

SDSU proposal for Eddy Covariance tower and other instruments and the power supply system in Ivotuk

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Ivotuk Flux Tower Instrumental Description

The primary flux tower is a triangular lattice approximately 4 m tall (approximate 30 cm wide). The instrumentation on the flux tower includes a 3D ultra-sonic heated anemometer (Metek BmbH), a CO₂/H₂O gas analyzer (LICOR Biosciences), and a CH₄ gas analyzer (LICOR Biosciences). Associated meteorological instrumentation on the primary tower includes sensors for air temperature and relative humidity (Vaisala), and a wind vane and 1D anemometer (R.M. Young). Two shorter, secondary mounting poles on tripods (approximately 2 m tall) include sensors for incoming and outgoing long-wave and shortwave radiation (Campbell Scientific, Kipp and Zonen), incoming and outgoing photosynthetic photon flux density (LICOR Biosciences), snow depth (Campbell Scientific), and surface temperature (Apogee). All instrumentation are controlled and data are collected using Campbell Scientific and LICOR Biosciences dataloggers. Under project location, the area that we are looking to have permitted and where all our equipment would be is approximately 1.8 acres. The system will be established 500 ft away from the calculated ASRC property line to ensure it does not encroach on ASRC land. All instrumentation except for the wind turbine is already permitted under LAS 31276. We have had no objection from the Division of Oil and Gas, the State Historic Preservation Office, the Department of Environmental Conservation, and the Department of Fish and Game. No public comments were received.

To understand the processes controlling CO₂ and CH₄ emissions during different seasons, we will also initiate measurements of subsurface CO₂ and CH₄ along with soil diffusivity to track the diffusive flux component of the net ecosystem exchange in Ivotuk. The diffusivity system (Fig. 2) will contain water impermeable/gas permeable membrana tubing at varying depths in the soil, an AlphaGuard radon monitoring system, and a Los Gatos Research (LGR) Ultraportable Greenhouse Gas Analyzer contained in a housing unit (Fig. 1).

Ivotuk Power System

Electrical Loads – Based on the electrical loads that have been quantified and those that are known but not quantified, we have based the system on the equivalent to a 250 watt continuous load.

Given the year round operation, we will need a base power system. The base system consists of a generator, battery bank, and inverter. The generator is on autostart. When the battery voltage drops to a preset voltage, the Espar heater ignites and pre-heats the generator block. The generator will then start and recharge the battery bank while powering the equipment directly. This allows the generator to operate at close to maximum capacity when running, dramatically reducing the amount of generator run time. The inverter- charger is over-sized for the electrical load to provide adequate battery charging capacity. The battery bank is sized for 10 days of unassisted operation to a 35% depth of discharge. This configuration should last 10 years without need of replacement.

We have also done a rough analysis of solar potential and included a solar array and wind turbine system as separate line. This would use expanded solar and wind systems. While the generator system is still in place as a fail-safe, the expanded battery, solar, and wind systems provide sufficient redundancies that, under typical conditions, they will render the generator operation unnecessary. Additionally the Metek heated anemometer (Fig. 4), required for year-round data collection in this type of environment due to icing of instrumentation affecting the validity of the data collected, requires more power than nonheated variants (Fig. 5), outlining the need for the wind turbine system. The system will be programmed for a bi-weekly generator exercise cycle that will confirm

generator readiness. Since the generator is the most prone to problems, this combination improves the reliability of the system substantially.

The base system would consist of the following components: Shelter

- 6 ft x 20 ft insulated shelter mfgd by CAC Plastics in Anchorage, complete with insulated door, and lighting. Skid mounted.
- Thermostatically controlled environmental system consisting of Trolec insulated dampers, snow hoods, and Belimo actuators.

Generator

- 6 kW Tier 4 Northern Lights diesel-fired generator
- Espar engine coolant preheat
- Dynagen TG410 autostart with Netbiter communication
- 300-500 gal double-walled fuel tank, skid mounted

Battery bank

- 48VDC (nominal) 3645 AH Concorde Sun Xtender non-spillable batteries
- Cabling and rack

Inverter-Charger

- 865-4048 Schneider 120/240VAC, 4000 w inverter-charger
- XW-SCP Inverter control panel
- XW-AGS Inverter autostart module
- 865-1016 Inverter DC panel
- 865-1017 Inverter AC panel
- 865-1058 Inverter Communication box

Solar Array

We sized the solar array for optimal efficiency. The average solar insolation during the peak summer months is

4.5 sun-hours/day. Based on a 6000 watt-hour daily load (250 watts x 24 hr), and adjusting for 15% system losses, a 1500 watt array is required for system balance.

The solar capacity has been doubled in the form of a completely redundant system. This will allow greater power production in the shoulder months and the additional reliability of the redundancy.

Components

- 12 ea 250 watt solar panel
- 2 ea Ground-mounted array frame
- 2 ea XW-MPPT60 charge controller
- 2 ea Wiring

The estimated average daily insolation is 3.0 sun-hours so the expanded system is capable of producing up to 2848 kWh. While there will be excess capacity during summer days where the irradiance exceeds 500 watts/sq meter, the increased capacity will dramatically reduce the incidence of short term power deficits. Also, the solar will be able to support the system down to 2 sun-hours/day, or the period from February through October, adding three months to the balanced period.

Wind Turbine System

The system will use the Bergey Excel 10 kW turbine. We have found in other remote sites with low average wind speeds that, while the Bergey turbine has substantial excess in full wind conditions, these conditions seldom exist in these sites. And when they do, they are short in duration. In the

wind speeds normally encountered, the Bergey turbine power production is well suited. The Bergey regulation system ideal for situations such as this where there will be periods of time that the turbine is in regulation. Instead of the traditional power diversion system, that, can itself present problems (particularly if used excessively), the Bergey control regulates turbine power output by shifting the sine wave. This is a much simpler and more reliable regulation system. Includes 60 ft tilt-up lattice tower, electrical, and anchors. We have taken feedback into consideration from ADOT&PF Aviation Design regarding height restrictions on infrastructure adjacent to airstrips for the location of the tower. $(60' \times 7) + 125' = 545'$ to $(60' \times 7) + 250' = 670'$; therefore, 545' would be the absolute minimum from the runway to place a 60' object.

Installation:

- Transportation of tools, materials and technicians to site for installation of the power system and to furnish, install Hughes Net system was done by hand/foot and used helicopter to sling the power building from the runway to tundra (in October 2016). The Hughes Net system anticipates their standard configuration with the following capacities: Upload 250 KB/sec; Download 1500 KB/sec Data limit 350 MB daily.

Work Plan

Ideally, the installation would occur prior to thawing of the active layer as that will minimize the disturbance to the tundra from the installation. A snow road would be constructed to support the Boxer for transport of the materials from the air strip to the site. If the installation occurs after the ground thaws, planking will be used to construct a temporary walkway for transport of materials. Materials will be flown in and staged on the Ivotuk air strip. They will be transported to the site with the Boxer (see attached data sheet). The auger head attachment for the Boxer will be used to set the tower base plate rods and the three guy anchors. The tower and turbine will be assembled, raised into position, and guyed. An armor jacketed electrical cable on the tundra will be used to electrically connect the wind turbine to the existing power building. If planking is used for the temporary walkway, that will be removed. Any remaining construction materials and the installation equipment will be removed and flown back to Fairbanks. The entire installation process should take one week.

Impact on the environment

If the installation can be accomplished in the spring prior to the thaw, the impact to the surrounding area will be negligible. The frozen ground and snow layer will protect the tundra from the installation activities. If installed after the thaw, there will be some disturbance to the tundra from the Boxer at the turbine site as it assists with the tower and turbine assembly.

The tower base rods and guy anchors will have negligible impact on the tundra.

Removal of instrumentation

Upon completion of the permitted activities at Ivotuk, SDSU will be responsible for removing all instrumentation and tower infrastructure. All sensors will be packed on site, and the tower itself removed along with all anchor wires, to ship back to San Diego beginning with a chartered flight from Ivotuk to Fairbanks. The decommissioning of the flux tower may take several days with two people, given the number of instruments, cables, delicate wiring that needs to be carefully packed, and hardware associated with the tower infrastructure.

Given that the science being conducted at Ivotuk hinges on the ability to monitor the behavior of undisturbed tundra, we will endeavor to minimize adverse impacts throughout the duration of the project by limiting personnel visits, and foot traffic between the power shed and the flux tower site. However, some damage to the tundra resulting from foot traffic between the power shed and the tower site, as well as in the immediate vicinity of the tower, will be unavoidable. SDSU will assume responsibility for rehabilitation of damaged tundra at the site as well as the power shed location. In order to restore damaged sites with respect to thermal and hydrological regimes, and with permission and consultation from the State of Alaska, we will apply fertilizer and potentially new seed according to guidelines set forth by the North Slope Science Initiative (northslope.org). For example, likely fertilizer application will involve NPK 20-20-10 applied at 100-200 lbs/acre, to facilitate new shoots and germination of neighboring healthy individuals. Much work has been conducted to determine the effects and the best approach for tundra ecosystem rehabilitation and

restoration following various disturbances (Forbes and Jefferies, 1999) such as ice road traffic (Adam and Hernandez, 1977) and oil and gas exploration (McKendrick, 1997; Khitun, 1997). We expect the damage incurred by our research activities to be substantially less severe than such activities and as such, we intend to avoid any permanent damage to the tundra at Ivotuk resulting from this project.

References

Forbes, B.C., Jefferies, R.L., 1999. Revegetation of disturbed arctic sites: constraints and applications. *Biological Conservation*, 88: 15-24.

Adam, K.M., Hernandez, H., 1977. Snow and ice roads: Ability to support traffic and effects on vegetation. *Arctic*, 30: 13-27.

Khitun, O., 1997. Self-recovery after technogenic and natural disturbances in the Central of the Yamal Peninsula (Western Siberian Arctic). In: Crawford, R.M.M. (Ed.), pp. 531-562.

McKendrick, J.D., 1997. Long-term recovery in northern Alaska. In: Crawford, R.M.M. (Ed.), *Disturbance and recovery in Arctic lands: an Ecological perspective*. Kluwer Academic, Dordrecht, The Netherlands, pp. 503-518.

Soil Diffusivity System

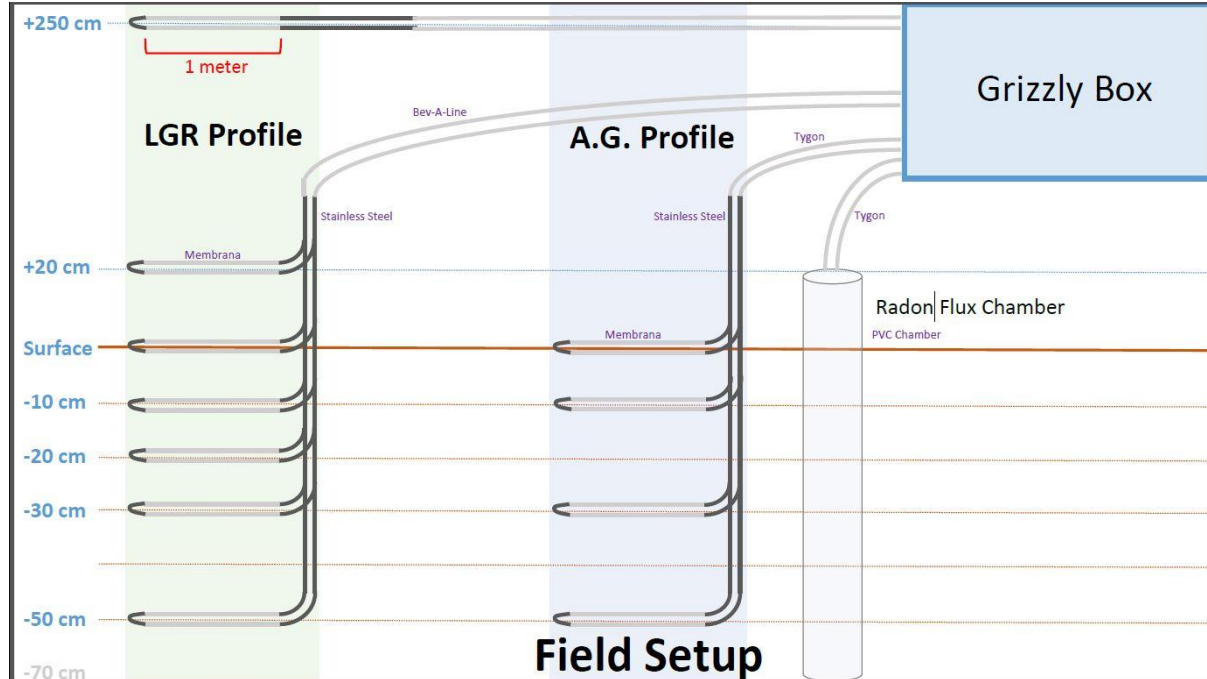


Fig. 1: Field Setup of Diffusivity System

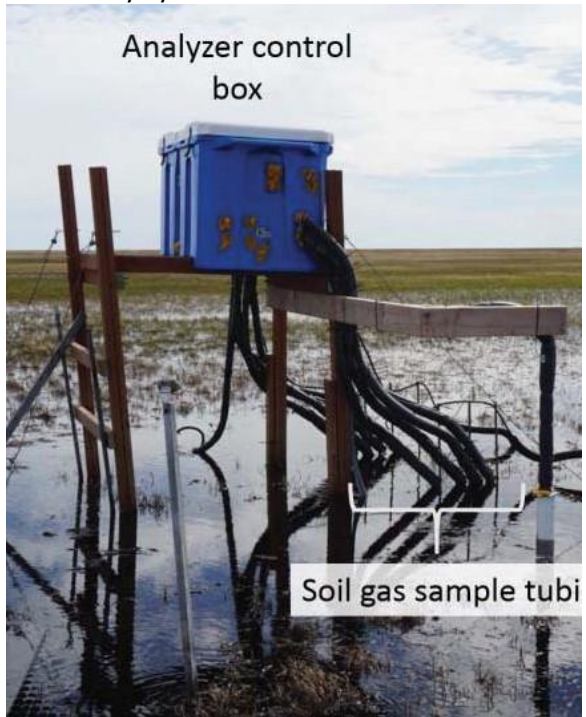


Fig. 2: Established Diffusivity Systems in Barrow, Alaska

Wind Turbine System

Testimonials.

"I installed my Bergey 10 kW in 2001. I haven't paid an electric bill since and the turbine has paid for itself. It's the best investment I ever made." **G. Sansone, Oak Hills, CA**

"I replaced a broken Whirlwind Power turbine with a Bergey 10 kW in 1988. I should have bought the Bergey in the first place." **R. Boki, Phillipsburg KS**

"My first Bergey 10 kW installation has operated for over 26 years with insignificant maintenance costs and has had a 100% availability factor. It couldn't be more reliable." **S. Chase, Shokan NY**

"I made a big mistake when I used a Chinese turbine with an American sounding name. It just didn't hold up. What a difference in the Bergey equipment." **S. Jackson, Chico, CA**

Specifications.

- Reference Rated Power: 10 kW
- AWEA Rated Power: 8.9 kW at 25 mph
- AWEA Rated Annual Energy: 13,800 kWh at 11 mph average
- AWEA Rated Sound Level: 42.9 dBA
- Cut-in Wind Speed: 5 mph
- Cut-out Wind Speed: none
- Peak Power: 12.6 kW at 28 mph
- Max. Design Wind Speed: 134 mph
- Design Operating Life: 30-50 years.
- Turbine Rotor Diameter: 23 ft



Why buy a small wind system?

A Bergey wind turbine is a smart investment that will lower your monthly expenses, increase your net worth, and help support American manufacturing jobs. At the same time it will help clean the air, slow climate change, and move us towards energy independence.

You will also enjoy watching your utility meter turn backwards and the lively interaction between the wind and your Bergey turbine. Finally, it will totally change your view of wind - you will start appreciating windy days.

For those fortunate enough to have a windy site of at least one acre, a Bergey wind system will be substantially less expensive than a comparable solar system, it will take up less space, and its performance won't degrade over time.

It's like buying vs. renting a home.

Over the next 10 years a typical homeowner or small business will pay \$18,000 to over \$50,000 in electric bills, at rates that often increase faster than inflation. When you choose a Bergey wind system you take the same monthly expense and invest it in a tangible asset. Once your Bergey turbine is paid off, you will enjoy more money in your pocket every month for the next 20 - 40 years.

A Bergey wind turbine is an excellent investment. It will typically provide a rate of return of 6% - 25%, much better than traditional investments.

Tax credits and rebates make it affordable.

Small wind turbines qualify for a 30% federal tax credit and, for businesses, accelerated depreciation. USDA grants are available for farmers, ranchers, and rural businesses. Many states offer additional incentives (see www.dsireusa.org). These incentives make owning a Bergey wind turbine surprisingly affordable.



Buying a Bergey turbine.

The best candidates for a Bergey 10 kW wind turbine are those with a residential or commercial property of at least 1 acre, an electric bill averaging over \$150 per month, and a wind resource of at least 10 mph. Each project is a little different so a site survey and quotation are necessary. The typical steps in buying a Bergey wind turbine are:

1. Contact a local Bergey dealer. For assistance, see the Dealer Lists page at www.bergey.com.
2. Purchase a site survey from the dealer. Following the survey you will receive a quotation and a projection of performance and payback.
3. Purchase the system. Your Bergey dealer will apply for the necessary permits and available rebates, contact your utility company, get your Bergey wind equipment shipped, and provide you with a preliminary schedule for the work at your home or business.
4. Once the permits and equipment are in hand, your Bergey dealer will schedule your installation. This will involve several visits for foundations, wiring, and turbine installation.

Typically, getting the permits to install the 80 - 140 ft towers we recommend is the biggest obstacle you and your BWC dealer will face. Few cities or counties have ordinances that favor small wind turbines.

For information on the permitting issues we recommend the DWEA ordinance guide at: distributedwind.org/zoning-resource-center

You will also find additional information at: www.bergey.com

ABS Alaskan, Inc
Fairbanks 907-452-2002
toll free 800-235-0689
Anchorage 907-562-4949

Why a Bergey wind turbine?

Bergey Windpower is the oldest and most experienced manufacturer of residential-sized wind turbines in the world. Thirty years ago Bergey pioneered the radically-simple "Bergey design" that has proven to provide the best reliability, performance, service life, and value of all of the hundreds of competitive products that have come and gone in that time. With only three moving parts and no scheduled maintenance necessary, the Bergey 10 kW has compiled a service record that no other wind turbine can match. We back it up with the longest warranty in the industry.

There are now many new small wind products on the market. Though sometimes heavily promoted, these new entrants lack the track record that provides confidence as a sound investment. Over the years Bergey wind turbines have often replaced unsuccessful competitive products. The bottom line is that wind turbines are a big investment, and Bergey is the wise choice.

Bergey turbines are simple, but they also incorporate sophisticated technology that has been refined over more than a quarter-century. From its custom airfoil to its "super magnet" low speed alternator to its custom inverter, there's no more advanced technology in the industry. The result is exceptional low wind speed performance, robust storm protection, and almost silent operation.

Finally, Bergey offers more tower options than any other small turbine manufacturer. We have Guyed-Lattice, Self-Supporting Lattice, Tubular Self-Supporting, and Guyed Tilt-up Lattice towers in heights from 60 ft to 160 ft.



Power your dream
with the wind
EXCEL 10



ABS Alaskan, Inc
BERGEY
WINDPOWER
www.bergey.com

Bergeys are built on strong basics:

- 1-2-3 Simplicity:**
The only moving parts are the parts you see moving.
- Reliability:**
Developed in "Tornado Alley", proven in critical military applications, and backed by our exclusive 10-year warranty.
- Performance:**
Low start-up (5 mph), continuous operation in high winds, and extremely quiet.

Our advanced technology makes it happen!

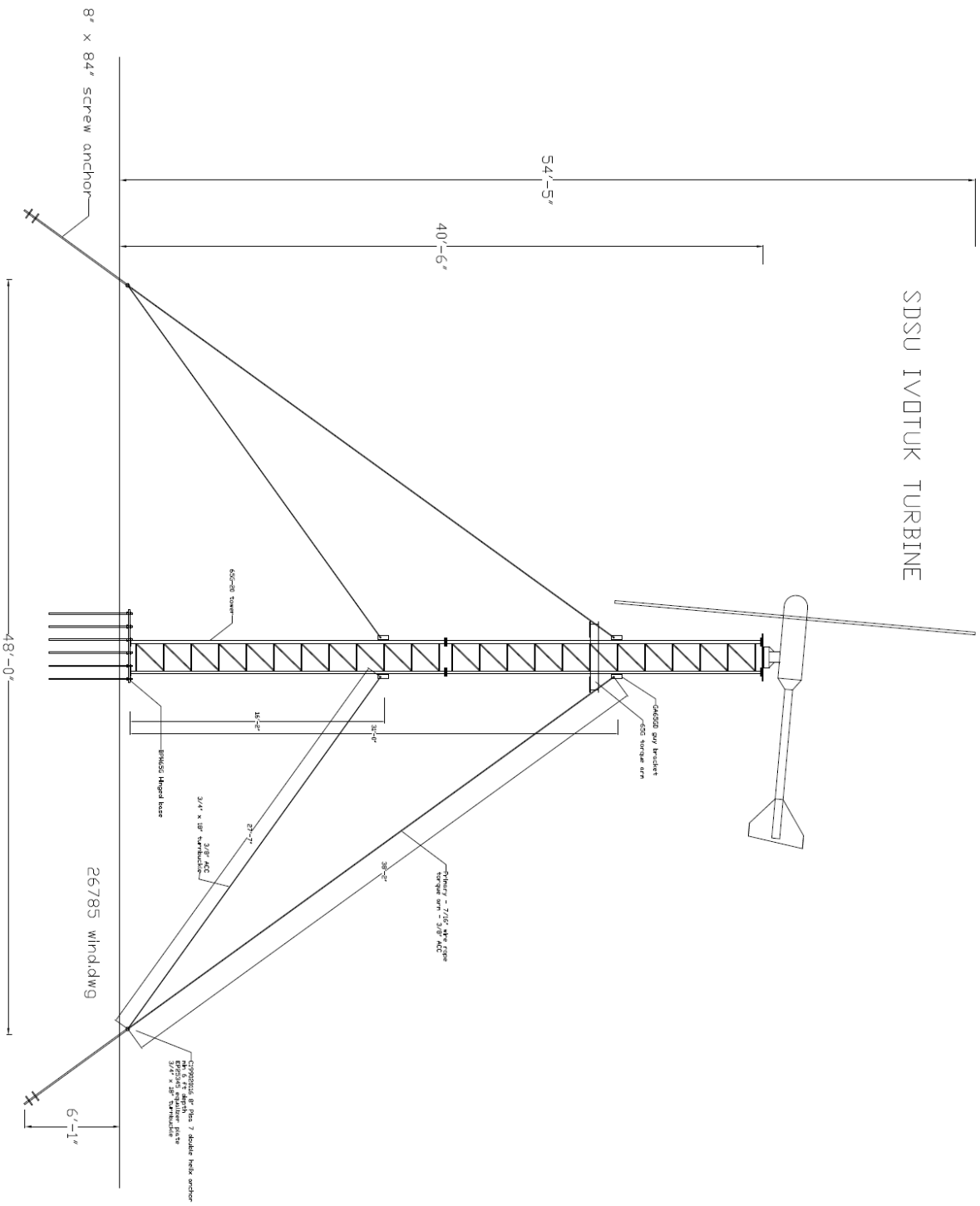
- PowerFlex Blades**
Our exclusive "full length reinforcement" fiberglass blades are stronger than steel and the strongest in the industry.
- BW-7 Airfoil**
Our custom designed airfoil (blade shape) is quieter and more efficient than the "catalog airfoils" others use.
- Neo-10 Alternator**
Our custom designed very-low-speed "super magnet" alternator also serves as the blade mounting hub, integrating what are typically two separate assemblies.
- AutoFurl Storm Protection**
Our uniquely simple passive, fully automatic, high wind protection is hurricane proven.
- Powersync II Inverter**
Our custom designed third-generation power converter is UL-certified and extremely rugged.



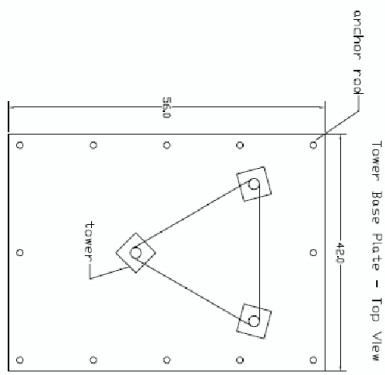
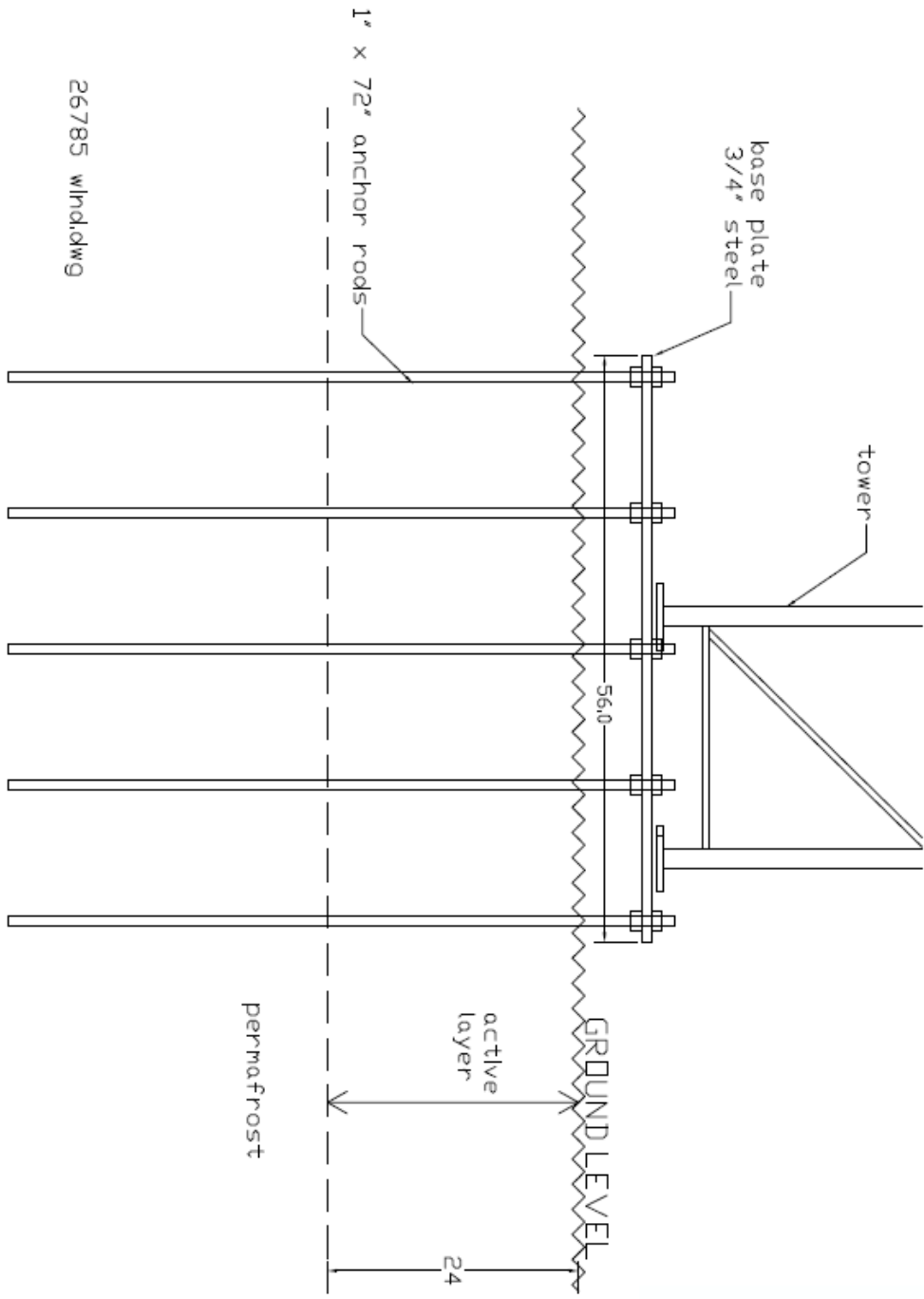
Certified to be in Conformance with:
AWEA Standard 9.1 - 2009

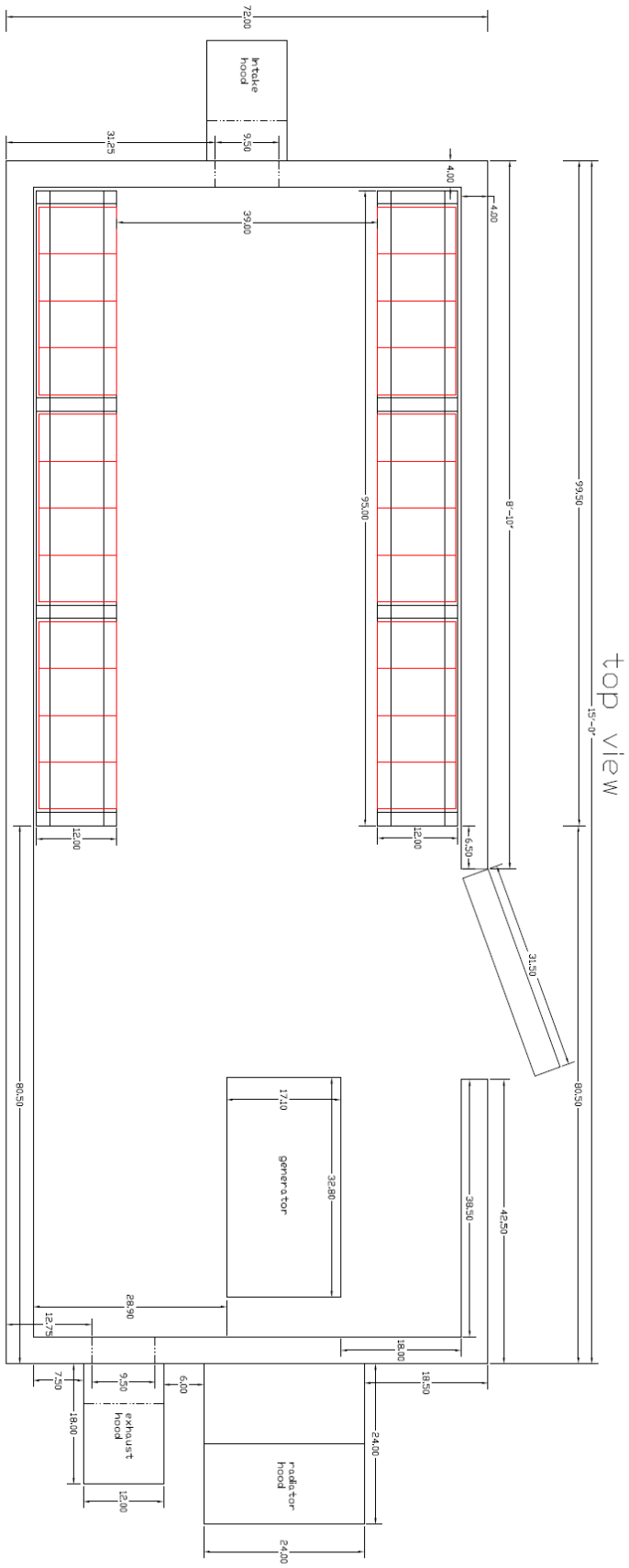
For a summary report and SWCC Certificate visit:
www.smallwindcertification.org

SDSU IVOTUK TURBINE

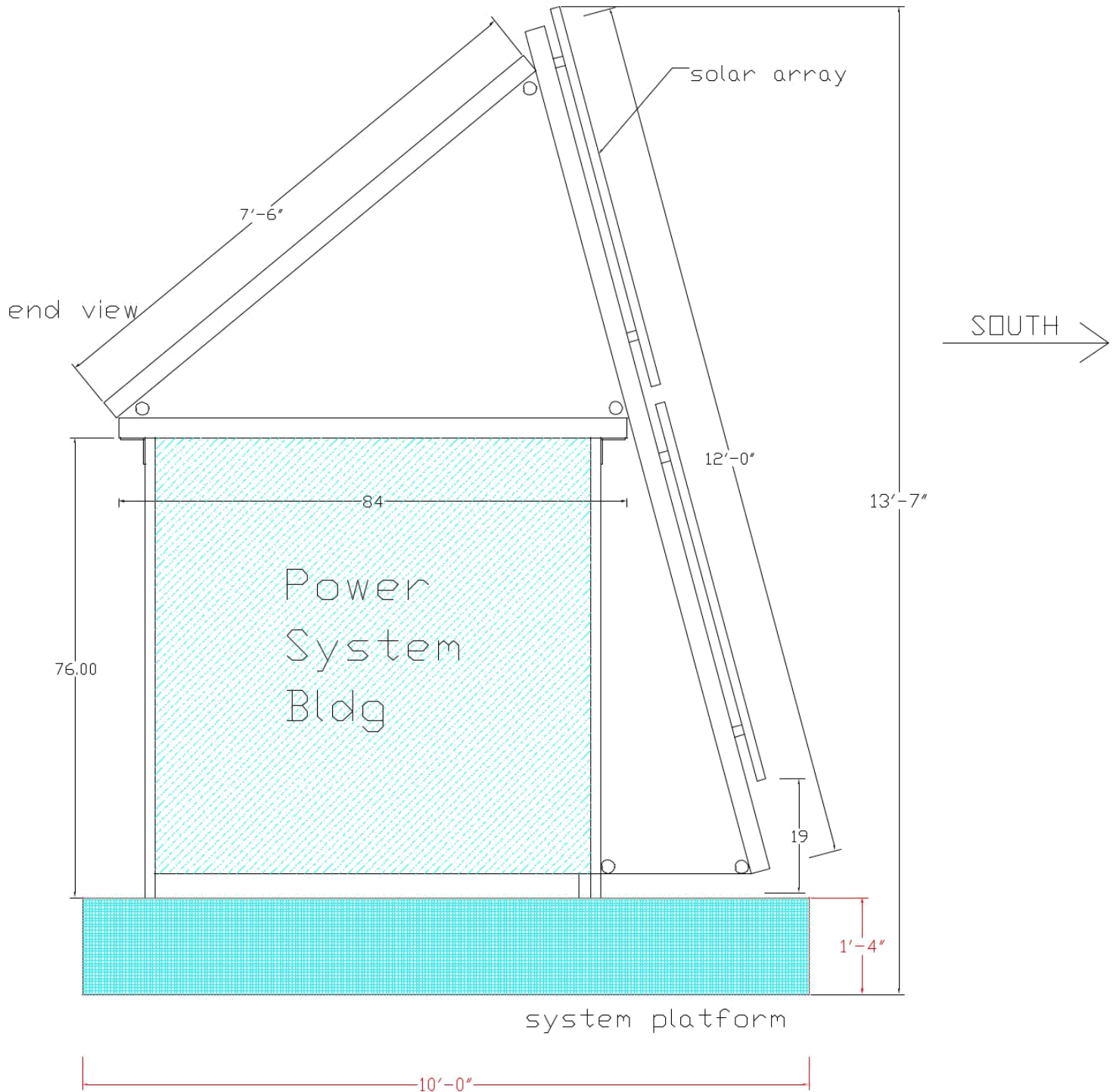


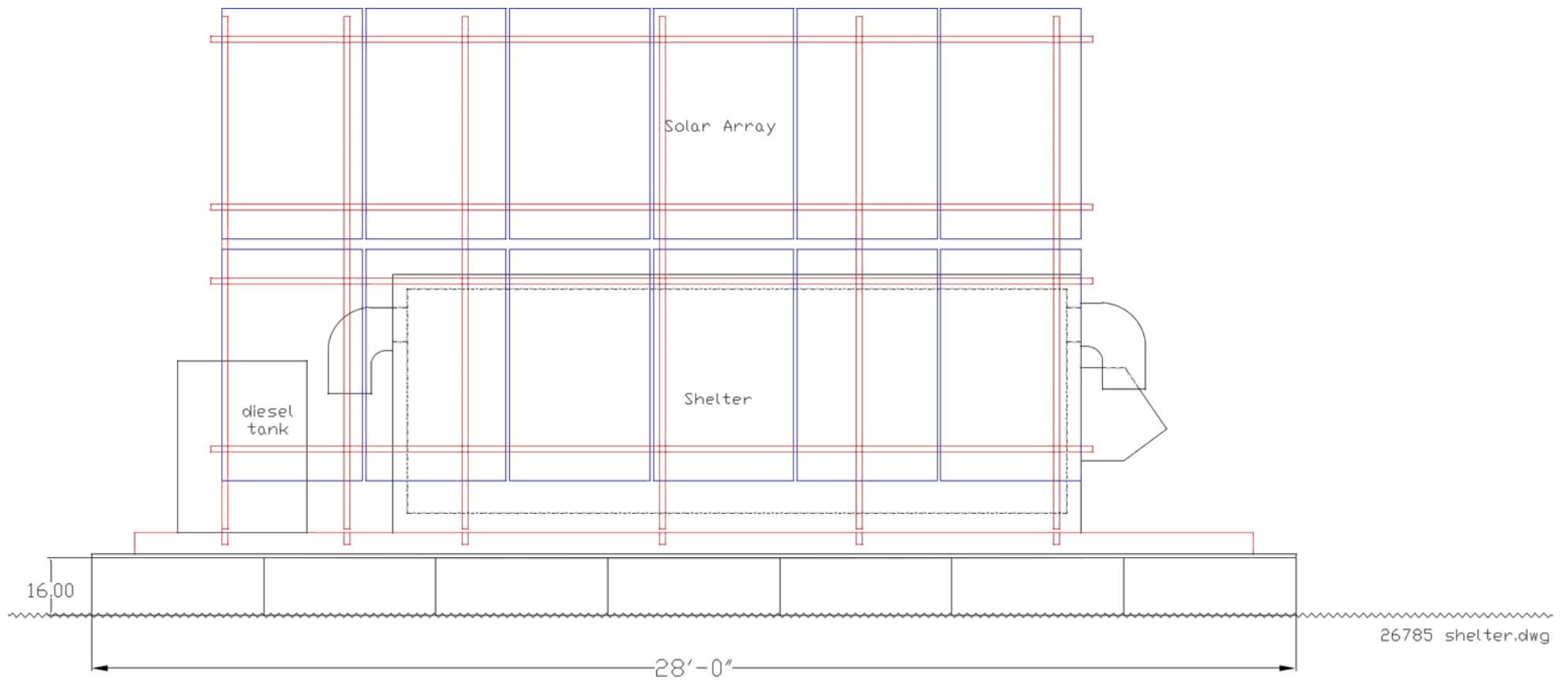
IVOTUK WIND TURBINE
BASE DETAIL



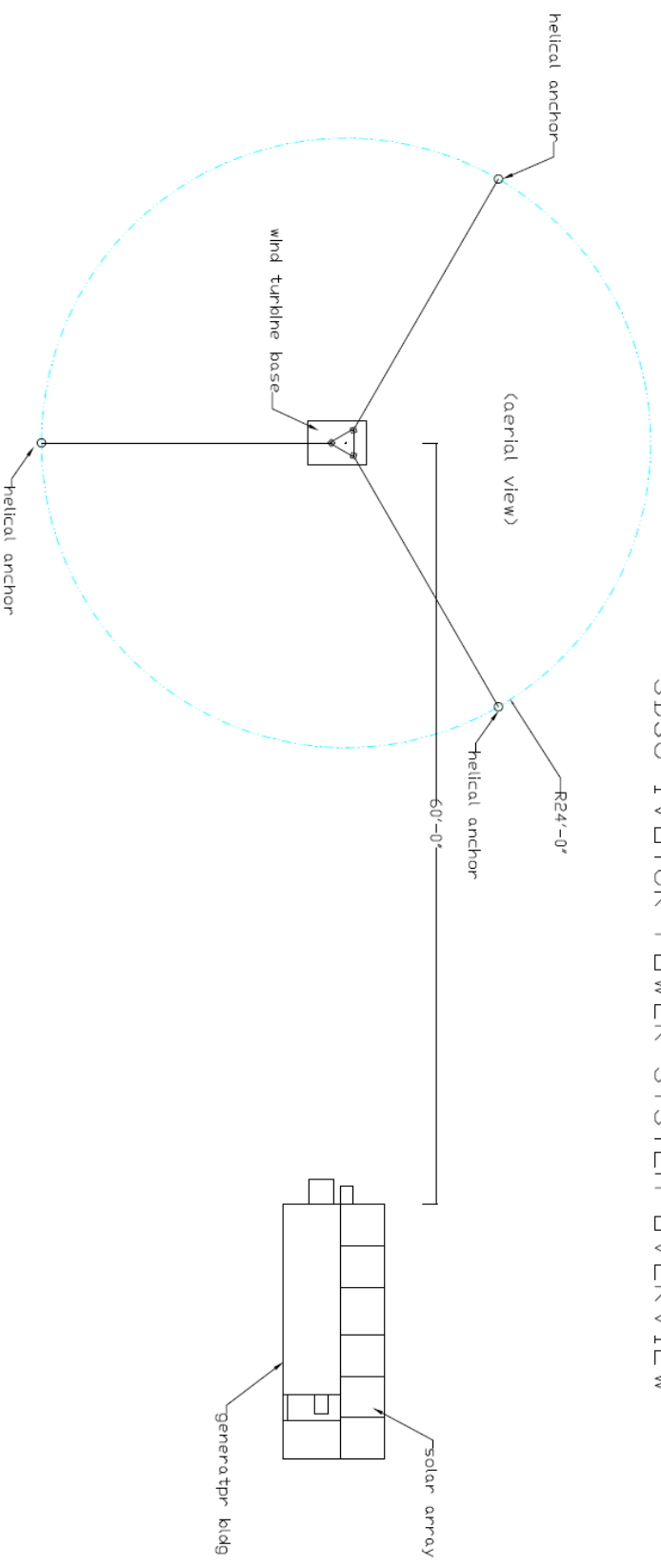


Power System





SDSU IVDTUK POWER SYSTEM OVERVIEW



Ivotuk Power Station Platform Harborware Dock Floats

Access walkway supports



System platform supports



HarborWare's dock floats (aka float drums) are designed for commercial and residential floating boat docks. Made of foam-filled plastic, they meet all industry quality standards.

HarborWare's dock floats (aka float drums) are designed and manufactured to last, meeting or exceeding all of the marine industry standards. The encapsulated dock flotation design offers maximum buoyancy and engineering integrity. This is accomplished by keeping our corners square and our sides taper, with reinforcement gussets to a minimum. This superior design offers strong corners and allows a straight corner line from the top of the dock to the water. With 52 different sizes available, our float drums will fit any boat dock frame. The same HarborWare float drums used on small lake house docks are trusted in multi-million dollar commercial marinas.

- Passes Army Corps of Engineers standards
- Passes "Hunt" Water Absorption Test
- EPS foam-filled, 1.0-1.5 lb density
- Roto-molded polyethylene shell
- Plastic shell made with UV inhibitors
- Heavy wall thickness of .150"
- Heavy-duty mounting flanges
- Square-reinforced corners
- 15 Year Prorated Warranty
- Resists gasoline, oil, saltwater and marine life
- Fits new or old dock frames
- Fits removable and permanent docks

Size: 4' x 10' x 24"

Buoyancy: 4208 lbs

Harborware floats.doc

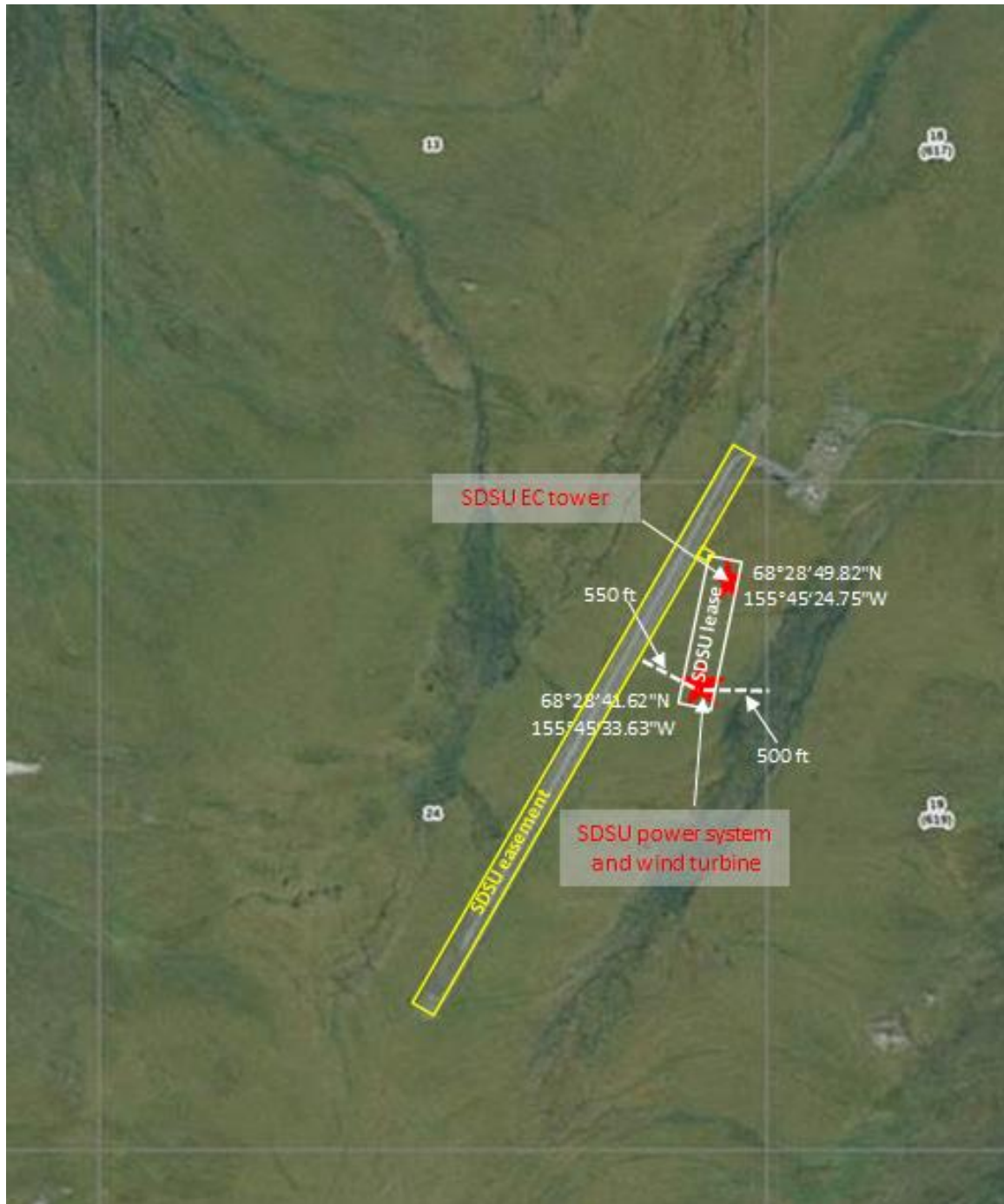


Fig 3. Map of Easement -Sections 13 and 24 of Township 11 South, Range 17 West, Umat Meridian.



Notice Criteria Tool

[Notice Criteria Tool - Desk Reference Guide V_2014.2.0](#)

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference [CFR Title 14 Part 77.9](#).

You must file with the FAA at least 45 days prior to construction if:

If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the [Air Traffic Areas of Responsibility map](#) for Off Airport construction, or contact the [FAA Airports Region / District Office](#) for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

Latitude:	<input type="text" value="68"/> Deg <input type="text" value="28"/> M <input type="text" value="56.71"/> s <input type="text" value="N"/>
Longitude:	<input type="text" value="155"/> Deg <input type="text" value="45"/> M <input type="text" value="22.40"/> s <input type="text" value="W"/>
Horizontal Datum:	<input type="text" value="NAD83"/>
Site Elevation (SE):	<input type="text" value="1920"/> (nearest foot)
Unadjusted Structure Height :	<input type="text" value="65"/> (nearest foot)
Height Adjustment:	<input type="text" value="15"/> (nearest foot)
Total Structure Height (AGL):	<input type="text" value="80"/> (nearest foot)
Traverseway:	

Boxer 535DX

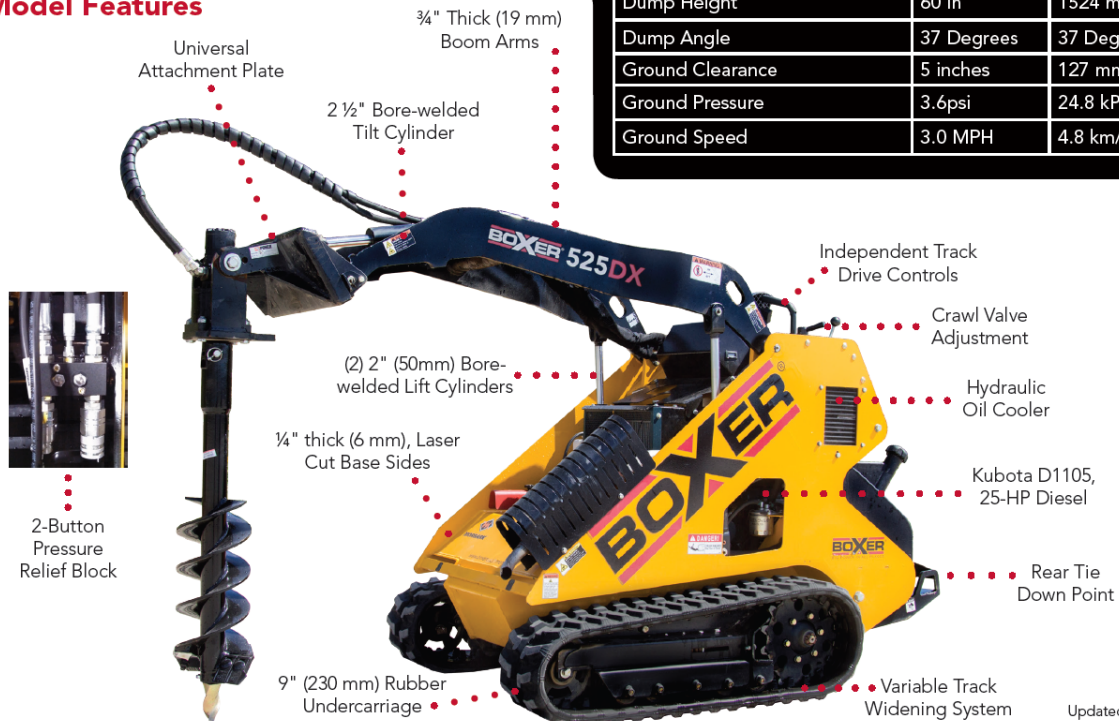
BOXER® 525DX

Model Specifications

Engine System	US	Metric
Type	Kubota	Kubota
Cooling System	Liquid	Liquid
HP/kW	24.8 HP	18.6 kW
Fuel Type	Diesel	Diesel
Fuel Capacity	9 Gallons	34 Litres
Hydraulic Capacity	24 Gallons	91 Litres
Hydraulic Flow (Aux)	11.2 GPM	42.5 LPM
Hydraulic Flow (Drive)	3.3 GPM	12.5 LPM
System Pressure	3000 PSI	20684 kPa
Engine Warranty	2 years	2 years
Product Warranty	1 year	1 year

Units	US	Metric
Track Width	9 in	230 mm
Weight (no attachment)	2700 lbs	1223 kg
Length (w/Bucket)	96 in	2438 mm
Length (w/out Bucket)	77 in	1956 mm
Width (Fully Retracted)	34.5 in	876 mm
Width (Fully Extended)	43.5 in	1105 mm
Height (Overall)	54 in	1372 mm
Height (Fully Raised)	98 in	2489 mm
Operating Capacity (35%)	735 lbs	333 kg
Operating Capacity (50%)	1050 lbs	476 kg
Tip Capacity	2100 lbs	951 kg
Hinge Pin Height (Fully Raised)	76 in	1930 mm
Dump Height	60 in	1524 mm
Dump Angle	37 Degrees	37 Degrees
Ground Clearance	5 inches	127 mm
Ground Pressure	3.6psi	24.8 kPa
Ground Speed	3.0 MPH	4.8 km/h

Model Features



Updated 5/8/15

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Manufactured by
MORBARK

Metek Heated Sonic Anemometer



Fig. 4: Metek Heated Anemometer



Fig. 5: Heated Anemometer (right) Compared to Regular Anemometer (left)

DNR application instructions list

Terrain changes – three 8” x 84” helical anchors will be drilled into the ground for the wind turbine tower guy lines. The power system will be mounted on a floating platform that sits on the tundra.

Access – access to the area is aircraft only. Access to the power system site is via the graveled taxiway pad. An elevated walkway will connect the pad to the system platform.

Buildings – the power system will be on a 10 ft x 28 ft x 16” float platform. The system consists of a 6 ft x 6 ft by 15 ft insulated fiberglass building (mfgd by CAC Plastics in Wasilla) that houses the battery bank, the generator, and the controls, a 40 ft Rohn 65G guyed lattice tower, a Bergey Excel 10 kW wind turbine, a 500 gal UL148 double-wall fuel tank, and a 2500 watt solar array (mounted to the building). All of these structures will be on the platform.

Power source – there is no power available at the site

Waste – once a year the generator engine oil will be changed. The waste oil (about 6 qt) and filter will be hauled back to Fairbanks and disposed of.

Hazardous substances –

Battery bank – consists of UN2800 non-spillable batteries so does not constitute a hazard to the environment

Diesel fuel – up to 450 gallons – contained in a UN148 compliant double-wall tank. Sorbent pads will be maintained on site to handle minor spills that might occur during filling of the tank.

Water – there is no water supply and no wastewater will be generated.

Parking – there is no long term parking or storage involved. A portion of the taxiway will be utilized during installation of the system for parking and storage of materials.

Number of people – 3 to 4 people will be involved for up to two weeks during the installation. One supervisor. One to two people for one day twice a year for inspection and maintenance.

Maintenance – annual – inspect system, re-tension tower guy wires (if necessary), refuel diesel tank (if necessary), change generator oil/filter (if necessary), inspect cable to tower for damage. In conjunction with the semi-annual trips. Maintenance handled by ABS Alaskan, Inc personnel.



MEMORANDUM

Department of Natural Resources

STATE OF ALASKA

Division of Mining, Land and Water
Northern Regional Land Office

DATE: September 16, 2016

TO: LAS 31276 – San Diego State University, Global Change Research Group

FROM: Kimberley Maher

RE: Adjudication Summary

I. Proposed Action

The Global Change Research Group at San Diego State University (SDSU) has submitted a Land Use Permit (LUP) application requesting the establishment of scientific research sites for an eddy covariance tower and its associated power system.

DMLW is proposing the following

Issue a 4-year LUP to SDSU to authorize the establishment of eddy covariance tower site and the associated power system.

II. Statutory Authority

AS 38.05.850

III. Decision Scope

The scope of this decision is to determine if it is appropriate to issue a temporary, renewable LUP to SDSU for authorizing the research site. The scope is limited to authorization of activities on state land, including submerged land. The scope is based upon the statutes, regulations, and other facts contained in case file LAS 31276 and the body of this decision.

IV. Location and Land Status Information

Geographic Location: Approximately 6 acres at a remote site on the North Slope, adjacent to the Ivotuk airstrip.

Sections 24, Township 11 S, Range 17 W, Umiat Meridian



Figure 1. Proposed area to be covered by the LUP

Title: The State received Tentative Approval 2003-001312-0 on October 31, 2013 under GS 4553.

Restrictions: Standard Reservations.

Other Conflicts & Pending Interests: The Ivotuk airstrip is an active airstrip, and use of the airstrip by other users shall not be impeded.

Planning & Classification: The site is within ADL 50666, North Slope Area Special Use Lands (11 AAC 96.10) which requires a permit for motorized vehicle use, unless that use is for subsistence purposes or is on a graveled road.

Municipality: North Slope Borough

Regional Corporation: Arctic Slope Regional Corporation

V. Background

Initial Application

An application was received July 13, 2016, requesting a Land Use Permit (LUP) to authorize an eddy covariance tower and a proposed power supply system that included (1) a 6 ft x 20 ft control building to house a non-spillable battery bank, 6 kW generator, 500-gallon diesel fuel tank, and solar array and (2) a 10 kW wind turbine. The proposed power supply system was to be located on the south side of the airstrip taxiway, placed on a floating dock foundation, and connect to the eddy covariance tower with 215-meter cables (Figure 2). This initial application was sent out for an agency review.

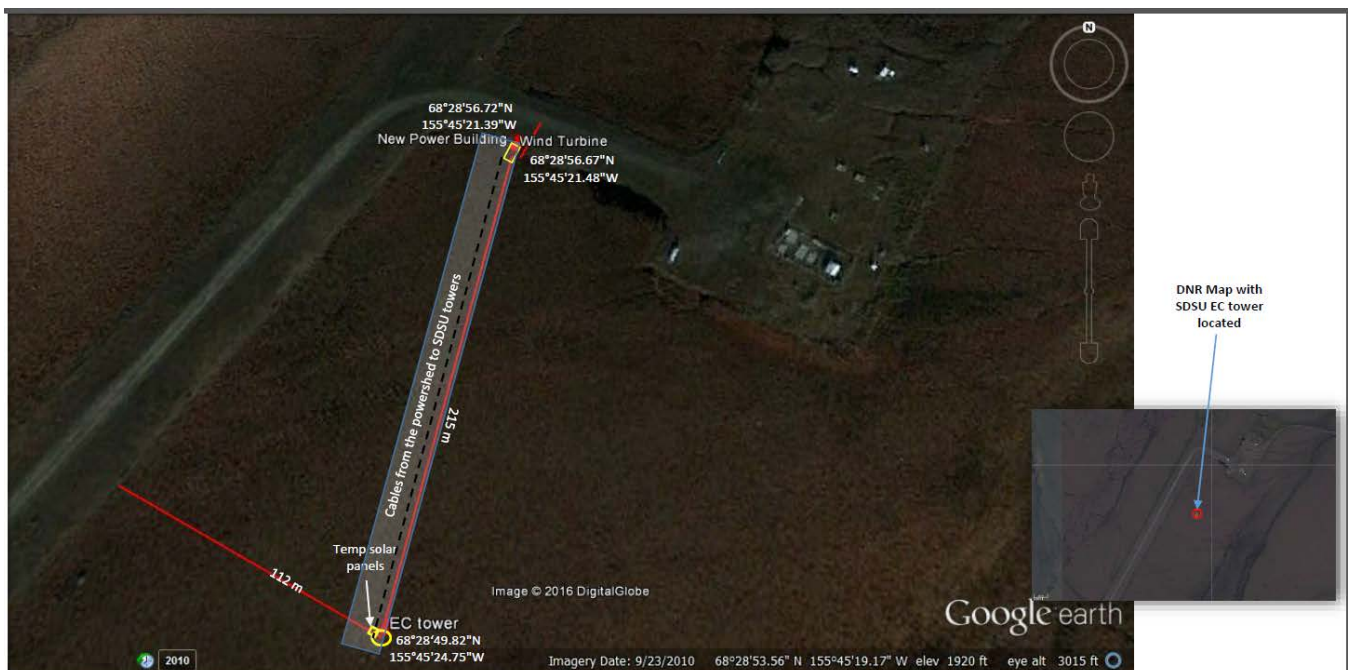


Figure 2. Proposed location of eddy covariance tower and power supply system submitted on July 13, 2016.

Revised Application

A revision to the application was received August 18, 2016, to address comments raised during the agency review (see below). The revised application removed the wind turbine from the application and moved the

location of the power supply system to a location south of the eddy covariance tower that is 550 ft from centerline of the airstrip and also has a 500 ft buffer from the adjacent property line (Figure 3). Additionally, it was clarified that during the installation, the materials will be moved from the airstrip to the site via helicopter



Figure 3. Revised location of eddy covariance tower and power supply system submitted on August 18, 2016.

VI. Review and Agency Notice/Public Notice

Agency Review Summary

Agency review was conducted July 18 – August 1, 2016. Agencies contacted for comment included: DMLW Water Resources Section, DNR Division of Oil and Gas (DOG), DNR Office of Project Management and Permitting (OPMP), DNR State Historic Preservation Office (SHPO), DNR State Pipeline Coordinator's Section (SPCS), Department of Environmental Conservation (DEC), Department of Fish and Game (ADF&G), Alaska Department of Transportation and Public Facilities (ADOT&PF), US Bureau of Land Management (BLM), US Army Corp of Engineers (USACE), and US Fish and Wildlife Service (USFWS), US National Park Service (NPS), and Federal Aviation Administration (FAA). The North Slope Borough (NSB) and Arctic Slope Regional Corporation (ASRC) were also sent notice of the proposed actions.

DOG, SHPO, DEC, and ADF&G provided no objection to the proposed permit.

Comments from ADOT&PF, Aviation Design:

The Aviation Design group provided general guidelines for calculating safety areas around runways and height restrictions on infrastructure adjacent to airstrips.

- Runway -primary surface/object free area will either be 500' or 250' (half the distance from centerline, either 250' or 125')
- Taxiway – 131' object free area (65.5' from centerline)
- After the object free area the Part 77 surface goes up at a 7:1 rate.

Calculating the clearance for a 60 tower (assuming the base of the tower is at the runway elevation) equates to $(60' \times 7) + 125' = 545'$ to $(60' \times 7) + 250' = 670'$; therefore, 545' would be the absolute minimum from the runway to place a 60' object. If room/space is not an issue, ADOT&PF Aviation Design recommends the turbine to be install 670' feet from the runway.

Comments from ADOT&PF, Aviation Leasing:

The Ivotuk Airstrip does not appear on the inventory as an ADOT&PF/State managed airport. However, the Aviation Leasing office would not allow a wind turbine to be installed along the taxiway as proposed.

The Aviation Leasing office calculates the safety area for similar an ADOT&PF/State managed gravel runways as typically twice the width of the runway but not less than 150' (75' either side of centerline) and can be specified a greater distance as needed. As noted in the Aviation Design comments, the edge of the safety area begins an imaginary 7':1' horizontal/vertical plane (referred to as the Part 77 Transitional Surface) which must not be penetrated without formal FAA approval.

The Aviation Leasing office noted that using some estimates from Google Earth, the proposed siting of solar panels, generator, and tower is located within the runway and taxiway safety areas and simply not allowed.

The Aviation Leasing office recommended that provided there is space available on the apron, which is some 400'-700' away from the runway, and off the taxiway, place of the proposed equipment should be on the apron or co-locate them with an existing tenant on the apron.

Comments from ASRC

ASRC provided comments and questions expressing concerns related to application. Much of the concerns and questions were focused on the placement of a 10 kW wind turbine placed adjunct to the Ivotuk airstrip and in close proximity to ASRC lands. Specifically:

1. Aviation safety concerns of placement of a large wind turbine tower close to a very remote airstrip that can routinely have very low ceilings.
2. The need for a taller/larger wind turbine when a much smaller one sufficed over the last 13 years.
3. Concern that the power system building, the turbine tower, and the turbine blades the will all be sitting on the tundra on "Dock Floats," which is highly likely to sink over time because the ground/tundra at Ivotuk is generally unstable, particularly once disturbed. How will the Dock Floats be re-leveled in the event the power system and tower sink in an irregular manner? How exactly will the tower base be anchored to account for this shifting ground? Any equipment or system failures could have direct impacts on the ASRC lands located just feet away.
4. Will the property line near the installation site be surveyed to ensure that SDSU does not cross over onto ASRC land? ASRC has "no trespassing" signs on site but they do not identify the actual property line. They are intentionally set back onto ASRC lands and should not be used as any type of property line marker. Are there any standard property line buffers or setbacks for this type of proposed installation?
5. Concern that the placement of the turbine tower is in close proximity to ASRC lands may devalue our land for subsistence hunting and other purposes. Caribou use this area heavily every fall as it is within a major migratory area.
6. The public lands at Ivotuk have a long history of usage by other user groups such has private hunters and other recreational users. Will this tower and turbine negatively impact their activities as it is located in the same general area they use?
7. The proposed location of the tower corresponds to the area most used by ASRC, BLM, and others for camping and other activities. What other specific alternative locations on State lands were evaluated at Ivotuk as possible sites for placement of this equipment?

ASRC noted that it has previously declined to host SDSU's research site and equipment. Because of the close proximity to the site to ASRC lands, the current proposed project site still causes concerns and questions related to its potential direct and indirect impacts to ASRC lands and activities. If their site was located 500 feet or more away from our lands and the tower and turbine size was substantially reduced, many of our concerns could be reduced or eliminated.

When ASRC was provided the revised application that removed the wind turbine and relocated the power supply system farther from the ASRC property boundary, ASRC stated that the revisions satisfy their concerns.

No other agency comments were received.

Public Notice Summary

Public notice was published on the ADNR website and was conducted July 18 – August 1, 2016. Everts Air Cargo, Wrights Air Service, and Warbelows AirVentures were sent a courtesy public notice because of their use of the Ivotuk airstrip. No comments were received.

VII.Environmental Risk

The environmental risks associated with this proposed LUP are minor. Risk includes the possibility of minor spills during refueling of the diesel storage tank. Risk also includes possible disturbance to the tundra ecosystem. Spill risks may be minimized by following standard fuel containment and transfer procedures as described in the stipulations attached to the LUP.

VIII.Performance Guaranty

Pursuant to 11 AAC 96.060, performance guarantees are means to assure performance and to provide ways to pay for corrective action if the permittee fails to comply with the requirements set forth in the permit document. They are also used to protect state land from damage and to make certain that improvements are removed and that the land is returned in a usable condition upon termination of the permit.

The performance guaranty associated with this activity was calculated to be **\$22,695** under the 2008 bond matrix, and the standard performance guaranty stipulation will be included in this permit. This bond amount is consistent with other performance guarantees required for similar off-road travel permits on the North Slope. This bond will be adequate to cover the activities that will be conducted under this permit.

IX.Insurance

Pursuant to 11 AAC 96.065, insurance is a means to protect the state from liabilities incurred through the use of state property, or from damage to state property as a result of accidental or catastrophic events. This type of protection is necessary in the event of an accident or negligence that was consequentially connected to activities conducted on state land, and/or if the state is named in a lawsuit as a result of an accident or negligence.

The standard insurance stipulation will be included in this permit.

X.Discussion

In adjudicating a LUP, DNR seeks to facilitate development, conservation, and enhancement of state lands for present and future Alaskans, while minimizing disturbance to vegetative, hydrologic, and topographic characteristics of the area that may impair water quality and soil stability.

The applicant has requested a LUP for the purpose of scientific research sites to study carbon dioxide, water, and methane fluxes using an eddy covariance tower. Additional measurements will be taken using soil temperature and moisture probes, small diameter water wells (2.5 cm in diameter and not deeper than 100 cm), and soil heat flux plates. Manual measurements will include permafrost thaw-depths, water table heights, and chamber measurements.

A power supply system is proposed to power the eddy covariance tower will use multiple components that are expected to supply power under different conditions. The power system will be placed on

platform constructed of floating dock blocks on the tundra and will include a 1500-watt (12 each of 250w panels) solar array, seventy-two UN2800 non-spillable lead acid batteries, and a diesel fuel generator with a 500-gallon UL142 compliant double wall tank within the control building. A 512-meter cable will connect the power system to the eddy covariance tower.

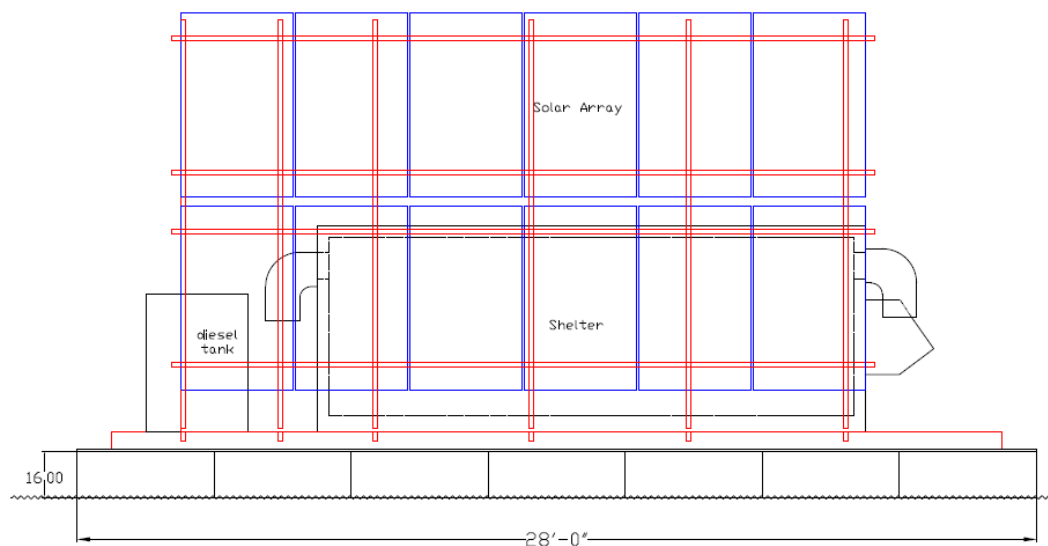


Figure 4. Power System Configuration

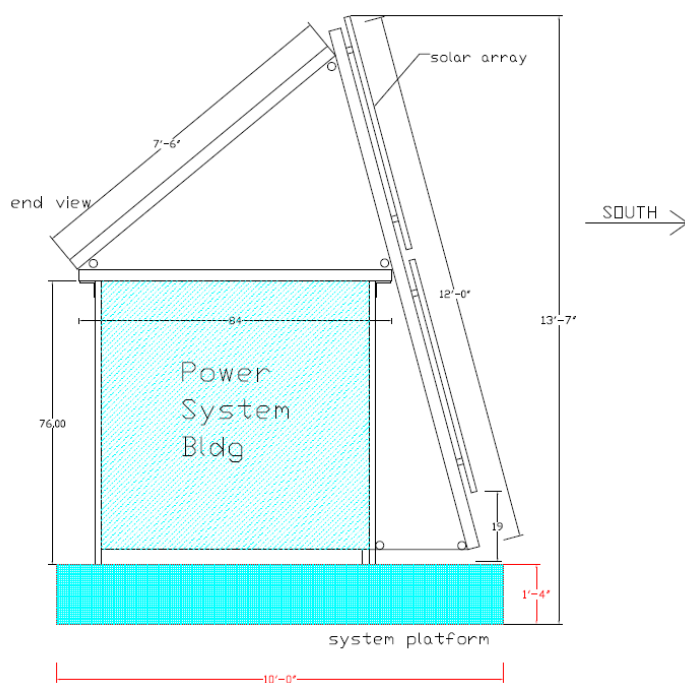


Figure 5. Side View of Power System Configuration

The site is located within the North Slope Area Special Use Lands (11 AAC 96.10), which requires a permit for motorized vehicle use, unless that use is for subsistence purposes or is on a graveled road. As stated in the revised application, the applicant will use a helicopter to move equipment from the airstrip to its location.

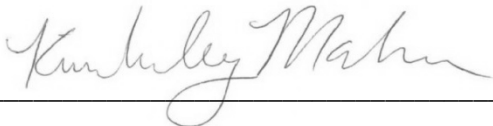
Upon completion of the permitted activities, SDSU will be responsible for removing all of the instrumentation and the power supply system. The tundra will be left in an acceptable condition to DNR.

Because the application and stipulations contained in the resulting LUP address all State concerns, and the proposed activities will further State objectives of natural resource conservation and enhancement, no alternatives to the application were considered.

XI.Adjudicator Recommendation

Issue Permit.

Based upon the information provided by the applicant, inter-agency and public review, and review of relevant planning documents, statutes, and regulations related to this application, it is the decision of the Alaska Department of Natural Resources, Division of Mining Land and Water, to issue this Land Use Permit on condition that all stipulations are followed. During the period of the permit periodic inspections will be conducted, at the discretion of DNR, to ensure permit compliance.



Kimberley Maher

September 16, 2016

Date



**LAND USE PERMIT
AS 38.05.850**

PERMIT # LAS 31276

San Diego State University, herein known as the Permittee, is issued this permit authorizing the use of the following state land located within:

6 acres within Section 24, Township 11 South, Range 17 West, Umiat Meridian

This permit is effective beginning **September 20, 2016** and ending **September 19, 2020** unless sooner terminated at the state's discretion. This permit does not convey an interest in state land and as such is revocable with or without cause. No preference right for use or conveyance of the land is granted or implied by this authorization.

This permit is issued for the purpose of authorizing:

establishing a scientific research site for an eddy covariance tower and power production system, as described and depicted in the approved plan of operation summary and attached map

All activities shall be conducted in accordance with the following **Stipulations**:

Stipulations

- 1. Authorized Officer.** The Authorized Officer for the Department of Natural Resources is the Regional Land Manager. The Authorized Officer may be contacted at 3700 Airport Way, Fairbanks, Alaska 99709 or (907) 451-2740. The Authorized Officer reserves the right to modify these stipulations or use additional stipulations as deemed necessary.
- 2. Compliance with Governmental Requirements; Recovery of Costs.** Permittee shall, at its expense, comply with all applicable laws, regulations, rules and orders, and the requirements and stipulations included in this authorization. Permittee shall ensure compliance by its employees, agents, contractors, subcontractors, licensees, or invitees.
- 3. Indemnification.** Permittee assumes all responsibility, risk and liability for its activities and those of its employees, agents, contractors, subcontractors, licensees, or invitees, directly or indirectly related to this permit, including environmental and hazardous substance risk and liability, whether accruing during or after the term of this permit. Permittee shall defend, indemnify, and hold harmless the State of Alaska, its agents and employees, from and against any and all suits, claims, actions, losses, costs, penalties, and damages of whatever kind or nature, including all attorney's fees and litigation costs, arising out of, in connection with, or incident to any act or omission by Permittee, its employees, agents, contractors, subcontractors, licensees, or invitees, unless the proximate cause of the injury or damage is the sole negligence or willful misconduct of the State or a person acting on the State's behalf. Within 15 days, Permittee shall accept any such cause, action or proceeding upon tender by the State. This indemnification shall survive the termination of the permit.

- 4. Performance Guaranty.** The permittee shall provide a surety bond or other form of security acceptable to the Division in the amount of **\$22,695.00** payable to the State of Alaska. Such performance guaranty shall remain in effect for the term of this authorization and shall secure performance of the permittee's obligations hereunder. The amount of the performance guaranty may be adjusted by the Authorized Officer upon approval of amendments to this authorization, changes in the development plan, upon any change in the activities conducted or performance of operations conducted on the premises. If Permittee fails to perform the obligations under this permit within a reasonable time, the State may perform Permittee's obligations at Permittee's expense. Permittee agrees to pay within 20 days following demand, all costs and expenses reasonably incurred by the State of Alaska as a result of the failure of the permittee to comply with the terms of this permit. The provisions of this permit shall not prejudice the State's right to obtain a remedy under any law or regulation. If the authorized officer determines that the permittee has satisfied the terms and conditions of this authorization the performance guaranty may be released. The performance guaranty may only be released in a writing signed by the Authorized Officer.
- 5. Insurance.** The Permittee shall secure or purchase at its own expense, and maintain in force at all times during the term of this permit, the following policy of insurance to protect both the Permittee and the permittor (the State, its officers, agents and employees). Where specific limits are shown, it is understood that they shall be the minimum acceptable limits. If the Permittee's policy contains higher limits, the State shall be entitled to coverage to the extent of such higher limits. Certificates of Insurance must be furnished to the Authorized Officer prior to occupancy. The certificate must provide for a 60-day prior notice to the State in the event of cancellation, nonrenewal or material change of conditions. Failures to furnish satisfactory evidence of insurance, or lapse of the policy, are material breaches of this permit and shall be grounds, at the option of the State, for termination of the permit. All insurance policies shall comply with, and be issued by, insurers licensed to transact the business of insurance under Alaska Statute, Title 21.

Commercial General Liability Insurance. Such policy shall have minimum coverage limits of \$1,000,000 combined single limit per occurrence. The policy shall be written on an "occurrence" form and shall not be written as a "claims-made" form unless specifically reviewed and agreed to by the Division of Risk Management, Department of Administration. The State must be named as an additional named insured on the policy with respect to the operations of the Permittee on or in conjunction with the permitted premises, referred to as the above LAS number.
- 6. Valid Existing Rights.** This authorization is subject to all valid existing rights in and to the land under this authorization. The State of Alaska makes no representations or warranties whatsoever, either expressed or implied, as to the existence, number, or nature of such valid existing rights.
- 7. Reservation of Rights.** The Division reserves the right to grant additional authorizations to third parties for compatible uses on or adjacent to the land under this authorization.
- 8. Public Access.** All operations must be conducted in a manner that will ensure minimum conflict with other users of the area. There shall be no interference with free public use of state lands and waters.
- 9. Public Trust Doctrine.** The Public Trust Doctrine guarantees public access to, and the public right to use, navigable and public waters and the land beneath them for navigation, commerce, fishing, and other purposes. This authorization is issued subject to the principles of the Public Trust Doctrine regarding navigable or public waters. The Division of Mining, Land and Water reserves the right to grant other interests consistent with the Public Trust Doctrine.
- 10. Inspection.**

 - a. Authorized representatives of the State of Alaska shall have reasonable access to the subject parcel for purposes of inspection.
 - b. The Permittee may be charged fees under 11 AAC 05.010(a)(7)(M) for routine inspections of the subject parcel, inspections concerning non-compliance, and a final close-out inspection.

- 11. Alaska Historic Preservation Act.** The permittee shall consult the Alaska Heritage Resources Survey (907) 269-8721 so that known historic, archaeological and paleontological sites may be avoided.

The Alaska Historic Preservation Act (AS 41.35.200) prohibits the appropriation, excavation, removal, injury, or destruction of any state-owned historic, prehistoric (paleontological) or archaeological site without a permit from the commissioner. Should any sites be discovered during the course of field operations, activities that may damage the site will cease and the Office of History and Archaeology in the Division of Parks and Outdoor Recreation (907) 269-8721 and shall be notified immediately.

- 12. Assignment.** This permit may not be transferred or assigned to another individual or corporation without prior authorization from the Authorized Officer.
- 13. Violations.** This authorization is revocable immediately upon violation of any of its terms, conditions, stipulations, nonpayment of fees, or upon failure to comply with any other applicable laws, statutes and regulations (federal and state). Should any unlawful discharge, leakage, spillage, emission, or pollution of any type occur due to Permittee's, or its employees', agents', contractors', subcontractors', licensees', or invitees' act or omission, Permittee, at its expense shall be obligated to clean the area to the reasonable satisfaction of the State of Alaska.
- 14. Termination.** This permit does not convey an interest in state land and as such is revocable, with or without cause and is revocable at will if the department determines that the revocation is in the state's interest. The permit remains in effect for the term issued, unless revoked sooner. The department will give 30 days' notice before revoking a permit at will. A revocation for cause is effective immediately.
- 15. Tundra damage reports.** Incidents of damage to the vegetative mat and follow-up corrective actions that have occurred while operating under this authorization shall be reported to the Authorized Officer within 72 hours of occurrence.
- 16. Debris and cleanliness.** Trails, campsites, and work areas must be kept clean. All solid waste including incinerator residue shall be backhauled to a solid waste disposal site approved by DEC. Trash, survey lath, roadway markers, and other debris that has accumulated along roads or cross country routes shall be picked up and properly disposed of prior to freeze-up the following winter.
- 17. Solid Waste.**
- All solid waste and debris generated from the activities conducted under this authorization shall be removed to a facility approved by the ADEC prior to the expiration, completion, or termination of the authorization or activities.
 - Paper products may be burned on site provided that measures (e.g. burn barrels, clearing of burn area to mineral soil) are taken to prevent wildfires.
 - Temporary storage and accumulation of solid waste (prior to its removal) shall conform to the following:
 - Solid waste shall be stored in a manner that prevents a litter violation under AS 46.06.080;
 - Putrescible wastes (material that can decompose and cause obnoxious odors) shall be stored in a manner that prevents the attraction of or access to wildlife or disease vectors; and
 - The premises shall be maintained free of solid waste that might create a health or safety hazard.
- 18. Use of existing roads and trails.** Existing roads and trails shall be used wherever possible. Trail width shall be kept to the minimum necessary. Trail surface may be cleared of timber, brush, stumps, and snags.
- 19. Equipment operation.** Equipment, other than vessels, must not enter the open water areas of a watercourse during winter. Filling of low spots and smoothing by the use of snow and ice is allowed. Ice or snow bridges and approach ramps constructed at stream, river, or slough crossings shall not contain extraneous material (i.e., soil, rock, brush or vegetation).

20. Prohibited activities. Vehicle maintenance, campsites, and storage or stockpiling of material on the surface ice of lakes, ponds or rivers is **prohibited**.

21. Storage of Equipment. The site shall be protected from leaking or dripping hazardous substances or fuel from equipment and vehicles. The Permittee shall place drip pans or other surface liners designed to catch and hold fluids under the equipment or develop an area for storage using an impermeable liner or other suitable containment mechanism.

22. Bear Avoidance. Operations must avoid grizzly bear dens by one-half mile unless alternative mitigative measures to minimize disturbance are authorized by DNR after consultation with DFG. Known bear den locations shall be obtained from the (DFG) Division of Wildlife Conservation (Fairbanks (907) 459-7283 or (907) 459-7242) prior to starting operations. Occupied dens encountered in the field must be reported to the above, and avoided.

Operations must avoid known polar bear dens by one mile. Known den locations shall be obtained from the U.S. Geological Survey ((907) 786-7093 or (800) 362-5148) prior to starting operations. New dens encountered in the field must be reported to the above, and subsequently avoided by one mile.

23. Fuel and Hazardous Substances. Secondary containment¹ shall be provided for fuel or hazardous substances².

- a. Container³ marking. All independent fuel and hazardous substance containers shall be marked with the contents and the permittee's or contractor's name using paint or a permanent label. (Note: The permittee is ultimately responsible for contractor's compliance with these stipulations.)
- b. Fuel or hazardous substance transfers. Secondary containment or a surface liner⁴ must be placed under all container or vehicle fuel tank inlet and outlet points, hose connections, and hose ends during fuel or hazardous substance transfers. Appropriate spill response equipment must be on hand during any transfer or handling of fuel or hazardous substances to respond to a spill of up to five gallons. Transfer operations shall be attended by trained personnel at all times.
- c. Vehicle refueling. Vehicle refueling shall not occur within the annual floodplain or tidelands.
- d. Storing containers within 100 feet of waterbodies. Containers with a total capacity larger than 55 gallons which contain fuel or hazardous substances shall not be stored within 100 feet of a waterbody.
- e. Exceptions. The review coordinating agency, after consultation with other resource agencies and affected communities, may under unique or special circumstances grant exceptions to this stipulation on a case-by-case basis. Requests for exceptions should be made to the review coordinating agency.

24. Notification. The permittee shall immediately notify DNR and DEC (18 AAC 75.300) by phone, fax, and/or email of any unauthorized discharge of oil to water, any discharge of hazardous substance (other than oil), and any discharge of oil greater than 55 gallons to land. Any unauthorized discharge of oil to land greater than 10 gallons but less than 55 gallons must be reported to DEC within 48 hours. Oil discharges to land less than 10 gallons and greater than 1

1 Secondary containment means an impermeable diked area or portable impermeable containment structure capable of containing 110 percent of the volume of the largest independent container. Double-walled tanks do not qualify as secondary containment unless an exception is granted for a particular tank.

2 Hazardous substances are defined under AS 46.03.826 as (a) an element or compound which, when it enters the atmosphere, water, or land, presents an imminent and substantial danger to the public health or welfare, including fish, animals, or vegetation; (b) oil; or (c) a substance defined as a hazardous substance under 42 U.S.C. 9601(14).

3 Containers means any item which is used to hold fuel or hazardous substances. This includes tanks, drums, double-walled tanks, portable testing facilities, fuel tanks on small equipment such as light plants and generators, flow test holding tanks, slop oil tanks, bladders, and bags. Manifolded tanks must be considered as single independent containers. Vehicles, including mobile seismic tanks, are not intended to be included under this definition.

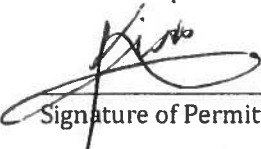
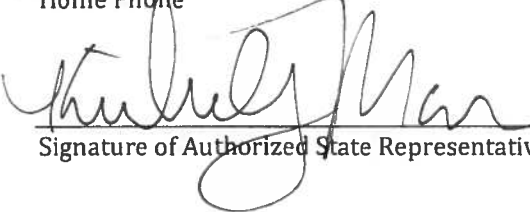
4 Surface liner means any safe, non-permeable container (e.g., drips pans, fold-a-tanks, etc) designed to catch and hold fluids for the purpose of preventing spills. Surface liners should be of adequate size and volume to contain the worst-case spill that is likely to occur.

gallon must be recorded and submitted to DEC in a monthly report. All fire and explosions must also be reported.

The DNR should be notified by email at dnr.nro.spill@alaska.gov and by calling the 24 hour spill report number at (907)451-2678. The DEC spill number during normal business hours is (907)451-2121, outside of normal business hours contact 1(800)478-9300; the Fax number is (907)451-2362. DNR and DEC shall be supplied with all follow-up incident reports.

25. **Rehabilitation.** All rehabilitation shall be completed to the satisfaction of DNR or the applicable land manager.
26. **Holes and Excavations.** All holes shall be backfilled with sand, gravel, native materials, or a substitute approved by the Authorized Officer.
27. **Other Authorizations.** The issuance of this authorization does not alleviate the necessity of the permittee to obtain authorizations required by other agencies for this activity.
28. **Publications and Reports.** Since the research conducted may benefit DNR's mission to develop, conserve, and maximize the use of Alaska's natural resources consistent with the public interest, DNR requests that a list of published articles and reports from the research conducted is submitted at the conclusion of the project study. If results of the research are not published, a summary of results and a list of the data sets produced is requested to be submitted to DNR.
29. **Completion Report.** A completion report shall be submitted to the Authorized Officer by June 30 each year. This report shall contain the following information:
 - a. Activities conducted at site, including number of visits and length of visits.
 - b. Any disturbances to tundra or change in tundra health must be reported.
30. **Amendments.** To proceed in areas other than approved on the Plan of Operations, the applicant must have prior authorization from the DMLW-NRO. The applicant must provide the following information when requesting an amendment:
 - a. A map showing the location and an anticipated schedule of operations.
 - b. Geographic data of the new location(s) that may be used in the ESRI ArcGIS mapping program (i.e., .shp or .gdb).
 - c. The name and telephone number of a person familiar with the daily location of the permit activities and easily contacted by the DMLW-NRO.

I have read and understand all of the foregoing and attached stipulations. By signing this permit, I agree to conduct the authorized activity in accordance with the terms and conditions of this permit.

	A. Kalhorn for W. Dechel	Research Scientist II	09/16/2016
Signature of Permittee or Authorized Representative		Title	Date
5500 Campanile dr.	San Diego	CA	92182
Permittee's Address	City	State	Zip code
(619) 549-4115	(619) 594-3443	Aram Kalhorn	
Home Phone	Work Phone	Contact Person	
	NRST II	9/20/16	
Signature of Authorized State Representative	Title	Date	

Approved plan of operation summary

This permit (LAS 31276) is for establishing scientific research sites and related activities to study carbon dioxide, water, and methane fluxes using an eddy covariance tower. Additional measurements will be taken using soil temperature and moisture probes, small diameter water wells (2.5 cm in diameter and not deeper than 100 cm), and soil heat flux plates. Manual measurements will include permafrost thaw-depths, water table heights, and chamber measurements. All instrumentation and wells will be removed at the end of the study. Access from the Ivotuk airstrip to the site will be by foot and helicopter.



Figure 1. Locations eddy covariance tower and power supply system.

The power system will be placed on platform constructed of floating dock blocks on the tundra and will includes a 1500-watt (12 each of 250w panels) solar array, seventy-two UN2800 non-spillable lead acid batteries, and a diesel fuel generator with a 500-gallon UL142 complaint double wall tank within the control building. A 512-meter cable will connect the power system to the eddy covariance tower.

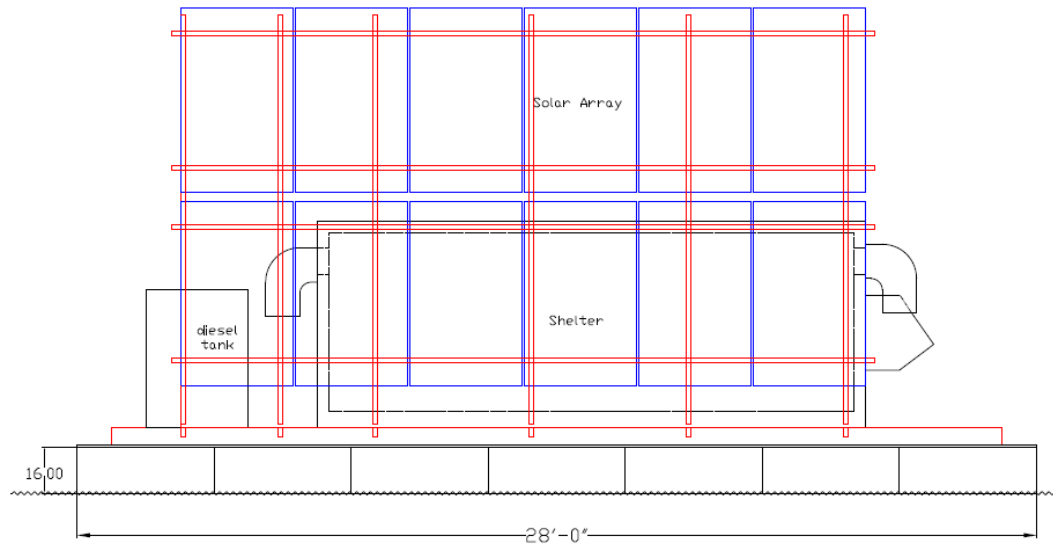


Figure 2. Power System Configuration

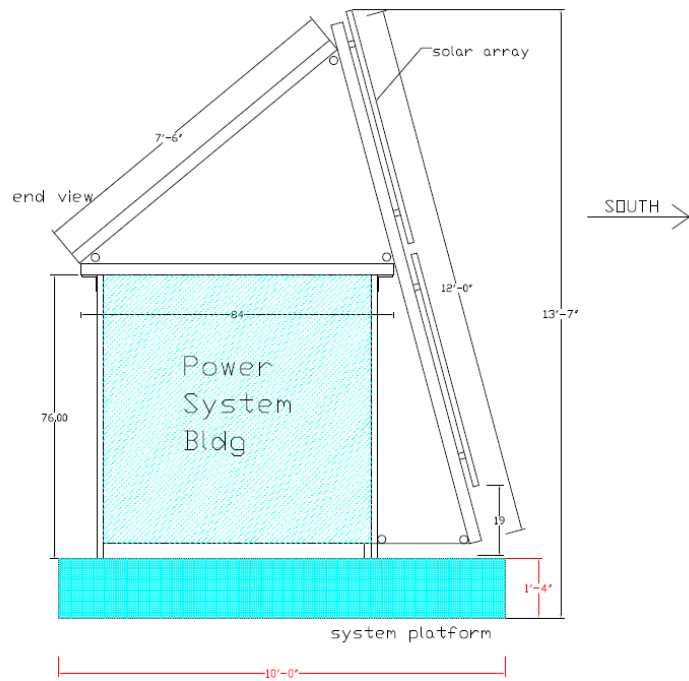


Figure 3. Side View of Power System Configuration

Attachment D – Research Site Provisionary Dismantlement Plan

Upon completion of the permitted activities at Ivotuk, SDSU will be responsible for removing all instrumentation and tower infrastructure. All sensors will be packed on site, and the tower itself removed along with all anchor wires, to ship back to San Diego beginning with a chartered flight from Ivotuk to Fairbanks. The decommissioning of the flux tower may take several days with two people, given the number of instruments, cables, delicate wiring that needs to be carefully packed, and hardware associated with the tower infrastructure.

Given that the science being conducted at Ivotuk hinges on the ability to monitor the behavior of undisturbed tundra, we will endeavor to minimize adverse impacts throughout the duration of the project by limiting personnel visits, and foot traffic between the power shed and the flux tower site. However, some damage to the tundra resulting from foot traffic between the power shed and the tower site, as well as in the immediate vicinity of the tower, will be unavoidable. SDSU will assume responsibility for rehabilitation of damaged tundra at the site as well as the power shed location.

In order to restore damaged sites with respect to thermal and hydrological regimes, and with permission and consultation from the State of Alaska, we will apply fertilizer and potentially new seed according to guidelines set forth by the North Slope Science Initiative (northslope.org). For example, likely fertilizer application will involve NPK 20-20-10 applied at 100-200 lbs/acre, to facilitate new shoots and germination of neighboring healthy individuals.

The following is an outline of a primary (plan A) and contingency (plan B) plan for the dismantling and removal of the wind turbine system associated with the ADL 420816, P&C lease for the SDSU research site after 25 years, at the end of the lease. The major components of the wind turbine system include the nacelle, the tower, and the blades. The nacelle weighs approximately 1335 lbs., the 60 ft. tower weighs approximately 1500 lbs., and the combined weight of all blades is approximately 295 lbs. The components will be disassembled at the site and taken to Coldfoot to be trucked further.

- The plan A for removal of the wind turbine system in the event that the airstrip is well maintained and functional is to use a fixed wing plane and the Ivotuk airstrip. The aircraft used to remove the components of the wind turbine will be the same that is utilized to install them, the Sherpa or SkyVan.
- The contingency plan B for the removal of the wind turbine components in the event that the airstrip is not maintained and no longer functional at the end of the lease period includes the use of either Maritime helicopters, or Northern Pioneer helicopters. In both scenarios, the turbine will be disassembled into the three main components, (the nacelle, the tower, and the blades) to be moved to Coldfoot.

All costs associated with dismantling and removing the site from the tundra will be covered by the NASA grant.