Alatna Village
Biomass Heat Pre-Feasibility Study

Prepared for Interior Regional Housing Authority
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Prepared by:
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ENERGY ACTION

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Acknowledgements

Energy Action thanks the following representatives for their assistance with this assessment:

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Summary of Findings

Alatna Village Council and the public are interested in energy projects that displace oil with local renewable resources and create jobs. Based on conversations at the public meeting on this topic in spring 2014, a biomass energy project seems well-suited to the community's interest.

The project building is the Washateria/ Water Plant. The biomass project would use an estimated 20 cords per year to displace about 85% of the building's demand, which totals 2,315 gallons per year. The project is considered financially unfeasible at this time, in part due to the relatively small building heat load, the limited temperature range of the existing heat system, and the high stoking requirements due to air freight constraints on the boiler size.

There may be an opportunity for Alatna Village Council to own and operate a biomass energy project and sell heat as a third-party. The Allakaket School building is scheduled to be replaced in 5 – 10 years. It appears that a heat sales project, owned and operated by a third-party, may satisfy Yukon-Koyukuk School District's interest in biomass energy. If the project owner can source fuel at $275 per cord, as the Tanana Chiefs Conference reconnaissance-level biomass resource assessment suggests, the project is considered pre-feasible. Sourcing wood at $275 per cord would result in about $25,000 of revenues per year for the supplier. A pre-feasibility study of the project, "Allakaket Village Biomass Heat Pre-Feasibility Study," is publically available from the Alaska Energy Authority or Interior Regional Housing Authority.

Statement of Purpose

Since 2008, the Alaska State Legislature has supported renewable electric and thermal energy projects through the Renewable Energy Grant Recommendation Program, administered by the Alaska Energy Authority. In Round 6 of the Program, the Interior Regional Housing Authority, which seeks opportunities to promote community self-sufficiency through community energy projects, received money to complete pre-feasibility studies of biomass heat in community buildings in seven villages. The following pre-feasibility study has been funded through that grant.

Community & Facility Information

Alatna Village (population 26) is an Alaska Native village located on the north bank of the Koyukuk River, southwest of its junction with the Alatna River, approximately 190 air miles northwest of Fairbanks and 57 miles upriver from Hughes. Alatna Village is located just west of the municipal boundary of Allakaket Village. In recent years, there has been no barge service. Imported goods and fuel are flown to the Allakaket airport, and then transported to Alatna Village by snow machine or boat. Occasionally an ice road is built between the communities. The Allakaket airport has a 4,000' x 100' gravel runway. Alatna Village depends on Allakaket Village for airport, postal, electric, and educational services.

Alatna Village is governed by Alatna Village Council. Alatna Village Council owns and operates the project building, which is the Washateria/ Water Plant and Clinic ("Washateria"). This building was selected for pre-feasibility assessment because it is the largest heat load in the community. At the time of the meeting, the Washateria manager was not present.

Fuel is purchased in Allakaket Village for $7.00 per gallon (see Appendix B). Delivery is by plane only. Additional transportation across the river, including labor, snow machine rental, and snow machine gas costs approximately $0.62 per gallon. These costs are well-documented in QuickBooks receipts. However, to be included as a fuel cost, these additional fuel transportation costs would need to be invoiced by the fuel vendor, in this case, Allakaket Village Council. The total cost is approximately $7.62 per gallon.

The current going rate for cordwood is $400 per cord. The Alatna Village Council office is primarily heated with wood, much of which is purchased from local residents (Council meeting, personal conversation, February 4, 2013).

Electricity is 82.85 cents per kWh, delivered by distribution lines from the AP&T power plant in Allakaket Village (See Appendix B).

Alatna Village was relocated two miles downriver to its current location after the flood of 1994. All buildings are located on high ground.

The Washateria was built in 2006. The approximately 2,300 ft^2 building has two (2) fuel oil boilers. The fuel oil boilers are Burnham V903A with 301,000 Btu net output. The hi / lo setting is 180/ 160°F. Three (3) Amtrol BoilerMates model transfer heat to the potable supply. A Heliodyne solar water heater is an additional heat source for the BoilerMates. The system is also equipped with an outdoor air reset.

The Washateria boilers provide space heating, domestic hot water, and heat to the community's potable water supply. In 2012, the Washateria used 2,315 gallons of fuel oil #1 (See Appendix B).

Five zones deliver heat to various end uses, which include: dryers (2), building heat (2), and hot water generator (1). Hot water appliances include dryers, washers, faucets, cabinet unit heaters, unit heaters, baseboard piping, radiant panel, and shell and tube heat exchangers.

Additionally, there are valves for a future recovered heat connection on the boiler return lines, indicated in drawings and verified in the field. There are also available breakers in the panel.

The project building is elevated off the ground. There is sufficient space on the south side of the Washateria, near the recovered heat valves, for a biomass project building.

The Alatna Village Council Office ("Office") is located about 400' from the Washateria. The Office is an approximately 1,200 ft^2 log building, built in 1995. According to 2nd Chief Michelle Sam, the Office needs to be re-leveled and the post foundation may need to be replaced. The Alatna Village Council plans to undertake this work in summer 2014. A wood stove is the primary heat source, supplemented by a Laser 56 oil stove, which provides up to 22,000 Btu. The building is in need of weatherization and potentially a wood stove which can supply more heat.

To the knowledge of the Alatna Village Council and the consultant, neither the Washateria nor the Council office have ever had an energy audit conducted or undergone weatherization. However, as mentioned, the Washateria is relatively recent construction, built in 2006.

Biomass Resource Availability

This pre-feasibility study was completed simultaneous to a reconnaissance-level biomass resource assessment by Tanana Chiefs Conference, which will be complete in fall 2014. The draft biomass resource assessment takes account of biomass stocking by ownership, resource distance from Alatna Village, and other factors. In summary, within a 5-mile radius of Alatna Village, there are approximately 144,000 cords of biomass, with nearly 82% of this material located K'oyitl'ots'ina, Limited lands. The average cost for biomass within a 5-mile radius of Alatna Village is about $121 per cord. This figure includes harvest, stumpage, administration, and transport costs, but does not include the cost of processing logs into cordwood or profit.

Site Control

The proposed project site, Block 18 & 19 of Plat 2002-114 in the Fairbanks Recording District, is vested in "Village of Alatna." Please see Appendix C.

Permitting

Applicable project permitting is considered below:

- The Alaska Department of Public Safety, Fire and Life Safety must approve the project plans before construction is started. Mechanical and electrical review is limited to that which is necessary to confirm compliance with fire and life safety requirements.
- Commercial harvests associated with the project may or may not be required to comply with the Alaska Forest Practices and Resources Act. While most commercial operations are required to comply, commercial operations of minor or small scale are sometimes exempted. The Act addresses forest management along water bodies, erosion mitigation, and reforestation.
- The 40CFR63 NESHAP Rule does not apply to the project. The Rule does not apply to a hot water heater, which is defined in Subpart 6J as a boiler with a heat input capacity is less than 1.6 MMBtu/hr and that does not generate steam.
- If State or Federal money is used to construct the project, the Alaska Department of Natural Resources Office of History and Archaeology, State Historic Preservation Office should review project plans to determine whether historic, prehistoric, or archaeological resources are likely to be affected. The Office also offers suggestions to mitigate potential effects on resources.

Proposed Biomass System

The proposed system is an 180,000 Btu cordwood boiler with hydronic heat storage, to be located in a stand-alone project building on the south side of the Washateria.

The project equipment must be suitable for delivery by plane. Contact was made with several air carriers to identify suitable aircraft for the project, which includes the ability to accommodate the project equipment and land at the Allakaket airport. Please see Appendix D.

Cordwood systems are not very effective when serving building heat systems that operate in a narrow temperature range, such at 180 /160°F. The project building currently operates in this range, and the biomass boiler operating and maintenance requirements have been modeled to maintain the existing temperature set points.

The cost of stoking the biomass boiler would decrease if the building could operate in a wider temperature range. Washateria staff may wish to test the existing heat system by lowering the set point to 140°F to see if the building heat emitters can supply sufficient heat at this temperature. Alternatively, new appliances and/or additional emitters could be installed. It may also be possible to meet heat needs with existing equipment by changing operations, such as longer clothes dryer cycles.

The proposed site is owned and controlled by Alatna Village, has sufficient space for the project, and offers good access to the Washateria's mechanical room and existing supplemental heat valves.

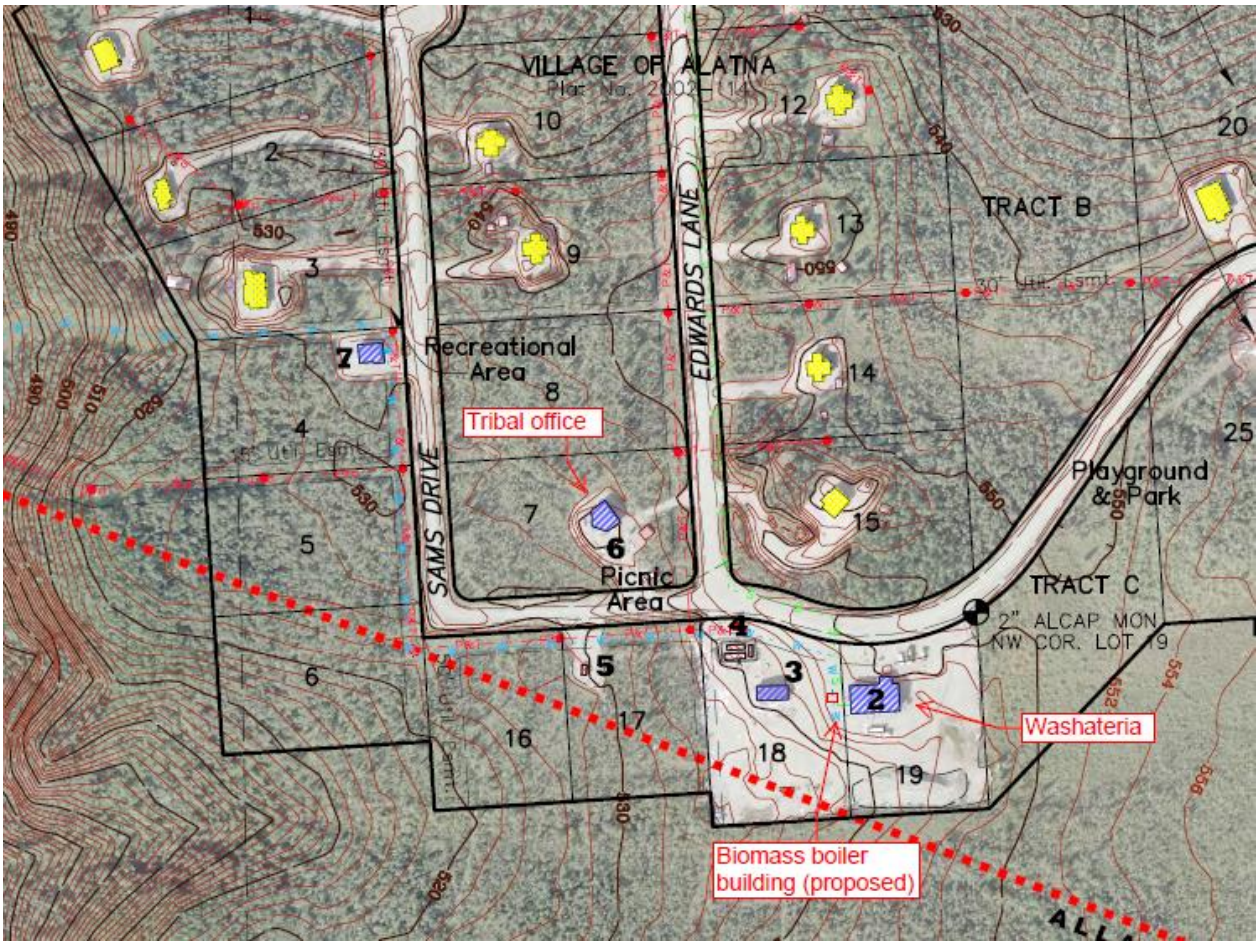
The following assumptions were made for the purpose of completing the pre-feasibility assessment, and are not a substitute for heat load calculations and boiler sizing to be completed by the project engineer during project development:

- Annual consumption of 2,315 gallons of fuel oil per year, 90% of which serves space heat load, 10% of which serves domestic hot water
- 180,000 Btu cordwood boiler with 980 gallons of water storage, delta T = 40°F
- Maximum 4 stokings per day, with additional heat demand served by oil. Each firing requires 20 minutes labor
- Annual inflation
    - Biomass O&M and scheduled repairs – 1.5%
    - Cordwood – 3%
    - Oil O&M and scheduled repairs – 1.5%
    - Oil – 4.8%
- Input prices, year 1
    - Cordwood -- $400/cord
    - Oil -- $7.62/gal
    - Loaded labor rate -- $20.17/ hr

Alternatives Considered

The project could also heat the Alatna Village Council office, which uses about 700 gallons of fuel oil per year. However, this office already has a wood stove, and is located approximately 400’ away. This distance is considered too large to consider justify the additional capital and operating expense of integration with the biomass boiler facility.

Figure 1: Biomass Project Site Map



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Heat Load & Biomass Requirements

Figure 2: Fuel Energy Values

	Gross btu/unit	System efficiency	Delivered btu/unit	Gross $/unit	Delivered $/mmbtu
Oil (gal)	134,500	80%	107,600	$ 7.62	$ 70.82
Biomass, 20% MC* (cord)	16,400,000	65%	10,660,000	$ 400	$ 37.52

*MC is Moisture Content. Moisture in biomass fuel evaporates and absorbs energy in combustion, thereby decreasing the net energy value of the fuel.

Figure 3: Current Fuel Use & Cost

Facility	Fuel Oil (gal)	$ / gal	Annual Fuel Cost
Washateria	2,315	$ 7.62	$ 17,640
		Total	**$ 17,640**

Figure 4: Projected Annual Fuel Use & Cost, Biomass Project

15%	Oil
85%	Biomass
1968	gallons displaced

Facility	Fuel Type	Units	$ / unit	Annual Fuel Cost
Washateria	Biomass, 20% MC* (cord)	19.9	$ 400	$ 7,945
Washateria	Oil (gal)	347	$ 7.62	$ 2,646
			Total	**$ 10,591**

Figure 5: Biomass Project Stoking Requirements

Facility	Total Stokings per Yr	Stoking Hrs Per Yr	$ / hr	Annual Stoking Cost
Washateria	777	259	$ 20.17	**$ 5,223**

Figure 6: Biomass O&M Costs (non-stoking)

Equipment (Btu)		180,000
Biomass Fuel		cordwood
Cost of Labor	$	20.17
Cost of Electricity	$	0.83
Number of Stokings		777

MATERIALS			Yrs to replacement		Replacement Cost per lifetime
Lower Gasket	$	23	5	$	92
Motor mount	$	27	10	$	54
Rear cleanout gasket kit	$	46	10	$	92
Manway cover gasket	$	19	10	$	38
5" cleaning brush	$	24	5	$	96
Motor assembly	$	518	12	$	863
1/2 HP motor	$	331	12	$	552
Motor mount kit	$	87	12	$	145
Motor mount ring & screws	$	17	12	$	28
Misc.	$	250	5	$	1,000
Anode Rod	$	98	5	$	392
Electricity 1/2 HP fan	$	40	1	$	800
Electricity -- pump	$	173	1	$	3,460
Chemicals	$	250	1	$	5,000
			Total Cost per Lifetime	$	12,612
			Straight-line Average Cost per Yr.	$	631

LABOR	Hours labor	Yrs to labor		Cost of Labor over Lifetime
Water test and replace	0.50	1	$	170
Cleanout covers and heat xger	2	1	$	807
Clean blower motor	0.75	0.5	$	605
Clean Ash & Combustion Air Intake	0.08	0.05	$	614
Check & replace gaskets	3	5	$	242
		Total Cost per Lifetime	$	2,437
		Straight-line Average Cost per Yr.	$	122

Total Annual Biomass O&M Cost (non-stoking) **$ 752**

Opinion of Probable Cost

Figure 7: Force Account Summary

Site & Foundation Work	$8,315
Biomass boiler building	$42,957
Biomass heat system	$58,070
End-user building integration	$8,674
Miscellaneous	$8,700
Overhead	$35,010
Freight	$43,040
CONSTRUCTION SUB-TOTAL	**$204,766**
Design & Construction Admin	$20,477
Construction Management	$10,238
PROJECT SUB-TOTAL	**$235,481**
Contingency @ 20%	$47,096
Admin @ 4%	$9,419
TOTAL PROJECT COST	**$291,996**

Figure 8: Force Account Detail

ITEM	QUAN	UNIT	UNIT COST	MATL COST	UNIT HRS	LAB HRS	LAB RATE	LABOR COST	CONTR COST	FREIGHT COST	TOTAL COST	UNIT WT	TOTAL WT(#)
SITE & FOUNDATION WORK													
Site prep (layout, excavation, backfill, compaction, grading)	1	lump							$5,000		$5,000	0.00	0
Wood timbers -- 8" x 8" x 8'	30	ea	$63.00	$1,890	0.50	15.00	$95	$1,425			$3,315	70.00	2100
BIOMASS BOILER BUILDING W/ WOOD STORAGE													
Sill plate - 2" x 6" x 20" PT	5	ea.	$20	$100	0.25	1.3	$95	$119			$219	51	255
SIP exterior walls -- 4' x 10'	18	ea.	$500	$9,000	0.3	5	$95	$513			$9,513	4	72
SIP roof -- 4' x 10' pkg	11	ea.	$500	$5,500	0.75	8	$95	$784			$6,284	4	44
SIP fasteners / hardware / framing anchors	1	lump	$400	$400	0	0	$95	$0			$400	500	500
SIP caulk, sealant, expanding foam	1	lump	$250	$250	4	4	$95	$380			$630	150	150
Roof, frame	2	lump	$900	$1,800	18.00	36	$95	$3,420			$5,220	400	800
Roof, Metal -- 3' x 10' Delta rib roofing	15	ea.	$175	$2,625	1.00	15	$95	$1,425			$4,050	96	1440
Floor Insulation, Rigid (2"x24"x96")	19	ea.	$28.00	$532	0.25	5	$95	$451			$983	1	19
Floor system, metal	1	lump	$1,200	$1,200	20.00	20	$95	$1,900			$3,100	1600	1600
Siding, Metal, plus trim -- 3' x 10' Delta rib roofing	24	ea.	$175	$4,200	1.00	24	$95	$2,280			$6,480	96	2304
Fasteners	1	lump	$250	$250	0	0	$95	$0			$250	100	100
Man-door w/ hardware	1	lump	$780	$780	6	6	$95	$570			$1,350	75	75
Overhead garage door (10' x 10')	1	lump	$1,350	$1,350	6	6	$95	$570			$1,920	250	250
Drywall -- 4' x 10' + tape	25	ea.	$27	$675	0.33	8	$95	$784			$1,459	50	1250
Interior paint -- 5 gal	2	ea.	$40	$80	4	8	$95	$760			$840	42	83
Fire protection	1	lump	$250	$250	0.1	0.1	$95	$10			$260	150	150
BIOMASS HEAT SYSTEM													
Boiler -- GARN 1000	1	ea.	$11,000	$11,000	16	16	$95	$1,520			$12,520	2200	2200
Pipe/Valves/Ftgs/Gauges	1	lump	$5,000	$5,000	54	54	$100	$5,400			$10,400	800	800
Circ pump	2	ea.	$500	$1,000	4	8	$100	$800			$1,800	60	120
Plate HXR, (300 MBh @ 20F)	2	ea.	$2,500	$5,000	2	4	$100	$400			$5,400	250	500
Misc Strut & Pipe Hangers	1	lump	$1,000	$1,000	20	20	$95	$1,900			$2,900	500	500
Tank Insulation	1	lump	$1,200	$1,200	3	3	$95	$285			$1,485	50	50
Stack -- 6" dia double wall UL listed + supporting infrastructure	1	lump	$1,700	$1,700	4	4	$95	$380			$2,080	3.8	4
Ventilation & Combustion Air Intake	1	lump	$1,200	$1,200	3	3	$95	$285			$1,485	50	50
BTU meter	0	ea.	$2,500	$0	18	0	$95	$0			$0	0	0
Electrical	1	lump	$10,000	$10,000	100	100	$100	$10,000			$20,000	750	750
INTEGRATION													
Artic Pipe -- 1,5" PEX	60	lf	$20	$1,200	0.27	16	$95	$1,539			$2,739	1	60
PEX accessories --	60	1/ft	$5	$300		0	$95	$0			$300	*1*	60
Pipe penetration exclosure	1	lump	$1,250	$1,250	3	3	$95	$285			$1,535	*200*	200
Temp controls	1	lump	$750	$750	8	8	$100	$800			$1,550	*200*	200
Electrical work	1	lump	$1,250	$1,250	13	13	$100	$1,300			$2,550	*200*	200
MISCELLANEOUS													
Misc Hardware	1	lump	$2,500	$2,500	0	0	$95	$0			$2,500	500	500
Misc Tools & Safety Gear	1	lump	$1,500	$1,500	0	0	$95	$0			$1,500	1446	1446
Consumables, Gases, Etc.	1	lump	$2,000	$2,000	0	0	$95	$0			$2,000	1500	1500
Wood splitter	1	ea	$2,700	$2,700	0	0	$95	$0			$2,700	657	657
OVERHEAD													
ROW Legal Work	0	lump							$0		$0		0
Rent Heavy Equip	1	lump							$1,500		$1,500		0
Misc Tool Rent	1	lump							$1,250		$1,250		0
Commission System & Training	20	hr			1	20	$90	$1,800			$1,800		0
Superintendent Overhd Off-Site	40	hr			1	40	$90	$3,600			$3,600		0
Superintendent Overhd On-Site	80	hr			1	80	$90	$7,200			$7,200		0
Crew Travel Time	10	hr			1	10	$90	$900			$900		0
Crew Airfares	2	trips	$680						$1,360		$1,360		0
Crew Per Diem	240	mn.dy.	$60						$14,400		$14,400		0
Housing Rent	2.0	mo.	$1,500						$3,000		$3,000		0
FREIGHT													**20,989**
Ground Freight	2200	lb.	$1.24							$2,733			
Air Freight	20989	lb.	$1.40							$29,307			
Air Freight Tool Mob & Demob	2	lump	$2,500							$5,000			
Misc Small Freight & Gold Streaks	1	lump	$6,000							$6,000			
CONSTRUCTION SUB-TOTAL				$81,432		564		$53,784	$26,510	$43,040	$204,766		
Engineering (Design & CCA)	10	%							$20,477				
Construction Management	5	%							$10,238				
PROJECT SUB-TOTAL				$81,432				$53,784	$ 57,225	$43,040	$235,481		
Contingency	20	%									$47,096		
Admin Fee	4	%									$9,419		
CONSTRUCTION TOTAL											**$291,996**		

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Financial Analysis

Financial Summary

The project is considered financially unfeasible at this time.

- Benefit/ Cost: 0.32
- Simple Payback Period: n/a
- Net present value: ($188,452)

Benefit/ Cost Model

The following model was designed by University of Alaska Anchorage Institute of Social and Economic Research, for use by the Alaska Energy Authority. The model has adapted to the project and completed according to the aforementioned assumptions.

AEA B/C Model (adapted)

Project Description		
Community	Alatna	
Nearest Fuel Community	Allakaket, Alatna	
Region	Rural	
RE Technology	Biomass	
Project ID		
Applicant Name	Alatna Village	
Project Title	Alatna Washateria_biomass	
Category		

Results	
NPV Benefits	$86,783
NPV Capital Costs	$275,234
B/C Ratio	0.32
NPV Net Benefit	($188,452)

Performance	**Unit**	**Value**
Displaced Petroleum Fuel	gallons per year	1,968
Displaced Petroleum Fuel	total lifetime gallons	39,355
Avoided CO2	tonnes per year	20
Avoided CO2	total lifetime tonnes	399

Proposed System	**Unit**	**Value**
Capital Costs	$	$291,996
Project Start	year	2015
Project Life	years	20
Displaced Heat	gallons displaced per year	1,968
Heating Capacity	Btu/hr	180,000
Heating Capacity Factor	%	85%

Parameters	**Unit**	**Value**
Heating Fuel Premium	$ per gallon	
Discount Rate	% per year	3%
Crude Oil	$ per barrel	

Annual Savings (Costs)	Units	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Project Capital Cost	$ per year	$ 291,996	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Electric Savings (Costs)	$ per year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Heating Saving (Costs)	$ per year	$1,074	$1,465	$1,883	$2,329	$2,803	$3,308	$3,845	$4,416	$5,022	$5,667	$6,351	$7,076	$7,846	$8,663	$9,528	$10,444	$11,415	$12,443	$13,530	$14,681
Transportation Savings (Costs)	$ per year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Savings (Costs)	**$ per year**	$1,074	$1,465	$1,883	$2,329	$2,803	$3,308	$3,845	$4,416	$5,022	$5,667	$6,351	$7,076	$7,846	$8,663	$9,528	$10,444	$11,415	$12,443	$13,530	$14,681
Net Benefit	**$ per year**	**($290,922)**	**$1,465**	**$1,883**	**$2,329**	**$2,803**	**$3,308**	**$3,845**	**$4,416**	**$5,022**	**$5,667**	**$6,351**	**$7,076**	**$7,846**	**$8,663**	**$9,528**	**$10,444**	**$11,415**	**$12,443**	**$13,530**	**$14,681**

Heating	Units	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Proposed																					
Renewable Heat	gal. disp./ yr.	1,968	1,968	1,968	1,968	1,968	1,968	1,968	1,968	1,968	1,968	1,968	1,968	1,968	1,968	1,968	1,968	1,968	1,968	1,968	1,968
Renewable Heat O&M (non-stoking)	$ per yr.	$ 752	$ 764	$ 775	$ 787	$ 799	$ 811	$ 823	$ 835	$ 848	$ 860	$ 873	$ 886	$ 900	$ 913	$ 927	$ 941	$ 955	$ 969	$ 984	$ 999
Renewable Heat Stoking	$ per yr.	$ 5,223	$ 5,302	$ 5,381	$ 5,462	$ 5,544	$ 5,627	$ 5,711	$ 5,797	$ 5,884	$ 5,972	$ 6,062	$ 6,153	$ 6,245	$ 6,339	$ 6,434	$ 6,530	$ 6,628	$ 6,728	$ 6,828	$ 6,931
Renewable Fuel Use Qty (biomass)	cords	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9
Renewable Fuel Cost	$ per unit	$ 400	$ 412	$ 424	$ 437	$ 450	$ 464	$ 478	$ 492	$ 507	$ 522	$ 538	$ 554	$ 570	$ 587	$ 605	$ 623	$ 642	$ 661	$ 681	$ 701
Total Renewable Fuel Cost	$ per yr.	$ 7,945	$ 8,183	$ 8,429	$ 8,682	$ 8,942	$ 9,210	$ 9,487	$ 9,771	$ 10,064	$ 10,366	$ 10,677	$ 10,998	$ 11,327	$ 11,667	$ 12,017	$ 12,378	$ 12,749	$ 13,132	$ 13,526	$ 13,931
Supplemental Fuel Qty (Oil)	gal.	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347
Fuel Cost	$ per gal.	$ 7.62	$ 7.99	$ 8.37	$ 8.77	$ 9.19	$ 9.63	$ 10.10	$ 10.58	$ 11.09	$ 11.62	$ 12.18	$ 12.76	$ 13.37	$ 14.02	$ 14.69	$ 15.39	$ 16.13	$ 16.91	$ 17.72	$ 18.57
Supplemental Fuel Cost	$ per yr.	$ 2,646	$ 2,773	$ 2,906	$ 3,046	$ 3,192	$ 3,345	$ 3,506	$ 3,674	$ 3,850	$ 4,035	$ 4,229	$ 4,432	$ 4,644	$ 4,867	$ 5,101	$ 5,346	$ 5,602	$ 5,871	$ 6,153	$ 6,449
Proposed Heat Cost	**$ per yr.**	**$ 16,567**	**$ 17,022**	**$ 17,491**	**$ 17,976**	**$ 18,476**	**$ 18,993**	**$ 19,526**	**$ 20,077**	**$ 20,646**	**$ 21,234**	**$ 21,841**	**$ 22,468**	**$ 23,116**	**$ 23,786**	**$ 24,479**	**$ 25,195**	**$ 25,935**	**$ 26,700**	**$ 27,491**	**$ 28,309**
Base																					
Fuel Use	gal. per yr.	2,315	2,315	2,315	2,315	2,315	2,315	2,315	2,315	2,315	2,315	2,315	2,315	2,315	2,315	2,315	2,315	2,315	2,315	2,315	2,315
Fuel Cost	$ per gal.	$ 7.62	$ 7.99	$ 8.37	$ 8.77	$ 9.19	$ 9.63	$ 10.10	$ 10.58	$ 11.09	$ 11.62	$ 12.18	$ 12.76	$ 13.37	$ 14.02	$ 14.69	$ 15.39	$ 16.13	$ 16.91	$ 17.72	$ 18.57
Fuel Cost	$ per yr.	$ 17,640	$ 18,487	$ 19,374	$ 20,304	$ 21,279	$ 22,300	$ 23,371	$ 24,493	$ 25,668	$ 26,900	$ 28,192	$ 29,545	$ 30,963	$ 32,449	$ 34,007	$ 35,639	$ 37,350	$ 39,142	$ 41,021	$ 42,990
Base Heating Cost	**$ per yr.**	**$ 17,640**	**$ 18,487**	**$ 19,374**	**$ 20,304**	**$ 21,279**	**$ 22,300**	**$ 23,371**	**$ 24,493**	**$ 25,668**	**$ 26,900**	**$ 28,192**	**$ 29,545**	**$ 30,963**	**$ 32,449**	**$ 34,007**	**$ 35,639**	**$ 37,350**	**$ 39,142**	**$ 41,021**	**$ 42,990**

ENERGY ACTION

Recommendations

Biomass heat at the Washateria is considered financially un-feasible at this time. The project does create employment and result in operational savings, but the sum of those savings is insufficient to justify the capital expense to develop the project.

The project also has challenges with technical feasibility, because the existing heat system operates in a narrow temperature range, 180 / 160°F. Cordwood systems are not very effective when serving building heat systems that operate in a narrow temperature range.

There may be an opportunity for Alatna Village Council to own and operate a biomass energy project and sell heat as a third-party. The Allakaket School building is scheduled to be replaced in 5 – 10 years. It appears that a heat sales project, owned and operated by a third-party, may satisfy Yukon-Koyukuk School District's interest in biomass energy. If the project owner can source fuel at $275 per cord, as the Tanana Chiefs Conference reconnaissance-level biomass resource assessment suggests, the project is considered pre-feasible. Sourcing wood at $275 per cord would result in about $25,000 of revenues per year for the supplier. The project pre-feasibility, "Allakaket Village Biomass Heat Pre-Feasibility Study," is publically available from the Alaska Energy Authority (contact Biomass/CHP Program Manager, 907-771-3068) or Interior Regional Housing Authority (contact Grants Manager, 907-452-835).

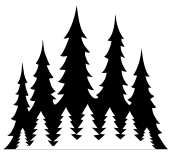
It is also recommended that Alatna Village Council proceed with plans to re-level and improve the foundation of the Alatna Village Council Office, and to weatherize the Office. After weatherization, Alatna Village Council may wish to upgrade the Office wood stove to better meet heat demand.

Appendix

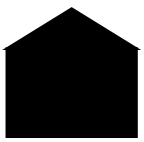
A—Biomass Technology
B – Utility Receipts
C – Plat Map
D – Aircraft Information
E – Site Photos

A – Biomass Technology

Although humans have used wood for heat for millennia, modern high-efficiency biomass boilers have only been in use for a few decades. Biomass boilers may use wood fuels such as cordwood, wood chips, or wood pellets, to heat commercial buildings. Biomass boiler projects depend on sustainable forest management, quality biomass fuel sourcing, processing, and storage, and reliable fuel handling. Biomass boilers frequently integrate with conventional hydronic heat systems, which use water to move heat from where it is produced to where it is needed. Small-scale biomass systems often incorporate a hot water storage tank, which promotes efficient combustion and improves the availability of biomass heat. To provide reliable heat, the biomass boiler, building heat distribution system, controls, and heat emitters must be properly matched.



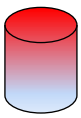
Sustainable Forest Management



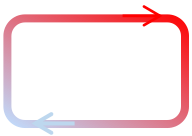
Wood fuel Processing & Storage

Handling

Combustion



Thermal Storage



Heat Distribution

The Nature of Wood Fuels

Composition

All wood is made primarily of cellulose, hemi-cellulose, and lignin. It is about 50% Carbon, 44% Oxygen, and 6% Hydrogen. Theoretically, complete combustion (100% efficient) would result in only two products: carbon dioxide and water. In practice, biomass boilers range from about 77 -- 83% efficient. Wood that is not completely burned become carbon monoxide and hydrocarbons, often in the form of smoke and ash.[1]

Combustion

Biomass fuel undergoes fascinating changes as it burns. Pyrolysis occurs at 500 – 600°F, in which organic gasses leave behind charcoal solids. Primary combustion is burning of charcoal solids.[2] Secondary combustion is burning of organic gasses. Because about 60% of the heating value is contained in gasses, secondary combustion is essential to high efficiency wood burning.

[1] Rick Curkeet, PE, *Wood Combustion Basics,* EPA Burnwise Workshop 2011, http://www.epa.gov/burnwise/workshop2011/WoodCombustion-Curkeet.pdf (June 19, 2014).
[2] Curkeet, Rick.

Emissions

In wood burning, the primary emissions concern is particulate matter 2.5 microns or less in size ("PM 2.5"), which is hazardous to human health. Additionally, unburned wood signifies lost heat and potential creosote formation. Creosote formation results in higher fuel costs, shortens the life of the boiler, and increases other maintenance costs. Boiler manufacturers have certified emissions tests conducted according to the ASTM E2618-13 standard that document boiler efficiency. High efficiency wood boilers emit about 0.07 – 0.3 lbs of PM 10 per million BTU in test conditions.

Boiler manufacturers specify operating conditions for the field. One important condition is wood fuel specifications, which include moisture content and fuel dimensions. Other important conditions for efficient operation include proper fuel storage, routine operations and maintenance, and system design (such as proper boiler sizing and incorporating a hot water storage tank).

One valuable source of information for seasoning cordwood in Interior Alaska is available at the Cold Climate Housing Research Center's (CCHRC) website.[3] "Properly prepared and stored" cordwood can be dry enough to burn safely within six weeks during the summer. In regions other than the Interior, similar storage principles would apply, but recommended storage durations may be different. Below is a summary of how to properly prepare and store cordwood:

- Cut to stove length (two feet or shorter)
- Split the wood at least once
- Stack in a pile with air space between the pieces
- Store wood in a shed or cover only the top of the pile with a large piece of plywood or some waterproof tarp
- Allow sun and air to reach the sides of the wood pile to help dry the wood
- Season at least six weeks during the summer months
- If beginning after August 1st, wait to burn until the next summer
- When properly stored, more time is always better

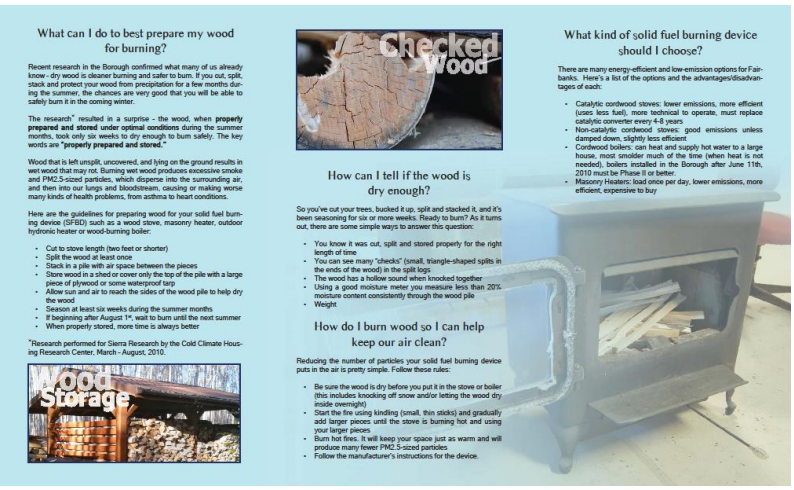


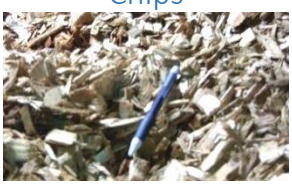
Figure 1: Excerpt from CCHRC's Cordwood Handling Brochure

[3] http://www.cchrc.org/docs/best_practices/Cordwood_Handling_Brochure.pdf

ENERGY ACTION

Wood Fueled Heating Systems

Below are the characteristics of cordwood, wood chip, and wood pellet boiler systems.

	Advantages	Disadvantages
Cordwood 	• Local wood resource • Small size (less than 1 MMBTU) • Simple to operate	• Higher labor costs, including hand-feeding the boiler, manual ash removal, and manual grate cleaning • Labor is needed intermittently, so someone must be available "on site" • Typically non-pressurized, which may require more frequent boiler chemical additions
Pellets 	• Can operate unattended, and automatically match heat load • Scalable from small to large sizes (generally 100,000 btu – 1 MMBTU) • Relatively small footprint • Typically the most efficient biomass combustion	• Pellet fuel is typically not locally produced, and therefore depends on "imports" • Shipping pellets is very costly; even a freight rate of $0.05 per lb. results in an additional cost of $100 per ton. • Relatively expensive wood fuel • Ash removal and grate cleaning may be automated or manual
Chips 	• Can operate unattended, and automatically match heat load • Wood chips may be the lowest cost fuel • Local wood resource may be available or produced • Large projects achieve economies of scale • Creates jobs in the woods and at the boiler plant	• Large systems are expensive • Typically large sizes > 1,000,000 MMBTU • Wood chip fuel can be diverse, which can make it difficult to meet fuel specifications. Screens and other devices can improve fuel quality.

ENERGY ACTION

B – Utility Receipts

1/16/2012

City of Allakaket **1,950.00

One Thousand Nine Hundred Fifty and 00/100**********

City of Allakaket
P O Box 30
Allakaket, AK 99720

300 Gallons Diesel-Washeteria

City of Allakaket	300 Gallons Diesel-Washeteria	1/16/2012	1,950.00
Key Bank	300 Gallons Diesel-Washeteria		1,950.00
City of Allakaket	300 Gallons Diesel-Washeteria	1/16/2012	1,950.00
Key Bank	300 Gallons Diesel-Washeteria		1,950.00

2/21/2012

City of Allakaket **1,950.00

One Thousand Nine Hundred Fifty and 00/100**********

City of Allakaket
P O Box 30
Allakaket, AK 99720

300 gallons diesel Clinic/Washeteria

City of Allakaket	300 gallons diesel Clinci/Washeteria	2/21/2012	1,950.00
Key Bank	300 gallons diesel Clinic/Washeteria		1,950.00
City of Allakaket	300 gallons diesel Clinci/Washeteria	2/21/2012	1,950.00
Key Bank	300 gallons diesel Clinic/Washeteria		1,950.00

4/2/2012

City of Allakaket **1,379.00

One Thousand Three Hundred Seventy-Nine and 00/100**********

City of Allakaket
P O Box 30
Allakaket, AK 99720

Diesel for Washeteria/Gas for Office

City of Allakaket		4/2/2012	
	150 Gallons Diesel for Washerteria 7 Gallons Gas for Office		1,379.00

Key Bank	Diesel for Washeteria/Gas for Office	1,379.00

City of Allakaket		4/2/2012	
	150 Gallons Diesel for Washerteria 7 Gallons Gas for Office		1,379.00

Key Bank	Diesel for Washeteria/Gas for Office	1,379.00

4/11/2012

City of Allakaket

**4,200.00

Four Thousand Two Hundred and 00/100**********

City of Allakaket
P O Box 30
Allakaket, AK 99720

Diesel for Washeteria & Office

City of Allakaket

4/11/2012

300 Gallons Diesel for Washerteria		2,100.00
300 Gallons Diesel -Tribal Office		2,100.00

Key Bank	Diesel for Washeteria & Office	4,200.00

City of Allakaket

4/11/2012

300 Gallons Diesel for Washerteria	2,100.00
300 Gallons Diesel -Tribal Office	2,100.00

Key Bank	Diesel for Washeteria & Office	4,200.00

8/1/2012

City of Allakaket **1,155.00

One Thousand One Hundred Fifty-Five and 00/100**********

City of Allakaket
P O Box 30
Allakaket, AK 99720

Diesel - Wash/Clinic

City of Allakaket	165 Gal Diesel WASH/CLINIC	8/1/2012	1,155.00

Key Bank Diesel - Wash/Clinic 1,155.00

City of Allakaket	165 Gal Diesel WASH/CLINIC	8/1/2012	1,155.00

Key Bank Diesel - Wash/Clinic 1,155.00

10/3/2012

City of Allakaket **3,500.00

Three Thousand Five Hundred and 00/100**********

City of Allakaket
P O Box 30
Allakaket, AK 99720

500 Gals Diesel

City of Allakaket 10/3/2012

COA/500 gals Diesel/Washeteria/Self-Gov 3,500.00

*PLEASE GET COPY OF RECEIPT

Key Bank 500 Gals Diesel 3,500.00

City of Allakaket 10/3/2012

COA/500 gals Diesel/Washeteria/Self-Gov 3,500.00

*PLEASE GET COPY OF RECEIPT

Key Bank 500 Gals Diesel 3,500.00

11/8/2012

City of Allakaket **4,200.00

Four Thousand Two Hundred and 00/100**********

City of Allakaket
P O Box 30
Allakaket, AK 99720

Labor 6 hrs - 2 - 3 ppl - #20/hr

600 Gals Diesel

City of Allakaket 11/8/2012 4,200.00

COA/600 gals Diesel/Washeteria/Self-Gov

*PLEASE GET COPY OF RECEIPT

Key Bank 600 Gals Diesel 4,200.00

City of Allakaket 11/8/2012 4,200.00

COA/600 gals Diesel/Washeteria/Self-Gov

*PLEASE GET COPY OF RECEIPT

Key Bank 600 Gals Diesel 4,200.00

1/2/2013

City of Allakaket

**4,200.00

Four Thousand Two Hundred and 00/100**********

City of Allakaket
P O Box 30
Allakaket, AK 99720

50 Gals Diesle

City of Allakaket 1/2/2013

COA/600 Gals Diesel/Wash/Self-Gov 4,200.00

Key Bank 50 Gals Diesle 4,200.00

City of Allakaket 1/2/2013

COA/600 Gals Diesel/Wash/Self-Gov 4,200.00

Key Bank 50 Gals Diesle 4,200.00

5/10/2013

City of Allakaket

**7,805.00

Seven Thousand Eight Hundred Five and 00/100**********

City of Allakaket
P O Box 30
Allakaket, AK 99720

Reissue Check

City of Allakaket

5/10/2013

Replace Chk No 10399/1000Gals Diesel/Wash	7,000.00
Replace Chk No 10404/50GalsDiesel/Office	350.00
Replace Chk No 10409/50GalsDiesel/Client	350.00
Replace Chk No 10411/10GalsGas/Wash	70.00
Replace Chk No 10412/5GalsGas/SolidWaste	35.00

Key Bank Reissue Check 7,805.00

City of Allakaket

5/10/2013

Replace Chk No 10399/1000Gals Diesel/Wash	7,000.00
Replace Chk No 10404/50GalsDiesel/Office	350.00
Replace Chk No 10409/50GalsDiesel/Client	350.00
Replace Chk No 10411/10GalsGas/Wash	70.00
Replace Chk No 10412/5GalsGas/SolidWaste	35.00

7,805.00

Key Bank Reissue Check

12/6/2013

City of Allakaket

**70.00

Seventy and 00/100**********

City of Allakaket
P O Box 30
Allakaket, AK 99720

10 gal's gas

gas for hauling diesel

City of Allakaket 12/6/2013

10 gal's gas diesel haul H.M. 70.00

hauled 10 drums
50 gals
each

Key Bank 10 gal's gas 70.00

City of Allakaket 12/6/2013

10 gal's gas diesel haul H.M. 70.00

Key Bank 10 gal's gas 70.00

12/3/2013

City of Allakaket

**7,700.00

Seven Thousand Seven Hundred and 00/100**********

City of Allakaket
P O Box 30
Allakaket, AK 99720

1000 gal's diesel Wash/Clin; 100 gal's Safehouse

City of Allakaket		12/3/2013	
	1000 gal's diesel Washeteria/Clinic		7,000.00
	100 gal's diesel Safehouse		700.00

Key Bank	1000 gal's diesel Wash/Clin; 100 gal's Safehous		7,700.00

City of Allakaket		12/3/2013	
	1000 gal's diesel Washeteria/Clinic		7,000.00
	100 gal's diesel Safehouse		700.00

7,700.00

Key Bank 1000 gal's diesel Wash/Clin; 100 gal's Safehous

AP&T

Customer Account #

Bill Date 01/30/2014 **Current Charges Due Date** 02/24/2014 **Clinic/Laundry-400 Amp Svc**

Past Due	Current Charges Due	TOTAL DUE	AMOUNT PAID
5,962.58	2,817.23	8,779.81	

ALATNA VILLAGE COUNCIL-(AN)
PO BOX 70
ALLAKAKET AK 99720-0070

Please send payment to:

Alaska Power Company Al
P O Box 207
Tok AK 99780-0207

PLEASE RETURN THIS PORTION WITH YOUR PAYMENT TO INSURE PROPER CREDITING TO YOUR ACCOUNT

ALATNA VILLAGE COUNCIL-(AN) **Account #** **Clinic/Laundry-400 Amp Svc**

Previous Balance	Applied to Prior	Past Due **	Current Activity	TOTAL DUE	AMOUNT PAID
5,962.58	0.00	5,962.58	2,817.23	8,779.81	

Payments Applied Through 01/29/2014 **Bill Date** 01/30/2014

Route Nbr: 00000-00713
Meter Nbr: 39724806

Present Reading: 4,094 01/27/2014
Previous Reading: 4,009 12/27/2013
85

Multiplier: 40
KWH Used: 3,400

SUMMARY OF CHARGES

Electric Rate @ 35.94 cents per KWH
Energy Chrg @ 44.88 cents per KWH

Balance Forward	5,962.58
A1 Electric Rate - Commercial	1,221.96
Energy Charge	1,525.92
Regulatory Cost Charge	1.97
A1 Customer Charge	13.21
Late Payment Charge	2.00
Finance Charges	52.17
Current Balance Due	8,779.81

ACCOUNT METER READING HISTORY

READ DATE	READING	USAGE
01/27/2014	4094	3,400
12/27/2013	4009	4,240
11/24/2013	3903	2,480
10/26/2013	3841	2,160
09/25/2013	3787	1,880
08/26/2013	3740	1,360
07/26/2013	3706	1,320
06/25/2013	3673	1,120
05/28/2013	3645	2,200
04/26/2013	3590	2,160
03/26/2013	3536	2,960
02/25/2013	3462	3,240
01/24/2013	3381	3,400

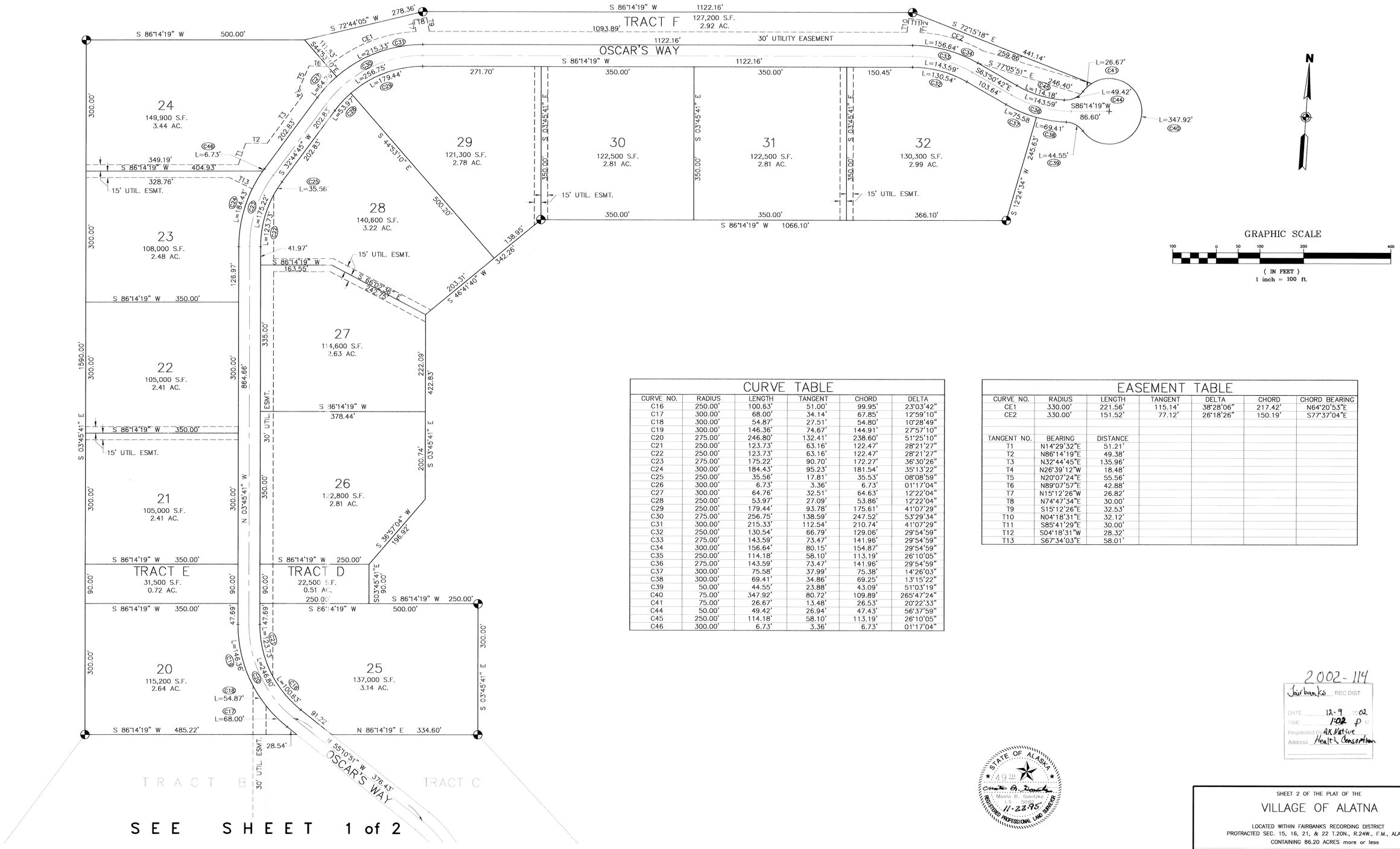
**** Accounts with past due balances are considered delinquent and are subject to disconnection 55 days after initial rendering.**

Thank You For Letting Us Serve You
Our Local Number is 692-5212
Our Toll-Free Number in the Tok Office is 1-800-478-7531
THE RCA CONSUMER HOT LINE IS 1-800-390-2782

PAYMENTS RECEIVED AFTER 2:00 PM WILL BE POSTED THE FOLLOWING BUSINESS DAY

C – Plat Map

ENERGY ACTION



SEE SHEET 1 of 2

CURVE TABLE

CURVE NO.	RADIUS	LENGTH	TANGENT	CHORD	DELTA
C16	250.00'	100.63'	51.00'	99.95'	23°03'42"
C17	300.00'	68.00'	34.14'	67.85'	12°59'10"
C18	300.00'	54.87'	27.51'	54.80'	10°28'49"
C19	300.00'	146.36'	74.67'	144.91'	27°57'10"
C20	275.00'	246.80'	132.41'	238.60'	51°25'10"
C21	250.00'	123.73'	63.16'	122.47'	28°21'27"
C22	250.00'	123.73'	63.16'	122.47'	28°21'27"
C23	275.00'	175.22'	90.70'	172.27'	36°30'26"
C24	300.00'	184.43'	95.23'	181.54'	35°13'22"
C25	250.00'	35.56'	17.81'	35.53'	08°08'59"
C26	300.00'	6.73'	3.36'	6.73'	01°17'04"
C27	300.00'	64.76'	32.51'	64.63'	12°22'04"
C28	250.00'	53.97'	27.09'	53.86'	12°22'04"
C29	250.00'	179.44'	93.78'	175.61'	41°07'29"
C30	275.00'	256.75'	138.59'	247.52'	53°29'34"
C31	300.00'	215.33'	112.54'	210.74'	41°07'29"
C32	250.00'	130.54'	66.79'	129.06'	29°54'59"
C33	275.00'	143.59'	73.47'	141.96'	29°54'59"
C34	300.00'	156.64'	80.15'	154.87'	29°54'59"
C35	250.00'	114.18'	58.10'	113.19'	26°10'05"
C36	275.00'	143.59'	73.47'	141.96'	29°54'59"
C37	300.00'	75.58'	37.99'	75.38'	14°26'03"
C38	300.00'	69.41'	34.86'	69.25'	13°15'22"
C39	50.00'	44.55'	23.88'	43.09'	51°03'19"
C40	75.00'	347.92'	80.72'	109.89'	265°47'24"
C41	75.00'	26.67'	13.48'	26.53'	20°22'33"
C44	50.00'	49.42'	26.94'	47.43'	56°37'59"
C45	250.00'	114.18'	58.10'	113.19'	26°10'05"
C46	300.00'	6.73'	3.36'	6.73'	01°17'04"

EASEMENT TABLE

CURVE NO.	RADIUS	LENGTH	TANGENT	DELTA	CHORD	CHORD BEARING
CE1	330.00'	221.56'	115.14'	38°28'06"	217.42'	N64°20'53"E
CE2	330.00'	151.52'	77.12'	26°18'26"	150.19'	S77°37'04"E

TANGENT NO.	BEARING	DISTANCE
T1	N14°29'32"E	51.21'
T2	N86°14'19"E	49.38'
T3	N32°44'45"E	135.96'
T4	N26°39'12"W	18.48'
T5	N20°07'24"E	55.56'
T6	N89°07'57"E	42.88'
T7	N15°12'26"W	26.82'
T8	N74°47'34"E	30.00'
T9	S15°12'26"E	32.53'
T10	N04°18'31"E	32.12'
T11	S85°41'29"E	30.00'
T12	S04°18'31"W	28.32'
T13	S67°34'03"E	58.01'

2002-114
Fairbanks REC DIST
DATE 12-9 2002
TIME 1:02 P M
Requested By AK Native
Address Health Consortium

STATE OF ALASKA
49TH
Monte R. Gontzke
L.S. 5098
11-22-95
REGISTERED PROFESSIONAL LAND SURVEYOR

SHEET 2 OF THE PLAT OF THE

VILLAGE OF ALATNA

LOCATED WITHIN FAIRBANKS RECORDING DISTRICT
PROTRACTED SEC. 15, 16, 21, & 22 T.20N., R.24W., F.M., ALASKA
CONTAINING 86.20 ACRES more or less

UMIAT Architecture • Engineering • Land Surveying • Planning
Anchorage Fairbanks Palmer Juneau

SCALE: 1"=100'	DRAWN: SMT	DATE DRAWN: 10/05/95	SHEET 2 OF 2
GRID:	CHECKED: MRC	W.O. 463939	
FB: 299	DATE SURVEYED:	DWG. FILE: PLAT2OF2	

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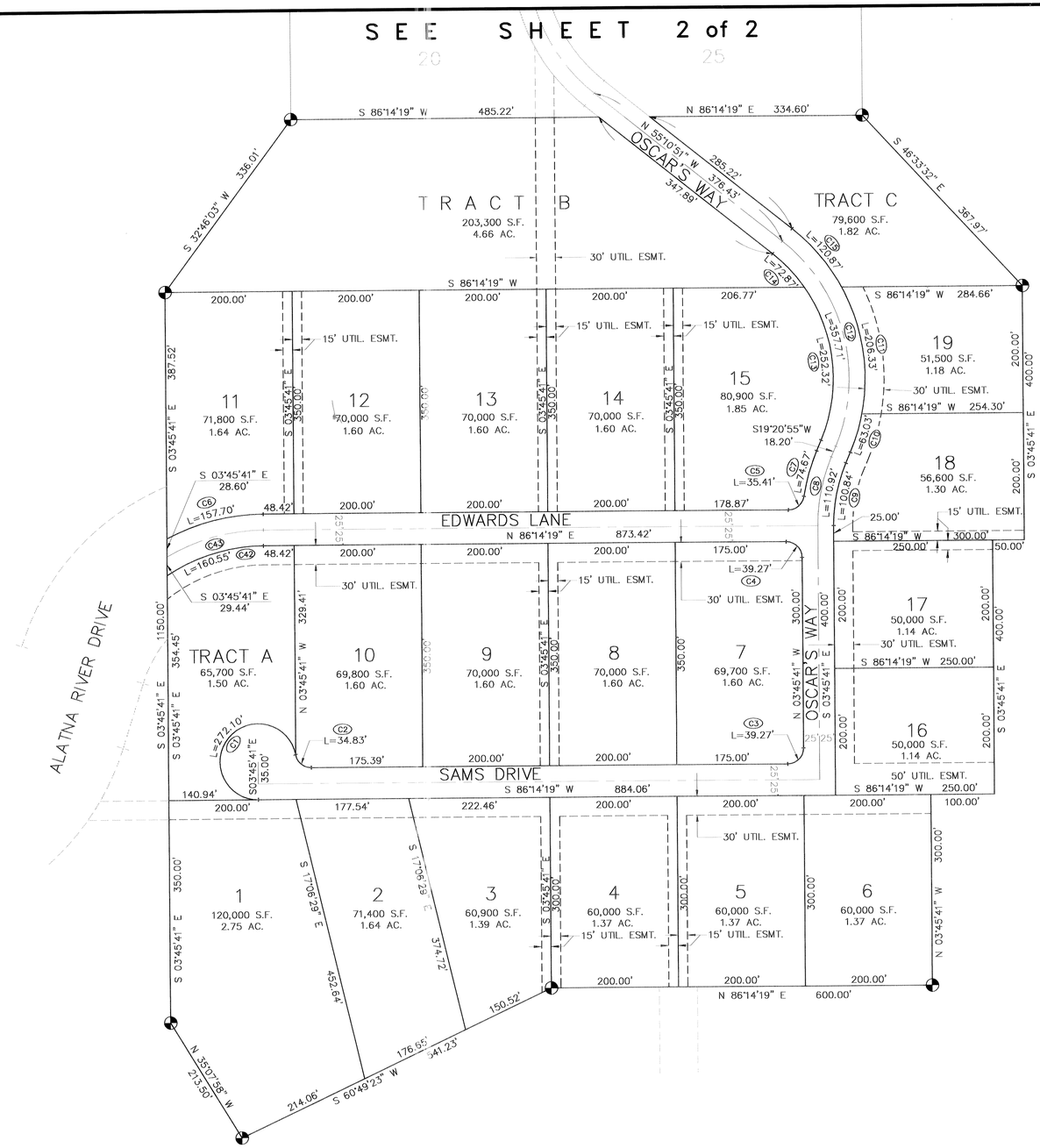
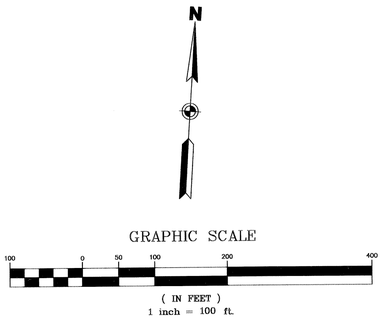
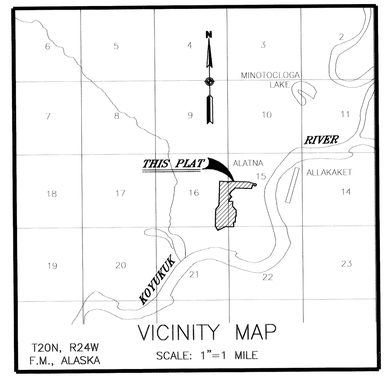
SEE SHEET 2 of 2







CURVE TABLE

CURVE NO.	RADIUS	LENGTH	TANGENT	CHORD	DELTA
C1	60.00'	272.10'	71.71'	92.04'	259°50'09"
C2	25.00'	34.83'	20.92'	32.08'	79°50'09"
C3	25.00'	39.27'	25.00'	35.36'	90°00'00"
C4	25.00'	39.27'	25.00'	35.36'	90°00'00"
C5	25.00'	35.41'	21.41'	32.52'	81°09'00"
C6	325.00'	157.70'	80.43'	156.16'	27°48'06"
C7	300.00'	74.67'	37.53'	74.47'	14°15'36"
C8	275.00'	110.92'	56.22'	110.17'	23°06'36"
C9	250.00'	100.84'	51.11'	100.15'	23°06'36"
C10	300.00'	63.03'	31.63'	62.91'	12°02'13"
C11	300.00'	206.33'	107.44'	202.29'	39°24'24"
C12	275.00'	357.71'	209.23'	333.02'	74°31'46"
C13	250.00'	252.32'	138.09'	241.75'	57°49'39"
C14	250.00'	72.87'	36.70'	72.62'	16°42'05"
C15	300.00'	120.87'	61.27'	120.06'	23°05'06"
C42	275.00'	160.55'	82.64'	158.28'	33°27'01"
C43	300.00'	158.91'	81.37'	157.06'	30°21'00"

LEGEND

SET 3 1/4" ALUMINUM CAP MONUMENT ON 2 1/2" X 30" ALUMINUM PIPE FLUSH WITH GROUND WITH CARSONITE MARKER WITNESS POST.

SET 2" ALUMINUM CAP ON 5/8" X 30" REBAR AT ALL LOT CORNERS

USKH LS-5082 1995

CERTIFICATE OF OWNERSHIP AND DEDICATION

ALAASUK INUPIAT TRIBE, HEREBY CERTIFIES THAT WE HOLD THE HEREIN SPECIFIED PROPERTY INTEREST IN THE PROPERTY DESCRIBED HEREON. WE HEREBY DEDICATE TO THE PUBLIC ALL AREAS DEPICTED FOR USE AS PUBLIC UTILITY EASEMENTS, STREETS, ALLEYS, THOROUGHFARES, PARKS, AND OTHER PUBLIC AREAS SHOWN HEREON. THERE SHALL BE RESERVED ADJACENT TO THE DEDICATED STREETS SHOWN HEREON, A SLOPE RESERVATION EASEMENT SUFFICIENT TO CONTAIN CUT AND FILL SLOPES OF 3 FEET HORIZONTAL FOR EACH 1 FOOT VERTICAL (3 TO 1) OF CUT OR FILL FOR THE PURPOSE OF PROVIDING AND MAINTAINING THE LATERAL SUPPORT OF THE CONSTRUCTED STREETS.

WE HEREBY AGREE TO THIS PLAT, AND TO ANY RESTRICTION OR CONVENANT APPEARING HEREON AND ANY SUCH RESTRICTION OR CONVENANT SHALL BE BINDING AND ENFORCEABLE AGAINST PRESENT AND SUCCESSIVE OWNERS OF THIS SUBDIVIDED PROPERTY.

Harvey Edwardson

OWNER – ALAASUK INUPIAT TRIBE

TAXATION CERTIFICATION

THIS PLAT NOT SUBJECT TO TAXATION AT TIME OF RECORDING.

NOTARY'S ACKNOWLEDGEMENT

SUBSCRIBED AND SWORN TO BEFORE ME THIS 7th DAY OF May, 1995. 1996

NOTARIZED SIGNATURE OF:

unknown — Virginia A. Bergman

MY COMMISSION EXPIRES: NOTARY FOR ALASKA

SURVEYOR'S CERTIFICATE

I, MONTE R. GONITZKE, PROFESSIONAL LAND SURVEYOR DO HEREBY CERTIFY THAT THE PLAT OF THE VILLAGE OF ALATNA IS A TRUE AND CORRECT REPRESENTATION OF LANDS ACTUALLY SURVEYED AND THAT THE DISTANCES AND BEARINGS ARE SHOWN CORRECTLY AND THAT ALL MONUMENTS SHOWN AND LOT CORNERS HAVE BEEN SET AND STAKED.

Monte R. Gonitzke — 11-22-95

MONTE R. GONITZKE, LS-5082 — DATE

STATE OF ALASKA — 5082 — Monte R. Gonitzke LS 5082 — 11-22-95 — REGISTERED PROFESSIONAL LAND SURVEYOR

PLAT APPROVAL

THIS PLAT HAS BEEN APPROVED BY THE ALLAKAKET CITY COUNCIL THIS 7 DAY OF May, 1995, AS RECORDED IN THE OFFICIAL MEETING MINUTES OF THE ALLAKAKET CITY COUNCIL.

V Agnes Bergman

MAYOR, CITY OF ALLAKAKET

ACCEPTANCE OF DEDICATION

_____ HEREBY ACCEPTS FOR PUBLIC USES AND FOR PUBLIC PURPOSES THE REAL PROPERTY DEDICATED ON THIS PLAT INCLUDING, BUT NOT LIMITED TO THE EASEMENTS, RIGHTS-OF-WAY, ALLEYS, ROADWAYS, THOROUGHFARES, AND PARKS SHOWN HEREON.

DATED AT _____, ALASKA

THIS _____ DAY OF _____, 1995.

ATTEST:

_____

AUTHORIZED OFFICIAL

CERTIFICATE OF APPROVAL by A.D.E.C.

WASTEWATER DISPOSAL: SOIL CONDITIONS, WATER TABLE LEVELS, AND SOILS SLOPES IN THIS SUBDIVISION HAVE BEEN FOUND SUITABLE FOR CONVENTIONAL ONSITE WASTEWATER TREATMENT AND DISPOSAL SYSTEMS SERVING SINGLE-FAMILY OR DUPLEX RESIDENCES AND MEETING THE REGULATORY REQUIREMENTS OF THE ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION EXCEPT TRACTS D & E. ANY OTHER TYPE OF WASTEWATER TREATMENT AND DISPOSAL SYSTEM MUST BE APPROVED BY THE ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION.

INSTALLATION OF ANY WASTEWATER TREATMENT SYSTEM MAY RESULT IN THAW CONSOLIDATION OF DEEP PERMAFROST WITH THE RESULTING POTENTIAL TO NEGATIVELY AFFECT BUILDING AND OTHER STRUCTURAL FOUNDATIONS ABOVE THE PERMAFROST. THE DESIGN AND CONSTRUCTION OF ANY WASTEWATER SYSTEM WITHIN OR ADJACENT TO THE SUBDIVISION SHOULD INCLUDE CONSIDERATION OF THIS POTENTIAL EFFECT.

SUBJECT TO ANY NOTED RESTRICTIONS, THE ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION APPROVES THIS SUBDIVISION FOR PLATTING.

Environmental Engr. Assist. 11/30/95

DATE

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
APPROVING OFFICIAL

PLAT OF THE

VILLAGE OF ALATNA

LOCATED WITHIN FAIRBANKS RECORDING DISTRICT
PROTRACTED SEC. 15, 16, 21, & 22 T.20N., R.24W., F.M., ALASKA
CONTAINING 86.20 ACRES more or less

USKH — Architecture • Engineering • Land Surveying • Planning — Anchorage, Fairbanks, Palmer, Juneau

SCALE: 1"=100'	DRAWN: SMT	DATE DRAWN: 10/95	SHEET 1 OF 2
GRID:	CHECKED: MRG	W.O. 46393.9	
FB: 299	DATE SURVEYED:	DWG. FILE: PLAT1OF2	

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Appendix D – Aircraft Information

For the purpose of this feasibility study, all project equipment should fit within a Shorts 330 Sherpa, with a maximum cargo length of 29', width of 75", and height of 76". Ravn Alaska charters the Sherpa to Allakaket for an estimated $6,315 with a 4,800 lb. maximum payload. Up to 5,400 lbs. can be accommodated for an additional cost.

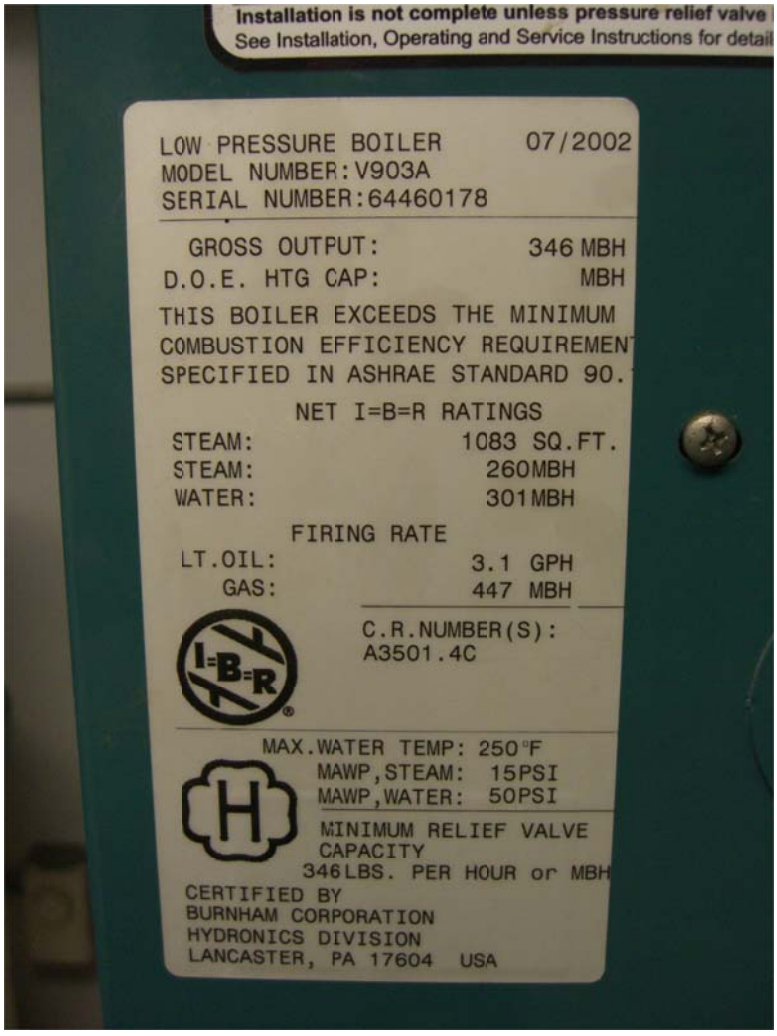
No cordwood boilers larger than 180,000 btu were identified that would be able to fit into a Shorts 330 Sherpa, McDonnell Douglas DC 6, or Casa 212. No other aircraft that could potentially accommodate the project equipment and land at the Allakaket Airport were identified.

Appendix E

ENERGY ACTION

ENERGY ACTION

ENERGY ACTION



ENERGY ACTION

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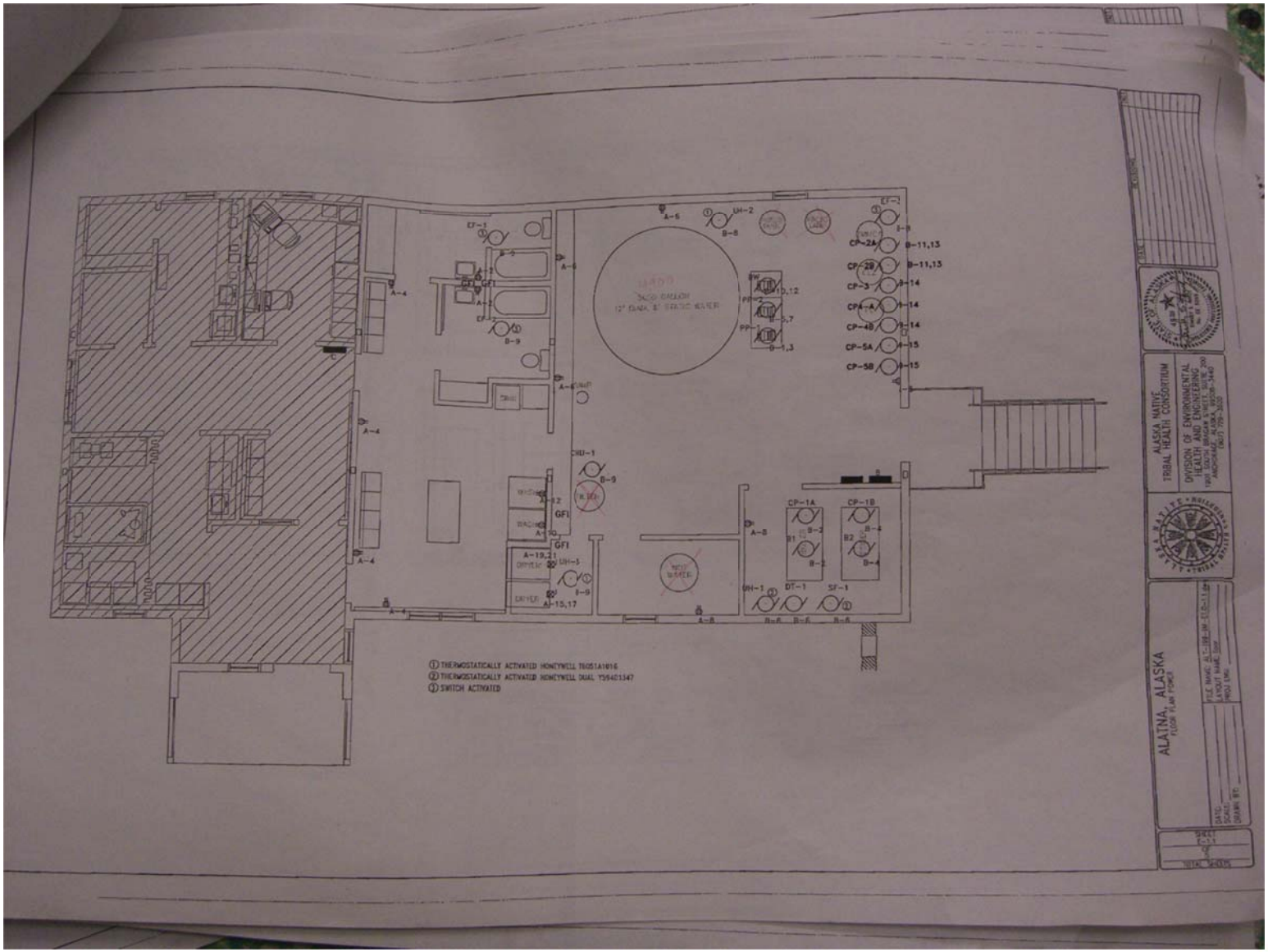

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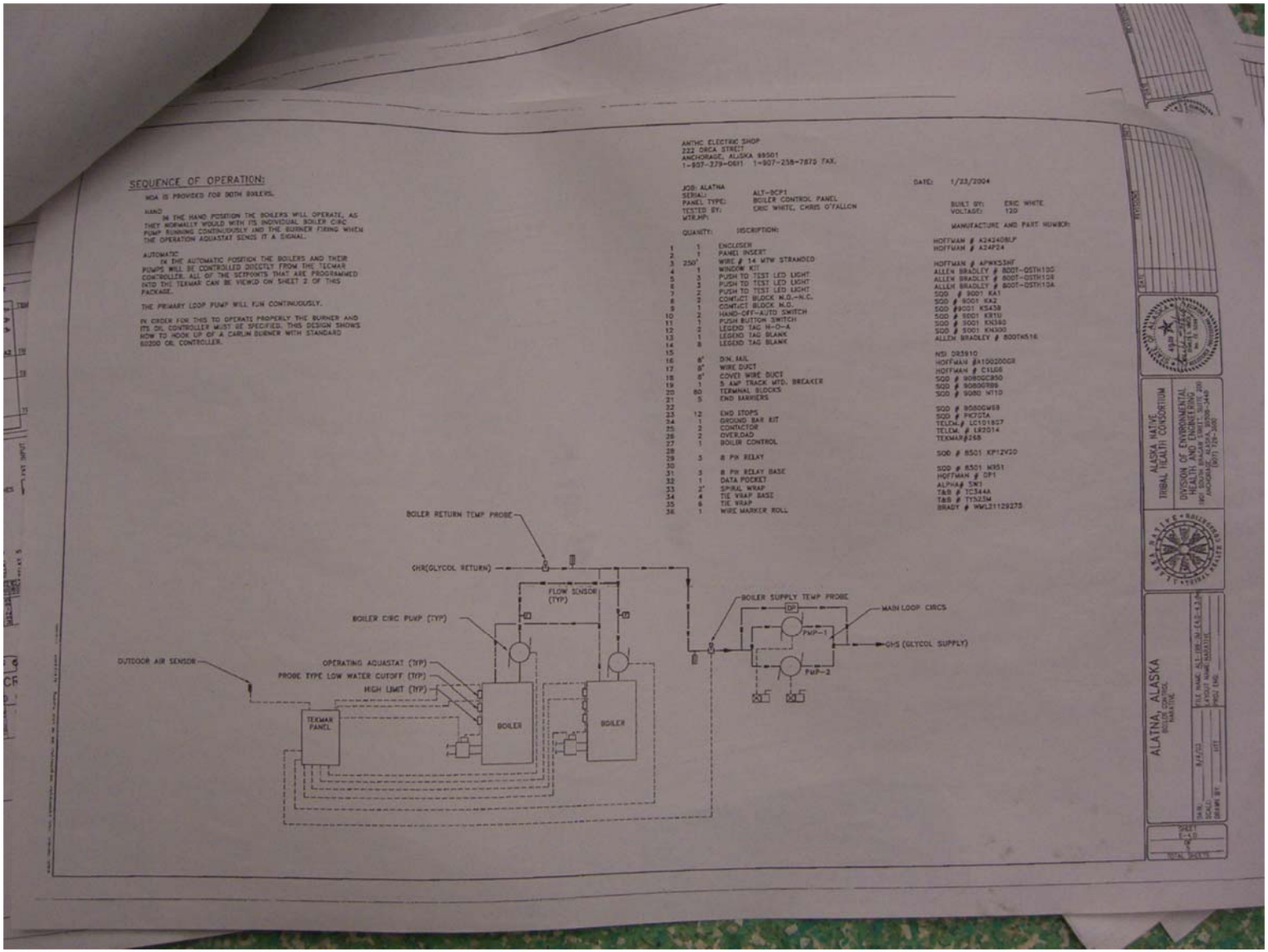

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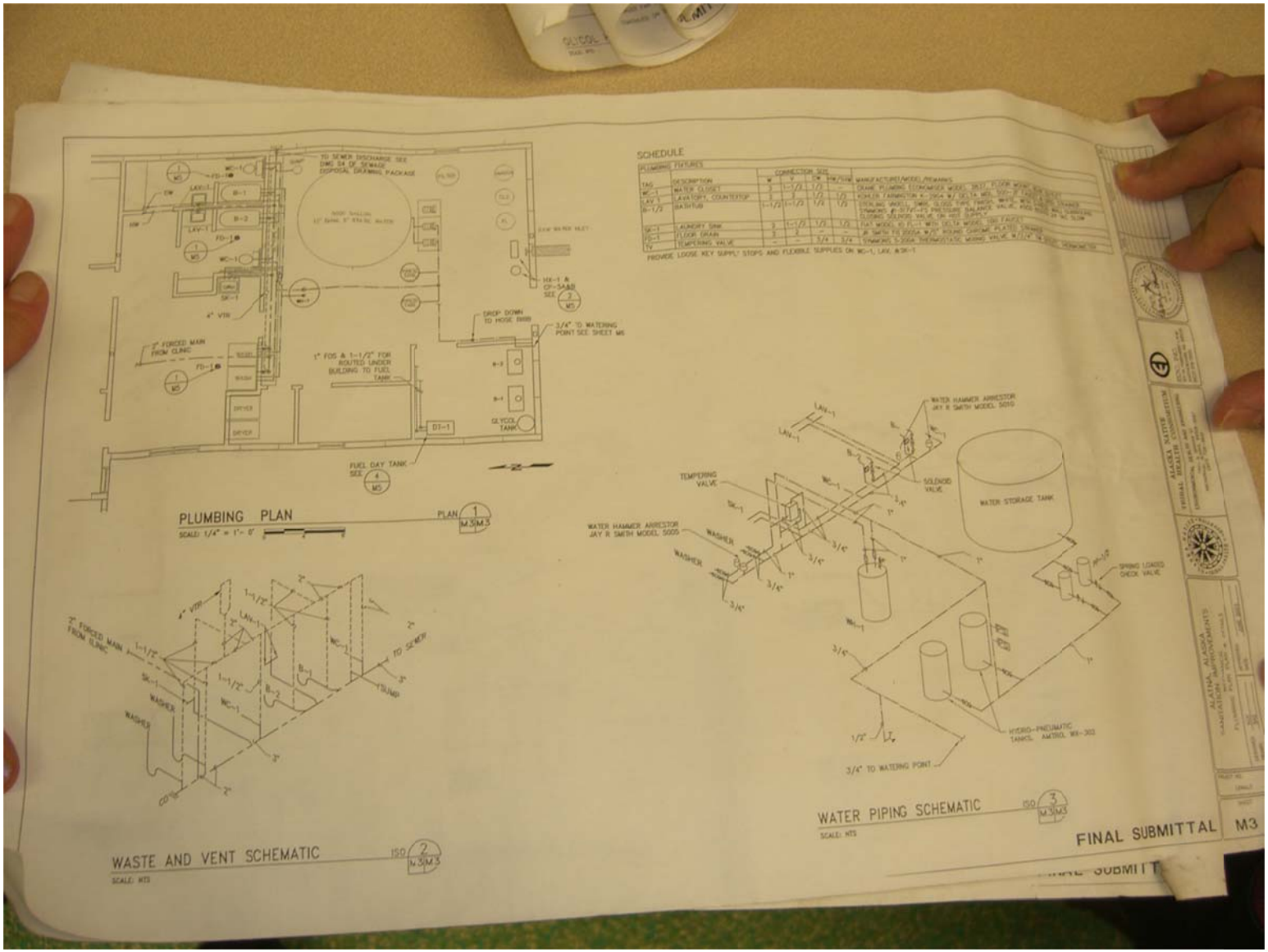

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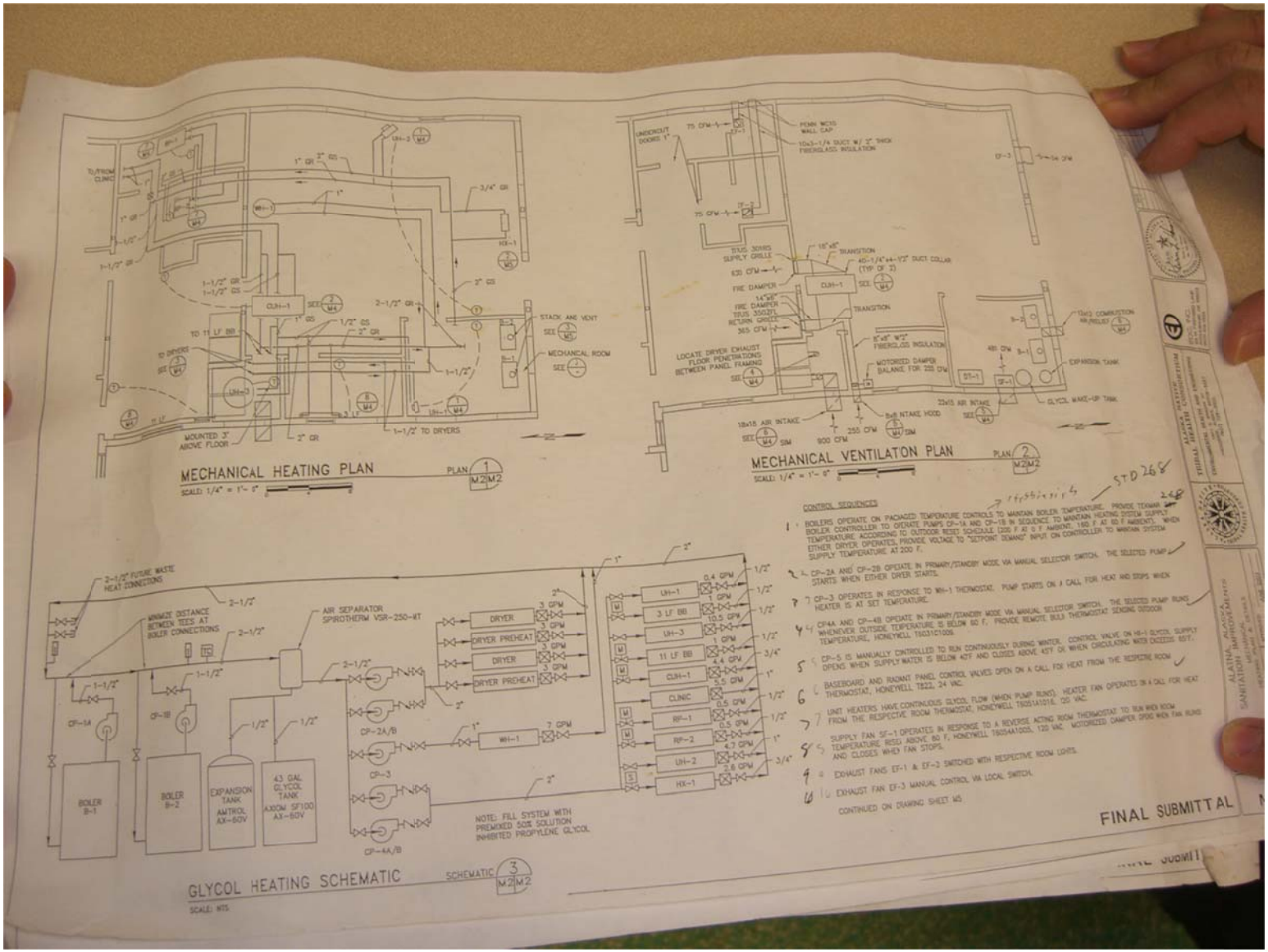

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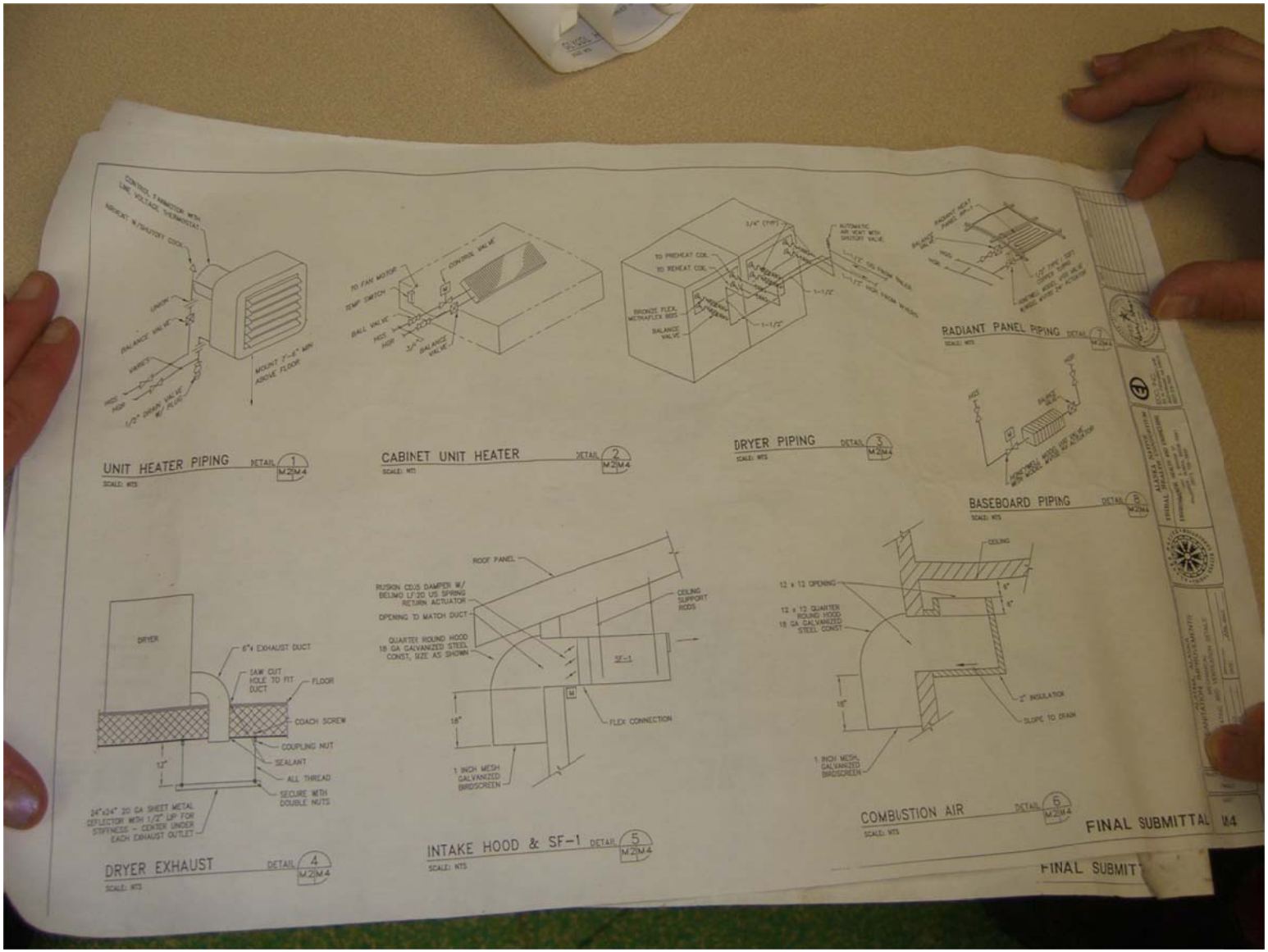

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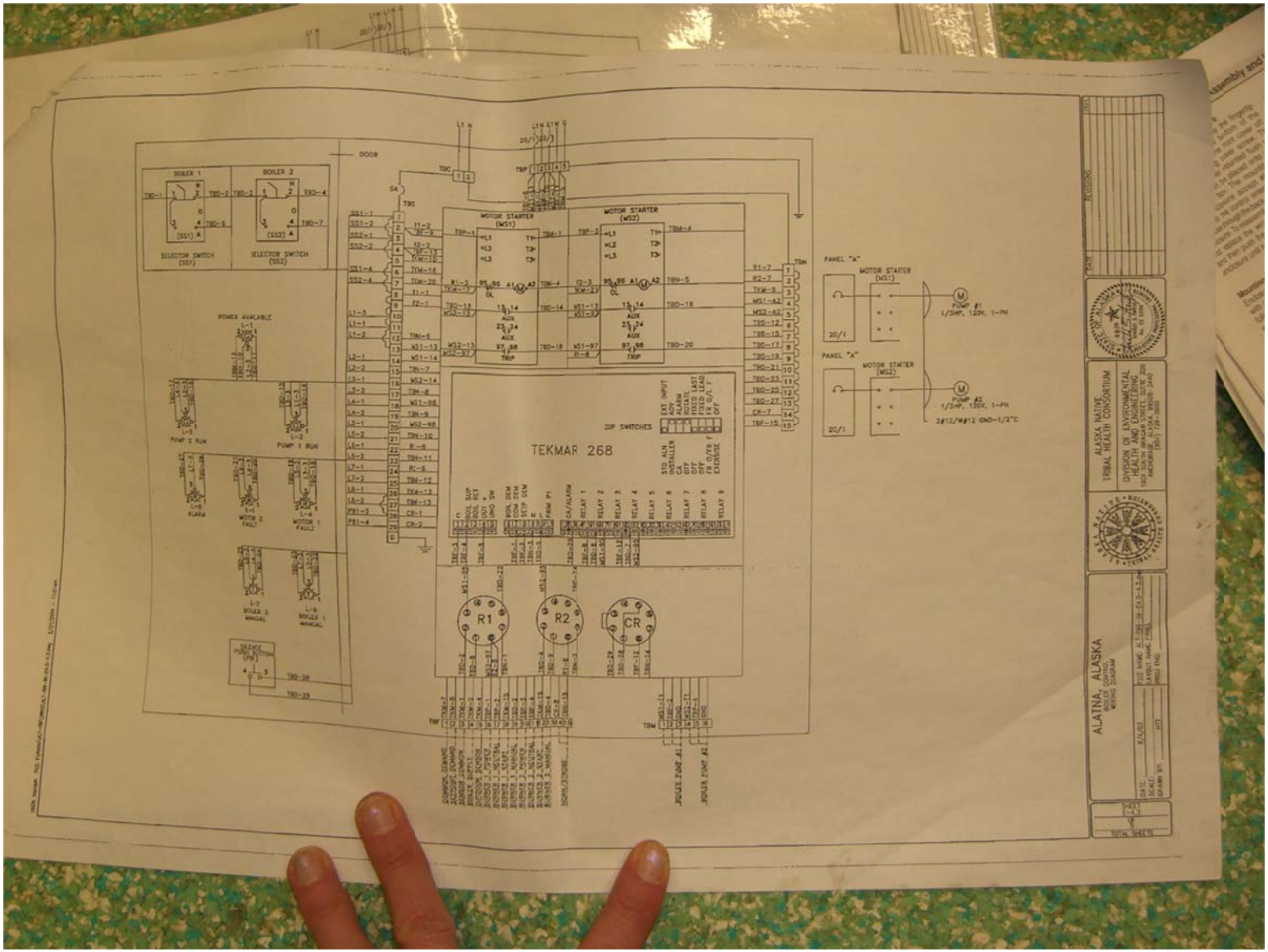

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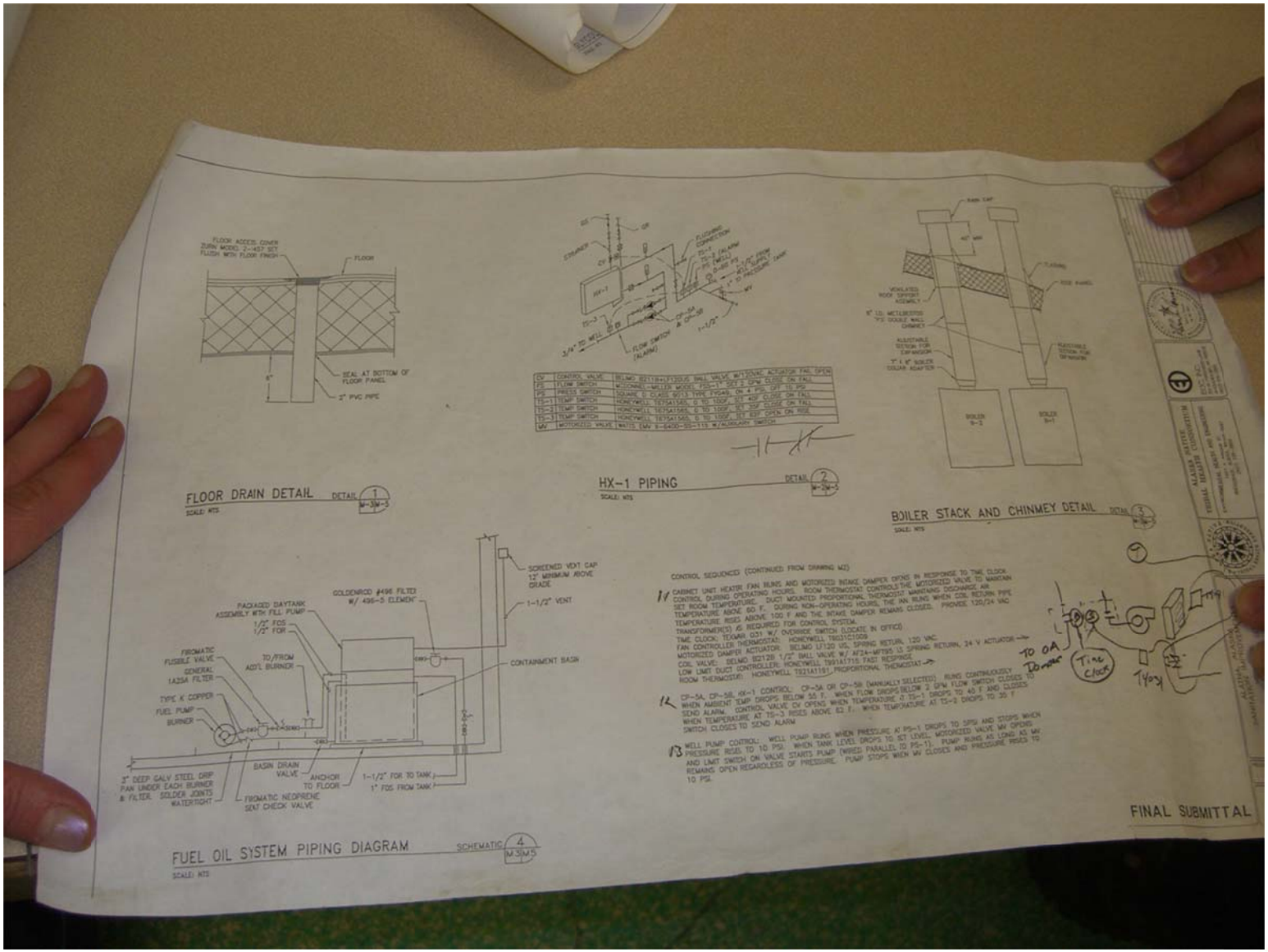

ENERGY ACTION