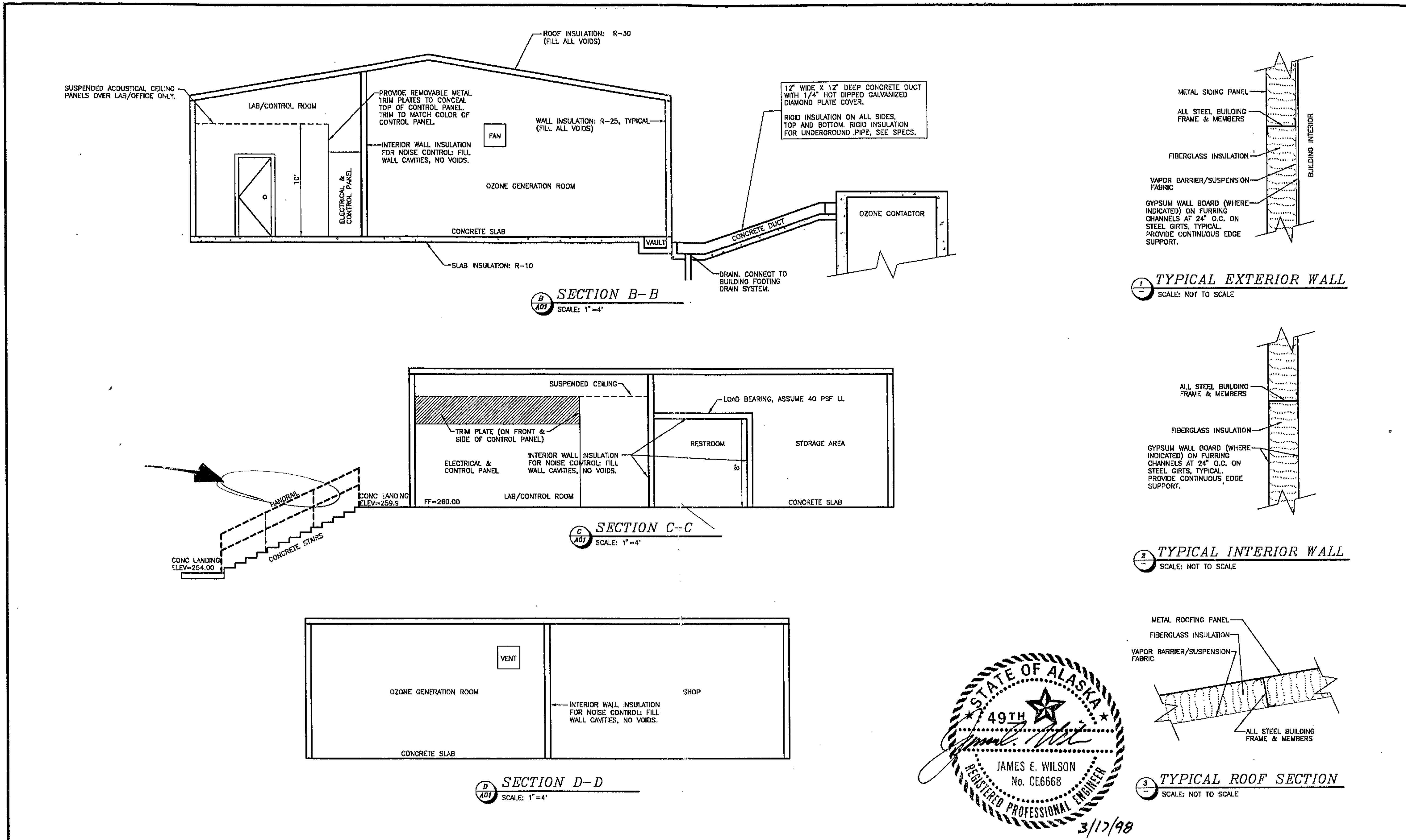
STATE OF ALASKA
49TH
JAMES E. WILSON
No. CE6668
REGISTERED PROFESSIONAL ENGINEER
3/17/98

C:\PROJECT\97070\DWG\97070A02 Thu Mar 12 07:24:12 1998 WAH

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: JGC	CITY OF WRANGELL	DATE 3/12/98	SHEET A02
DRAWN BY: JGC	WRANGELL ISLAND ALASKA	SCALE AS SHOWN	OF A06
CHECKED BY:	PHASE 2 WATER SYSTEM IMPROVEMENTS CONTROL BUILDING ELEVATIONS	JOB NUMBER 97070	



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Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

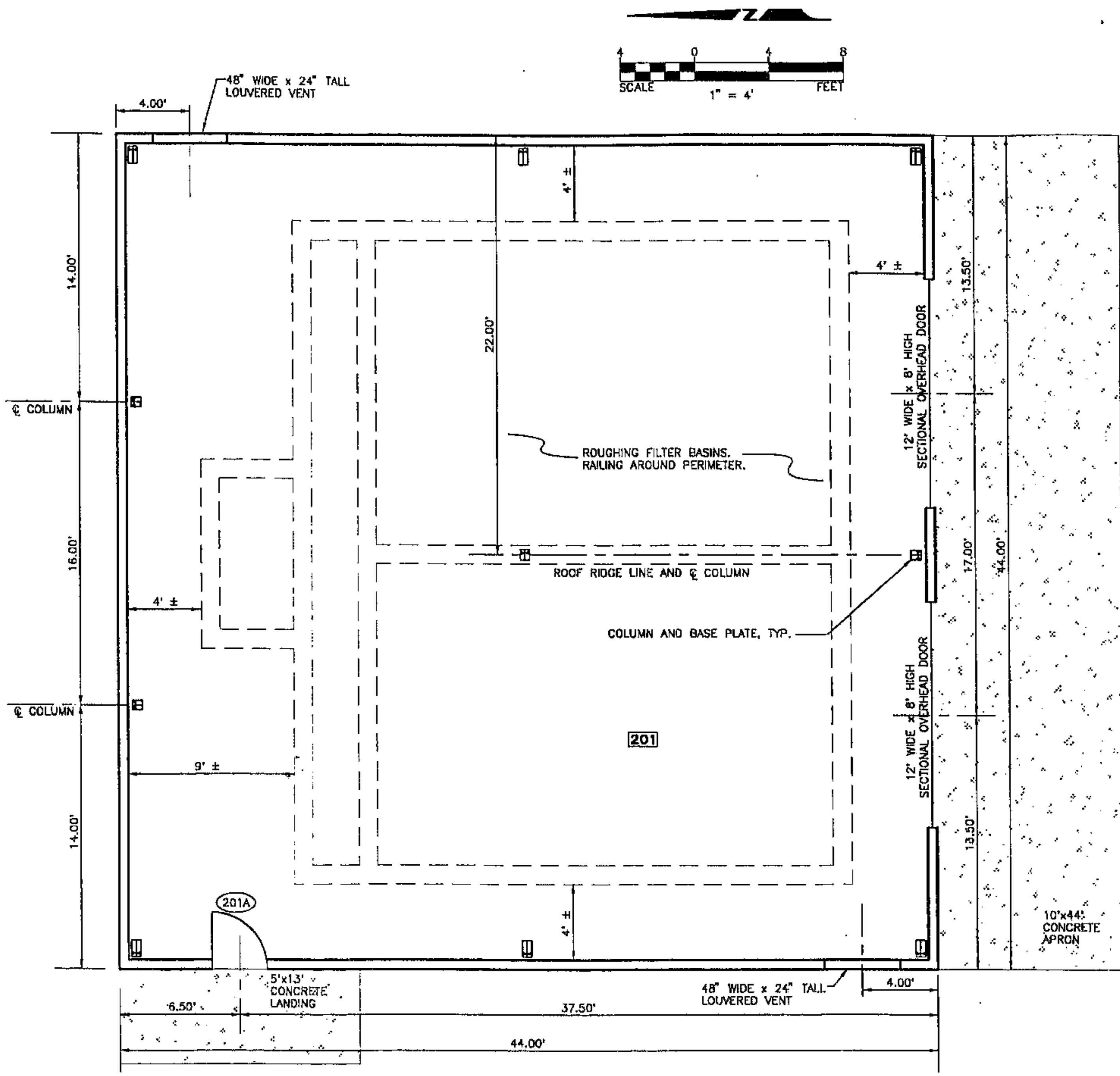
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: JGC
DRAWN BY: JGC
CHECKED BY:

CITY OF WRANGELL
WRANGELL ISLAND — ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
CONTROL BUILDING SECTIONS

DATE 3/13/98
SCALE AS SHOWN
JOB NUMBER 97070
SHEET A03 OF A06

C:\PROJECT\97070\DWG\97070A03 Fri Mar 13 16:46:43 1998 WAH

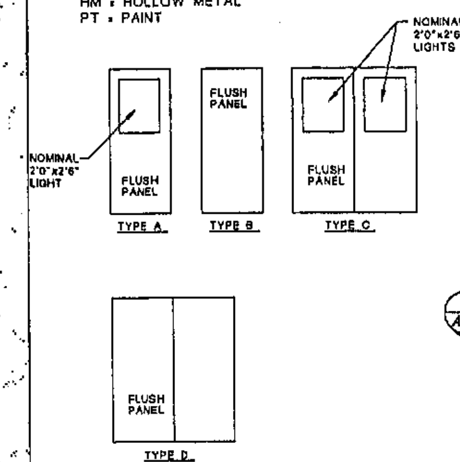


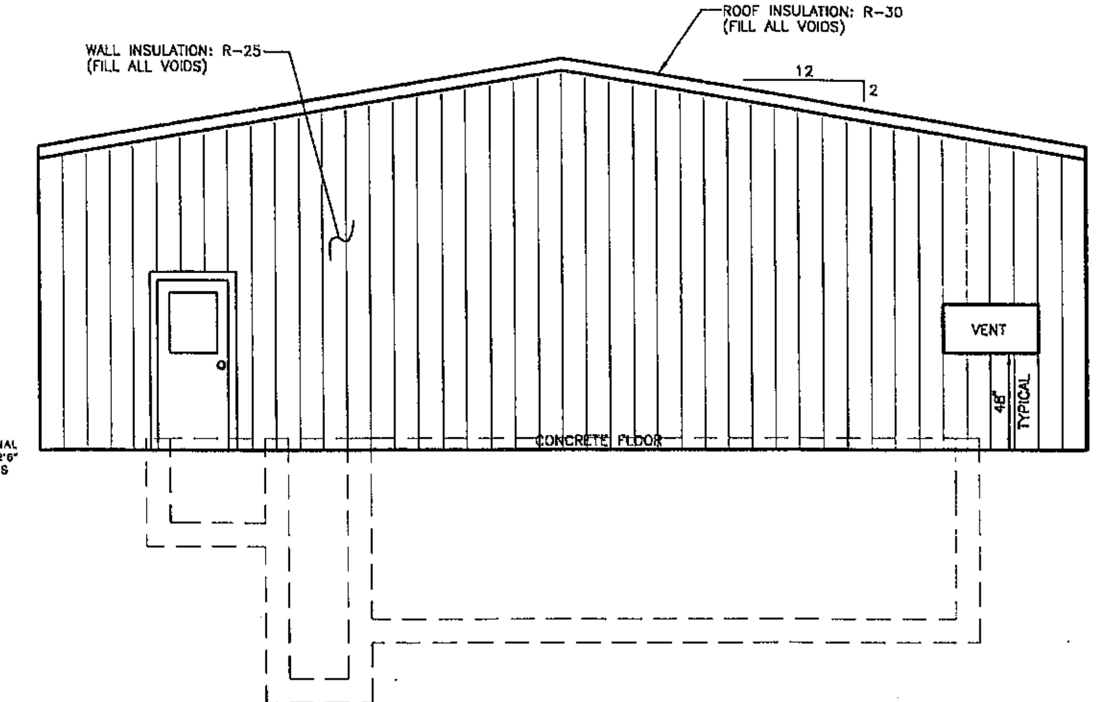
ROUGHING FILTER BUILDING FLOOR PLAN

DOOR SCHEDULE

DOOR NO.	DOOR SIZE WxHxT	TYPE	MATERIAL	FINISH	HARDWARE
201A	3'-0"x7'-0"x1 3/4"	A	INS HM	PT	1

INS HM : INSULATED HOLLOW METAL
HM : HOLLOW METAL
PT : PAINT





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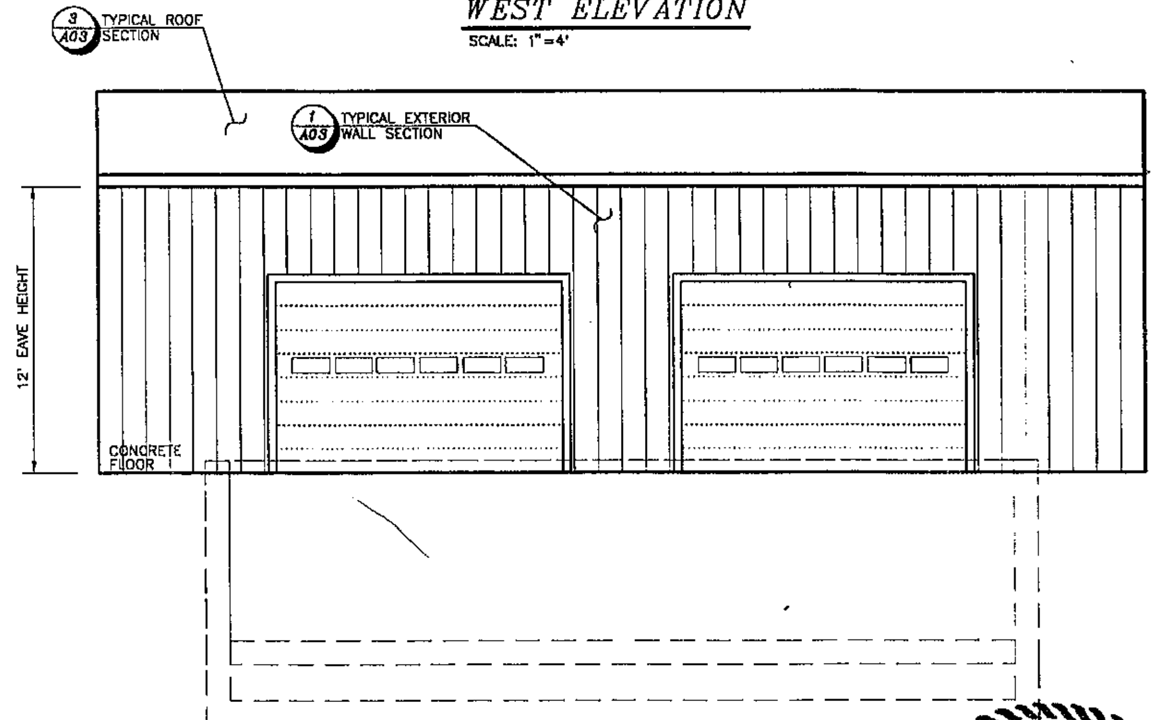
SCALE: 1"=4'



SOUTH ELEVATION
SCALE: 1"=4'

GENERAL INFORMATION:

1. ALL WORK SHALL CONFORM TO ALL APPLICABLE CODES AND ORDINANCES, THE MORE STRINGENT TO GOVERN. DISCREPANCIES BETWEEN CONTRACT DOCUMENTS AND CODES SHALL BE BROUGHT TO THE ENGINEER'S ATTENTION PROMPTLY AND RESOLUTION OBTAINED BEFORE PROCEEDING.
2. BUILDING SHALL BE A RIGID STEEL FRAME, BOLTED FLANGE, PRE-MANUFACTURED BUILDING GENERALLY USING GALVANIZED COLD FORMED SECONDARY STRUCTURAL MEMBERS BOLTED TO WELDED CLIPS WITH PROFILED AND PRE-COATED METAL ROOFING AND SIDING SCREW ATTACHED. BUILDING SHALL BE ENGINEERED, MANUFACTURED AND ERECTED CONSISTENT WITH BOTH AISC (AMERICAN INSTITUTE OF STEEL CONSTRUCTION) AND MBMA (METAL BUILDING MANUFACTURER'S ASSOCIATION).
3. UNIFORM BUILDING CODE CLASSIFICATOINS (1994)
   CONSTRUCTION TYPE: TYPE II-N
   BUILDING OCCUPANCY: F2
4. BUILDING SQUARE FOOTAGE: 1936 SQUARE FEET.

FINISH SCHEDULE

ABBREVIATIONS
SUS CEIL Suspended Ceiling Tile
RES FLR Resilient Flooring
FACT Factory
GWB Gypsum Wall Board
R.B. Rubber Base
EXP STR Exposed Structure

ROOM NAME	ROOM NO.	FLOOR MAT'L	FLOOR FINISH	BASE MAT'L	WALL MAT'L	WALL FINISH	CEILING MAT'L	CEILING FINISH	CEILING HEIGHT
ROUGHING FILTER BUILDING	-	CONCRETE	SEALER	NONE	EXP STR	FACT	EXP STR	FACT	-

STATE OF ALASKA
49TH
JAMES E. WILSON
No. CE6668
REGISTERED PROFESSIONAL ENGINEER
3/17/98

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: JGC
DRAWN BY: JGC
CHECKED BY:

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
ROUGHING FILTER BUILDING

DATE 3/13/98
SCALE AS SHOWN
JOB NUMBER 97070
SHEET A04 OF A06

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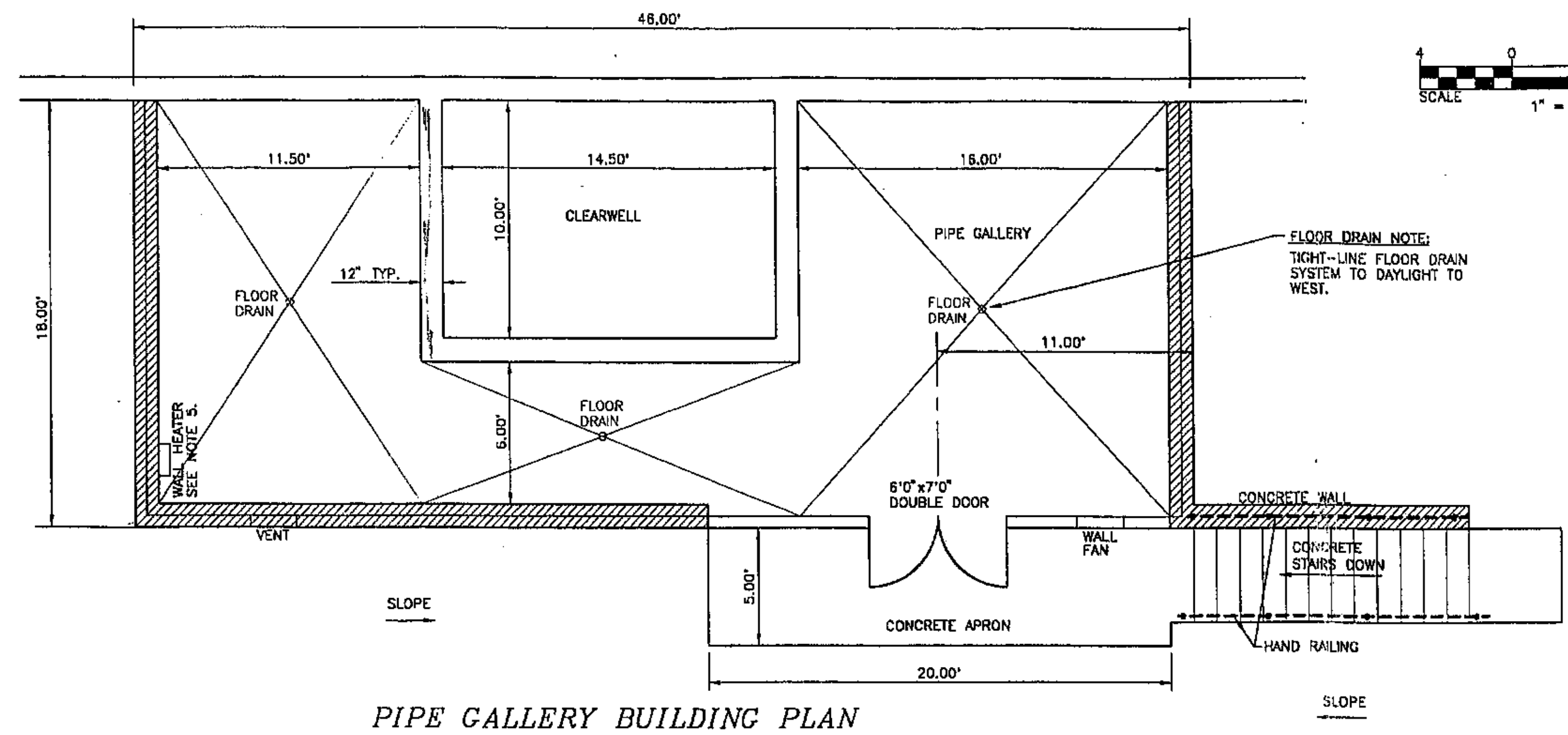
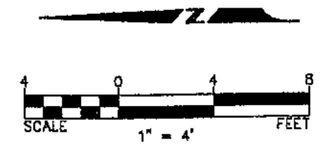
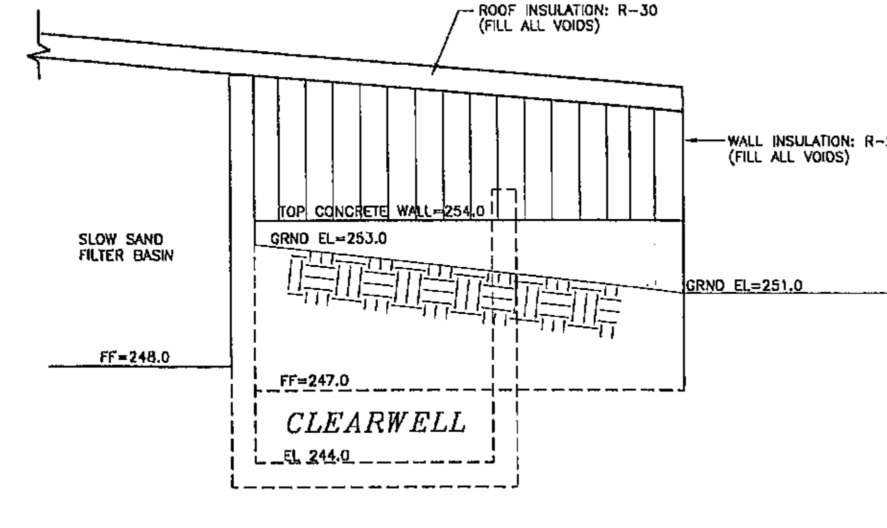


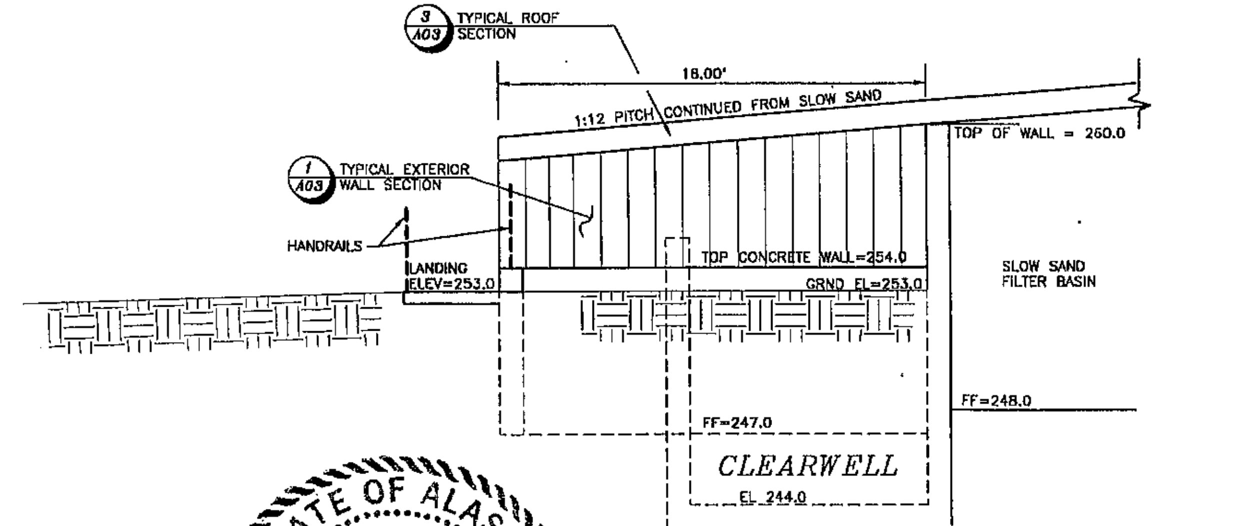
PIPE GALLERY BUILDING PLAN





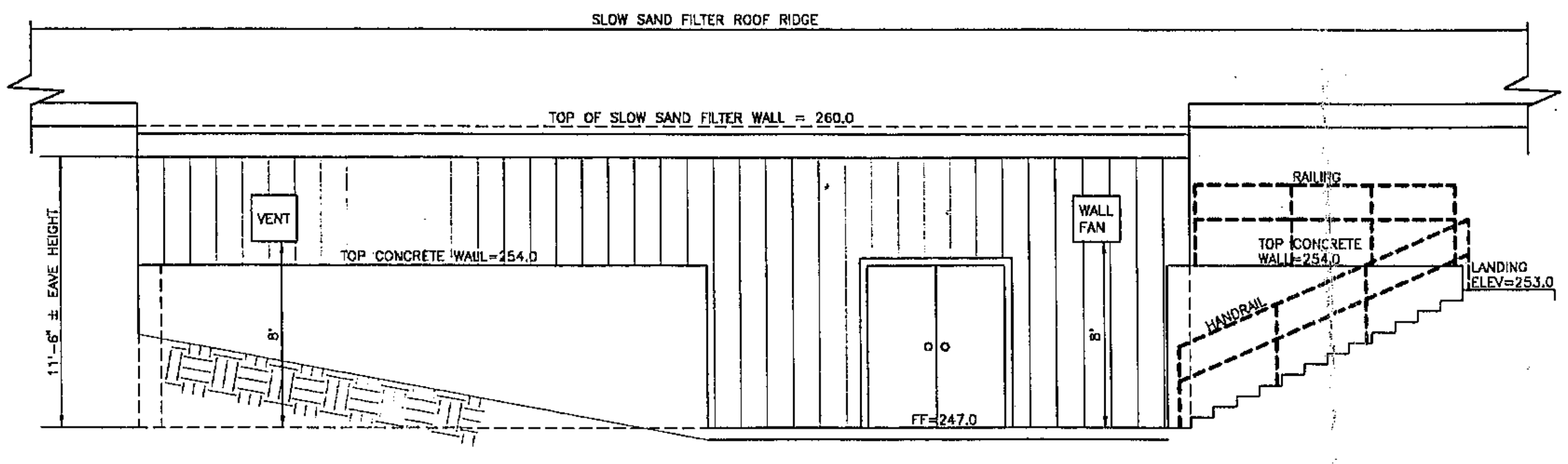
NORTH ELEVATION

SCALE: 1"=4'



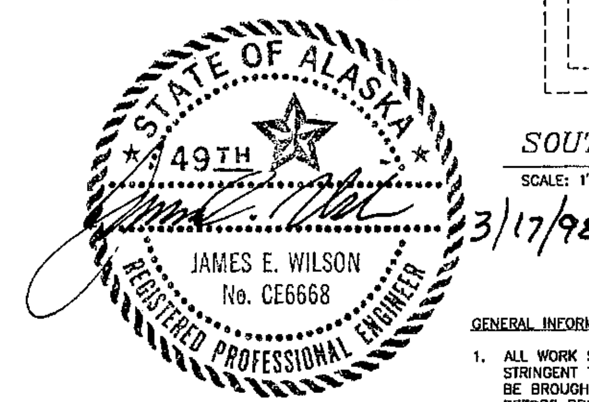
SOUTH ELEVATION

SCALE: 1"=4'



WEST ELEVATION

SCALE: 1"=4'



FINISH SCHEDULE

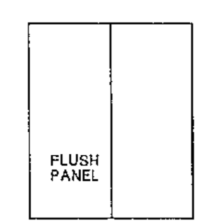
ABBREVIATIONS
SUS CEIL Suspended Ceiling Tile
RES FLR Resilient Flooring
FACT Factory
GWB Gypsum Wall Board
R.B. Rubber Base
EXP STR Exposed Structure

ROOM NAME	ROOM NO.	FLOOR MAT'L	FLOOR FINISH	BASE MAT'L	WALL MAT'L	WALL FINISH	CEILING MAT'L	CEILING FINISH	CEILING HEIGHT
PIPE GALERY	-	CONCRETE	SEALER	NONE	EXP STR	FACT	EXP STR	FACT	-

DOOR SCHEDULE

DOOR NO.	DOOR SIZE WxHxT	TYPE	MATERIAL	FINISH	HARDWARE
-	6'-0"x7'-0"x1 3/4"	D	INS HM	PT	5

INS HM = INSULATED HOLLOW METAL
HM = HOLLOW METAL
PT = PAINT



TYPE D

GENERAL INFORMATION:

1. ALL WORK SHALL CONFORM TO ALL APPLICABLE CODES AND ORDINANCES, THE MORE STRINGENT TO GOVERN, DISCREPANCIES BETWEEN CONTRACT DOCUMENTS AND CODES SHALL BE BROUGHT TO THE ENGINEER'S ATTENTION PROMPTLY AND RESOLUTION OBTAINED BEFORE PROCEEDING.
2. BUILDING SHALL BE A RIGID STEEL FRAME, BOLTED FLANGE, PRE-MANUFACTURED BUILDING GENERALLY USING GALVANIZED COLD FORMED SECONDARY STRUCTURAL MEMBERS BOLTED TO WELDED CLIPS WITH PROFILED AND PRE-COATED METAL ROOFING AND SIDING SCREW ATTACHED. BUILDING SHALL BE ENGINEERED, MANUFACTURED AND ERECTED CONSISTENT WITH BOTH AISC (AMERICAN INSTITUTE OF STEEL CONSTRUCTION) AND MBMA (METAL BUILDING MANUFACTURER'S ASSOCIATION).
3. UNIFORM BUILDING CODE CLASSIFICATOINS (1994)
   CONSTRUCTION TYPE: TYPE II-N
   BUILDING OCCUPANCY: F2
4. BUILDING SQUARE FOOTAGE: 736 SQUARE FEET.
5. 1500 WATT, 5120 BTU, 120V, 12.5 AMP, CHROME FASCO WALL HEATER, GRAINGER #2E434, WITH SURFACE MOUNT HOUSING, GRAINGER #2E443. MOUNT UNIT WITH 2' CLEARANCE FROM FINISH FLOOR & ADJACENT WALL.

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: JGC
DRAWN BY: MJG
CHECKED BY:

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
PIPE GALLERY BUILDING

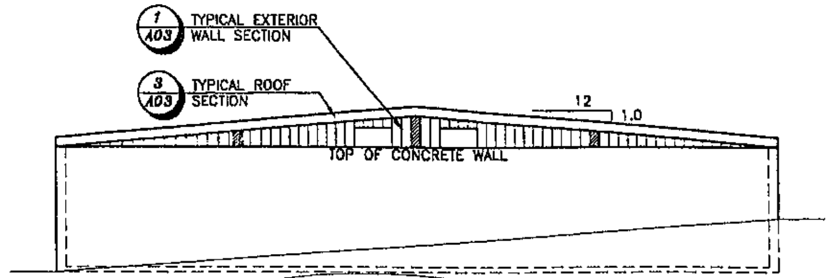
DATE 3/13/98
SCALE AS SHOWN
JOB NUMBER 97070
SHEET A05 OF A06

C:\PROJECT\97070\DWG\97070A05 Fri Mar 13 16:47:56 1998 WAH

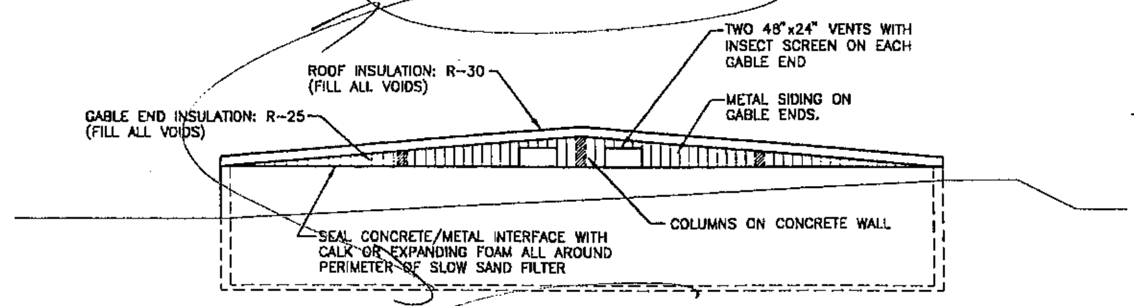
GENERAL INFORMATION:

1. ALL WORK SHALL CONFORM TO ALL APPLICABLE CODES AND ORDINANCES, THE MORE STRINGENT TO GOVERN. DISCREPANCIES BETWEEN CONTRACT DOCUMENTS AND CODES SHALL BE BROUGHT TO THE ENGINEER'S ATTENTION PROMPTLY AND RESOLUTION OBTAINED BEFORE PROCEEDING.
2. ROOF STRUCTURE SHALL BE A RIGID STEEL FRAME, BOLTED FLANGE, PRE-MANUFACTURED BUILDING GENERALLY USING GALVANIZED COLD FORMED SECONDARY STRUCTURAL MEMBERS BOLTED TO WELDED CLIPS WITH PROFILED AND PRE-COATED METAL ROOFING AND SIDING SCREW ATTACHED. BUILDING SHALL BE ENGINEERED, MANUFACTURED AND ERECTED CONSISTENT WITH BOTH AISC (AMERICAN INSTITUTE OF STEEL CONSTRUCTION) AND MBMA (METAL BUILDING MANUFACTURER'S ASSOCIATION).
3. UNIFORM BUILDING CODE CLASSIFICATOINS (1994)
   CONSTRUCTION TYPE: TYPE II-N
   STRUCTURE OCCUPANCY: NOT OCCUPIED
4. ROOF SQUARE FOOTAGE: 12,705 SQUARE FEET.

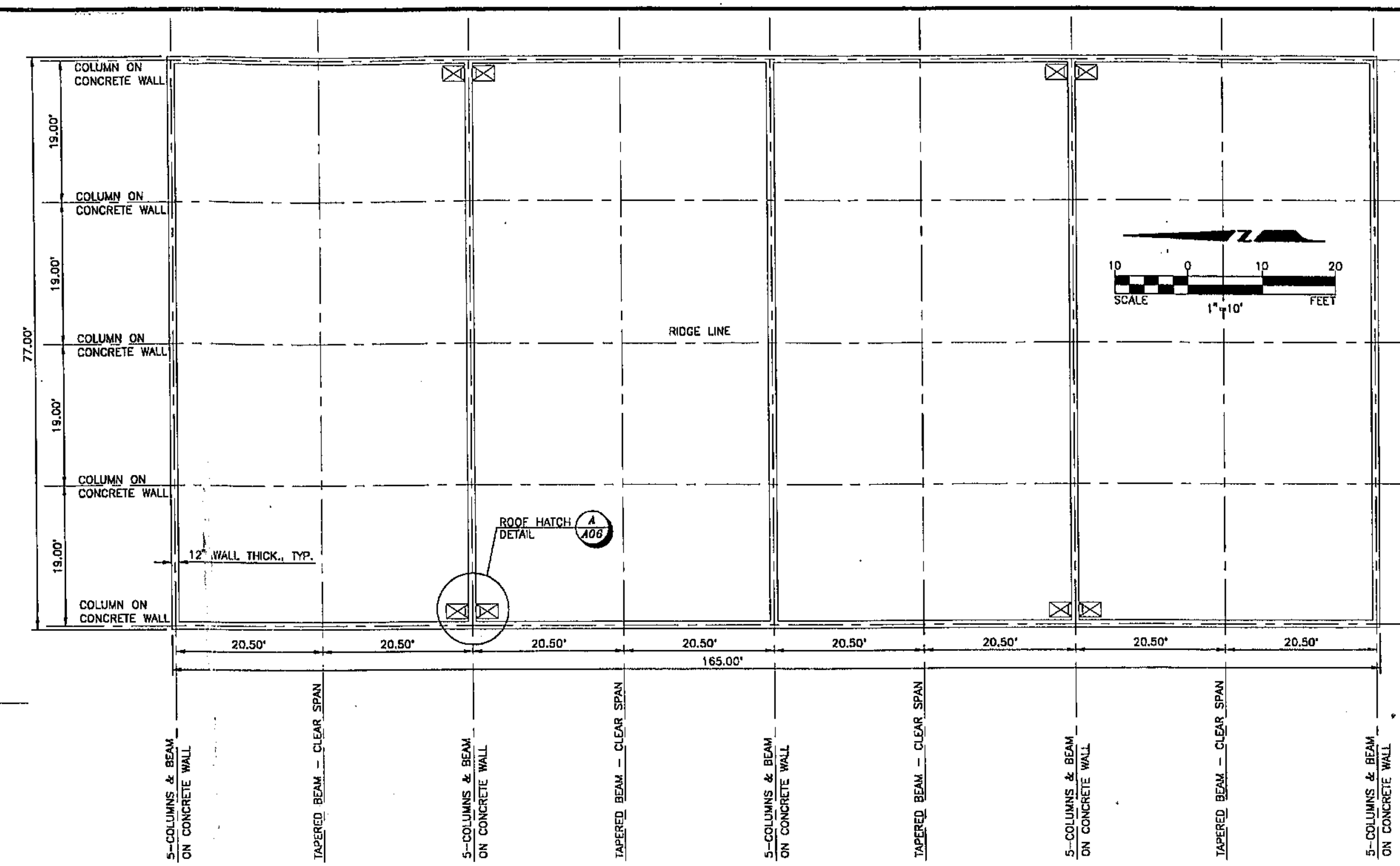
INTERIOR FINISHES:
ROOF: EXPOSED STRUCTURE
GABLE END WALLS: EXPOSED STRUCTURE
WALLS & FLOORS: EXPOSED CONCRETE



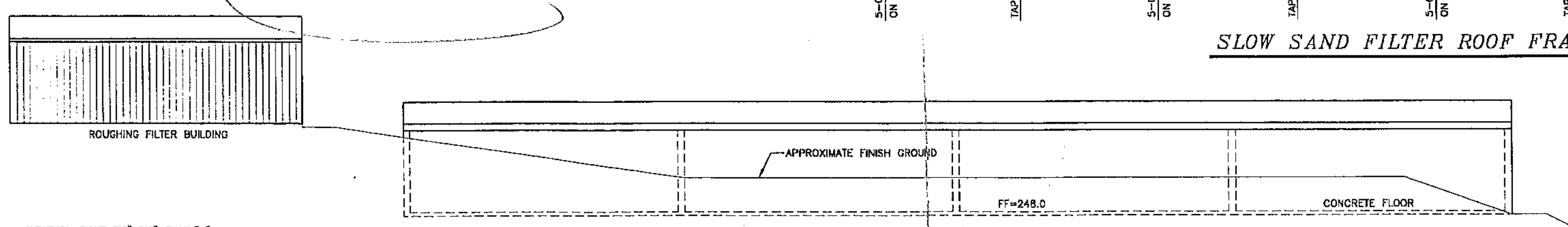
SOUTH ELEVATION



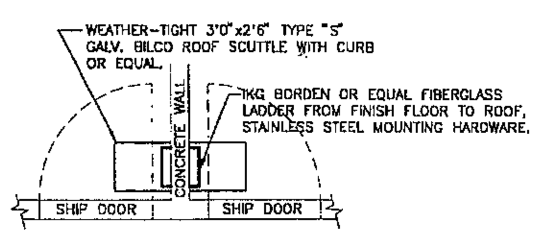
NORTH ELEVATION



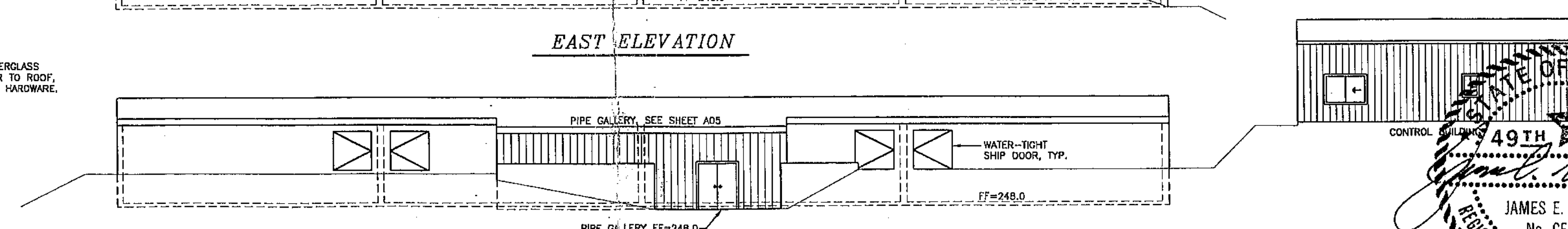
SLOW SAND FILTER ROOF FRAMING PLAN



EAST ELEVATION



A A06 ROOF HATCH
NOT TO SCALE



WEST ELEVATION

STATE OF ALASKA
49TH
JAMES E. WILSON
No. CE6668
REGISTERED PROFESSIONAL ENGINEER
3/17/98

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: WAH
DRAWN BY: WAH
CHECKED BY:

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
SLOW SAND FILTER ROOF PLAN & ELEVATIONS

DATE 3/5/98
SCALE AS SHOWN
JOB NUMBER 97070
SHEET A06 OF A06

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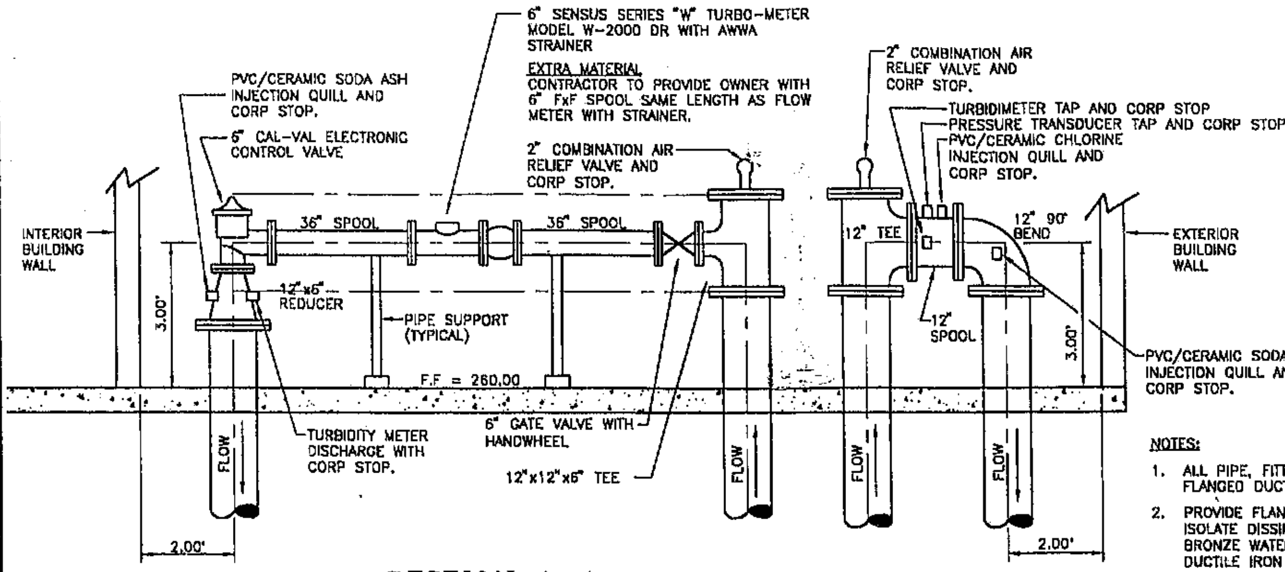


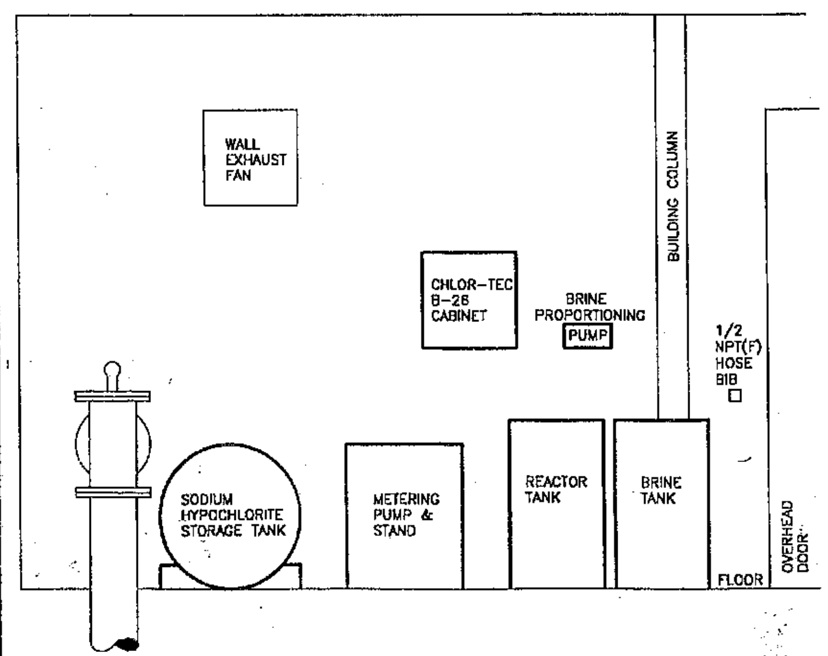
SECTION A–A
A/A01 SCALE: 1"=2'

NOTES:

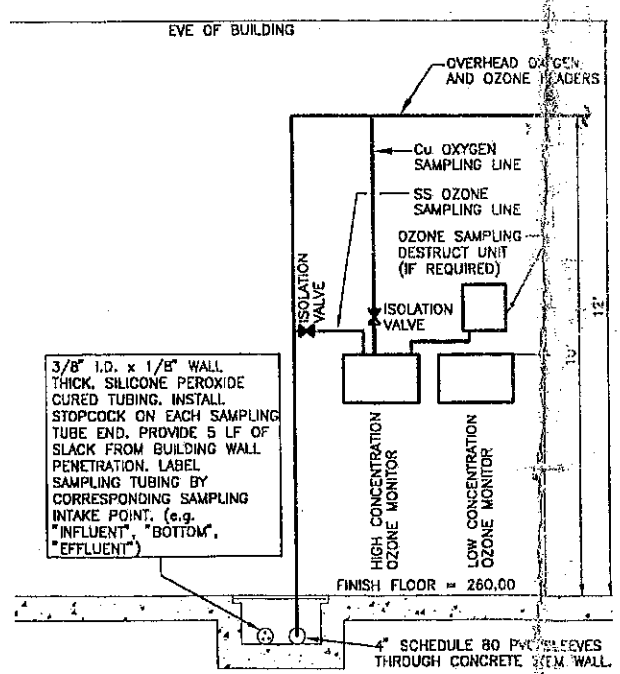
1. ALL PIPE, FITTINGS, AND VALVES SHOWN ARE FLANGED DUCTILE IRON.
2. PROVIDE FLANGE INSULATION KITS TO ISOLATE DISSIMULAR METALS SUCH AS BRONZE WATER METER AND ADJACENT DUCTILE IRON PIPE.
3. EACH TAP AND INJECTION POINT SHOWN, SHALL INCLUDE A CORP STOP FOR ISOLATION OF THE CONNECTING EQUIPMENT.

OZONE GENERATION ROOM PIPING NOTES:

1. OXYGEN HEADER AND OZONE HEADER PIPING SHALL BE SUSPENDED FROM THE CEILING A MINIMUM OF TEN (10) FEET ABOVE FINISH FLOOR ELEVATION. PROVIDE PIPE HANGERS AND SUPPORTS PER 1994 UNIFORM PLUMBING CODE. CONNECT EQUIPMENT TO PIPE HEADERS BY VERTICAL STUBS THAT DROP TO THE EQUIPMENT CONNECTION POINT ELEVATION.
2. COOLING WATER SUPPLY AND RETURN HEADERS SHALL BE PLACED UNDERGROUND FOUR (4) FEET BELOW FINISH FLOOR ELEVATION. VERTICAL STUBS SHALL BE LOCATED AND RISE WITHIN WALL CAVITIES. INSTALL SHUT-OFF VALVES OUTSIDE OF WALL CAVITIES AT ELEVATION OF COOLING WATER CONNECTION TO OZONE GENERATOR CABINET.
3. COOLING WATER SUPPLY AND RETURN HEADERS SHALL BE AN INDEPENDENT SYSTEM AND NOT BE CONNECT TO CONTROL BUILDING WATER SERVICE LINES OR PLUMBING.
4. ALL PIPE EXPOSED TO ROOM SHALL RUN AT RIGHT ANGLES AND/OR PARALLEL TO CEILING, WALLS, AND FLOOR. RUN OVERHEAD PIPING AS CLOSED TO WALLS AS POSSIBLE.
5. ALL STAINLESS STEEL PIPING JOINTS SHALL BE WELDED OR FLANGED.
6. OXYGEN & OZONE GAS PIPING SHALL BE SIZED BY OZONE SYSTEM SUPPLIER.

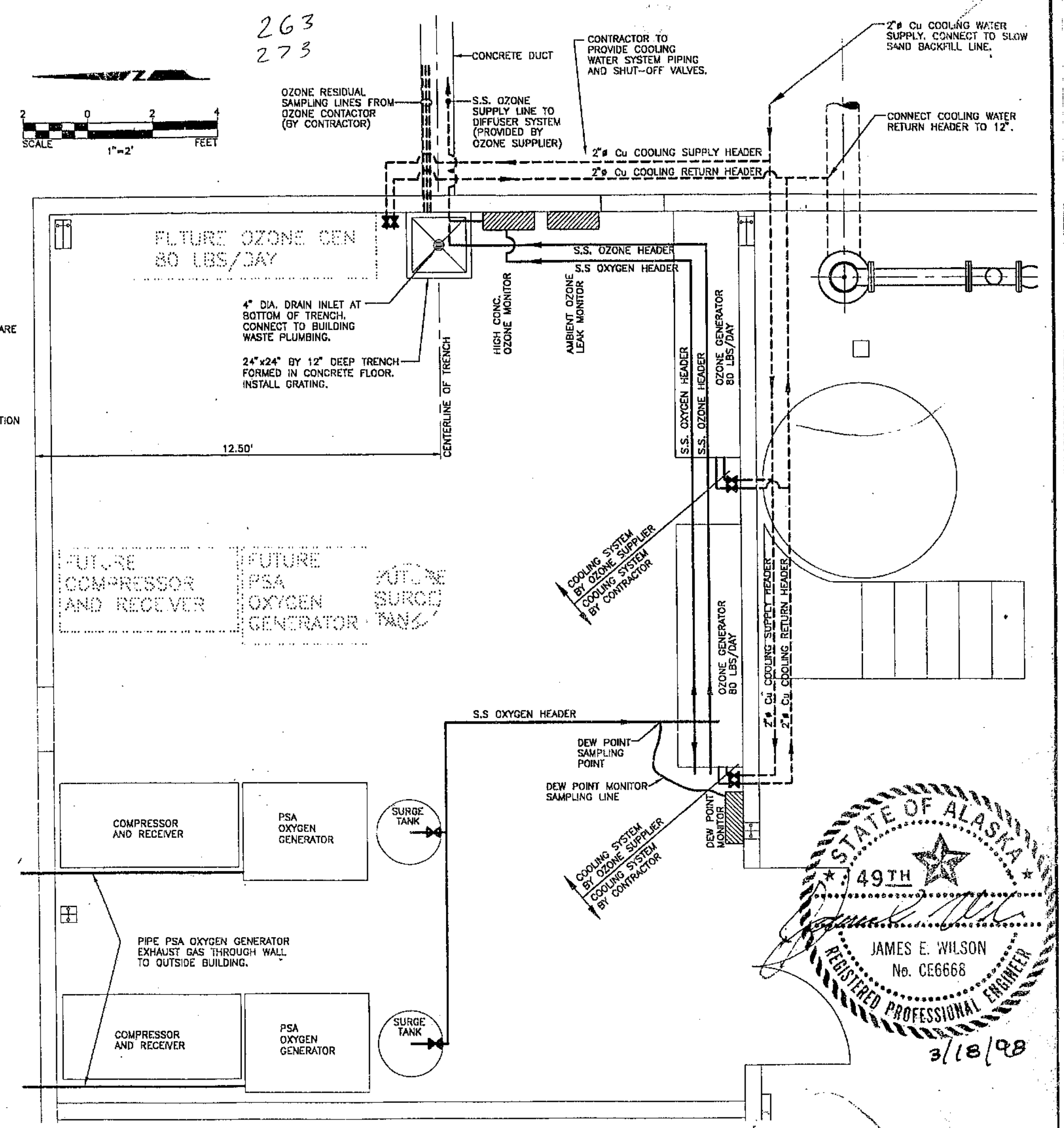


SODIUM HYPOCHLORITE GENERATION SYSTEM
SOUTH WALL ELEVATION
SCALE: 1"=2'



OZONE MONITOR INSTALLAITON
EAST WALL ELEVATION
SCALE: 1"=2'

263
273



STATE OF ALASKA
49TH
JAMES E. WILSON
No. CE6668
REGISTERED PROFESSIONAL ENGINEER
3/18/98

CONTROL BUILDING
OZONE GENERATION ROOM PIPING

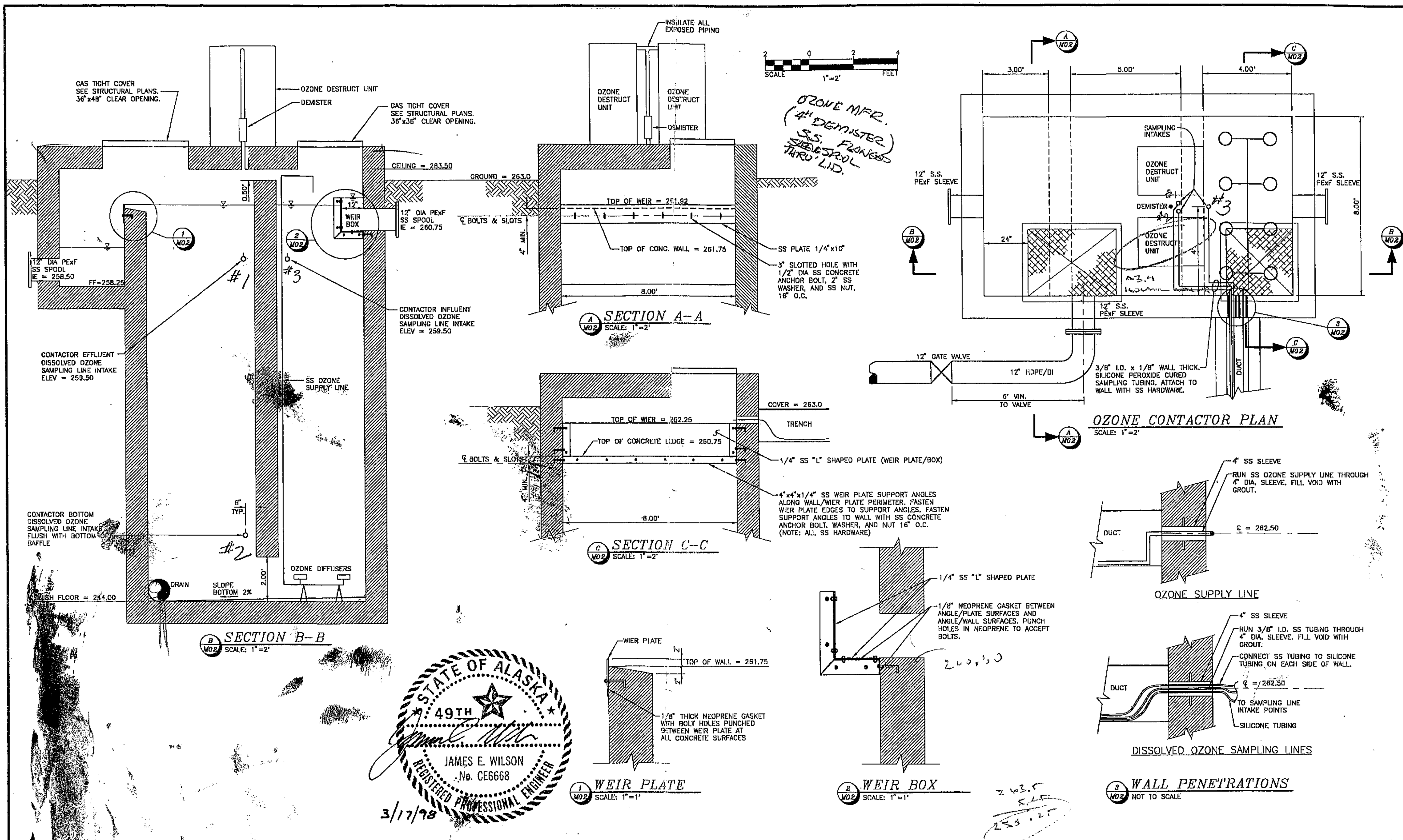
C:\PROJECT\97070\DWG\97070M01 Tue Mar 17 16:00:00 1998 WAH

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX (360) 647-9061

DESIGNED BY: MAC DRAWN BY: WAH CHECKED BY:	CITY OF WRANGELL WRANGELL ISLAND ALASKA PHASE 2 WATER SYSTEM IMPROVEMENTS CONTROL BUILDING PIPING	DATE 3/13/98 SCALE AS SHOWN JOB NUMBER 97070	SHEET M01 OF M08



NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: MAC	CITY OF WRANGELL	DATE 3/12/98	SHEET M02
DRAWN BY: WAH	WRANGELL ISLAND — ALASKA PHASE 2 WATER SYSTEM IMPROVEMENTS	SCALE AS SHOWN	OF
CHECKED BY: MAC	OZONE CONTACTOR	JOB NUMBER 97070	M08

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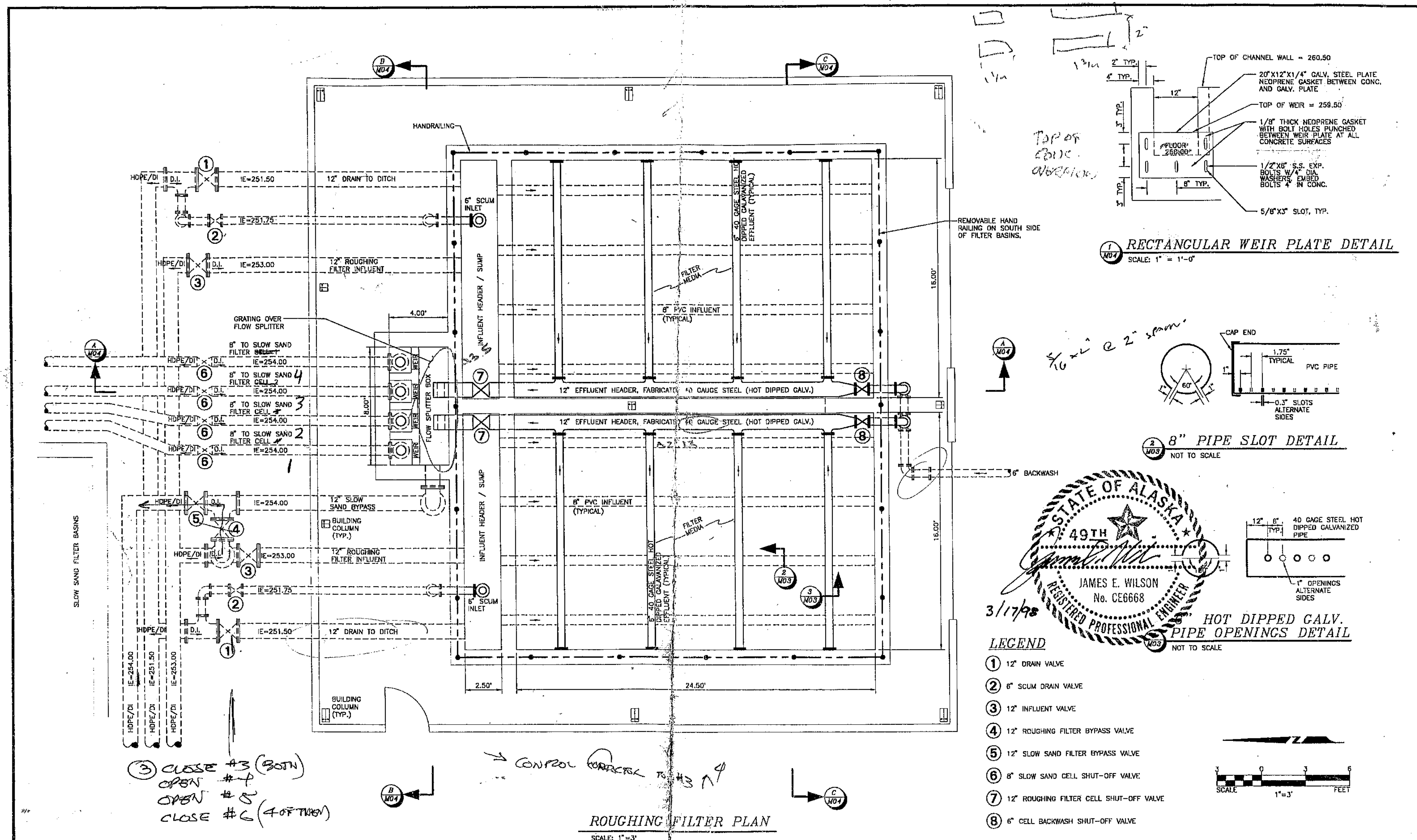

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NO.	REVISIONS	BY	DATE

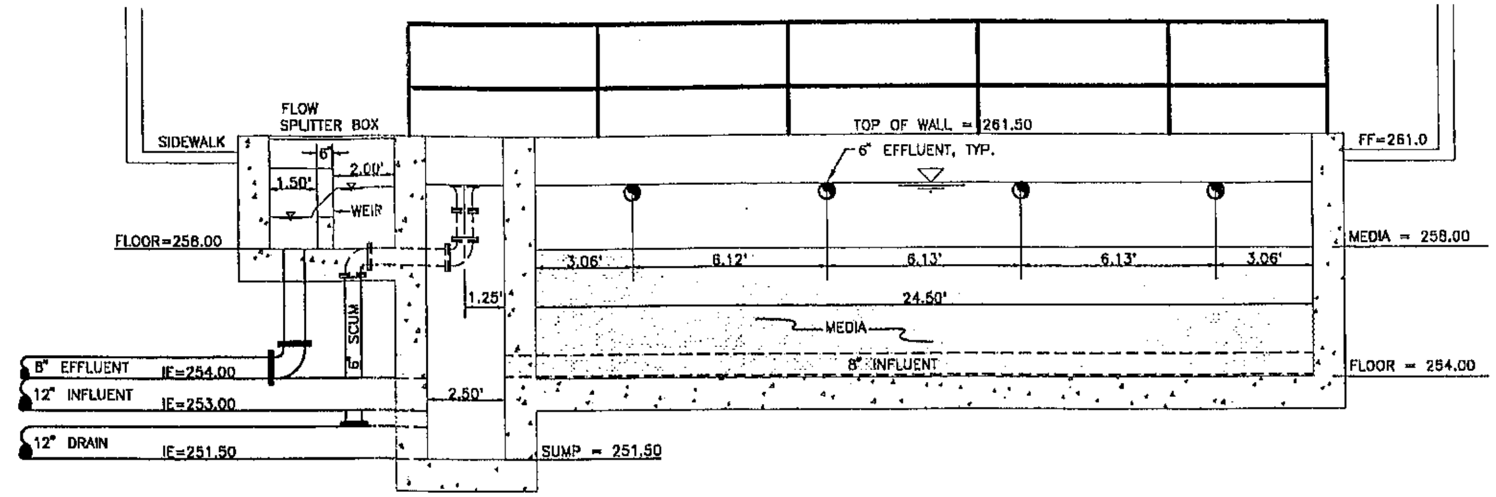
Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: JGC
DRAWN BY: JGC
CHECKED BY:

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
ROUGHING FILTER/FLOW SPLITTER PLAN

DATE 3/12/98
SCALE AS SHOWN
JOB NUMBER 97070
SHEET M03 OF M08



SECTION A–A
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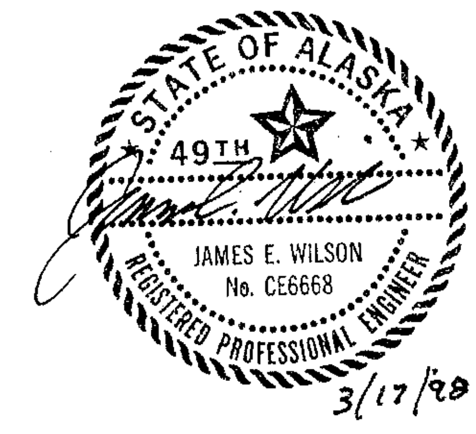

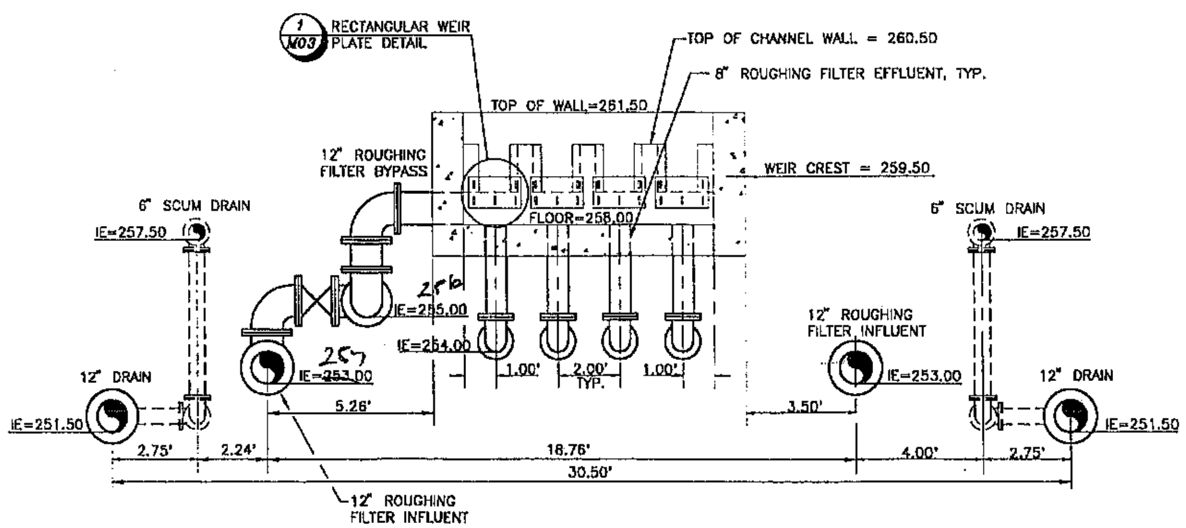

SECTION B–B
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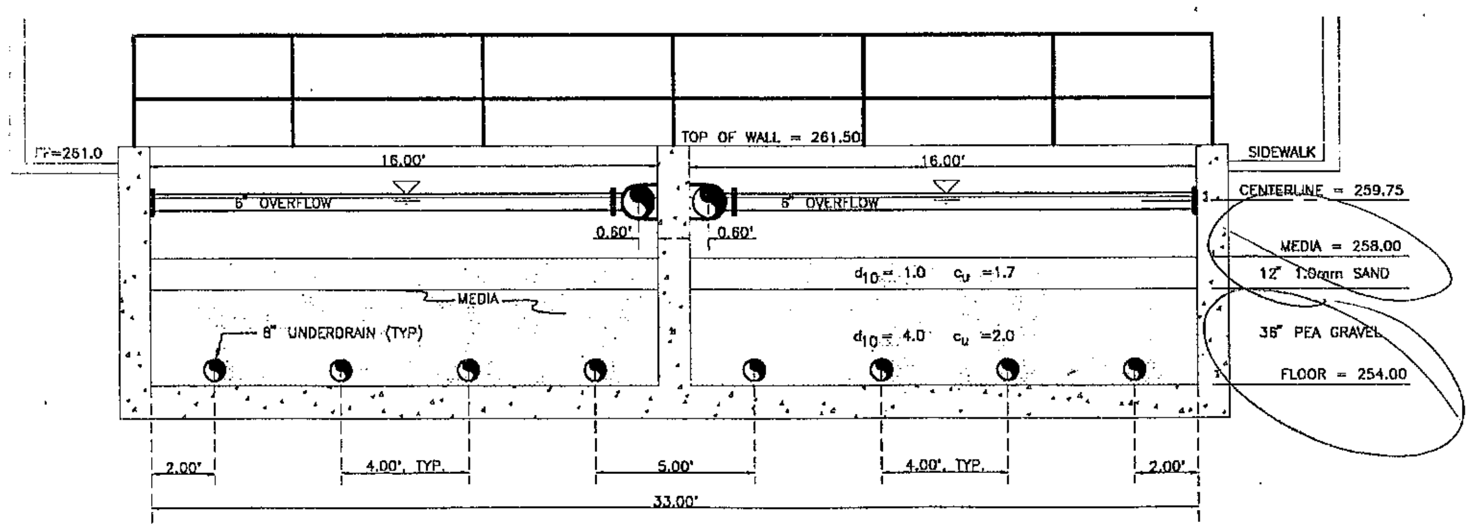

SECTION C–C
SCALE: 1"=3'

d_{10} = EFFECTIVE SIZE (PARTICAL DIAMETER WHICH 10% BY WEIGHT OF SAMPLE ARE SMALLER)

c_u = COEFFICIENT OF UNIFORMITY (d_{60}/d_{10})

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NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

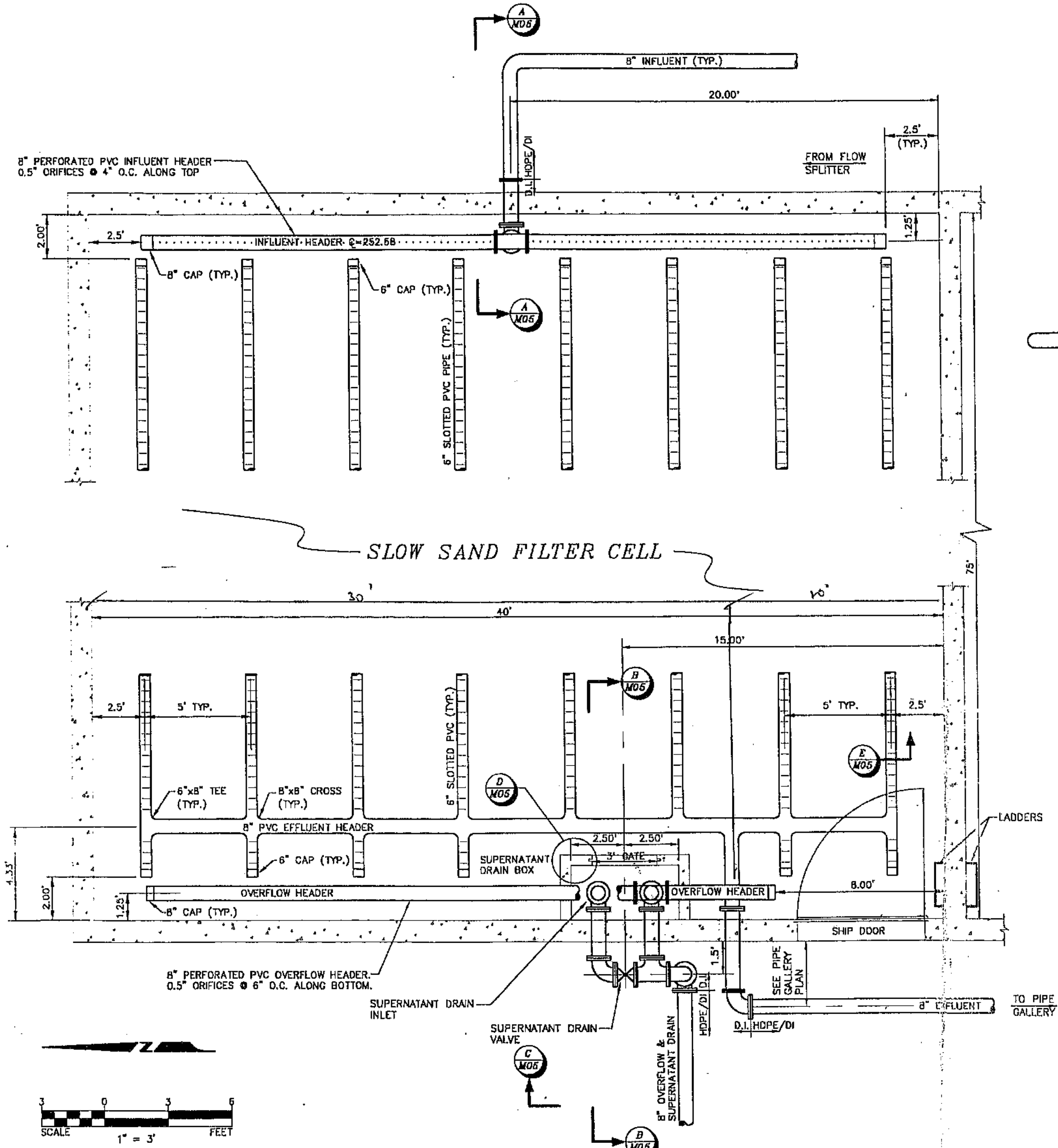
DESIGNED BY: JGC
DRAWN BY: JGC
CHECKED BY:

CITY OF WRANGELL

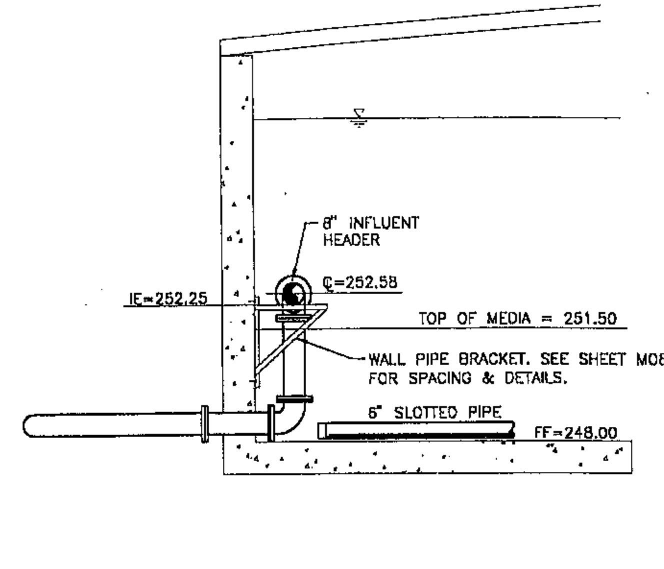
WRANGELL ISLAND — ALASKA

PHASE 2 WATER SYSTEM IMPROVEMENTS
ROUGHING FILTER/FLOW SPLITTER SECTIONS

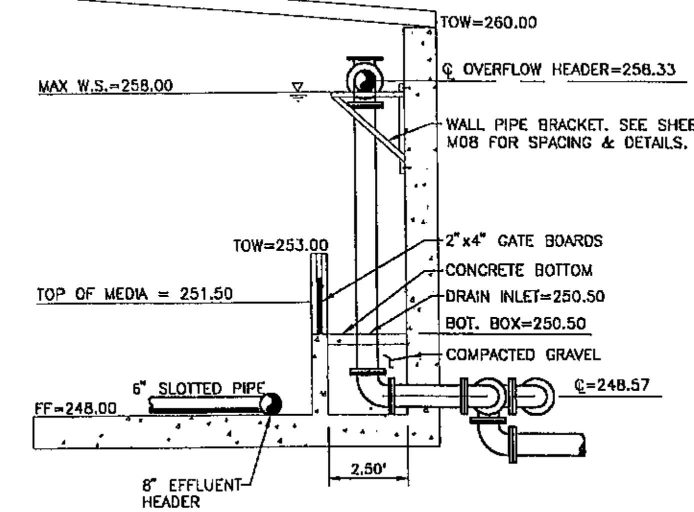
DATE 3/12/98
SCALE AS SHOWN
JOB NUMBER 97070
SHEET M04 OF M08



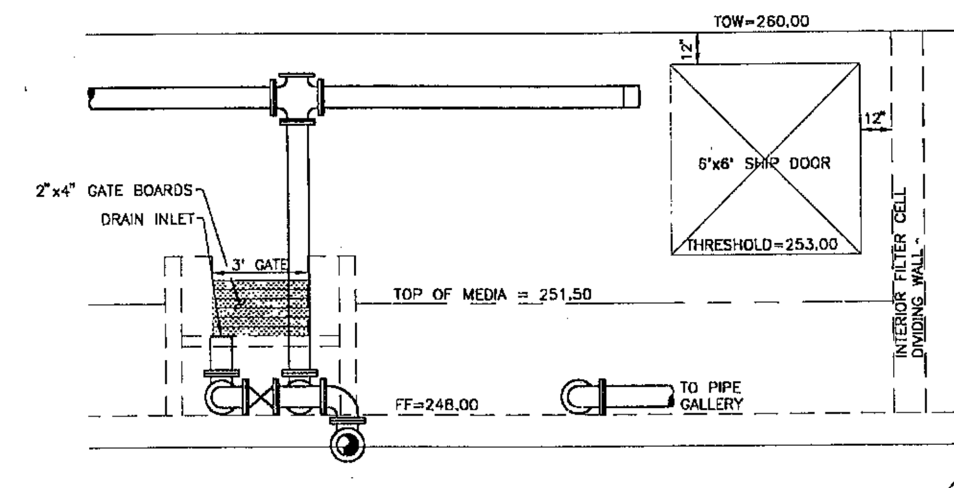
TYPICAL SLOW SAND FILTER CELL PIPING PLAN



A/M05 SECTION A–A
SCALE: 1"=3'

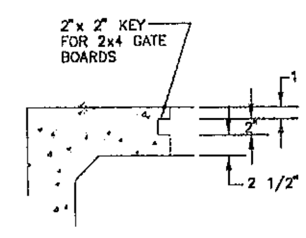


B/M05 SECTION B–B
SCALE: 1"=3'

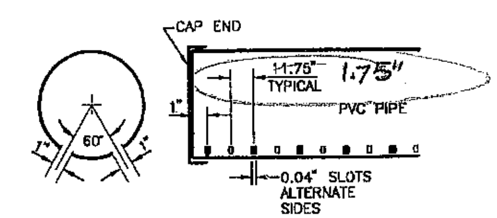


C/M05 SECTION C–C
SCALE: 1"=3'

STATE OF ALASKA
49TH
JAMES E. WILSON
No. CE6668
REGISTERED PROFESSIONAL ENGINEER
3/17/98



D/M05 GATE BOARD KEY
TO TO SCALE



E/M05 6" PIPE SLOT DETAIL
NOT TO SCALE

24/25

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: WAH
DRAWN BY: WAH
CHECKED BY:

CITY OF WRANGELL
WRANGELL ISLAND — ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
SLOW SAND FILTER CELL PIPING

DATE 3/17/98
SCALE AS SHOWN
JOB NUMBER 97070
SHEET M05 OF M08

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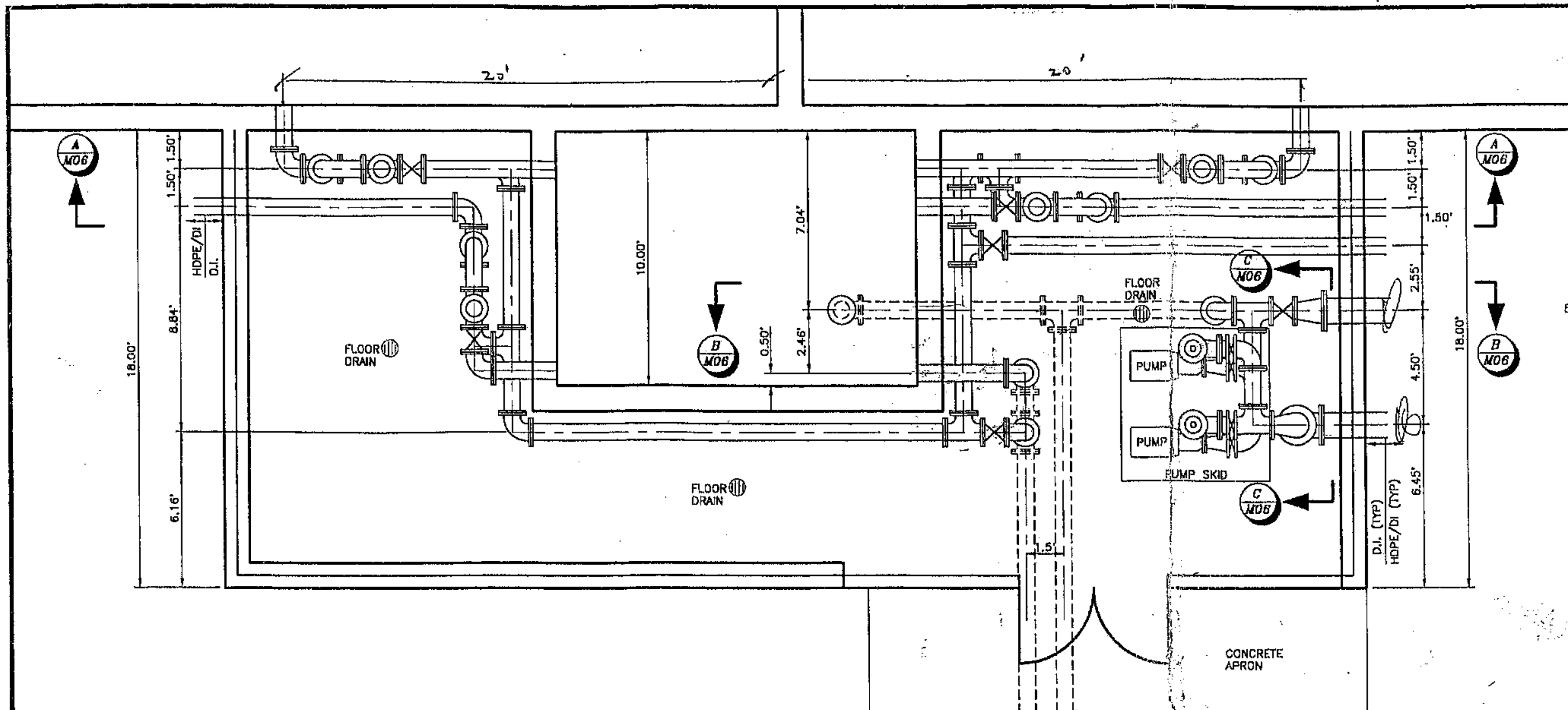
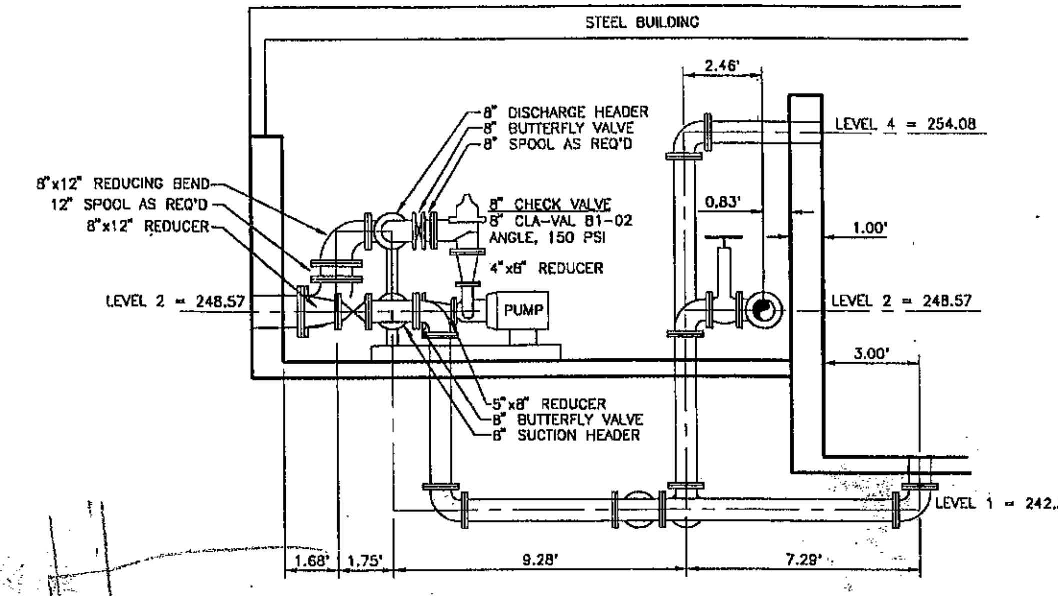


PIPE GALLERY AND CLEARWELL PLAN VIEW

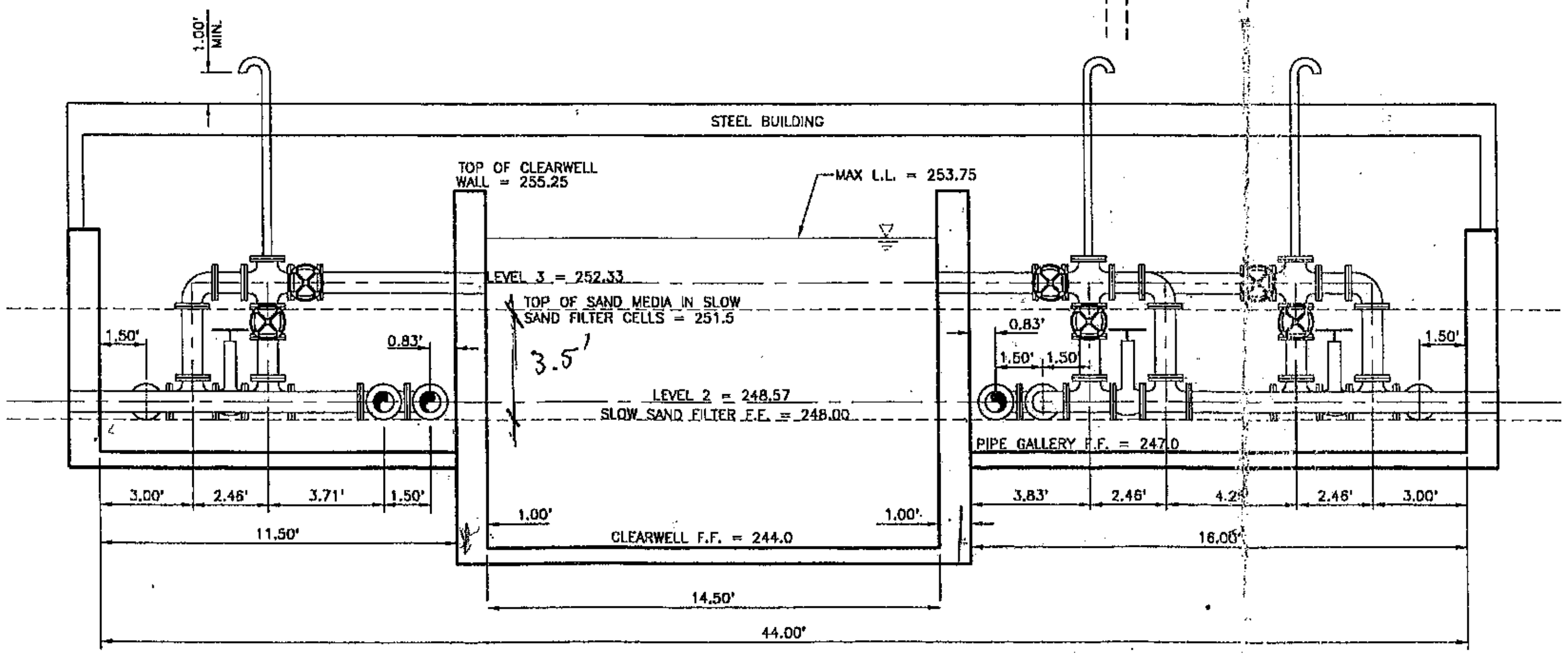


SECTION B–B

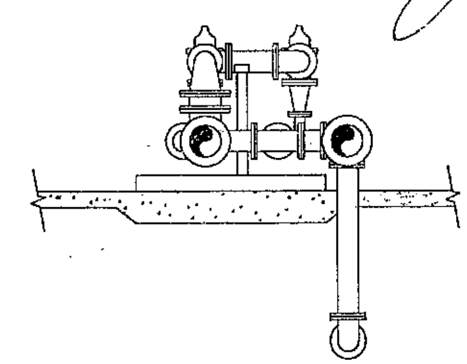
NOTE:
ALL PIPE FITTINGS AND VALVES ARE 8" DUCTILE IRON, FLANGED, UNLESS OTHERWISE NOTED.

STATE OF ALASKA
49TH
JAMES E. WILSON
No. CE6668
REGISTERED PROFESSIONAL ENGINEER
3/17/98

251.56
248.00
3.56



SECTION A–A



SECTION C–C

SCALE 1"=3' FEET

C:\PROJECT\97070\DWG\97070M06 Thu Mar 12 17:28:01 1998 WAH

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

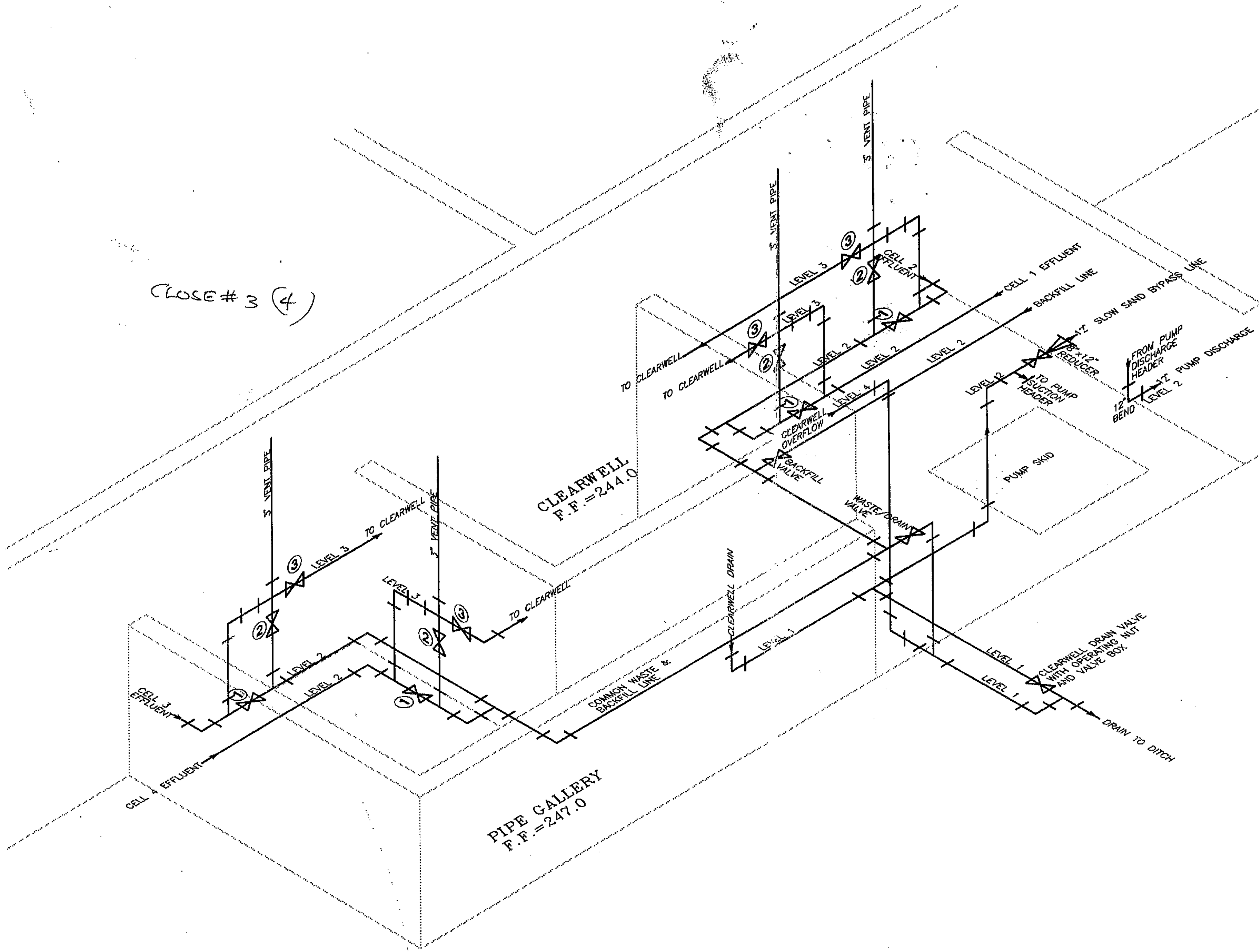
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: MAC
DRAWN BY: WAH
CHECKED BY:

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
PIPE GALLERY PLAN & SECTIONS

DATE 3/12/98
SCALE N.T.S.
JOB NUMBER 97070
SHEET M06 OF M08

CLOSE #3 (4)



NOTE:
ALL PIPE FITTINGS AND VALVES ARE 8" DUCTILE IRON, FLANGED, UNLESS OTHERWISE NOTED.

PIPE CENTERLINE ELEVATIONS
LEVEL 1 = 242.33
LEVEL 2 = 248.57
LEVEL 3 = 252.33
LEVEL 4 = 254.08

LEGEND

- 90° BEND, SHORT RADIUS
- TEE
- CROSS
- GATE VALVE WITH HANDWHEEL
- (1) CELL DRAIN VALVE
- (2) FILTER TO WASTE & BACKFILL VALVE
- (3) CLEARWELL SHUT-OFF VALVE

STATE OF ALASKA
49TH
JAMES E. WILSON
No. CE6668
REGISTERED PROFESSIONAL ENGINEER
3/17/98

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

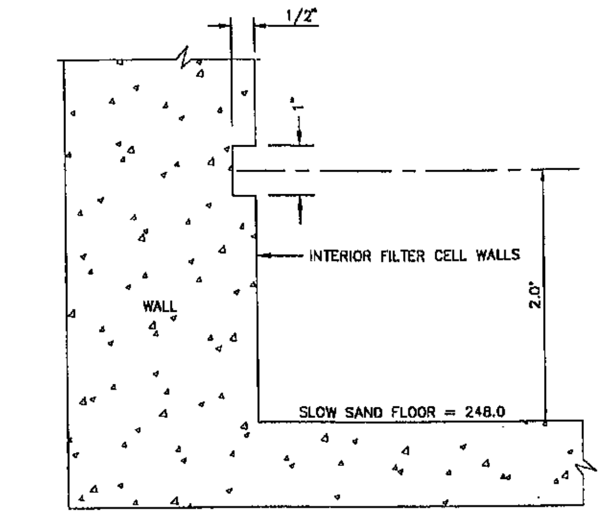
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: MAC
DRAWN BY: WAH
CHECKED BY:

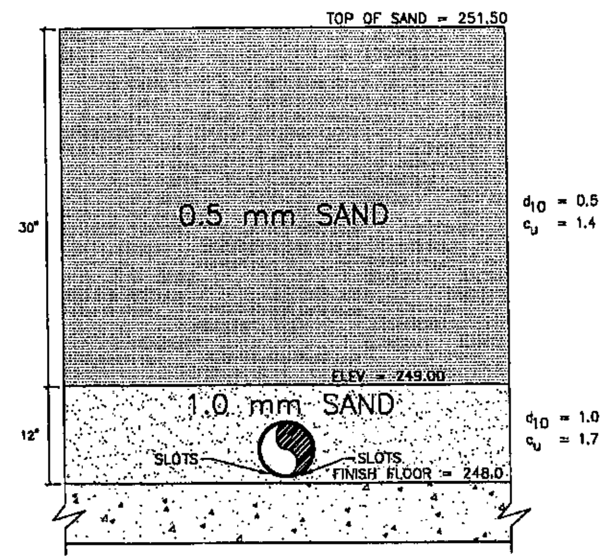
CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
PIPE GALLERY ISOMETRIC

DATE 3/12/98
SCALE N.T.S.
JOB NUMBER 97070
SHEET M07 OF M08

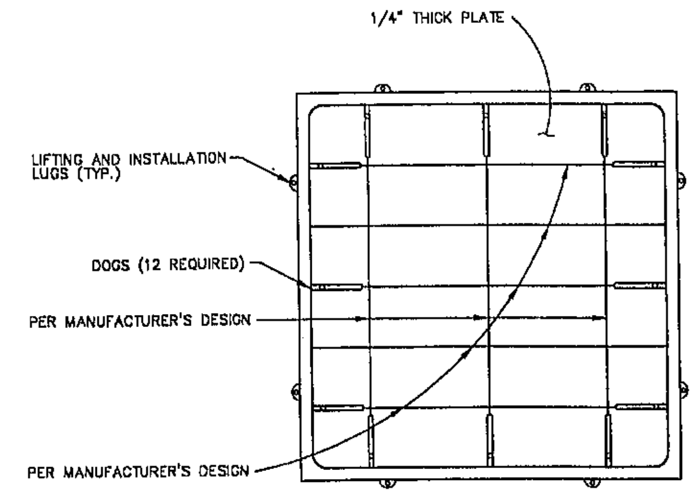
C:\PROJECT\97070\DWG\97070M06 Thu Mar 12 17:28:31 1998 WAH



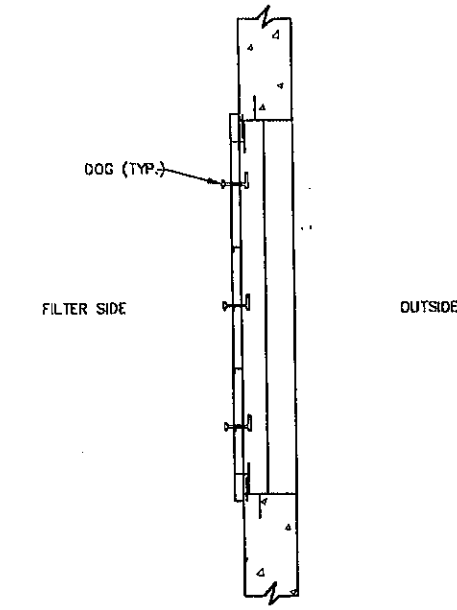
LOW SAND LEVEL INDICATOR NOTCH
N.T.S.



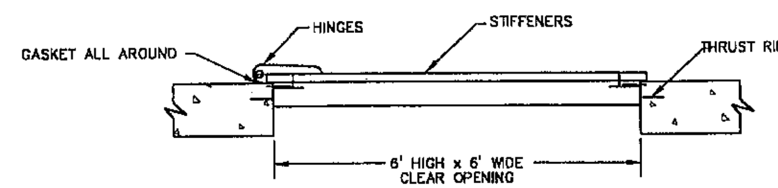
UNDERDRAIN ORIFICE DETAIL
N.T.S.



FRONT VIEW



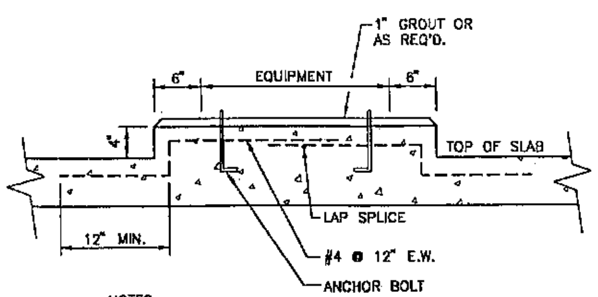
SECTION



SECTION

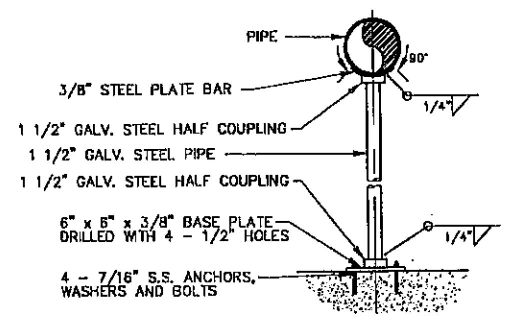
NOTES:
1. THE WATERTIGHT SHIP DOORS SHALL BE AS DESIGNED AND MANUFACTURED BY MANLY MARINE CLOSURES LTD. OR APPROVED EQUAL.
2. ENGINEERING DESIGN AND CALCULATIONS SHALL BE PROVIDED FOR THE DOORS, STAMPED BY AN ENGINEER CERTIFIED IN THE STATE OF WASHINGTON.
3. STRUCTURAL DETAILS ON THIS SHEET ARE FOR REFERENCE ONLY AND ACTUAL DESIGN SHALL BE PERFORMED BY THE MANUFACTURER.

WATERTIGHT DOOR DETAIL



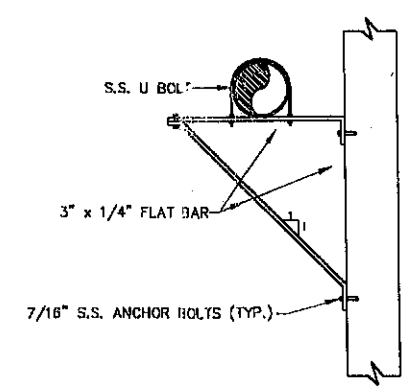
NOTES:
1. PAD DIMENSIONS, ANCHOR BOLT SIZE AND LOCATION AND OTHER EMBEDDED STEEL SHALL CONFORM TO EQUIPMENT MANUFACTURER'S REQUIREMENTS.
2. ALL MECHANICAL AND ELECTRICAL EQUIPMENT SHALL BE ANCHORED TO THE EQUIPMENT PAD. ANCHORAGES SHALL MEET THE REQUIREMENTS OF SEISMIC ZONE 2B, AND SHALL WITHSTAND LATERAL AND UPLIFT FORCES DUE TO 90 MPH, EXPOSURE C WIND.

CONCRETE EQUPMENT PAD
N.T.S.



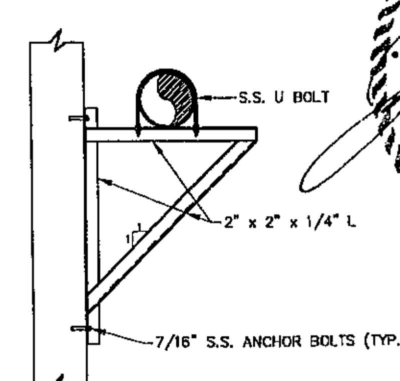
INSTALL SUPPORTS 6'-0" O.C. AND AT HORIZONTAL BENDS

PIPE SUPPORT DETAIL
N.T.S.



PIPE GALLERY VENTED RISERS - INSTALL WALL PIPE BRACKETS AT 5' O.C.

VERTICAL WALL PIPE BRACKET DETAIL
N.T.S.



INFLUENT HEADER AND OVERFLOW - INSTALL WALL PIPE BRACKETS AT HEADER ENDS AND SPACE BRACKETS @ 4' O.C.

WALL PIPE BRACKET DETAIL
N.T.S.

STATE OF ALASKA
49TH
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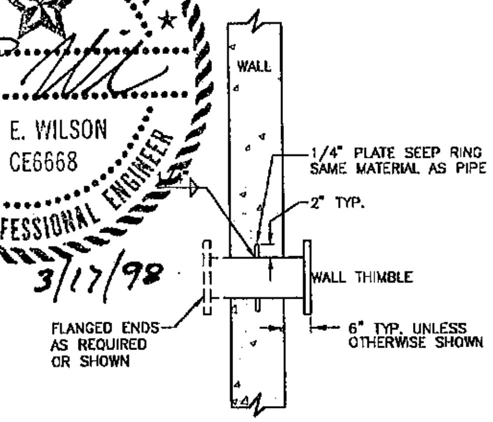
3/17/98



TYPICAL WALL PENETRATION
N.T.S.

ALUM BRACKETS HOT DIP GALVANIZED

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: MAC
DRAWN BY: WAH
CHECKED BY:

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
SLOW SAND FILTER DETAILS

DATE 3/12/98
SCALE N.T.S.
JOB NUMBER 97070
SHEET M08 OF M08

C:\PROJECT\97070\DWG\97070M08 Thu Mar 12 17:29:13 1998 WAH

ELECTRICAL SYMBOLS

- LIGHTING FIXTURE, FLUORESCENT PENDANT MOUNTED.
- LIGHTING FIXTURE, FLUORESCENT SURFACE MOUNTED.
- LIGHTING FIXTURE, FLUORESCENT, WALL OR BRACKET MOUNT
- LIGHTING FIXTURE, (HID)

NOTE: SUBSCRIPT "X" ON LIGHTING FIXTURE INDICATES FIXTURE TYPE PER LIGHTING FIXTURE SCHEDULE. "Y" INDICATES CIRCUIT NUMBER. "Z" INDICATES CONTROLLING SWITCH LOCATION IF REQUIRED.

- $ — SWITCH, SINGLE POLE, SINGLE THROW
- $3 — SWITCH, 3-WAY
- RECEPTACLE, DUPLEX, GROUNDING TYPE ("G" INDICATES GFCI)
- RECEPTACLE, FOURPLEX, GROUNDING TYPE
- OUTLET, TELEPHONE
- THERMOSTAT
- JUNCTION BOX
- RATE OF RISE HEAT DETECTOR
- SMOKE DETECTOR, IONIZATION TYPE
- SMOKE DETECTOR, PHOTOELECTRIC
- ELECTRICAL EQUIPMENT ENCLOSURE: SWITCHBOARD, MOTOR CONTROL CENTER, CONTROL PANEL, TRANSFORMER OR OTHER EQUIPMENT AS SHOWN
- CONTROL PANEL FURNISHED WITH PROCESS, HVAC OR OTHER EQUIPMENT. IF MOTOR STARTERS ARE REQUIRED, AND ARE NOT SHOWN ON THE ELECTRICAL ONE-LINE DIAGRAM, THEY SHALL BE FURNISHED AS PART OF THE CONTROL PANEL
- MOTOR, EXPECTED HORSEPOWER AS SHOWN. "X": INDICATES MOTOR SIZE
- GROUND CONNECTION
- SWITCH, TOGGLE (SPST)
- LIGHTNING ARRESTER
- LIMIT SWITCH, N.C.
- LIMIT SWITCH, N.O.
- SAFETY SWITCH FUSED IF INDICATED BY "F" INSIDE BOX
- SAFETY SWITCH FURNISHED WITH MECHANICAL OR PROCESS EQUIPMENT
- INDICATING LIGHT, PUSH-TO-TEST
- SWITCH, DISCONNECT
- DISCONNECT SWITCH, FUSED
- SWITCH, LEVEL, CLOSES ON RISING LEVEL
- SWITCH, LEVEL, OPENS ON RISING LEVEL
- SWITCH, PRESSURE, CLOSES ON RISING PRESSURE
- SWITCH, PRESSURE, OPENS ON RISING PRESSURE

ELECTRICAL SYMBOLS

- SWITCH, FLOW, CLOSES ON FLOW INCREASE
- SWITCH, FLOW, OPENS ON FLOW INCREASE
- SWITCH, NORMALLY OPEN WITH TIME DELAY CLOSING (T.C.)
- SWITCH, NORMALLY CLOSED WITH TIME DELAY OPENING (T.O.)
- SWITCH, NORMALLY OPEN WITH INSTANT CLOSING AND TIME DELAY OPENING (I.C.T.O.)
- SWITCH, NORMALLY CLOSED WITH INSTANT OPENING AND TIME DELAY CLOSING (I.O.T.C.)
- SWITCH, PUSHBUTTON, NORMALLY OPEN, MOMENTARY CLOSE
- SWITCH, PUSHBUTTON, NORMALLY CLOSED, MOMENTARY OPEN
- SWITCH, PUSHBUTTON, NORMALLY CLOSED/ NORMALLY OPEN
- ON OFF — SWITCH, TWO-POSITION SELECTOR H-HAND, M-MANUAL, R-REMOTE, L-LOCAL, A-AUTOMATIC
- H O A — SWITCH, THREE-POSITION SELECTOR H-HAND, M-MANUAL, R-REMOTE, L-LOCAL, A-AUTOMATIC, O-OFF
- CONTROL RELAY OR COIL
- CONTACT, NORMALLY OPEN
- CONTACT, NORMALLY CLOSED
- OL — CONTACT, OVERLOAD RELAY
- CS — CONTROL STATION
- 400/3 — CIRCUIT BREAKER, TRIP SETTING/NO. OF POLES AS SHOWN. NOTE THAT FRAME SIZE IS NOT NECESSARILY SHOWN WHEN THE SELECTION IS STANDARD. IN GENERAL, TRIP SETTING, FRAME SIZE, AND NO. OF POLES IS NOT SHOWN WHEN THE CIRCUIT BREAKER IS AN INTEGRAL PART OF THE EQUIPMENT, SUCH AS A COMBINATION MAGNETIC STARTER
- 200E/3 — FUSE, SIZE AND QUANTITY AS SHOWN. IN GENERAL, CURRENT RATING AND QUANTITY ARE NOT SHOWN FOR CONTROL CIRCUITS OR WHERE THE FUSE IS AN INTEGRAL PART OF THE EQUIPMENT SUCH AS FUSING OF A POTENTIAL TRANSFORMER
- POTENTIOMETER (VARIABLE RESISTOR)
- BUS STAB
- FUSE WITH BLOWN FUSE INDICATOR
- TRANSFORMER, CURRENT (CT)

ELECTRICAL SYMBOLS

- TRANSFORMER, POTENTIAL (PT)
- TRANSFORMER, POTENTIAL (VOLTAGE) WITH PRIMARY FUSE
- MCP, A, B, C — COMBINATION MAGNETIC STARTER WITH MOTOR CIRCUIT PROTECTOR (MCP) TYPE CIRCUIT BREAKER DISCONNECT. RATING OF MCP SHALL BE DETERMINED BY THE MANUFACTURER OF THE STARTER AND THEREFORE IS NOT SHOWN ON THE DRAWINGS.
  - A: STARTER TYPE:
    - FVNR - FULL VOLTAGE NON-REVERSING
    - FVR - FULL VOLTAGE REVERSING
  - B: NEMA SIZE
  - C: CONTROL DIAGRAM NUMBER
- TRANSFORMER, POWER, RATIO AND RATING AS SHOWN
- CONDUIT TURNING UP OR TOWARD VIEWER
- CONDUIT TURNING DOWN OR AWAY FROM VIEWER
- (XXXX) — NUMBER INDICATES CONDUIT NO. SHOWING QUANTITY/SIZES OF CONDUIT/WIRES & ROUTING
  - C = CONTROL
  - J = INSTRUMENTATION
  - P = POWER

STATE OF ALASKA 49TH RALPH J. TITUS No. 9668 REGISTERED PROFESSIONAL ENGINEER 3/16/98

Titus Engineering Inc.
3003 160th Ave. N.E.
Bellevue, WA 98008
Telephone (425) 861-6335
Fax (425) 861-7317

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

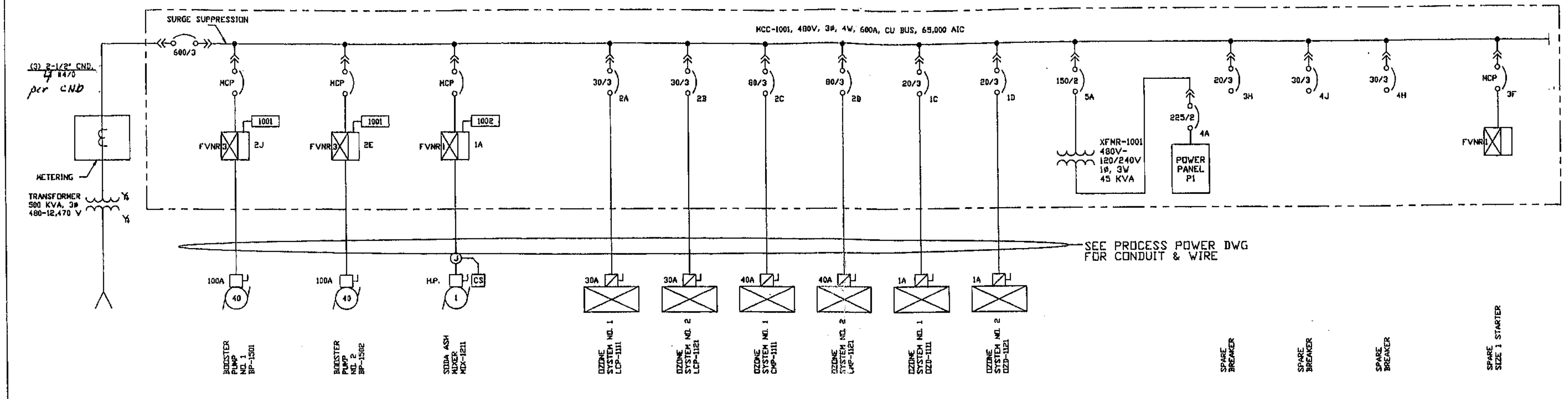
DESIGNED BY:	RJT
DRAWN BY:	CWA
CHECKED BY:	RJT/MAC

CITY OF WRANGELL

WRANGELL ISLAND — ALASKA

PHASE 2 WATER SYSTEM IMPROVEMENTS
ELECTRICAL SYMBOLS

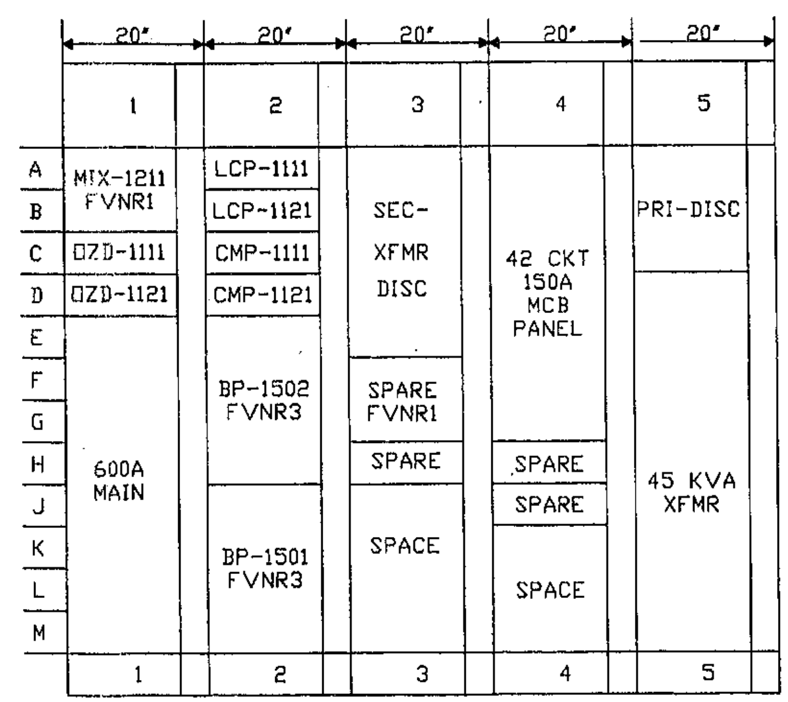
DATE	3/16/98
SCALE	NO SCALE
JOB NUMBER	97070
SHEET	E01 OF E06



MCC-1001 ONE LINE DIAGRAM

PANEL SCHEDULE FOR: PANEL P1									225 AMP PANEL WITH MAIN 225A 120/240 VOLTS 1 PHASE 3 WIRE
DESCRIPTION:	VOLT-AMPS A	VOLT-AMPS B	BRKR A/P	AB		BRKR A/P	VOLT-AMPS A	VOLT-AMPS B	DESCRIPTION:
MAIN CONTROL PANEL (MCP-1001)	1500		30	1	2	30	1500		MAIN OZONE CNTRL PANEL (OCP-1100)
MAIN CONTROL PANEL (MCP-1001)		1500	2	3	4	2		1500	MAIN OZONE CNTRL PANEL (OCP-1100)
HEATER (UH-1001) OZONE ROOM	1500		20/1	5	6	20/1	1500		UNIT HEATER (UH-1002) SHOP
UNIT HEATER (UH-1003) STORAGE AREA		1500	20/1	7	8	20/1		1500	UNIT HEATER (UH-1004) RESTROOM
UNIT HEATER (UH-1005) LAB/CNTRL RM	1500		20/1	9	10	20/1	X		SPARE
SODA ASH FEED PUMP (CFP-1221)		500	20/1	11	12	20/1		500	Ca(OCl)2 FEED PUMP (CFP-1621)
LIGHTS: OUTDOOR	300		20/1	13	14	20/1	585		LIGHTS: SHOP
LIGHTS: INDOOR ROUGHING		195	20/1	15	16	20/1		130	LIGHTS: RESTROOM
LIGHTS: INDOOR OZONE	520		20/1	17	18	20/1	650		LIGHTS LAB/CONTROL ROOM
UPS		2500	20/1	19	20	20/1		1200	120V MOTOR (JET TANK)
OUTLETS: OZONE	540		20/1	21	22	20/1	720		OUTLETS: ROUGHING FILTERS
OUTLETS: LAB/BATH		540	20/1	23	24	20/1		X	SPARE
OUTLETS: SHOP	720		20/1	25	26	20/1	360		OUTLETS: OUTSIDE CONTROL BUILDING
OUTLETS: SHOP		720	20/1	27	28	20/1		720	OUTLETS: LAB
SPARE	X		20/1	29	30	20/1	X		SPARE
CNTRL BLDG WALL FANS		1056	20/1	31	32	20/1		180	SMOKE DETECTOR (P218)
HEAT TAPE (P203)	60		20/1	33	34	40	3840		LCP-1601
FILTER PANEL 2		1900	60	35	36	2		3840	LCP-1601
FILTER PANEL 2	3530		1	37	38	20/1	X		SPARE
AIT-1001		500	20/1	39	40	20/1		X	SPARE
FIT-1001	500		20/1	41	42	20/1	X		SPARE
TOTAL VA LEFT	10670	10911	TOTAL CONNECTED LOAD: 40306 VA, 171 AMPS				REMARKS: ENTRANCE: INTERNAL TO MCC-1001, MOUNTING: MCC-1001. FEEDER SOURCE: 45 KVA XFMR IN MCC-1001, FEEDER SIZE: 3-1/0 AWG, 1-#6G GRD.		
TOTAL VA RIGHT	9155	9570							
TOTAL VA	19825	20481							
TOTAL AMPS	166	171							

POWER PANEL (P1)



MOTOR CONTROL CENTER ELEVATION (MCC-1001)

NOTES

FIELD VERIFY NAME PLATE OF EQUIP PRIOR TO ORDERING MCC & FEEDER SIZES

METERING TO BE LOCATED AT 500 KVA TRANSFORMER, BUSHING CT'S ON LOW SIDE, 1" CONDUIT TO METER BASE

H.P. - HORSEPOWER RATED SWITCH

MCC SHALL BE EXPANDABLE TO 6 SECTIONS

DITTLE & ASSOCIATES, INC.
Engineers and Consultants
LYNNWOOD, WA
(425) 672-9851

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

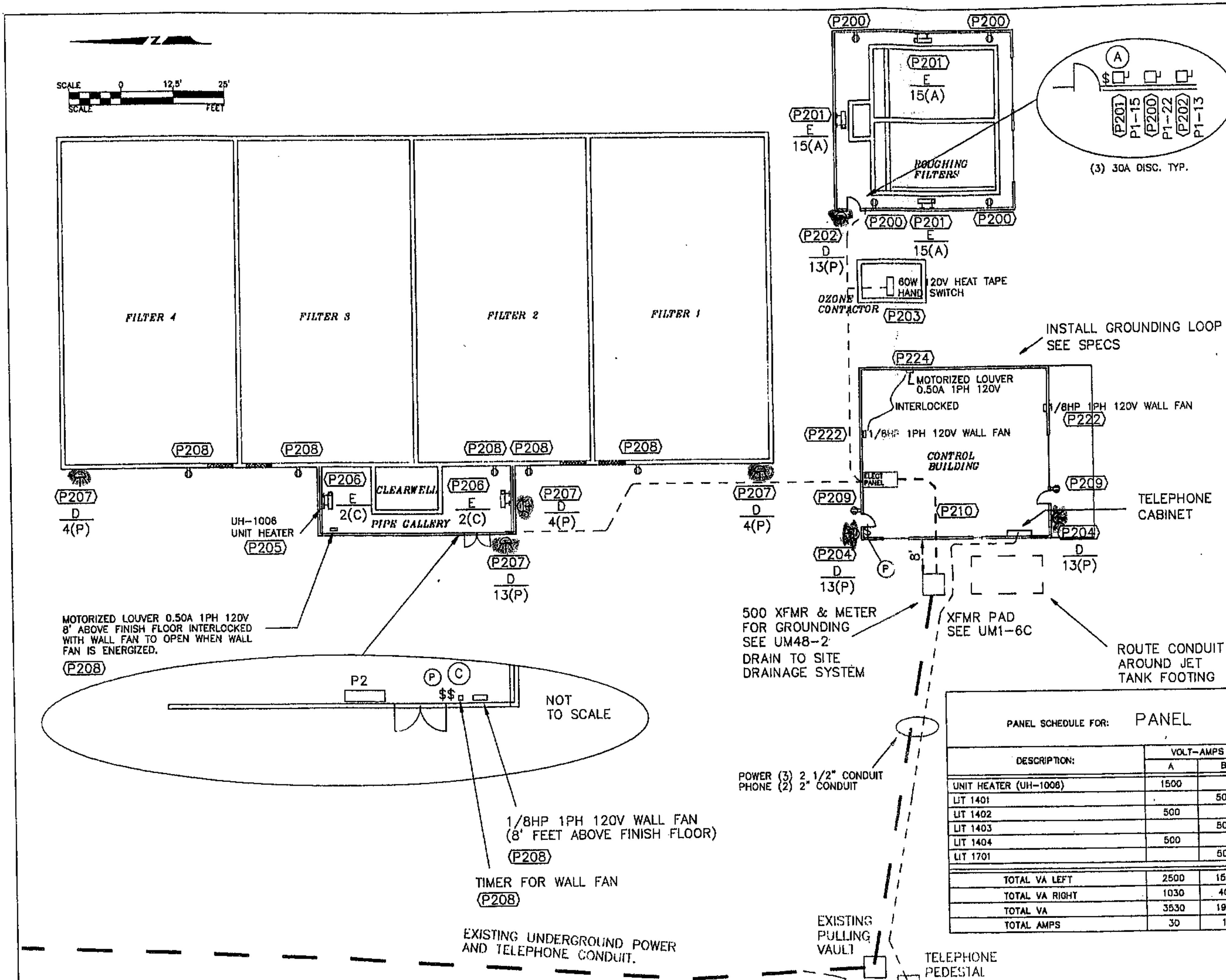
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: JAK/JAS/RKS
DRAWN BY: JAK
CHECKED BY: JAS

CITY OF WRANGELL
WRANGELL ISLAND ALASKA

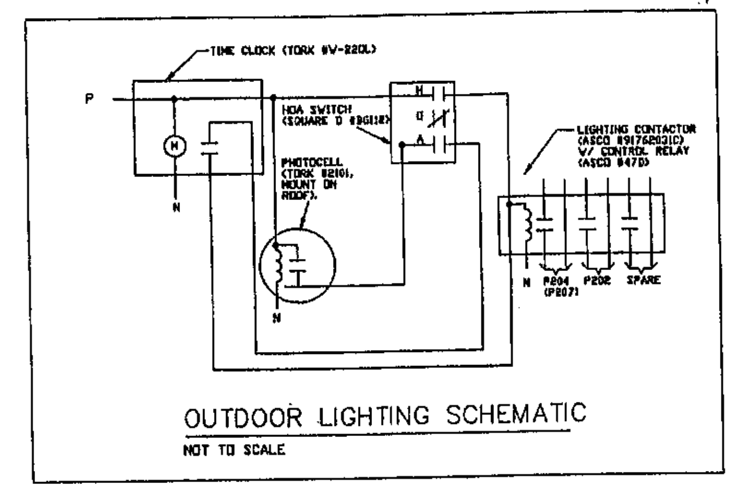
ELECTRICAL -
ONE LINE DIAGRAM & MISC. DETAILS

DATE: MARCH 1998
NO SCALE
SHEET E02
SHEET E06



NOTES:

INSTALL ALL OUTSIDE OUTLETS 5' ABOVE THE GROUND.
ALL OUTLETS SHALL BE GFCI.
ALL OUTSIDE OUTLETS SHALL BE WEATHERPROOF WHILE IN USE.
ELECTRICAL COMPETENTS & WIRING NOT TO SCALE



OUTDOOR LIGHTING SCHEMATIC
NOT TO SCALE

DHITTLE & ASSOCIATES, INC.
Engineers and Consultants
LYNNWOOD, WA
(425) 672-9651

PANEL SCHEDULE FOR: PANEL P2

100 AMP PANEL
120/240 VOLTS
1 PHASE
3 WIRE

DESCRIPTION:	VOLT-AMPS A	VOLT-AMPS B	BRKR A/P	AB		BRKR A/P	VOLT-AMPS A	VOLT-AMPS B	DESCRIPTION:
UNIT HEATER (UH-1006)	1500		20/1	1	2	20/1	130		INDOOR LIGHTS
LIT 1401		500	20/2	3	4	20/2		400	OUTDOOR LIGHTS
LIT 1402	500		20/1	5	6	20/1	900		OUTLETS
LIT 1403		500	20/1	7	8	20/1		X	SPARE
LIT 1404	500		20/1	9	10	20/1	X		SPARE
LIT 1701		500	20/1	11	12	20/1		X	SPARE

	A	B
TOTAL VA LEFT	2500	1500
TOTAL VA RIGHT	1030	400
TOTAL VA	3530	1900
TOTAL AMPS	30	16

TOTAL CONNECTED LOAD: 5430 VA, 30 AMPS

REMARKS:

POWER PANEL (P2)

NO.	REVISIONS	BY	DATE

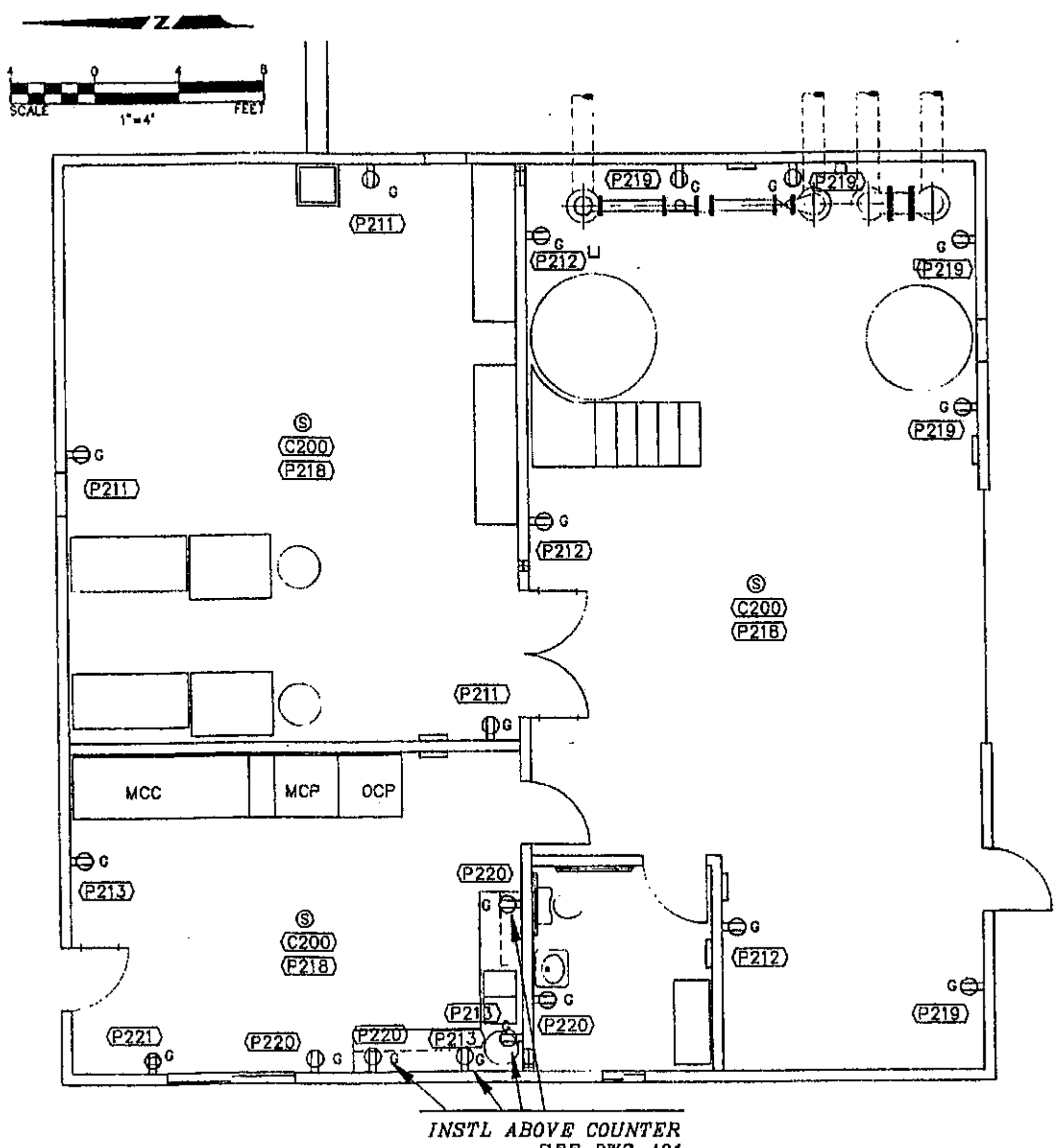
Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

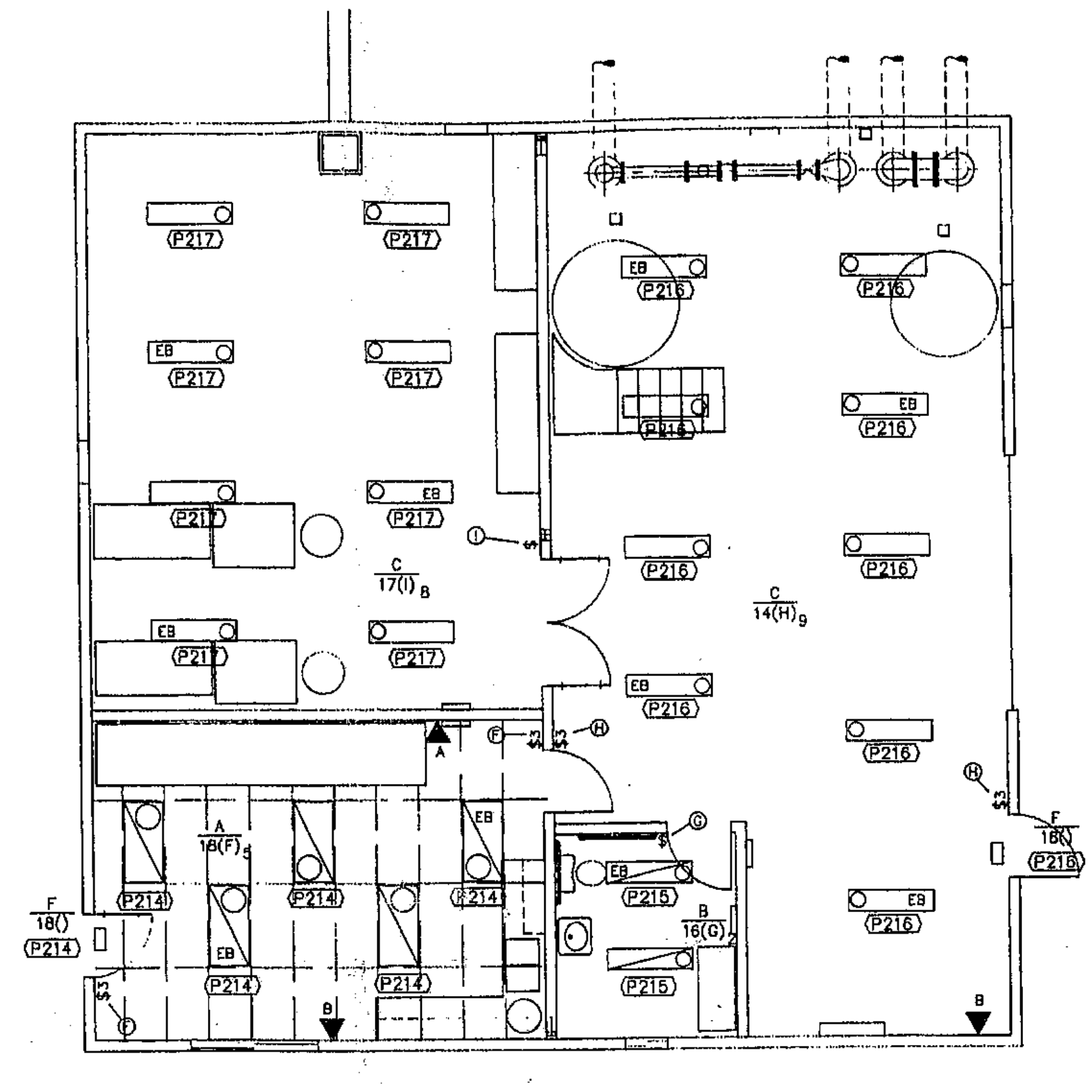
DESIGNED BY: JAK/JAS/RKS
DRAWN BY: JAK
CHECKED BY: JAS

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
WATER TREATMENT PLANT
SITE ELECTRICAL PLAN

DATE MARCH 1998
SCALE AS SHOWN
SHEET E03
SHEET E06



POWER PLAN



LIGHTING PLAN

NOTES

VENTILATION & HEATING NOT SHOWN ON THIS DRAWING.

A IS LEASED TELEPHONE LINE OUTLET FOR CNTRL

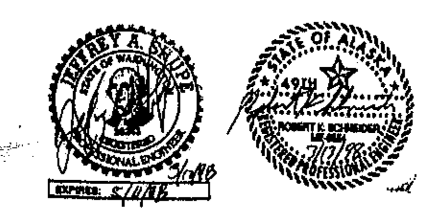
B IS TELEPHONE OUTLET

G IS GFCI OUTLET

ELECTRICAL COMPONENTS AND WIRING NOT TO SCALE

LIGHTING FIXTURE SCHEDULE

SYM	MANUFACTURER NAME	MANUFACTURER CATALOG NO.	FIXT VA	LAMP TYPE	MOUNTING	REMARKS
A	LITHONIA	2SP-G-B-4-32-FW-A12-120-GEB10	130	T8	RECESSED	LAB, W/EMERGENCY BALLAST AS NOTED
B	LITHONIA	LB-232-A-120-ES	65	T8	SURFACE	RESTROOM, W/EMERGENCY BALLAST AS NOTED
C	LITHONIA	EJ-2-32-120-ES-HC	65	T8	CHAIN	SHOP, W/EMERGENCY BALLAST AS NOTED
D	LITHONIA	TWP-100S-120-CR	100	HPS	SURFACE	OUTDOOR
E	LITHONIA	DHW-2-32-120-ES-CW	65	T8	SURFACE	UNHEATED BLDGS
F	LITHONIA	LQM-S-W-1-G-120-EL N	5		SURFACE	EXIT SIGN



DHITTLE & ASSOCIATES, INC.
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LYNNWOOD, WA
(425) 672-9651

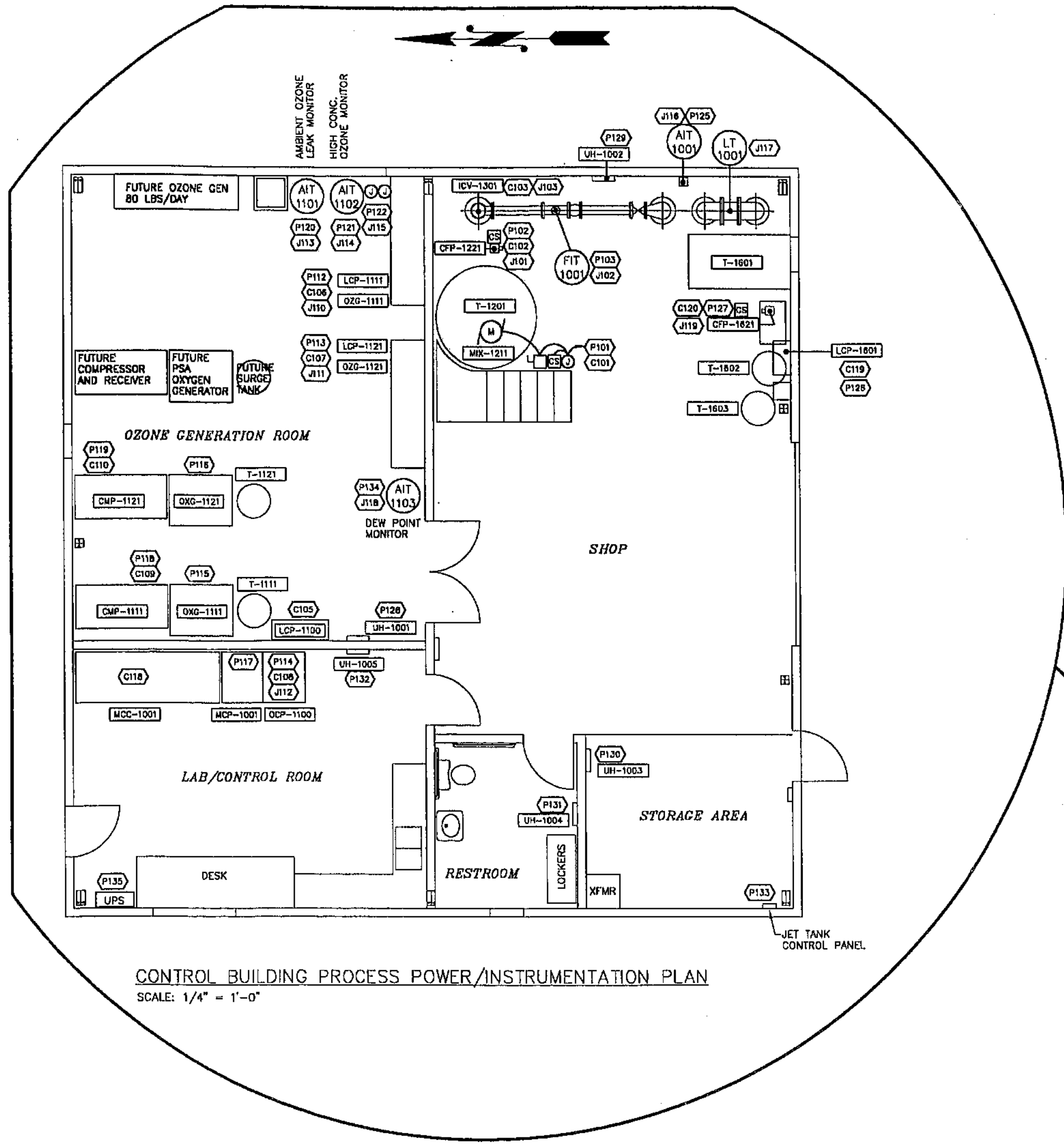
NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

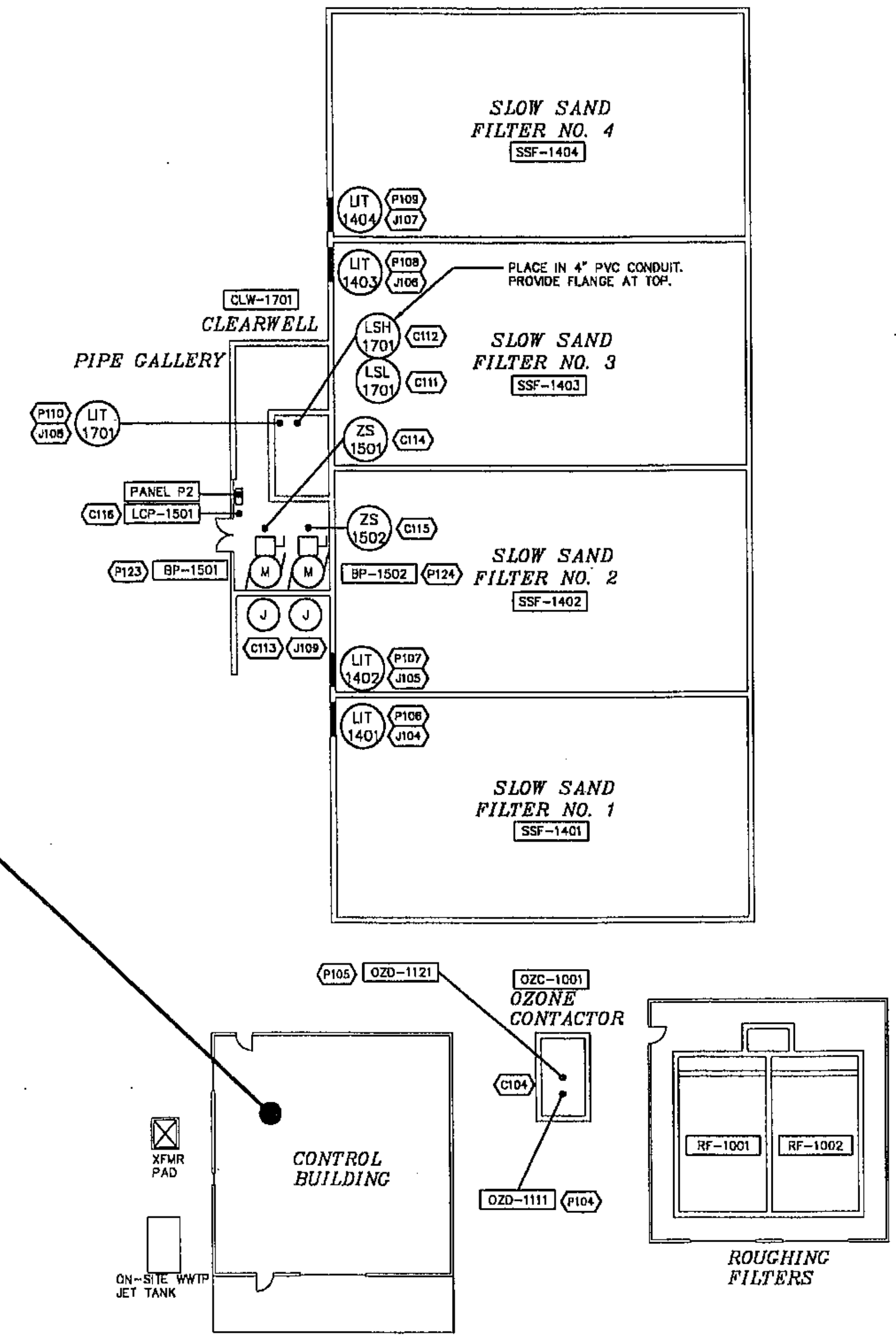
DESIGNED BY: JAK/JAS/RKS
DRAWN BY: JAK
CHECKED BY: JAS

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 CONTROL BUILDING AND FACILITY POWER PLAN

DATE MARCH 98
SCALE AS SHOWN
JOB NUMBER 97070
SHEET E-04 OF E06



CONTROL BUILDING PROCESS POWER/INSTRUMENTATION PLAN
SCALE: 1/4" = 1'-0"



SITE PROCESS POWER/INSTRUMENTATION PLAN
SCALE: 1/16" = 1'-0"

STATE OF ALASKA 49TH RALPH J. TITUS No. 9668 REGISTERED PROFESSIONAL ENGINEER

Titus Engineering Inc.
3003 169th Ave. N.E.
Bellevue, WA 98008
Telephone (425) 861-6335
Fax (425) 861-7317

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

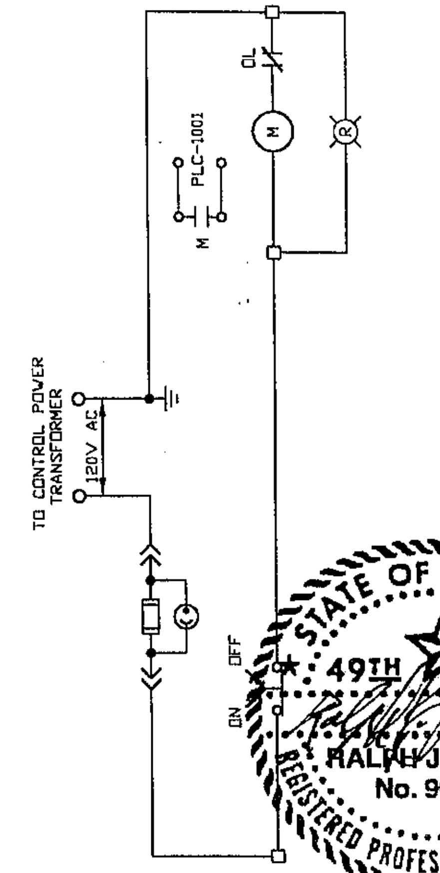
DESIGNED BY: RJT	CITY OF WRANGELL	DATE 3/16/98	SHEET E05
DRAWN BY: CWA/RJT	WRANGELL ISLAND ALASKA	SCALE AS NOTED	OF
CHECKED BY: RJT/MAC	PHASE 2 WATER SYSTEM IMPROVEMENTS PROCESS POWER/INSTRUMENTATION PLAN	JOB NUMBER 97070	E06

C:\PROJECT\97070\DWG\CONTROL\E05 Fri Mar 13 15:36:35 1998 WAH

CONDUIT NO.	CONDUCTORS	CONDUIT NO.	CONDUIT SIZE	FUNCTION	FROM	TO	COMMENTS
P101	4-NO10	1	1"	POWER	MIX-1211	MCC-1001	ROUTE W/ CONDUIT NO. C101
P102	3-NO12	1	1"	POWER	CFP-1221	PANEL P1	-
P103	3-NO12	1	1"	POWER	FIT-1001	PANEL P1	-
P104	4-NO10	1	1"	POWER	OZD-1111	MCC-1001	-
P105	4-NO10	1	1"	POWER	OZD-1121	MCC-1001	-
P106	3-NO12	1	1"	POWER	LIT-1401	PANEL P2	-
P107	3-NO12	1	1"	POWER	LIT-1402	PANEL P2	-
P108	3-NO12	1	1"	POWER	LIT-1403	PANEL P2	-
P109	3-NO12	1	1"	POWER	LIT-1404	PANEL P2	-
P110	3-NO12	1	1"	POWER	LIT-1701	PANEL P2	-
P111	-	-	-	-	-	-	-
P112	4-NO8	1	1"	POWER	OZG-1111	MCC-1001	-
P113	4-NO8	1	1"	POWER	OZG-1121	MCC-1001	-
P114	3-NO8	1	1"	POWER	OCP-1100	PANEL P1	-
P115	3-NO12	1	1"	POWER	OXG-1111	OCP-1100	-
P116	3-NO12	1	1"	POWER	OXG-1121	OCP-1100	-
P117	3-NO8	1	1"	POWER	MCP-1001	PANEL P1	-
P118	4-NO8	1	1"	POWER	CMP-1111	MCC-1001	-
P119	4-NO8	1	1"	POWER	CMP-1121	MCC-1001	-
P120	3-NO12	1	1"	POWER	AIT-1101	JUNCTION BOX	-
P121	3-NO12	1	1"	POWER	AIT-1102	JUNCTION BOX	-
P122	6-NO12	1	1"	POWER	JUNCTION BOX	OCP-1100	-
P123	4-NO4	1	1 1/2"	POWER	BP-1501	MCC-1001	-
P124	4-NO4	1	1 1/2"	POWER	BP-1502	MCC-1001	-
P125	3-NO12	1	1"	POWER	AIT-1001	PANEL P1	-
P126	3-NO8	1	1"	POWER	LCP-1601	PANEL P1	-
P127	3-NO12	1	1"	POWER	CFP-1621	PANEL P1	-
P128	3-NO10	1	1"	POWER	UH-1001	PANEL P1	-
P129	3-NO10	1	1"	POWER	UH-1002	PANEL P1	-
P130	3-NO10	1	1"	POWER	UH-1003	PANEL P1	-
P131	3-NO10	1	1"	POWER	UH-1004	PANEL P1	-
P132	3-NO10	1	1"	POWER	UH-1005	PANEL P1	-
P133	3-NO10	1	1"	POWER	JET TANK	PANEL P1	-
P134	3-NO12	1	1"	POWER	AIT-1103	OCP-1100	-
P135	3-NO8	1	1"	POWER	UPS	MCP-1001	EMERGENCY BACKUP POWER
-	-	-	-	-	-	-	-
C101	3-NO14	1	1"	CONTROL	CONTROL STATION	MCC-1001	ROUTE W/ CONDUIT NO. P101
C102	3-NO14	1	1"	CONTROL	CFP-1221	MCP-1001	AUTO MODE STATUS
C103	6-NO14	1	1"	CONTROL	ICV-1301	MCP-1001	OPEN/CLOSE CONTROL
C104	10-NO14	1	1"	CONTROL	OZD-1111/OZD-1121	OCP-1100	RUN STATUS/START
C105	10-NO14	1	1"	CONTROL	LCP-1100	OCP-1100	CONTROL INTERFACING
C106	30-NO14	1	1"	CONTROL	LCP-1111	OCP-1100	CONTROL INTERFACING
C107	30-NO14	1	1"	CONTROL	LCP-1121	OCP-1100	CONTROL INTERFACING
C108	50-NO14	1	2"	CONTROL	OCP-1100	MCP-1001	INTERFACING
C109	12-NO14	1	1"	CONTROL	CMP-1111	OCP-1100	INTERFACING
C110	12-NO14	1	1"	CONTROL	CMP-1121	OCP-1100	INTERFACING
C111	4-NO14	1	1"	CONTROL	LSL-1701	JUNCTION BOX	HARDWIRED TO EACH STARTER VIA JB
C112	4-NO14	1	1"	CONTROL	LSH-1701	JUNCTION BOX	HARDWIRED TO EACH STARTER VIA JB
C113	8-NO14	1	1"	CONTROL	JUNCTION BOX (JB)	MCC-1001	-
C114	2-NO14	1	1"	CONTROL	ZS-1501	LCP-1501	-
C115	2-NO14	1	1"	CONTROL	ZS-1502	LCP-1501	-
C116	16-NO14	1	1"	CONTROL	LCP-1501	MCP-1001	-
C117	-	-	-	-	-	-	-
C118	20-NO14	1	1"	CONTROL	MCC-1001	MCP-1001	-
C119	12-NO14	1	1"	CONTROL	LCP-1501	MCP-1001	-
C120	6-NO14	1	1"	CONTROL	CFP-1621	MCP-1001	MODE/ALARM

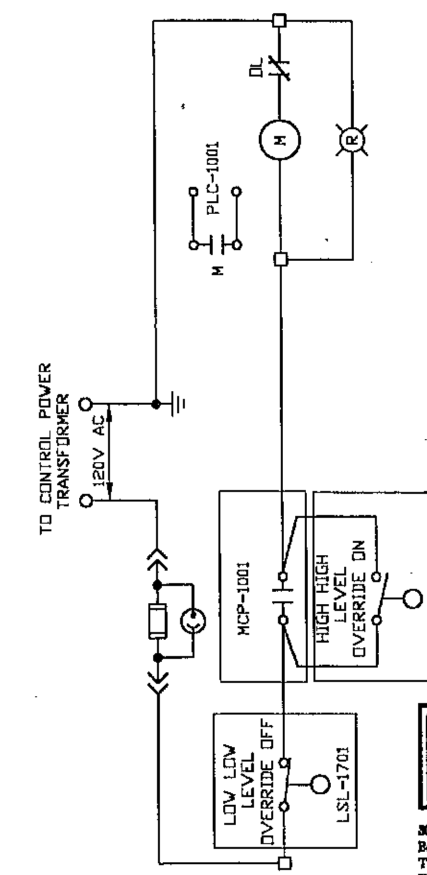
CONDUIT NO.	CONDUCTORS	CONDUIT NO.	CONDUIT SIZE	FUNCTION	FROM	TO	COMMENTS
C200	6-NO14	1	1"	CONTROL	SMOKE DETECTOR	MCP-1001	FIRE ALARM SIGNAL PER DETECTOR
P200	3-NO10	1	1"	POWER	PANEL P1	ROUGHING FILTER	-
P201	3-NO12	1	1"	POWER	PANEL P1	ROUGHING FILTER	-
P202	3-NO12	1	1"	POWER	PANEL P1	ROUGHING FILTER	-
P203	3-NO12	1	1"	POWER	PANEL P1	OZONE CANT.	-
P204	3-NO12	1	1"	POWER	PANEL P1	CONTROL BLDG.	-
P205	3-N10	1	1"	POWER	PANEL P2	FILTERS	-
P206	3-NO12	1	1"	POWER	PANEL P2	FILTERS	-
P207	3-NO12	1	1"	POWER	PANEL P2	FILTERS	-
P208	3-NO10	1	1"	POWER	PANEL P2	FILTERS	-
P209	3-NO12	1	1"	POWER	PANEL P1	CONTROL BLDG.	-
P210	12-NO4/0	3	2 1/2"	POWER	XFMR	MCC-1001	DUCT BANK, 30" BURY, 7.5"SPACING
P211	3-NO12	1	1"	POWER	PANEL P1	CONTROL BLDG.	-
P212	3-NO12	1	1"	POWER	PANEL P1	CONTROL BLDG.	-
P213	3-NO12	1	1"	POWER	PANEL P1	CONTROL BLDG.	-
P214	3-NO12	1	1"	POWER	PANEL P1	CONTROL BLDG.	-
P215	3-NO12	1	1"	POWER	PANEL P1	CONTROL BLDG.	-
P216	3-NO12	1	1"	POWER	PANEL P1	CONTROL BLDG.	-
P217	3-NO12	1	1"	POWER	PANEL P1	CONTROL BLDG.	-
P218	3-NO12	1	1"	POWER	PANEL P1	CONTROL BLDG.	-
P219	3-NO12	1	1"	POWER	PANEL P1	CONTROL BLDG.	-
P220	3-NO12	1	1"	POWER	PANEL P1	CONTROL BLDG.	-
P221	3-NO12	1	1"	POWER	PANEL P1	CONTROL BLDG.	-
P222	3-NO12	1	1"	POWER	PANEL P1	CONTROL BLDG.	-
P223	3-NO6	1	1"	POWER	PANEL P1	PANEL P2	1-NO10 GROUND
P224	-	-	-	-	-	-	-
P225	-	-	-	-	-	-	-
P226	-	-	-	-	-	-	-

J101	1-TSP	1	1"	INSTRUMENTATION	CFP-1221	MCP-1001	AUTO SIGNAL
J102	1-TSP	1	1"	INSTRUMENTATION	FIT-1001	MCP-1001	WTP FLOW
J103	1-TSP	1	1"	INSTRUMENTATION	ICV-1301	MCP-1001	ICV-1301 POSITION
J104	1-TSP 3-NO.14	1	1"	INSTRUMENTATION	LIT-1401	JUNCTION BOX	SSF-1401 LEVEL SSF-1401 HIGH LEVEL WARNING
J105	1-TSP 3-NO.14	1	1"	INSTRUMENTATION	LIT-1402	JUNCTION BOX	SSF-1402 LEVEL SSF-1402 HIGH LEVEL WARNING
J106	1-TSP 3-NO.14	1	1"	INSTRUMENTATION	LIT-1403	JUNCTION BOX	SSF-1403 LEVEL SSF-1403 HIGH LEVEL WARNING
J107	1-TSP 3-NO.14	1	1"	INSTRUMENTATION.	LIT-1404	JUNCTION BOX	SSF-1404 LEVEL SSF-1404 HIGH LEVEL WARNING
J108	1-TSP 4-NO.14	1	1"	INSTRUMENTATION	LIT-1701	JUNCTION BOX	CLW-1701 LEVEL HIGH & LOW LEVEL WARNINGS
J109	6-TSP 16-NO.14	1	2"	INSTRUMENTATION	JUNCTION BOX	MCP-1001	SSF LEVELS SSF HIGH HIGH LEVEL ALARMS
J110	6-TSP	1	2"	INSTRUMENTATION	LCP-1111	OCP-1100	SIGNAL INTERFACING
J111	6-TSP	1	2"	INSTRUMENTATION	LCP-1121	OCP-1100	SIGNAL INTERFACING
J112	10-TSP	1	2"	INSTRUMENTATION	OCP-1100	MCP-1001	SIGNAL INTERFACING
J113	1-TSP	1	1"	INSTRUMENTATION	AIT-1101	JUNCTION BOX	OZONE MONITORING
J114	1-TSP	1	1"	INSTRUMENTATION	AIT-1102	JUNCTION BOX	OZONE MONITORING
J115	2-TSP	1	1"	INSTRUMENTATION	JUNCTION BOX	OCP-1100	-
J116	1-TSP 3-NO.14	1	1"	INSTRUMENTATION	AIT-1001	MCP-1001	WTP TURBIDITY TURBIDITY HIGH LEVEL WARNING
J117	1-TSP	1	1"	INSTRUMENTATION	LT-1001	MCP-1001	RESERVOIR TANK LEVEL MONITORING
J118	1-TSP	1	1"	INSTRUMENTATION	AIT-1103	OCP-1100	DEW POINT MONITORING
J119	1-TSP	1	1"	INSTRUMENTATION	CFP-1621	MCP-1001	CHEMICAL FEED SIGNAL



STATE OF ALASKA
49TH
RALPH J. TITUS
No. 9668
REGISTERED PROFESSIONAL ENGINEER

CONTROL DIAGRAM 1002



CONTROL DIAGRAM 1001

Titus Engineering Inc.
3003 169th Ave. N.E.
Bellevue, WA 98008
Telephone (425) 861-6335
Fax (425) 861-7317

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY:	RJT
DRAWN BY:	CWA/RJT
CHECKED BY:	RJT/MAC

CITY OF WRANGELL

WRANGELL ISLAND ALASKA

PHASE 2 WATER SYSTEM IMPROVEMENTS

CIRCUIT SCHEDULE & CONTROL DIAGRAMS

DATE	SHEET
3/16/98	E06
SCALE NO SCALE	OF
JOB NUMBER 97070	E06

C:\PROJECT\97070\DWG\CONTROL\E06 Mon Mar 16 09:45:35 1998 WAH

INSTRUMENTATION SYMBOLS

SYMBOL	DESCRIPTION
	CONNECTION TO PROCESS, MECHANICAL LINK, OR INSTRUMENT SUPPLY
	DISCRETE ELECTRIC SIGNAL
	ANALOG ELECTRIC SIGNAL
P	ELECTRIC POWER, P: VOLTAGE AS INDICATED
	ULTRASONIC SIGNAL
	HYDRAULIC SIGNAL
	PNEUMATIC SIGNAL
	INTERNAL SYSTEM LINK (SOFTWARE OR FIRMWARE)
	PLC INPUT/OUTPUT
XXX-XXX	XXX-XXXX: EQUIPMENT IDENTIFICATION
A B	A: DRAWING REFERENCE NUMBER B: CONNECTION POINT
	PUMP
MTR	CHEMICAL PUMP
MTR	MIXER
MTR	MOTOR
	FLOW METER
	COMPRESSOR
S	SOLENOID VALVE
	CHECK VALVE
	ISOLATION VALVE
D	DRAIN

INSTRUMENTATION IDENTIFICATION

(ZZ) XXX XXX XA Δ

AAA SEE INSTRUMENT IDENTIFICATION TABLE
X LOOP NUMBER
YYY TWO OR MORE DIGITS IDENTIFYING LOOP NUMBER
B SUFFIX UTILIZED WHEN TWO OR MORE INSTRUMENTS WITHIN LOOP HAVE SAME FUNCTIONAL IDENTIFICATION I.E.: A: FIRST INSTRUMENT, B: SECOND, C: THIRD, ETC.
Δ ITEMS SUPPLIED BY EQUIPMENT MANUFACTURER
XA PANEL ID (SEE PANEL LOCATIONS)
(ZZ) INDICATES TYPICAL OF ZZ

OTHER INSTRUMENTATION IDENTIFICATION NOTATIONS

SIGNAL CONVERTERS

XXX XXX NOTE X: PROCESS OR INITIATING VARIABLE
Y: OUTPUT FUNCTION
Z/Z: E: VOLTAGE
I: CURRENT
ISO: ISOLATION
P: PNEUMATIC
PD: PULSE DURATION
PF: PULSE FREQUENCY
R: RESISTANCE
RAMP: RAMP GENERATOR

HAND SELECTOR SWITCHES

XXX XXX XXX NOTE XXX: AM: AUTO/MANUAL
AO: AUTO/OFF
FOR: FORWARD/OFF/REVERSE
FOS: FAST/OFF/SLOW
FR: FORWARD/REVERSE
HOA: HAND/OFF/AUTO
LL: LEAD/LAG
LR: LOCAL/REMOTE
JOG: JOG
OC: OPEN/CLOSE
OO: ON/OFF
OSC: OPEN/STOP/CLOSE
SS: START/STOP

NOTE: ALL MAINTAINED CONTACT UNLESS NOTED OTHERWISE

ANALYSIS INSTRUMENTS

XXX XXX XXX NOTE XXX: CL: CHLORINE
H2S: HYDROGEN SULFIDE
OZ: OZONE
PC: PARTICLE COUNTER
PH: PH
TUR: TURBIDITY

INDICATOR LIGHTS

XXX XXX XXX NOTE XXX: AUTO: AUTO
CLS: CLOSED
FLD: FIELD
HAND: HAND
OC: OPEN/CLOSED
OFF: OFF
OPN: OPENED
RDY: READY
REM: REMOTE
RR: RUN/READY
RUN: RUN

XXX XXX FIELD MOUNTED
XXX XXX PANEL FACE MOUNTED
XXX XXX INTERNAL PANEL MOUNTED
XXX XXX AUXILIARY PANEL MOUNTED
XXX XXX INTERNAL AUXILIARY PANEL MOUNTED
XXX XXX INDICATOR LIGHT
XXX XXX XXX XXX MULTIPLE FUNCTION INSTRUMENT

PANEL LOCATIONS

ID	PANEL	LOCATION
01	MCP-1001	LAB/CONTROL ROOM
02	OCP-1100	LAB/CONTROL ROOM
03	LCP-1100	OZONE GENERATION ROOM
04	LCP-1111	OZONE GENERATION ROOM
05	LCP-1121	OZONE GENERATION ROOM
06	LCP-1501	CLEARWELL AREA (BOOSTER PUMPS)
07	LCP-1601	SODIUM HYPOCHLORITE AREA
08	-	NOT USED
09	-	NOT USED

INSTRUMENT IDENTIFICATION TABLE

SEE NOTES BELOW

FIRST-LETTER		SUCCEEDING-LETTERS		
MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A ANALYSIS		ALARM		
B BURNER, COMBUSTION				
C			CONTROL	
D NOT USED	DIFFERENTIAL			
E VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F FLOW RATE	RATIO (FRACTION)	GLASS, VIEWING DEVICE		
G				
H HAND				HIGH
I CURRENT (ELECTRICAL)		INDICATE		
J POWER	SCAN			
K TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L LEVEL		LIGHT		LOW
M MOTOR, MOISTURE	MOMENTARY		MIDDLE, INTERMEDIATE	
N TORQUE				
O OXYGEN		ORIFICE, RESTRICTION		
P PRESSURE, VACUUM		CONNECTION POINT		
Q QUANTITY	INTEGRATE, TOTALIZE			
R RADIATION		RECORD		
S SPEED, FREQUENCY	SAFETY		SWITCH	
T TEMPERATURE			TRANSMIT	
U MULTIVARIABLE		MULTIFUNCTION	NOT USED	
V VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W WEIGHT, FORCE				
X UNCLASSIFIED	X AXIS	WELL	STARTER	
Y EVENT, STATE, OR PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

INSTRUMENT IDENTIFICATION TABLE NOTES

1. TABLE DEFINES BUILDING BLOCKS OF THE INSTRUMENTATION IDENTIFICATION AND SYMBOLS USED. NOMENCLATURE IS SOMETIMES IDENTIFIED BY NOTATION OUTSIDE OF SYMBOLS UTILIZED. SYMBOLS ARE TO BE USED WITH CONTROL LOOP DESCRIPTIONS, CONTROL DIAGRAMS, ETC.
2. GRAMMATICAL FORM OF SUCCEEDING LETTERS ARE MODIFIED AS REQUIRED. I.E.: "INDICATE" MAY BE "INDICATOR" OR "INDICATING".
3. UTILIZATION OF A DOUBLE HIGH OR LOW MODIFIER, I.E.; LAHH OR LALL INDICATES A VERY HIGH OR VERY LOW CONDITION. IF BOTH MODIFIERS ARE USED, I.E. LAHL; THEN BOTH HIGH AND LOW ALARMS HAVE BEEN COMBINED.
4. ANY FIRST LETTER IF USED IN COMBINATION WITH MODIFYING LETTERS D (DIFFERENTIAL), F (RATIO), M (MOMENTARY), K (TIME OR RATE OF CHANGE), Q (INTEGRATE OR TOTALIZE), OR ANY COMBINATION REPRESENTS A NEW AND SEPARATE MEASURED VARIABLE, AND THE COMBINATION IS TREATED AS A FIRST LETTER ENTRY.
5. FIRST LETTER "U" IS USED FOR MULTI-VARIABLE ALARMS AND FIRST LETTER "Y" IS USED FOR MULTIPLE EVENT FUNCTIONS.
6. FOR FURTHER CLARIFICATION REGARDING INSTRUMENTATION TABLE, SEE ANSI/ISA-S5.1 STANDARD TABLES 1 AND 2.

STATE OF ALASKA
49TH
RALPH J. TITUS
No. 9668
REGISTERED PROFESSIONAL ENGINEER

GENERAL NOTES

1. THIS IS A GENERAL INSTRUMENTATION SHEET, NOT ALL SYMBOLS OR NOTATIONS MAY BE USED ON THIS PROJECT.
2. SEE ELECTRICAL DRAWINGS FOR CONTROL DIAGRAMS. SEE OTHER DISCIPLINE DRAWINGS FOR EQUIPMENT LOCATIONS AND INTERFERENCES.
3. INPUT/OUTPUT POINTS SHOWN ON DRAWINGS ARE NOT ALL INCLUSIVE. SEE SPECIFICATIONS FOR OTHER PLC I/O REQUIREMENTS.

Titus Engineering Inc.
3003 159th Ave. N.E.
Bellevue, WA 98008
Telephone (425) 861-6335
Fax (425) 861-7317

NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

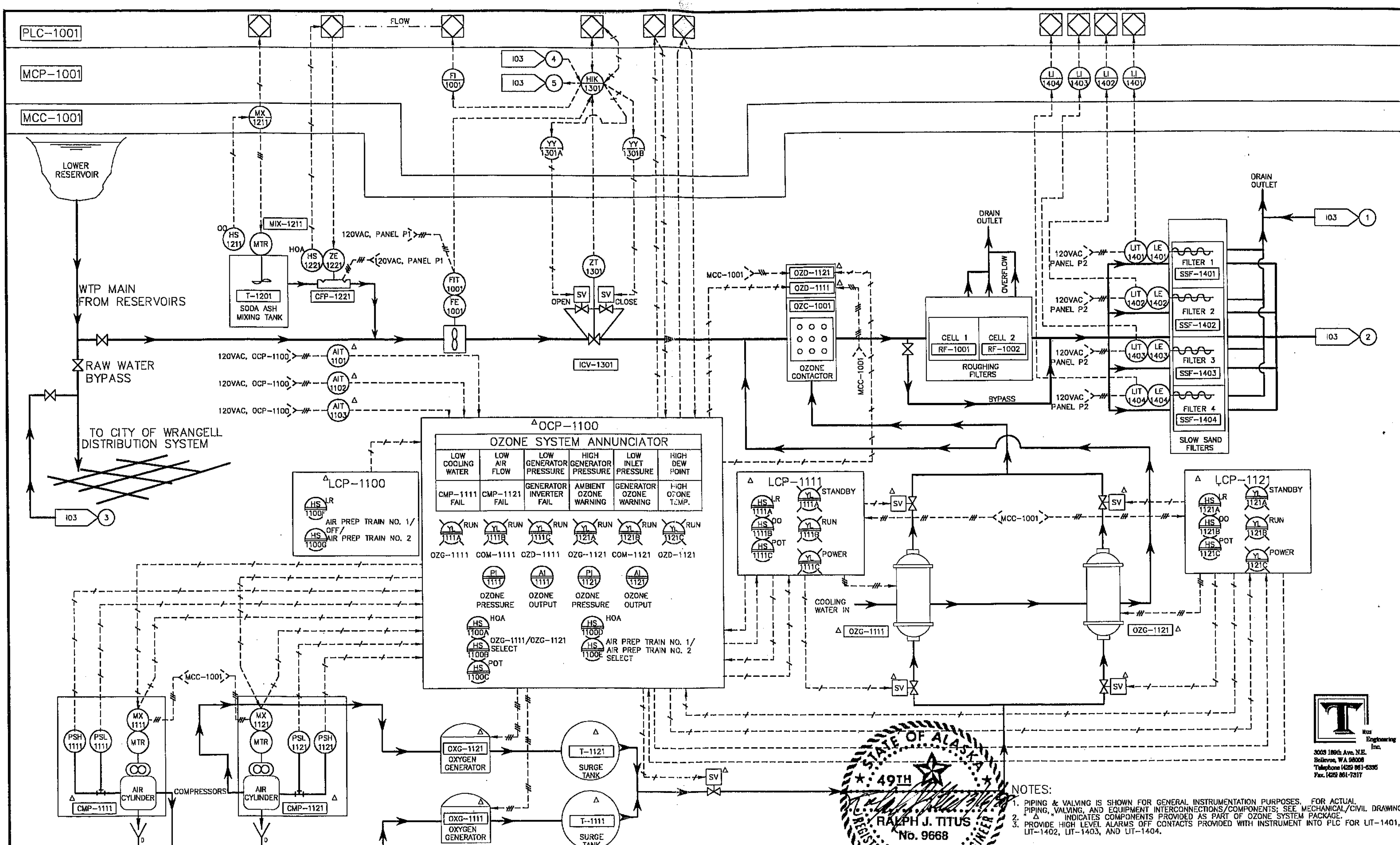
DESIGNED BY: RJT
DRAWN BY: CWA
CHECKED BY: RJT/MAC

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
INSTRUMENTATION SYMBOLS

DATE 3/16/98
SCALE NO SCALE
JOB NUMBER 97070
SHEET I01 OF I03

C:\PROJECT\97070\DWG\CONTROL\I01 Fri Mar 13 15:57:08 1998 WAH

J:\DWG\CONTROL\PID1 Fri Mar 13 15:51:17 1998 WAH



NOTES:
1. PIPING & VALVING IS SHOWN FOR GENERAL INSTRUMENTATION PURPOSES. FOR ACTUAL PIPING, VALVING, AND EQUIPMENT INTERCONNECTIONS/COMPONENTS; SEE MECHANICAL/CIVIL DRAWINGS.
2. "Δ" INDICATES COMPONENTS PROVIDED AS PART OF OZONE SYSTEM PACKAGE.
3. PROVIDE HIGH LEVEL ALARMS OFF CONTACTS PROVIDED WITH INSTRUMENT INTO PLC FOR LIT-1401, LIT-1402, LIT-1403, AND LIT-1404.

STATE OF ALASKA 49TH RALPH J. TITUS No. 9668 REGISTERED PROFESSIONAL ENGINEER

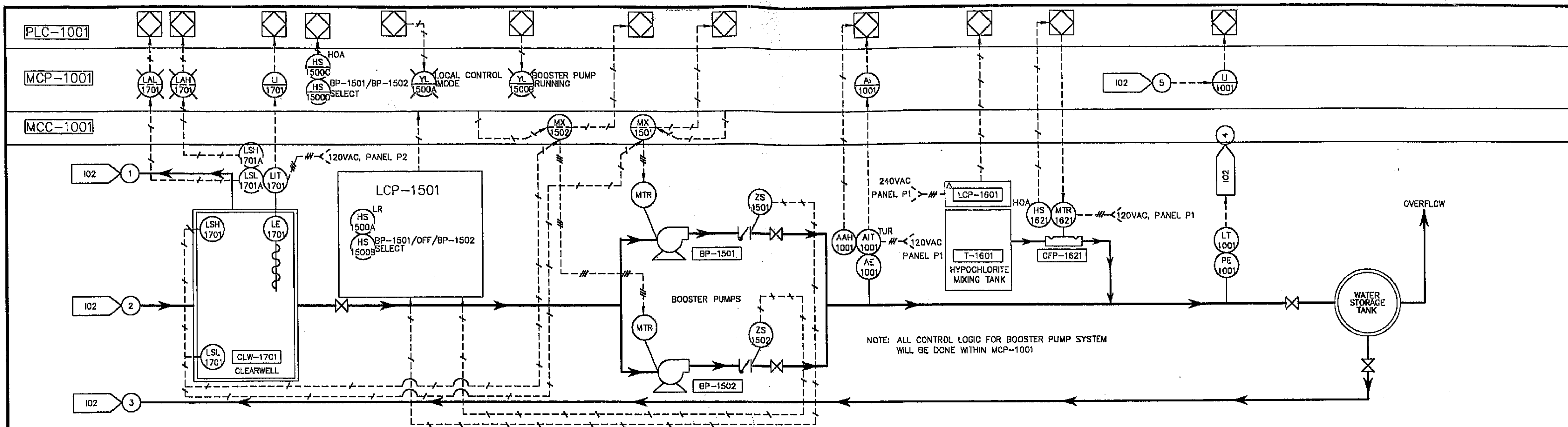
Titus Engineering Inc.

REVISIONS	BY	DATE

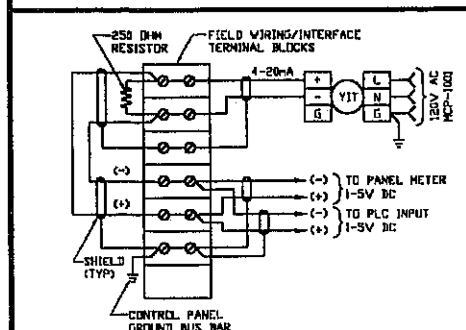
Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: RJT	CITY OF WRANGELL	DATE 3/16/98	SHEET I02
DRAWN BY: CWA/RJT	WRANGELL ISLAND — ALASKA	SCALE NO SCALE	OF
CHECKED BY: RJT/MAC	PHASE 2 WATER SYSTEM IMPROVEMENTS — PID SCHEMATIC NO. 1	JOB NUMBER 97070	I03

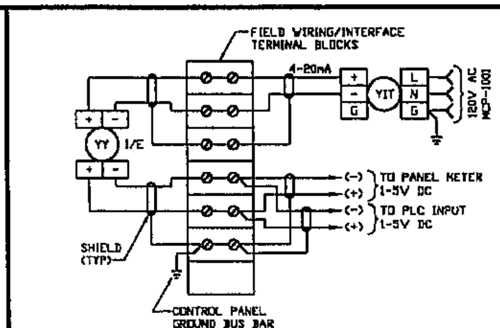


PID SCHEMATIC NO. 2



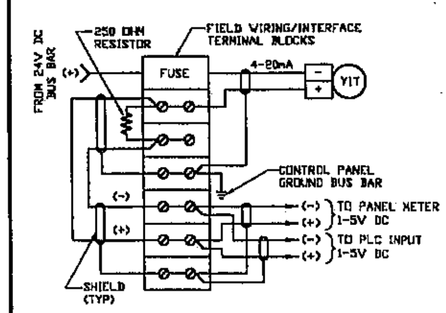
EXTERNALLY POWERED TRANSMITTER WITH ISOLATED OUTPUT

DETAIL 1
NTS



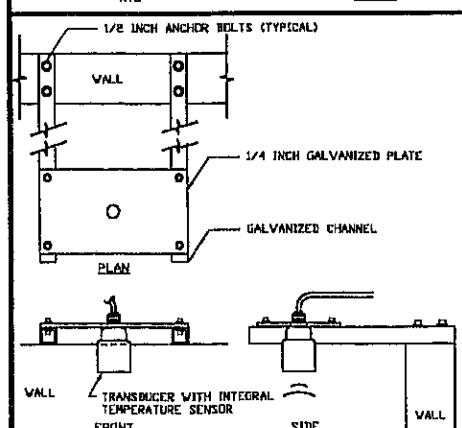
EXTERNALLY POWERED TRANSMITTER WITH NON-ISOLATED OUTPUT

DETAIL 2
NTS



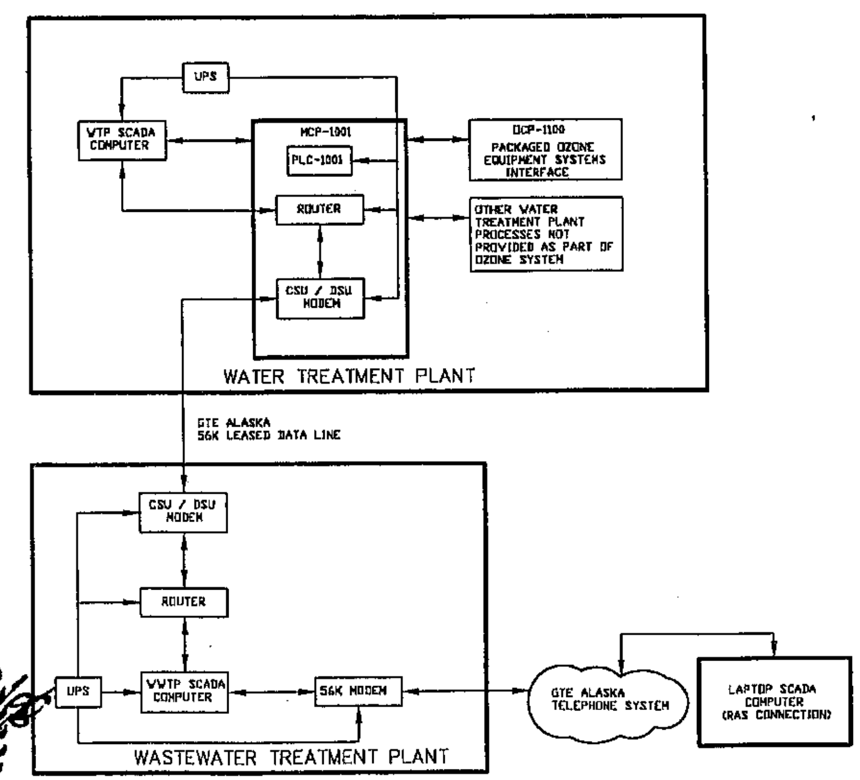
LOOP POWERED TRANSMITTER

DETAIL 3
NTS



ULTRASONIC LEVEL SENSOR MOUNTING

DETAIL 4
NTS



SCADA SYSTEM BLOCK DIAGRAM

STATE OF ALASKA
49TH
RALPH J. TITUS
No. 9668
REGISTERED PROFESSIONAL ENGINEER

Tetra Tech Engineering Inc.
3003 160th Ave. N.E.
Bellevue, WA 98008
Telephone (425) 861-6335
Fax (425) 861-7317

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

NO.	REVISIONS	BY	DATE

DESIGNED BY:	RJT
DRAWN BY:	CWA/RJT
CHECKED BY:	RJT/MAC

CITY OF WRANGELL

WRANGELL ISLAND ALASKA

PHASE 2 WATER SYSTEM IMPROVEMENTS

PID SCHEMATIC NO. 2 & MISC. DETAILS

DATE	3/16/98
SCALE	NO SCALE
JOB NUMBER	97070
SHEET	I03
OF	I03

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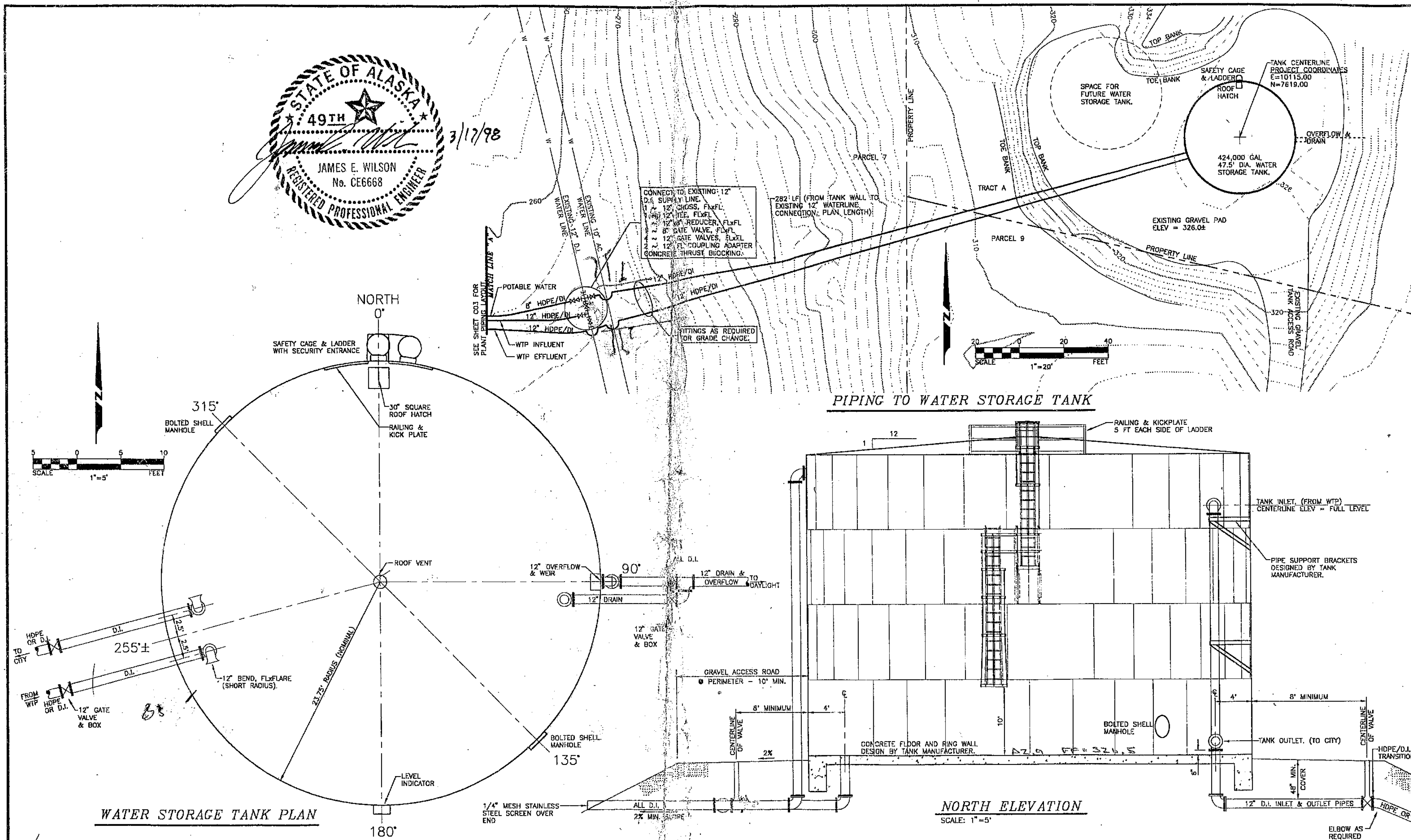


NO.	REVISIONS	BY	DATE

Wilson Engineering
CONSULTING ENGINEERS & SURVEYORS

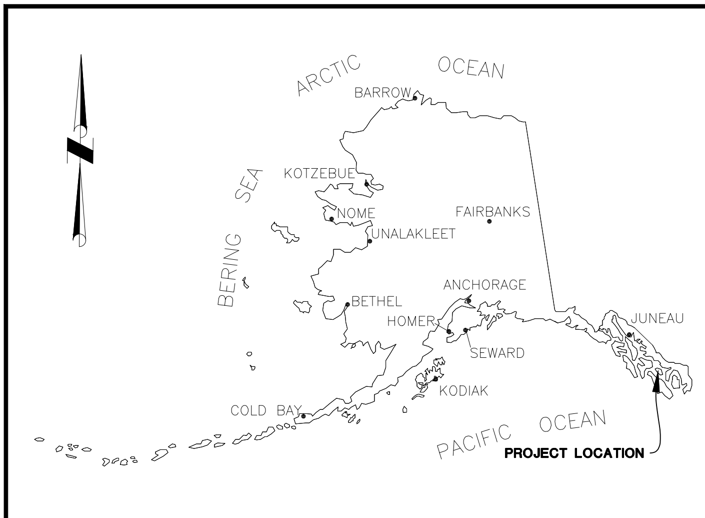
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100
FAX: (360) 647-9061

DESIGNED BY: WAH
DRAWN BY: WAH
CHECKED BY:

CITY OF WRANGELL
WRANGELL ISLAND ALASKA
PHASE 2 WATER SYSTEM IMPROVEMENTS
WATER STORAGE TANK PLAN & PIPING

DATE 3/13/98
SCALE AS SHOWN
JOB NUMBER 97070
SHEET R01 OF R01

C:\PROJECT\97070\DWG\97070R01 Fri Mar 13 16:41:02 1998 WAH

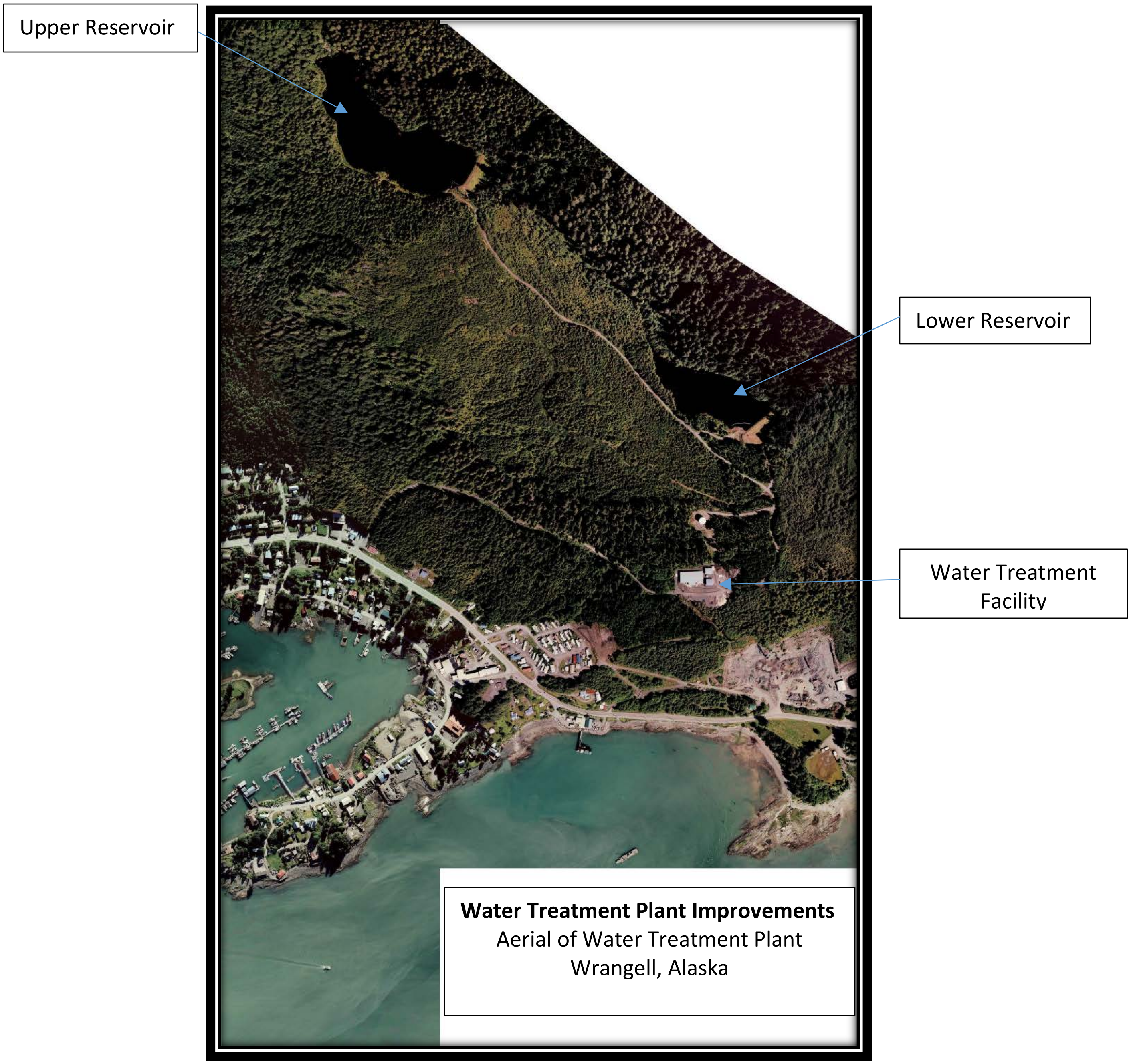


LOCATION MAP

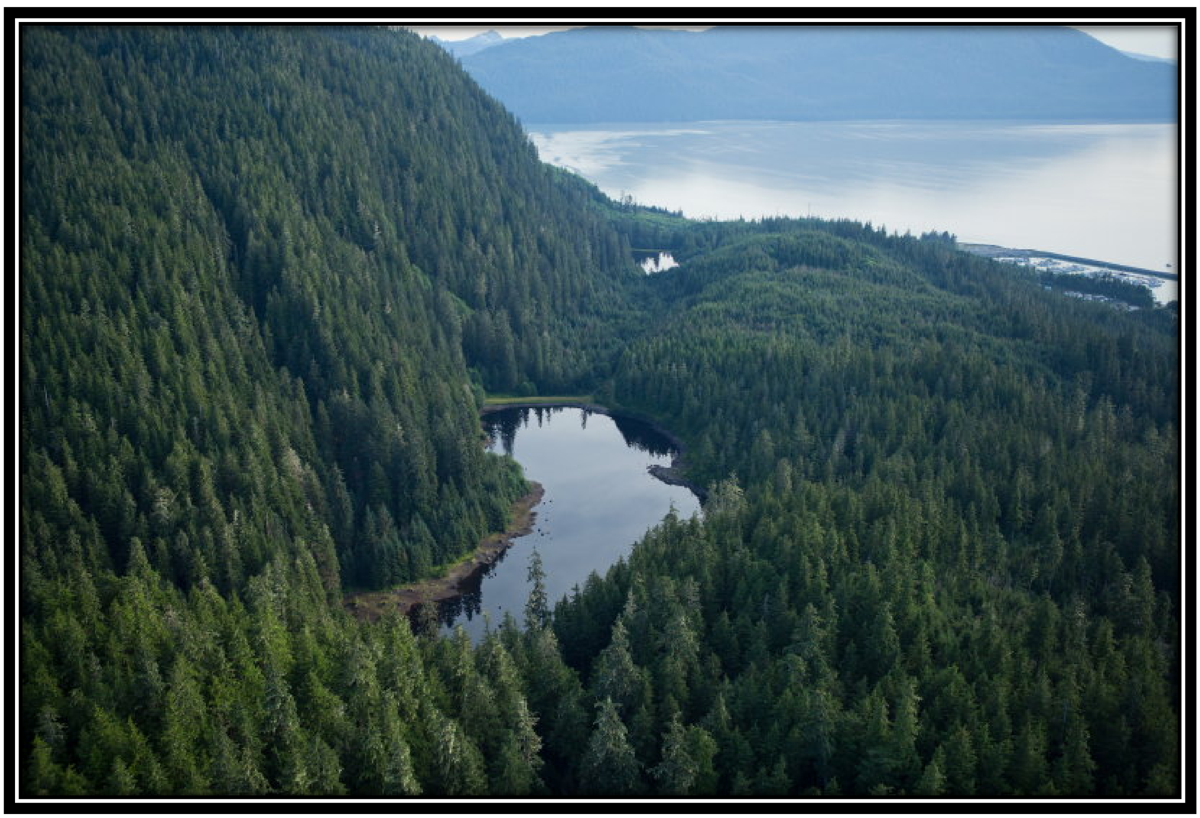
CRW ENGINEERING GROUP, LLC		CITY AND BOROUGH OF WRANGELL PRELIMINARY ENGINEERING REPORT	Project No: 20901.00
			Drawn By: WMK
		Figure 1	Scale: NTS
Project:		VICINITY MAP	Date: 10/5/2016
STATUS: DRAFT			

FILE NAME: J:\Jobsdata\20901.00 Wrangell Water Treatment Pilot Study\00 CADD\01 Working Set\01 Civil\20901.00 Vicinity Map.dwg

MAPS / PHOTOGRAPHS OF EXISTING PROJECT SITE
WRANGELL WATER TREATMENT PLANT IMPROVEMENTS



Water Treatment Facility



View from Upper Reservoir