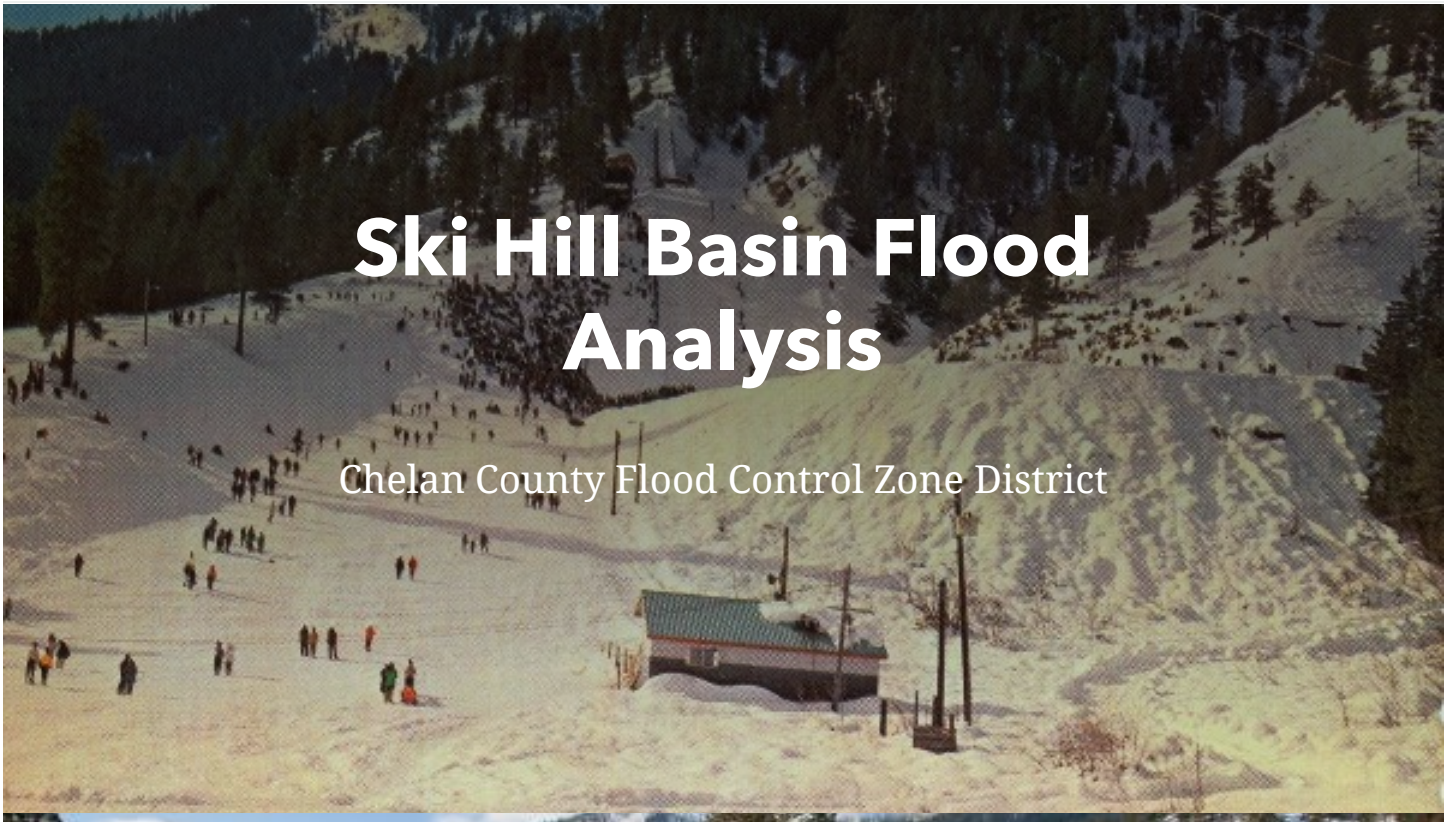


Ski Hill Basin Flood Analysis

Chelan County Flood Control Zone District

Welcome to the Ski Hill Basin Story Map!

Purpose

The Chelan County Flood Control Zone District is performing a

study to identify solutions to reduce impacts of runoff coming from the Ski Hill basin.

The County's project team performed an engineering study to estimate how much runoff comes from the Ski Hill basin, and where that runoff goes. The results of the study were used to identify six potential alternatives that vary in complexity and cost to reduce the impacts of flooding.

Due to COVID-19 the project team is unable to hold a public open house as planned. The project team prepared this story map to help you learn about the project.

How to Use This Story Map

Keep scrolling down to learn more about the existing conditions, alternatives, and to take our survey. Use the links along the top to move quickly between sections.

This story map includes several interactive features to help you learn about the project:

- **Interactive Maps.** All of the maps can be zoomed in and out to take a closer look at the proposed alternatives. If you're on a mobile phone, you can tap the map to make it full size for easier viewing. You can also click the white box with two arrows to make the map full screen.
- **PDF Downloads.** A PDF of each alternative is available for download.
- **Alternatives Survey.** Take a survey to provide feedback on the alternatives.

Background

Located just north of the City of Leavenworth, Ski Hill is a popular winter and summer recreation destination. Since 1928, Leavenworth Ski Hill has played an important role in the city's history, from hosting national ski jumping competitions and Special Olympics cross country skiing competitions, to providing local residents and visitors a place to learn winter sports and recreate.

Leavenworth Ski Hill is also known for runoff from rapid snow melt that floods and damages adjacent county roads and private property. Over the years, runoff has changed and appears to occur on a more frequent basis.

Current Conditions

Ski Hill Drainage Basin

A drainage basin (also referred to as a watershed) is an area of land where rainfall and snowmelt collect and drains to the same location, such as a creek or lake.

Runoff from the Ski Hill basin (shown in orange on the map) flows on to roads and into drainage ditches, and eventually makes its way to Chumstick Creek and the Wenatchee River.

In the winter and spring, runoff from Ski Hill basin frequently causes flooding on public and private property. Flooding is caused by a variety of conditions.

Flooding Conditions

Warm winter rains or rapid temperature increases

When the ground is frozen and covered in snow, rain causes a type of flooding called a “rain-on-snow” event. Flooding can also happen when temperatures quickly warm and cause rapid snowmelt. The frozen ground prevents runoff from infiltrating. When snow is in the road ditches and blocking culverts, runoff is forced onto roads and private property.

In this photo: The ditches are full of snow, causing the runoff to sheet flow across the road. Sheet flow is when runoff flows over a ground surface as a thin, even layer.

Shallow groundwater

When there is shallow groundwater, runoff does not infiltrate into the ground.

Undersized conveyance system

In the study area, the conveyance system includes roadside ditches, culverts, drainage ditches and ponds.

An undersized conveyance system means there is more water flowing in the system than it can carry. For example, during high flows, when the ditches and culverts are too small, the runoff overtops them and flows onto the roadway and over private property.

In this photo: The culvert is much smaller than the ditch and is partially blocked.

This survey is currently closed. Please contact the author of this survey for further assistance.

Do you feel there is a flooding problem in the Ski Hill basin?

If you're on a computer or tablet, click on the survey to activate it. If you're on a cell phone, click here to open the survey in a new window.

Project Steps

Chelan County Flood Control Zone District partnered with

TetraTech, Perteet and Grette Associates to complete the study. For the past several months, the project team has been gathering data and performing engineering studies to better understand the current conditions and identify potential solutions.

Step 1: Analysis

At the beginning of the study process, the project team performed a two-day site visit. During the site visit the project team made field observations to better understand the local topography and drainage patterns and to evaluate the existing stormwater infrastructure.

After the site visit, the project team performed a hydrology and hydraulic analysis. A hydrology analysis estimates **how much** water will run off the hills and out of the drainage basin, and a hydraulic analysis predicts **where** the water will flow.

The project team developed the hydrology model to estimate the peak flows and runoff volumes for the 2-year through 100-year return interval, rain-on-snow events. The hydraulic model was used to evaluate the flow paths, depths and velocity of the runoff and to evaluate the capacity of the existing drainage infrastructure.

Step 2: Identify Possible Alternatives

Using the results of the model, the project team identified several alternatives that might reduce flood impacts. The project team generated an initial list of alternatives and reduced the list to the six alternatives presented below.

Step 3: Evaluate Alternatives

Now the project team needs your input to help evaluate the alternatives. Keep scrolling to learn more about the six alternatives and to take a survey.

In addition to the survey results, the project team will use the following criteria to evaluate the alternatives:

- Improvement to drainage
- Reduction of flooding
- Reduction of damage to public infrastructure (roads, ditches, etc.) and private property
- Resiliency to flooding
- Construction costs
- Long-term maintenance costs

Step 4: Select Preferred Alternative(s)

After the survey closes, the project team will apply a ranking system to select the preferred alternative(s). The ranking system will compare the benefits and costs for the alternatives and then determine the most cost-effective alternatives. The results will be presented to the FCZD for final selection of the preferred alternative(s).

Following selection of the preferred alternative(s), the project team will finalize a report that details the analysis, public outreach process, and selection process, and provides conceptual level design drawings and cost estimates. The FCZD can use the report to support planning, permitting and applying for state and federal grants.

Step 5: Fund and Implement the Preferred Alternative(s)

To support implementation of the preferred alternative(s), the project team will assist the FCZD in identifying and pursuing state and federal grant opportunities.

Conveyance System Components

The proposed alternatives include a series of storm water features aimed to capture and convey the runoff more efficiently. The different features are described below:

Culvert – A tunnel that carries water under a structure such as road or railroad. They are commonly constructed out of concrete or corrugated metal pipe.

Channel – A path for flowing water that is confined by banks and a streambed (such as a creek).

Ditch – A narrow channel dug in the ground, typically used for drainage alongside a road or the edge of a field.

Gallery – An underground tank used to collect runoff, sediment and pollutants. The gallery has an outflow pipe that can be used to limit flow rates back into the existing stormwater network.

LID – Low Impact Development is a sustainable management strategy to protect water quality and associated aquatic habitat.

Pond – A small body of water formed in a natural depression, by excavating the ground or by constructing a dam.

Swale – A shallow channel with gently sloping sides that are often vegetated or lined with rocks. Swales are commonly constructed as an LID to collect runoff, filter pollutants and increase infiltration.

Wetland – Areas where water covers the soil or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season.

Alternatives

The six alternatives chosen for further evaluation are shown below. The alternatives increase in complexity and cost, with Alternative 1 being the least complex and least expensive and Alternatives 5 and 6 being the most complex and most expensive.

Each alternative includes a description of how the costs relate to the other alternatives.

$** - Least expensive, **$$** - Less expensive, **$$$** - More expensive, **$$$$ - Most expensive

After reviewing the alternatives, please take our survey.

Alternative #1

Alternative 1 is the “No Action” alternative. No new drainage features will be constructed, but on-going maintenance of the ditches and culverts will continue as necessary.

Relative Cost: **$**

Download PDF of Alt #1

Alternative #2

Alternative #2 is the most basic alternative.

It includes increasing the size of the roadside ditches and culverts along Detillion and Titus Roads. A field inspection indicated that many of the ditches and culverts are undersized. Increasing the size of the ditches and culverts will capture more runoff from uphill, particularly during spring runoff when the ditches may be partially blocked by snow.

The ditch adjacent to Titus Road may be improved to prevent erosion. All runoff would be directed to the channel shown as a green dashed line which drains into Chumstick Creek.

Relative Cost: **$$**

Download PDF of Alt #2

Alternative #3

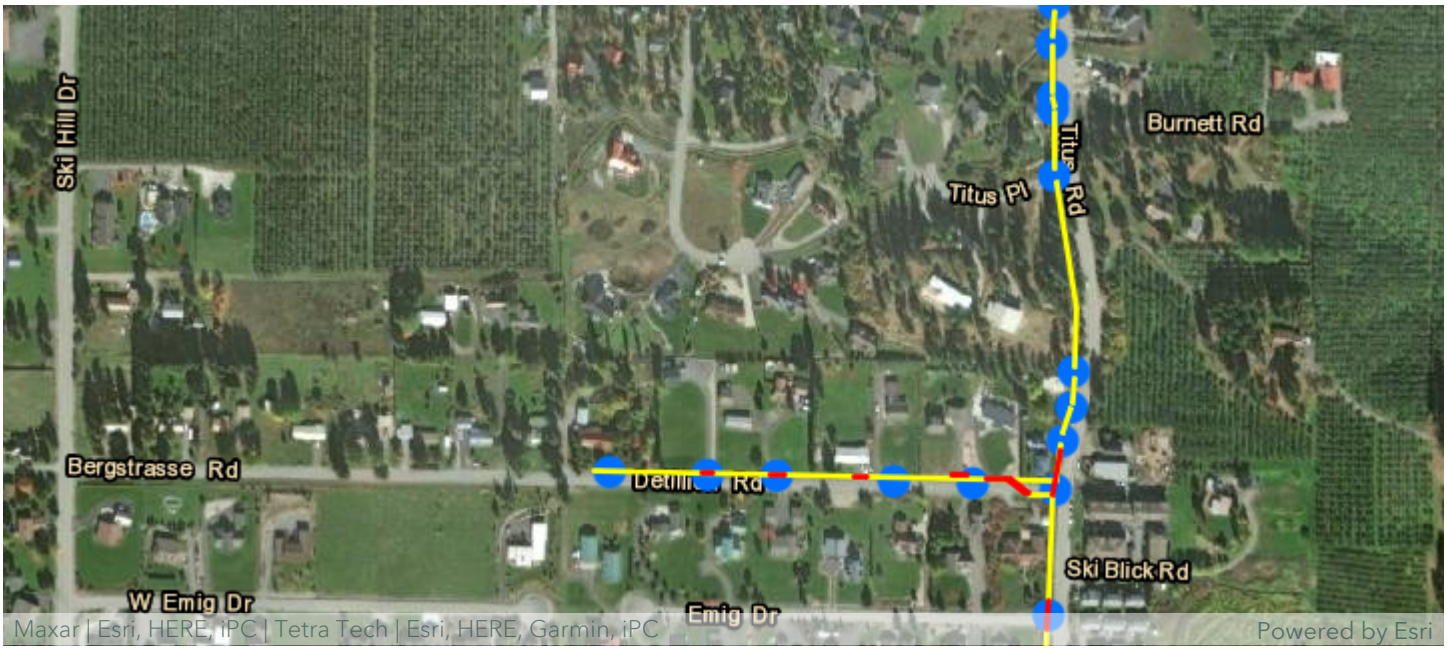
Alternative #3 includes all the features of Alternative #2 with the addition of:

- Construct a pond or install a gallery in the vicinity of the Ski Hill parking lot, and
- Construct larger swales along the north side of Titus Road between the existing culverts.

The intent of the pond or gallery at the Ski Hill parking lot is to store water and reduce the amount of runoff flowing along the north side and the overtopping of Titus Road. The features near the Ski Hill parking lot will also pass more flow through the culverts under Titus Road and reduce flow going over the road.

Relative Cost: **$$$**

Download PDF of Alt #3



Alternative #4

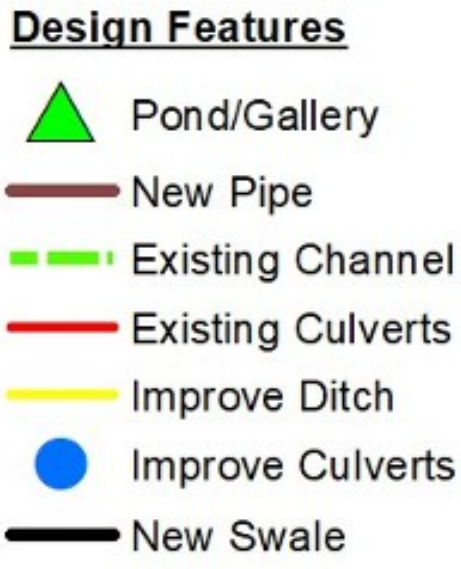
Alternative #4 includes all the features of Alternative #3 with the addition of:

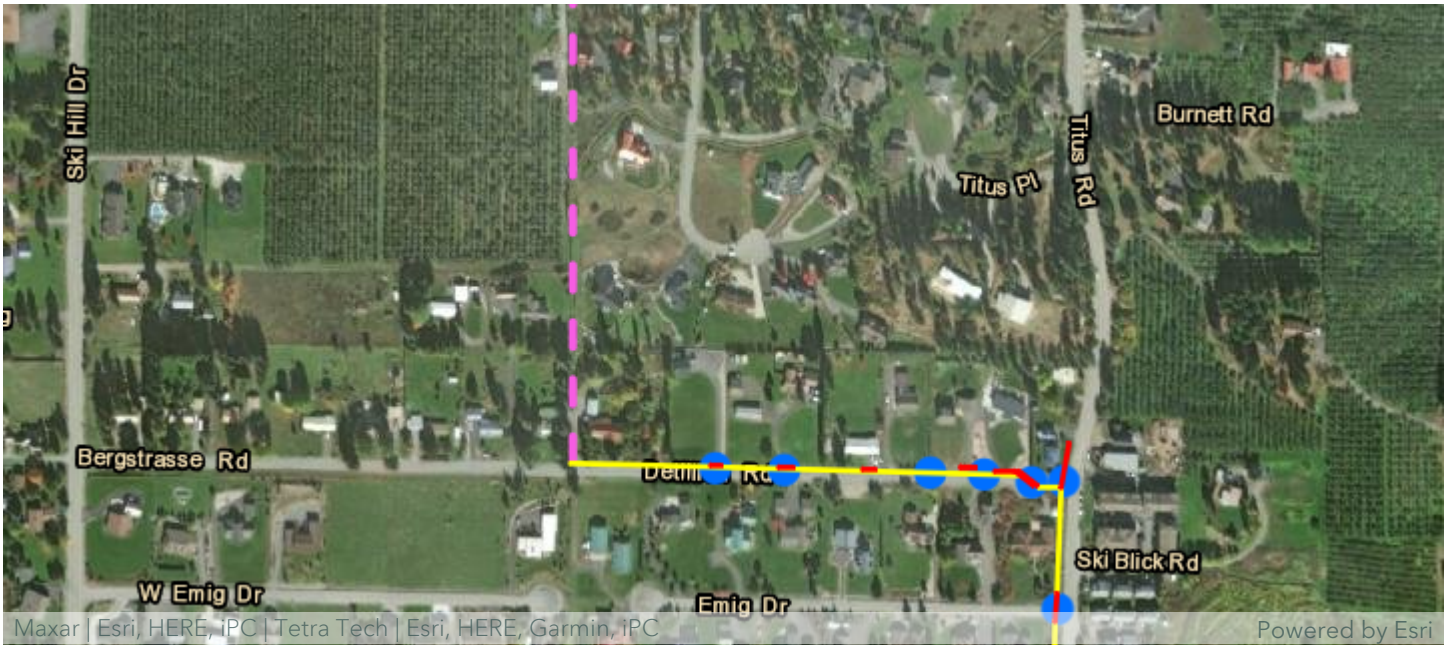
- Construct a larger swale and install a culvert (pipe) to collect and convey water along Titus Road from west to east, and
- Improve the roadside ditches and culverts along Titus Road in the north-to-south direction.

The intent of Alternative 4 is to reduce the amount of flow into the orchard south of Ski Hill by conveying more flow along the north side of Titus Road to the existing ditch that starts where Titus Road turns south.

Relative Cost: **$$$$**

Download PDF of Alt #4





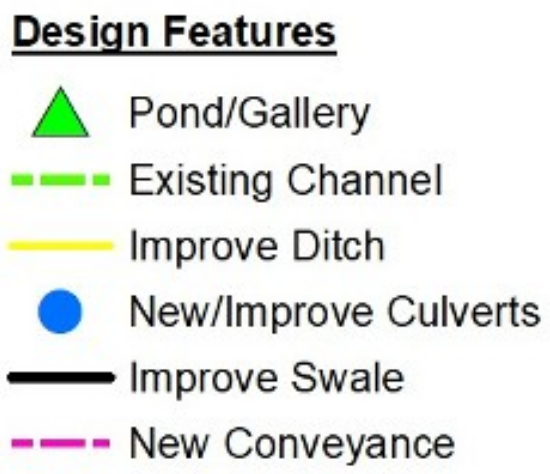
Alternative #5

Alternative #5 includes all the features of Alternative #3 with the addition of:

- Construct a new flow conveyance feature that flows in a north-south direction along a thin strip of land that extends from Titus Road to Detillion Road. The new conveyance feature, shown as a pink dashed line in the figure, may be a ditch, swale or a very long culvert or pipe. The type and alignment of the new conveyance feature will need to take into account the existing irrigation infrastructure.

Relative Cost: **$$$$**

Download PDF of Alt #5



Alternative #6

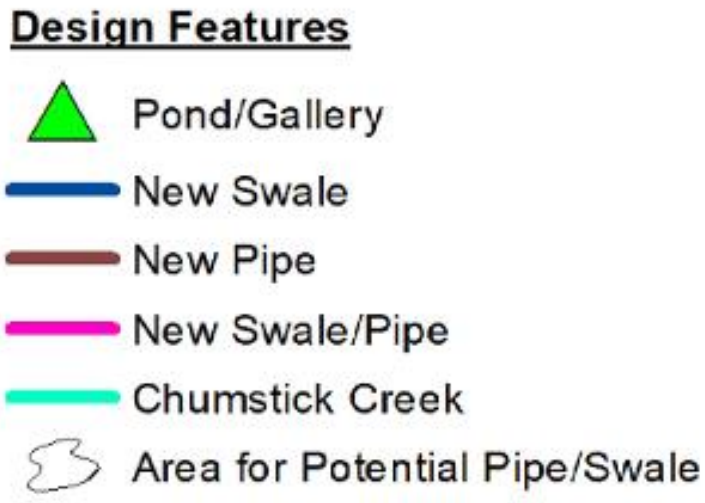
Alternative #6 is a ***conceptual idea***, with the intent being to collect and convey some of the runoff from Ski Hill basin more directly into Chumstick Creek. It will require construction of:

- A new swale and pipe along the north side of Titus Road,
- A new conveyance feature (such as a swale or pipe) across USFS land and private land,
- A new culvert under Chumsick Highway, and
- Construction of a pond or gallery at the Ski Hill parking lot to limit flows into the new conveyance system.

The project team did not identify at this time an exact location of this alternative. A potential section of the conveyance feature is shown as a magenta-colored line crossing US Forest Service land. The remainder of the conveyance feature would be constructed within the hatched area that is privately owned. Permission from multiple landowners will be required to construct the conveyance feature.

Relative Cost: **$$$$**

Download PDF of Alt #6



Alternatives Survey

If you are on a desktop computer or a tablet, click on the survey to activate it. If you are on a mobile device, click on the link to take the survey.

To view the survey in a new window, click on the white box with an arrow in the upper right corner, or click here https://www.surveymonkey.com/r/CK8HJKX.

This survey is currently closed.

For more information, please contact:

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Cover Photo	skisprungschanzen.com | Bill Pooley
Ski Hill Photos	Leavenworth Winter Sports Club Facebook Page
Site Visit Photos	Chelan County and Tetra Tech
Maps and Content	Tetra Tech and Perteet