## **Building Alaska's Future Together**

COLD CLIMATE HOUSING RESEARCH CENTER

CCHRC

# 2016 Annual Report



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Dear members & friends of CCHRC:

The title of this year's annual report, "Building Alaska's Future Together," clearly reflects the work of your housing research center. Since CCHRC's founding by a group of builders and Alaskans over 18 years ago, we have consistently focused on collaboration and inclusiveness to find solutions to Alaska's housing and energy issues. This begins with the individuals, families, villages and communities of the Great Land, where the needs for a healthy future are defined. We need to listen to one other and respect the rich diversity of our cultures, environmental regions, economic realities, and varied talents.

The founders of CCHRC realized that one building science approach was not appropriate for Alaska's many climates and cultures. That's why our designers, engineers, and builders have always used a collective and locally driven approach to develop energy efficient, healthy housing. Making our communities stronger and more sustainable is a broad mission that cannot be done in isolation. I invite each of you to join that effort. Contribute what you can in your ideas and positive attitudes. With the most creative and deeply committed individuals on the planet, together we can change the world and lead the way for others.

Best to each of you,



Jack Hébert Founder/CEO Cold Climate Housing Research Center COLD CLIMATE HOUSING RESEARCH CENTER

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Need to update your CCHRC membership? Visit us <u>here</u>!

## Thank You Members!

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# The Holistic Approach in Oscarville

CCHRC is working with the village of Oscarville on the Holistic Approach to Sustainable Northern Communities, an effort that brings together community developers and local villagers to make rural communities healthier and more resilient. First, communities set priorities based on their lifestyle, values, and culture, then use the resources and expertise of government agencies and NGOs to achieve them. Rather than focusing on a single issue, like energy or housing, the Holistic Approach looks at how each of these pieces strengthen the community as a whole.



Oscarville is located in the Lower Kuskokwim Delta and is accessible from Bethel by boat or ice road. Residents say they live there because it's quiet, safe, and offers a rich variety of subsistence resources such as moose, fish, seal, birds, and berries. Infrastructure is minimal in Oscarville, with no running water or sewer system, no landfill, and no roads or airstrip.



Olga Mesak raised her children in Oscarville because she values the traditional way of life. It's not an easy place to live-there are few jobs, not enough housing, and travel is impossible when the river is freezing or breaking up. Most of Olga's siblings have moved away to find better opportunities elsewhere. While life may be more challenging in Oscarville, Olga doesn't want to move. "That's not a solution for us."



The Holistic Approach creates opportunities by capitalizing on the unique strengths of a village. The people of Oscarville say their greatest assets are their Yup'ik culture and subsistence lifestyle. They have a strong connection to the land where they have lived for many generations, working together to bring in food and supporting one another throughout the long winters.



Locals said the number one need in Oscarville was clean water. Since the community well failed years ago, residents have been collecting water and ice from the Kuskokwim River. Just a few miles downriver from Bethel, it's not a safe source of drinking water. The second priority was to reduce power costs, which were twice as high as those in neighboring Bethel.



Through teaming up with local, state, and federal agencies, Oscarville was able to drill two new wells and revamp the village electric grid, reducing electric bills for residents by 60%. The strides made in Oscarville show the value of working together as we face continuing challenges and tightening budgets in Alaska.



CCHRC is helping Oscarville build a vision for the future. What type of lifestyle do they see for themselves? How can they create more jobs and housing? And how can they adapt to climate change? The local people are already seeing changes to the river, the shoreline, and the wetlands that are impacting their subsistence schedules and food security. Through a grant from the Bureau of Indian Affairs, CCHRC is documenting these changes and preparing a climate resilience plan for Oscarville. This project will provide a template for the many other villages facing similar issues.

# Indoor Air Quality

Years of research on Indoor Air Quality has shown the enormous health effects that can result from poor ventilation. While difficult to see or quantify, there are many things in your home that may be unhealthy to breathe. The most hazardous one is PM 2.5, produced primarily from cooking. Volatile Organic Compounds are also very dangerous: acrolein, produced by cooking and cigarette smoke, can cause asthma and lung cancer, while formaldehyde generated by offgassing furniture and other household materials is linked to eye irritation as well as cancer.

A new report underscores the importance of ventilation, especially in the type of airtight homes that are common in cold climates today. The best way to maintain healthy air quality is to bring in clean outside air regularly-between one-third to one-half complete air changes per hour-through bathroom fans, range hoods, and a heat recovery ventilator (HRV), which provides fresh air throughout the home.

Read the full snapshot he



Today's homes are so well-insulated that they trap pollutants and humidity inside. An HRV gets rid of combustion gases from cooking, VOCs from off-gassing carpets and furniture, carbon monoxide from the garage, and other indoor pollutants. It also controls indoor humidity. The HRV replaces stale indoor air the HRV outdoor air, keeping with fresh outdoor althy and comfortable.

The HRV transfers heat from outgoing air to incoming air to save energy and money.

Ventilation is incredibly important to the respiratory health of occupants. On a national scale, poor air quality is responsible for more harm than traffic accidents. While ventilation requires extra energy, and may sometimes result in cold drafts, it's essential to get rid of the pollutants inside your house.

# Rebuilding Allage

Newtok

Newtok is one of the first communities in North America that is losing its home to climate change. As the shoreline erodes and the permafrost degrades, the Bering Sea village is starting to disappear. Less than 100 feet from the encroaching river, the community is in a race to relocate. CCHRC has been working with the people of Newtok since 2008 to design durable homes that they can build themselves. In 2016, we built a demonstration home together at the new village site, Mertarvik.

### Newtok elder Sophie John describes growing up in a sod igloo

Though the Yup'ik people have lived in the region for thousands of years, Newtok is a relatively new village. Before settling on the Ninglick River, they traveled around seasonally, hunting seals on the coast in the fall and moving upriver in the spring to fish. They spent winters in an area called Kealavik, living in mud huts along the river built from driftwood and sod. Compared to the modern homes of today, the mud huts were very basic, but warm.



In 1959, the federal government shipped materials out to Kealavik to build a school. But when the barge bottomed out in shallow water, the school was built instead at a low-lying spot where the Kealavik River poured into the Ninglick River. The village of Newtok grew up around it. But the Ninglick River was already becoming wider and more powerful. Today, the village is losing a battle to the river.



Erosion has been an issue from the very beginning of Newtok. Sometimes it moves slow and steady, claiming about 80 feet per year; other times it surges, devouring the same amount of land in a single storm. Between 1954 and 2003, the river chewed off nine football fields worth of coast. Today, only 80 yards of soft, thawing tundra protect the nearest house from the river. Newtok is one big storm away from disaster.



The village voted to move in 1996, and picked a spot on a rocky island across the river. They call it Mertarvik, which means "place to get water" in Yup'ik. In addition to a fresh spring, the island also contains moose, muskox, blackberries, and salmonberries. But relocation is a complicated process. So far, only a handful of families have moved to the new site, which can only be reached by boat in the summer or traveling over the ice in winter. The Newtok Village Council is now seeking funding to build infrastructure, housing, and a school at the new site.



In August 2016, a new house was built at Mertarvik as a model for the future. The house was designed by CCHRC to be energy efficient, durable, and moveable. The superinsulated walls fend off the cold Bering Sea climate, and the water and sewer systems can function independently or plug into centralized utilities.



The demonstration home was built by a village crew with the help of two CCHRC instructors. The goal was to teach workers the intricacies of the house and its systems so they can build more in the future.



Because there is no infrastructure in Mertarvik and the village plan has not been finalized, the home was built with a skiddable foundation so it can be moved to its final spot. Three ski-like tracks allow the house to move across ice or tundra, and a triodetic foundation can move up and down in response to shifting ground. This type of flexibility is essential in the changing environment of the Yukon Kuskokwim Delta.



People of Newtok see themselves not as refugees but as pioneers, leading the way in a changing world. There are many challenges when it comes to relocating an entire community, including funding, appropriate designs, and the logistics of building at a remote site. As other communities face the effects of a warming climate, they can look to Newtok for lessons on how to build a strong, sustainable village.



Permafrost has vexed builders for as long as they have been building in Alaska. To predict how permafrost will respond to construction, you need to know complex properties of permafrost at a particular site, which is notoriously difficult since it's all underground. So if you're building in a permafrost region, the first thing you need to know is what kind of ground you're on.

CCHRC partnered with the U.S. Army Cold Regions Research and Engineering Lab (CRREL) to test new methods of detecting and assessing permafrost and to match up soil information with appropriate foundation designs. We published a new software tool that can help you decide where to build and what kind of foundation to choose depending on where your property is.

A beta version of the site is available here. (Free registration is required.)

#### Please provide a name for your assessment.

This name will be stored in the DSS, and can be reloaded with all your saved settings. You can modify this assessment and save it under a different name, as well.

home near Thompson Dr







STEP 1: Pick a site in the Fairbanks area and the software will load whatever ground data is available.

#### How would you describe the topography?

Flat or nearly level (0-2% slope)

Moderately sloping (3-10%)

Steeply sloping (>10%)

The slope, or grade, is used to express how flat or steep the land is. It is often used to estimate the erosion potential of a site. The slope is calculated as the number of feet (or meters) the land surfaces rises or falls over a distance of 100 feet (or meters).



#### Flat O Moderate O Steep

Have you observed evidence of ice-wedge polygons or troughs at the site? They will likely be covered by vegetation and difficult to spot. The troughs develop above ice wedges, as shown in the photo, and are sometimes wet or ponded?





Observed Ice Wedges No Observed Ice Wedges



STEP 2: Answer questions about the property to see the "difficulty factor" of building there. gether data and expertise on ive you an idea of the level of difficulty ntended area.

where you collect data in the field to essment area. A key part of field and electromagnetic scans of your stand what's going on under the

#### Map Query Results

Assessment Conclusions Detail Recommendations

A preliminary assessment, based on the publically available data and the information you provided, yields a DDF score of 27. This suggests that building at this site might be problematic, but it is difficult to be more certain without additional information. This means that, to be safe, you are advised to obtain more information that is specific to the building site such as soil cores or geophysical surveys. The DSS will guide you through this process. Just hit close and move to the next screen.

#### **Conditions Increasing Difficulty**

Raised Foundation Medium Acceptable Risk of Failure Heated Structure Flat Topography Early Succession Boreal Forest Pipeline Existing Structure Heated

#### **Conditions Decreasing Difficulty**

Light Structure Type 2 Ice Wegdes not present Thermokarst Not Present Drunken Forest Not Present Marshes Standing Water Not Present Streams Not Present Existing Structure Foundation is Good

> STEP 3: Learn positives and negatives of building on your land and whether more data should be collected (e.g. permafrost boreholes).



### **Map Query Results**

#### **Terrain Units**

#### Terrain Units:

Alluvial Fan Silt: Alluvial-fan silt overlying flood-plain sand and gravel; thickness as much as 50 feet. Discontinuous permafrost with moderate to low ice content primarily as pore ice but may contain ice seams and lenses. No large ice masses. Slight to moderate subsidence upon thawing. Seasonal frost action moderate to intense. High bearing strength when frozen or dry; low when wet or thawed when not well drained.

#### Ice Content, Permafrost Extent

#### **Development Difficulty Factor**

Development Difficulty summarizes the expected difficulty of developing your structure in the selected site. It includes material type, ice content, vegetation, required resiliency, and cost as factors. The table below shows your DDF result.



STEP 4: Learn additional info about your site based on all available data under "Assessment Details"



The final version of the software will suggest a range of appropriate foundation designs for your site, with cost/benefit summaries for each option, as a solid starting point for building your home. For example, a slab-on-grade foundation may be recommended for solid bedrock while an adjustable post-on-pad foundation would be better on permafrost.

## Thank you for your support. Have a great summer!



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