

# APU Nordic Ski Facility Improvements

Spring 2016 Senior Design Project



## Background and Purpose

- Alaska Pacific University's (APU) Nordic Ski Facility is running out of potable water earlier each year.
- The facility is used to train Nordic Skiing athletes from all over the world in the summer months.
- The facility needs a water catchment system to support the users throughout the summer, and a shed to house APU's PistenBully 100.



## Project Scope

- Design a water reservoir with an appropriate liner,
- Provide a grading plan for the new reservoir design,
- Design a structure that can house the PistenBully 100 year round,
- Suggest construction phasing, and
- Deliver engineering documents



## Reinforced Polyethylene (RPP) Lined Basin - Alternative

### Advantages

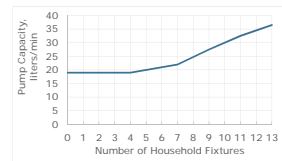
- Relatively inexpensive
- Available in Anchorage
- Extremely durable and rip resistant
- Least labor intensive alternative

### Disadvantages

- Difficult to place by hand for this size
- Without grading the site, a geotextile underlay would need to be placed

### Estimated Water Use for Facility

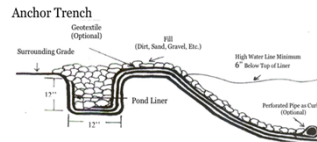
- 31,500 gallons per season



With the pump capacity, accurate flow rates at fixtures can be determined (View figure Right). Using that, an estimation of water consumption for each person, per day, can be determined. By this method, an estimate of 563 gallons per day and 31,500 gallons per season was determined.

### Estimated Water from RPP Liner Placed 4 Feet from Basin Bottom

- Using a contour line four feet from the bottom of the basin, and snow with a 30% water content, the amount of water that will accumulate within the liner is 71,097 Gallons.



Anchor method that would be used for the liner (ABOVE), and the upper boundary of the basin along with the approximate water line needed (RIGHT).



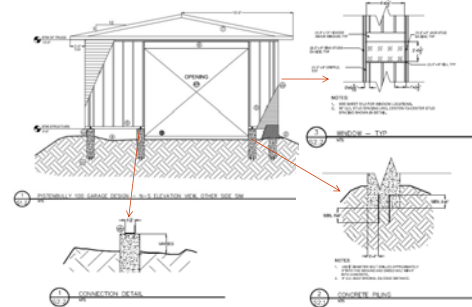
## Conventional Stick Frame With Open Floor - Alternative

### Advantages

- Relatively inexpensive
- Wide availability of needed materials
- Lighter than other alternatives
- Some parts of the structure can be manufactured off-site in order to save time during building construction
- Open floor allows water to pass through

### Disadvantages

- Construction will take longer than other alternatives
- Will require more tools and materials than other alternatives



### Design Criteria for the Structure

- Wind load of 50 psf (140 mph 3-second gusts)
- Snow load of 223 psf

### Anchor System for the Structure

- Concrete pilings
  - 1 foot diameter cylindrical piles
  - 4 foot length for each pile
  - 3 foot embedment depth
  - 18 piles for the entire structure
  - Concrete mixed on-site



3D Model of the designed shed with the PistenBully 100 shown in front

## Special Considerations

- The work site sits atop Eagle Glacier, and is remote (Vertically)
- Only safely accessible by helicopter
- Operating season of the facility is between June and September
- Due to the site location, the chosen alternatives should be able to be built without heavy equipment

## Conclusion

The APU Nordic Ski Facility is in need of a water catchment system that will support water consumption needs throughout the facilities training season. Given the significance of the PistenBully 100 to all training operations, an adequate structure to house the equipment is also needed.

## Recommendations

- 45 mil. RPP lined basin with a 12-oz geotextile underlay
- Conventional stick frame structure with doors on either side, four total windows, and 18 concrete pilings

## Acknowledgements

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## TEAM MEMBERS:

RILEY BRONGA, CE, JESSICA FARRELL, CE, JOSHUA SMITH, CE  
GABRIEL THOMAS, CE