

# Holden Village's Micro Grid

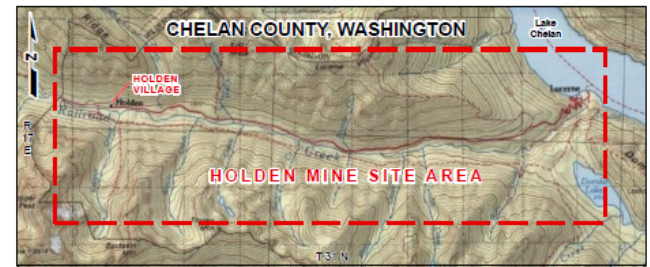
IEEE NWESS Presentation – May 1, 2014 University of Washington





# How to get to Holden

- Drive to Lake Chelan
- Catch the Lady of the Lake in Chelan or at Fields Point
- 2-3 Hour Boat Ride to Lucerne
- 40 Minute Bus Ride from Lucerne to Holden Village

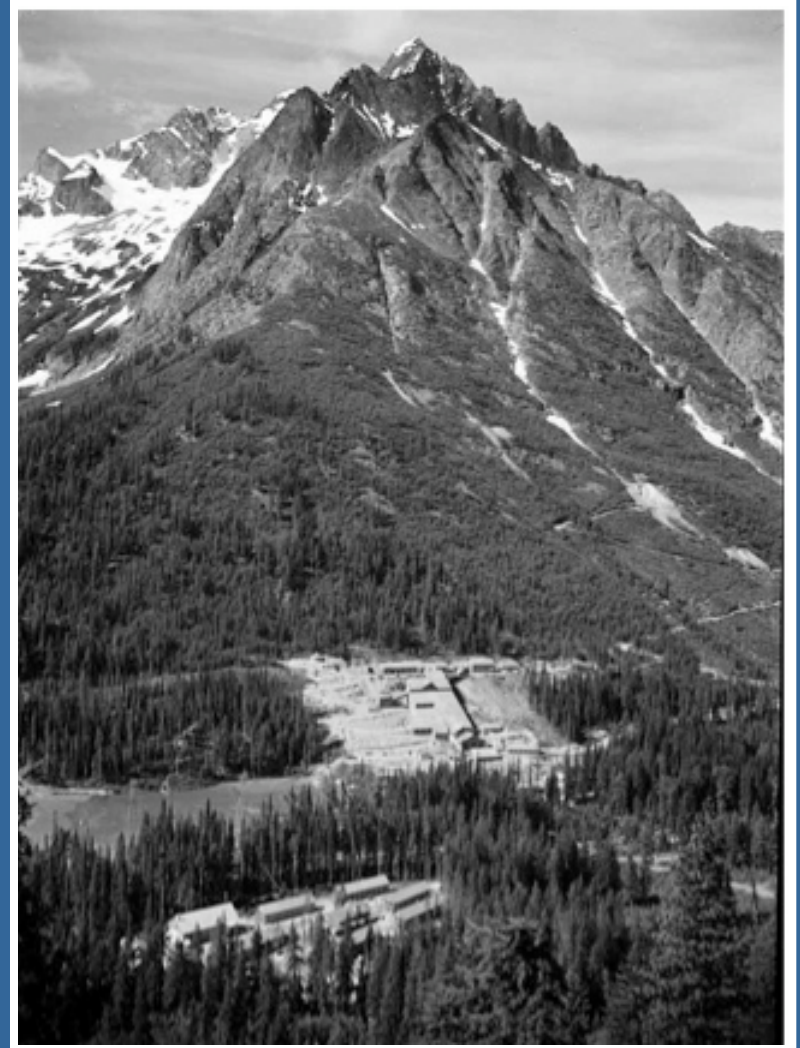


MAP OF SITE AREA  
(not to scale)



# Brief History of Holden Village

- James Holden Discovered Ore – 1896
- Many attempts to develop the mine – all failed
- Howe Sound ran Holden Mine run from 1937 to 1957
- Extracted >\$500 million of Copper, Gold, Zinc and Silver in today's dollars
- After no buyers – Sold to LBI for \$1
- Lutheran Retreat Center since 1962



# Holden Village Mission and Core Values



**The Mission of Holden Village**, a Lutheran ministry, is to welcome all people into the wilderness to be called, equipped and sent by God as we share rhythms of

- Word and sacrament
- work, recreation and study
- intercession and healing

## **Holden Village Core Values**

Worship - Theology - Hospitality - Vocation - Diversity - Grace - Shalom - Ecology - Gifts - Study - Rest - Place - Community - Hilarity

# Village Built – 1937 and 1938

14 Chalets

6 Lodges

Dinning Hall

Recreation Building

School

Hospital



Buildings owned by Holden

National Forest Land

National Historic Registry

# Power in the Village

- Mining Days - Transmission Line from Chelan Falls
- When the mine was shut down the transmission line was taken down
- No Power in the Village when it was sold to LBI
- Distribution lines in the Village remained
- 1961 – 2 Diesel Generators
- 1964 – Hydro Plant Built



# Diesel Generators – Installed 1961



# Hydro Generators Installed 1964





# Description of Hydroelectric System

- Diversion Dam – 640 feet of Head
- 14" Diameter Steel Penstock
- 2 – 250KVA Generators at 2.4kV
- Pelton Flyball Governors
- 1 – Static Exciter
- 1 – Rotating DC Exciter
- 2.4kV Distribution Voltage
- Overhead Distribution Lines
- Distribution Transformers Delta/Delta  
2400/240-120 Volts  
with Wild Leg

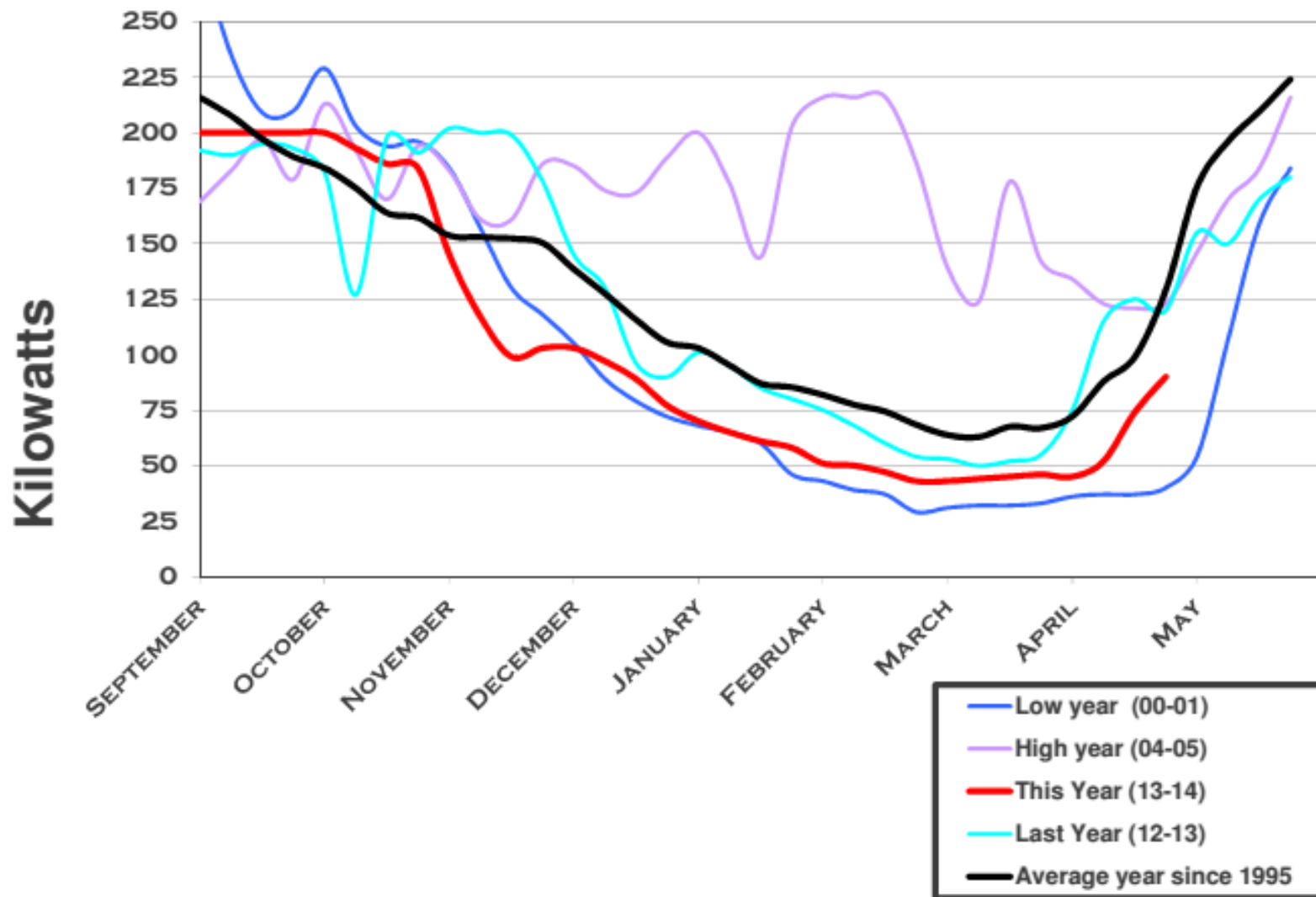


# Operation of Power System

- No Storage Reservoir
- No Automatic Voltage Regulators
- Peak Power Output in Summer – 250KW
- Winter Output 30 KW or Less



# Available Hydro Power

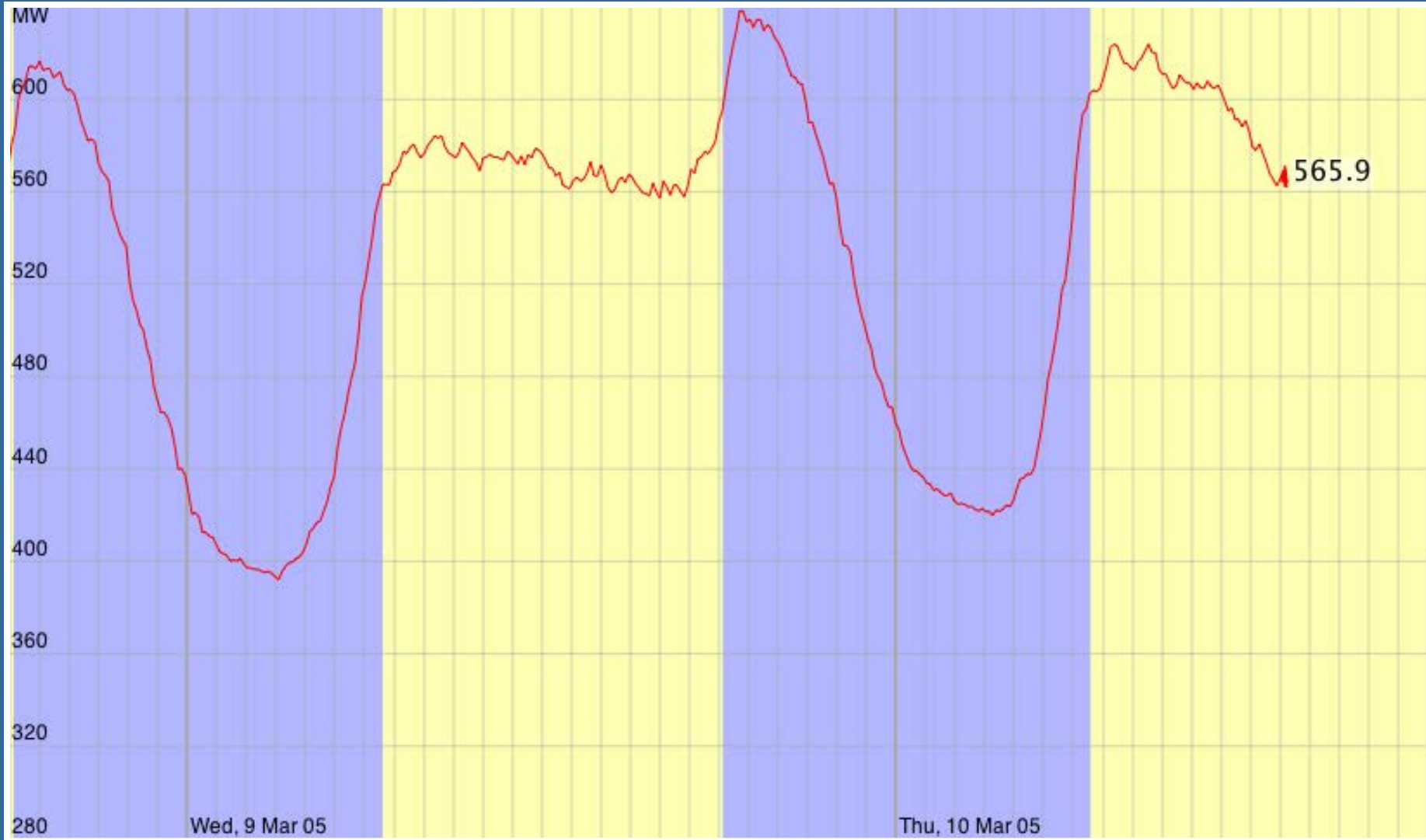


# Ways We Handle Winter Power Drop

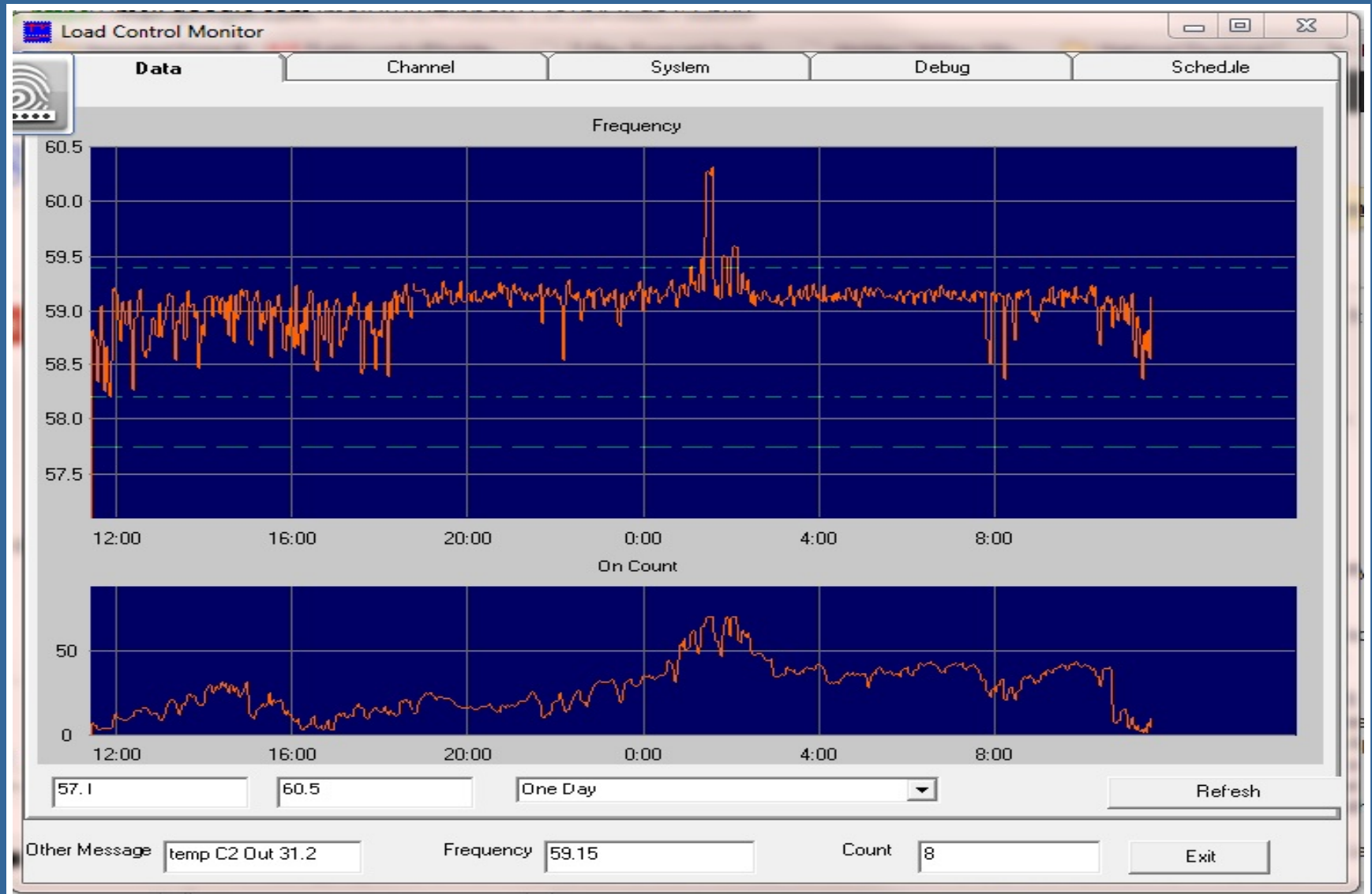
- Shut down buildings (Reduced Winter Pop.)
  - 3 Lodges
  - Village Center – Recreation Building
  - 2 or 3 Chalets
- Turn off Unnecessary Loads
  - Large Freezer and Refrigerator, Oven
  - Only one large kitchen load at a time
  - All Dryers – Only wash cloths after kitchen shuts down
  - Electric Heat – Wood or Diesel
  - Conserve
  - Automatic Load Controller



# Typical Load Cycle on Grid



# Holden's Load Control Program



# Holden's Load Control Program

Load Control Monitor

Data Channel System Debug Schedule

Refresh

|        | Type    | Name                          | Priority |      |         | Lock      | Fudge | State | Speed | Today  |          | Yesterday |          |       |       |    |
|--------|---------|-------------------------------|----------|------|---------|-----------|-------|-------|-------|--------|----------|-----------|----------|-------|-------|----|
|        |         |                               | Low      | High | Current |           |       |       |       | Ontime | Switches | Ontime    | Switches |       |       |    |
| N34:01 | Network | Hotel Tank 1/Hobart Center    | 12       | 89   | 89      | Lock_Auto | 1.00  | On    | slow  | 13:40  | 1        | 18:43     | 53       | 49218 | 67376 | 2  |
| N34:00 | Network | Hotel Tank 1/Hobart Top       | 12       | 88   | 88      | Lock_Auto | 1.00  | On    | slow  | 13:39  | 1        | 17:26     | 53       | 49158 | 62763 | 3  |
| N27:06 | Network | Agape Dryer Element A         | 5        | 87   | 87      | Lock_Auto | 1.00  | On    | slow  | 10:40  | 1        | 9:51      | 36       | 38415 | 35463 | 4  |
| N34:02 | Network | Hotel Tank 2 Bottom           | 69       | 86   | 86      | Lock_Auto | 1.00  | On    | slow  | 20:38  | 2        | 19:13     | 14       | 74251 | 69194 | 5  |
| N34:04 | Network | Hotel Tank 3 Bottom           | 69       | 86   | 86      | Lock_Auto | 1.00  | On    | slow  | 20:37  | 2        | 19:15     | 38       | 74237 | 69307 | 6  |
| N27:07 | Network | Agape Dryer Element B         | 5        | 83   | 83      | Lock_Auto | 1.00  | On    | slow  | 10:34  | 3        | 3:16      | 8        | 38041 | 11752 | 7  |
| N34:15 | Network | Hotel Tank 1/Hobart Bottom    | 12       | 80   | 80      | Lock_Auto | 1.00  | On    | slow  | 13:26  | 9        | 15:39     | 25       | 48364 | 56319 | 8  |
| N34:13 | Network | Dining Hall Heat 2            | 40       | 73   | 73      | Lock_Auto | 1.00  | On    | slow  | 13:09  | 26       | 14:28     | 16       | 47321 | 52078 | 9  |
| N34:12 | Network | Dining Hall Heat 1            | 40       | 73   | 73      | Lock_Auto | 1.00  | On    | slow  | 13:07  | 58       | 14:34     | 42       | 47207 | 52436 | 10 |
| N34:03 | Network | Hotel Tank 2 Top              | 12       | 72   | 72      | Lock_Auto | 1.00  | Off   | slow  | 5:18   | 26       | 6:47      | 31       | 19083 | 24403 | 11 |
| N34:05 | Network | Hotel Tank 3 Top              | 12       | 72   | 72      | Lock_Auto | 1.00  | Off   | slow  | 5:26   | 40       | 6:52      | 61       | 19565 | 24697 | 12 |
| N27:08 | Network | Agape Dryer Element C         | 5        | 70   | 70      | Lock_Auto | 1.00  | Off   | slow  | 8:05   | 26       | 6:01      | 36       | 29091 | 21676 | 13 |
| N16:10 | Network | Lodge 1 Electric Boiler E     | 37       | 69   | 69      | Lock_Off  | 1.00  | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 14 |
| N18:02 | Network | Jacuzzi A                     | 45       | 65   | 65      | Lock_Off  | 1.00  | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 15 |
| N18:00 | Network | Lodge 3 Left HW               | 40       | 60   | 60      | Lock_Off  | 1.00  | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 16 |
| N34:14 | Network | Guest Laundry Heat            | 40       | 60   | 40      | Lock_Auto | 1.00  | Off   | slow  | 15:07  | 44       | 14:33     | 31       | 54430 | 52384 | 17 |
| N18:01 | Network | Lodge 3 Right HW              | 40       | 60   | 40      | Lock_Off  | 1.00  | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 18 |
| N18:03 | Network | Jacuzzi B                     | 12       | 40   | 40      | Lock_Off  | 1.00  | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 19 |
| N16:08 | Network | Lodge 1 Electric Boiler C     | 37       | 67   | 37      | Lock_Off  | 1.00  | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 20 |
| N16:07 | Network | Lodge 1 Electric Boiler B     | 37       | 67   | 37      | Lock_Off  | 1.00  | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 21 |
| N16:06 | Network | Lodge 1 Electric Boiler A     | 37       | 67   | 37      | Lock_Off  | 1.00  | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 22 |
| N16:09 | Network | Lodge 1 Electric Boiler D     | 37       | 67   | 37      | Lock_Off  | 1.00  | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 23 |
| N16:11 | Network | Lodge 1 Electric Boiler F     | 37       | 67   | 37      | Lock_Off  | 1.00  | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 24 |
| N34:10 | Network | Hotel Men's Hot Water         | 30       | 70   | 30      | Lock_Auto | 10.00 | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 25 |
| N34:11 | Network | Hotel Women's Hot Water       | 30       | 70   | 30      | Lock_Off  | 10.00 | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 26 |
| N16:01 | Network | Lodge 1 Right Water Heater    | 29       | 69   | 29      | Lock_Auto | 10.00 | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 27 |
| N16:00 | Network | Lodge 1 Left Water Heater     | 29       | 69   | 29      | Lock_Auto | 20.00 | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 28 |
| N22:06 | Network | Chalet 2 Hot Water Upstairs   | 15       | 68   | 15      | Lock_Auto | 10.00 | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 29 |
| N22:05 | Network | Chalet 2 Hot Water Downstairs | 15       | 68   | 15      | Lock_Auto | 10.00 | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 30 |
| N21:01 | Network | Lodge 6 Hot Water Leg 3       | 15       | 68   | 15      | Lock_Auto | 10.00 | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 31 |
| N21:00 | Network | Lodge 6 Hot Water Leg 2       | 15       | 68   | 15      | Lock_Auto | 1.00  | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 32 |
| R05A   | Remote  | Chalet 5 Hot Water            | 15       | 68   | 15      | Lock_Auto | 4.00  | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 33 |
| R04A   | Remote  | Chalet 4 Hot Water            | 15       | 68   | 15      | Lock_Auto | 4.00  | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 34 |
| R03A   | Remote  | Chalet 3 Hot Water            | 15       | 68   | 15      | Lock_Auto | 10.00 | Off   | slow  | 0:00   | 0        | 0:00      | 0        | 0     | 0     | 35 |

Set Channel Schedule

Priority Schedule for Channel N34:11

High

Low

0:00 3:00 6:00 9:00 12:00 15:00 18:00 21:00 24:00

Copy Paste OK Cancel

Other Message temp L6 Out 23.5 Frequency 58.65 Count 9 Exit

# H.E.L.P.

Holden  
Electric  
Light &  
Power





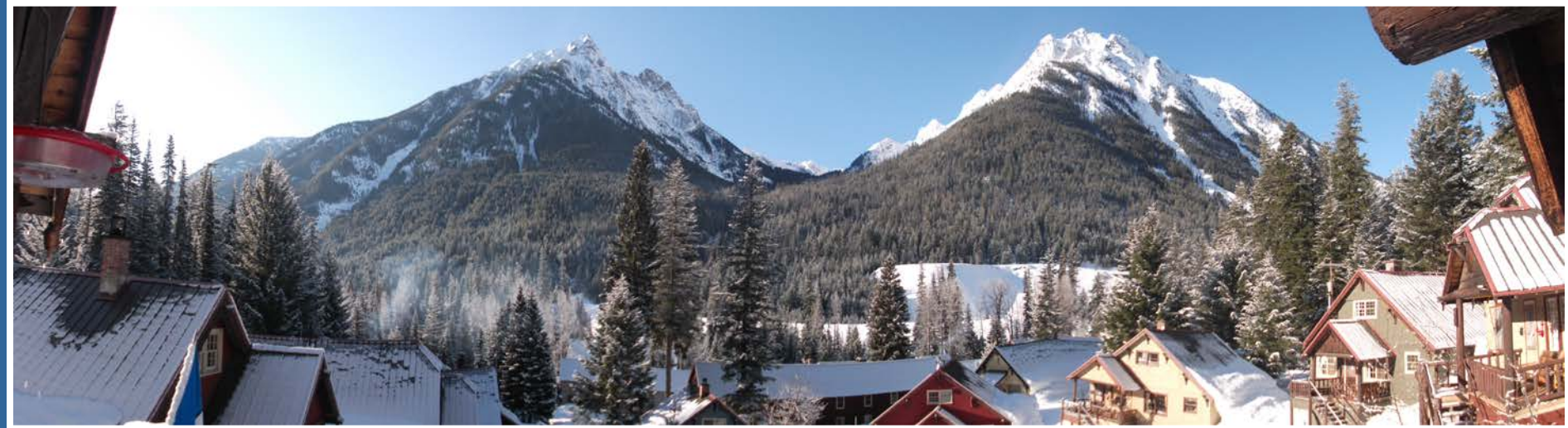
# Avalanches



# Snow & Trees



# Questions about HELP?





# Holden Upgrades

## Utilities

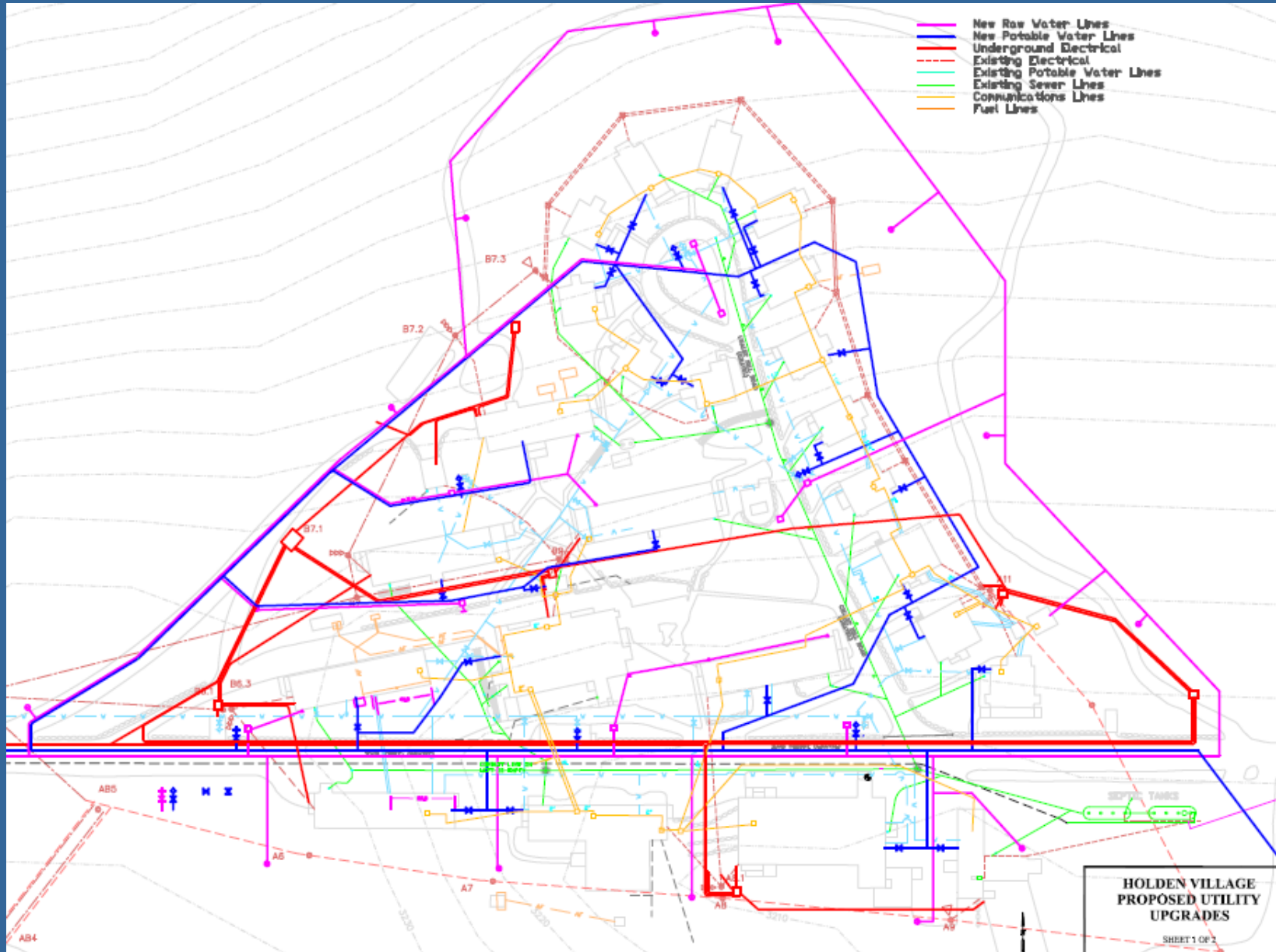
- Upgrade Hydro
- Electrical distribution
- Potable Water Mains
- Raw Water Main
- Communications

## Building Improvements

- National Historic Registry
- New roofs on lodges
- Renovate Buildings
- Log porches
- Health and safety issues in lodges and chalets



# Planned Utility Upgrades



# Work in 2013



Lots of Digging



# Water and Fire Protection



- Potable Water Main Replacement
- Untreated Water Main
  - Lawn Irrigation
  - Wild Fire Protection for Village



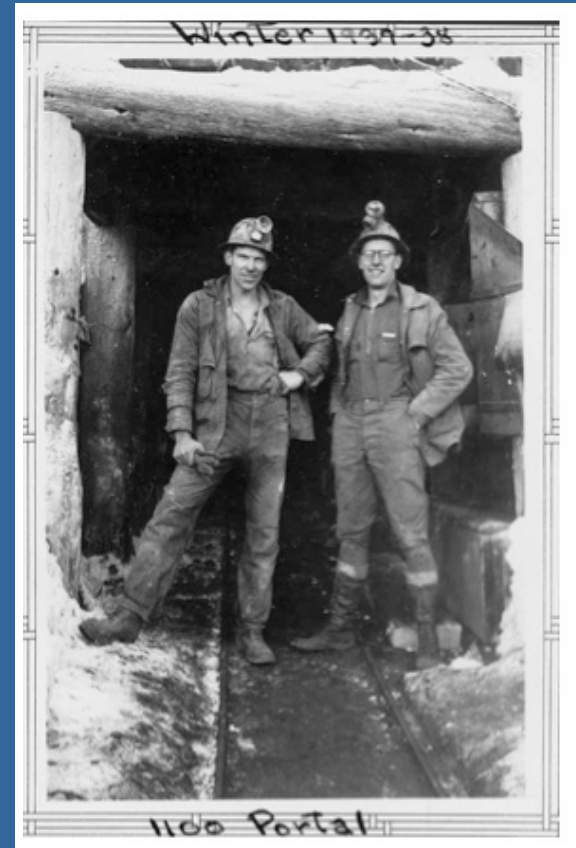
# Electrical Upgrades



- Eliminate overhead power lines
- Expand and upgrade hydro-electric plant
- Communications Paths

# You Can HELP

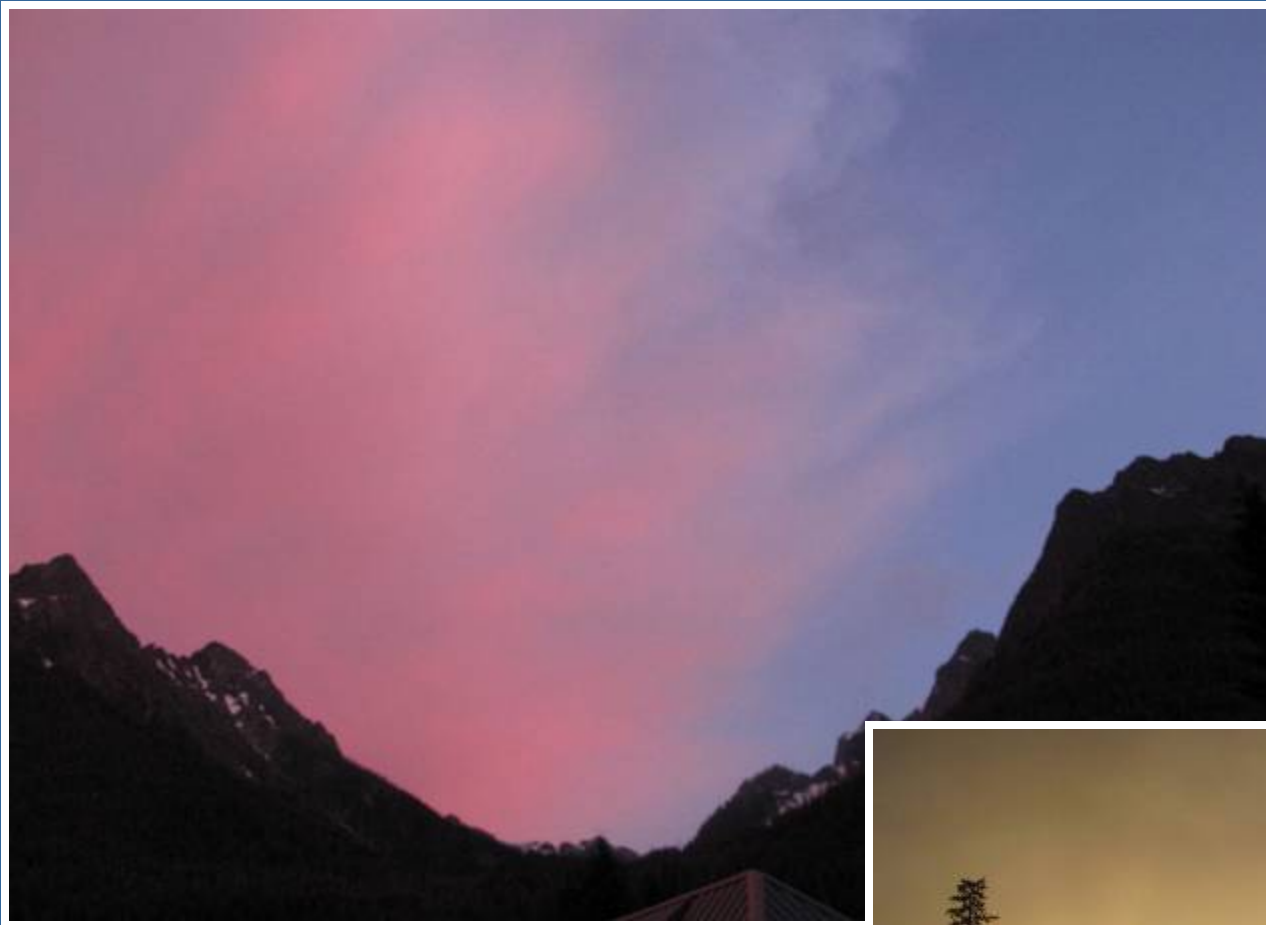
- Chris Shultz [publicworks@holdenvillage.org](mailto:publicworks@holdenvillage.org)
- Technical Skills
  - Electrical Construction/Design
  - Construction Management
  - Drafting
  - Journey-level electricians/linemen
  - Pipe installers/plumbers
  - Backhoe operators
  - Heavy equipment operators
  - Plus many other opportunities...
- [www.holdenvillage.org](http://www.holdenvillage.org)



Miners at the 1100 Portal from collection of Bill Phillips (Source: Ray Baker)



Questions?



Thank you