The GRAIP Road Inventory

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Overview

- The ingredients of a GRAIP inventory
- GRAIP step by step
- The definitions of the attributes
- Terra Sync

Goals of the GRAIP Inventory

To efficiently describe the attributes of the road and its area of influence in order to predict it's geomorphic impact and risk to resources.

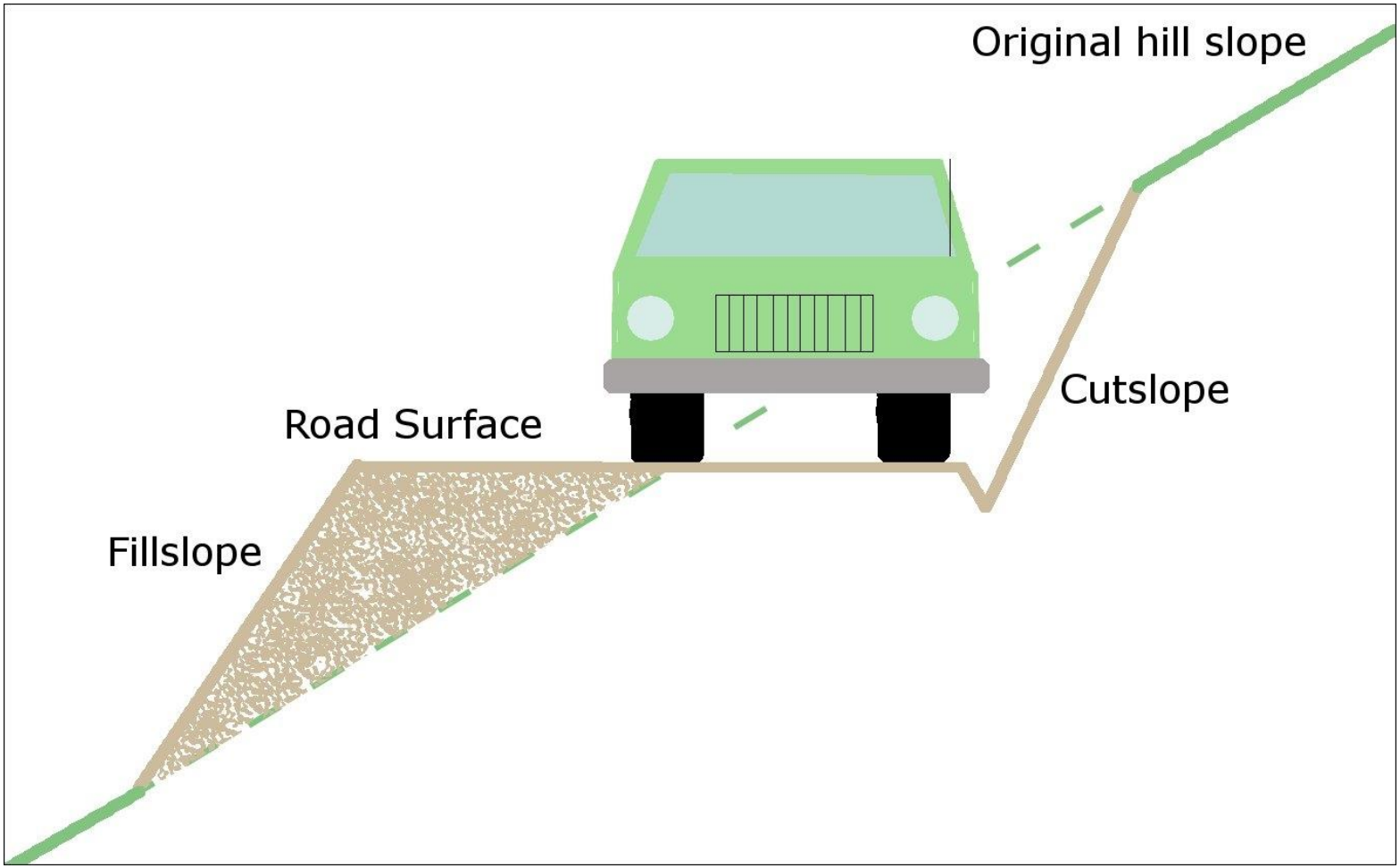
The Inventory Manual

United States
Department of Agriculture
Forest Service
Rocky Mountain Research Station
Boise Aquatic Sciences Lab

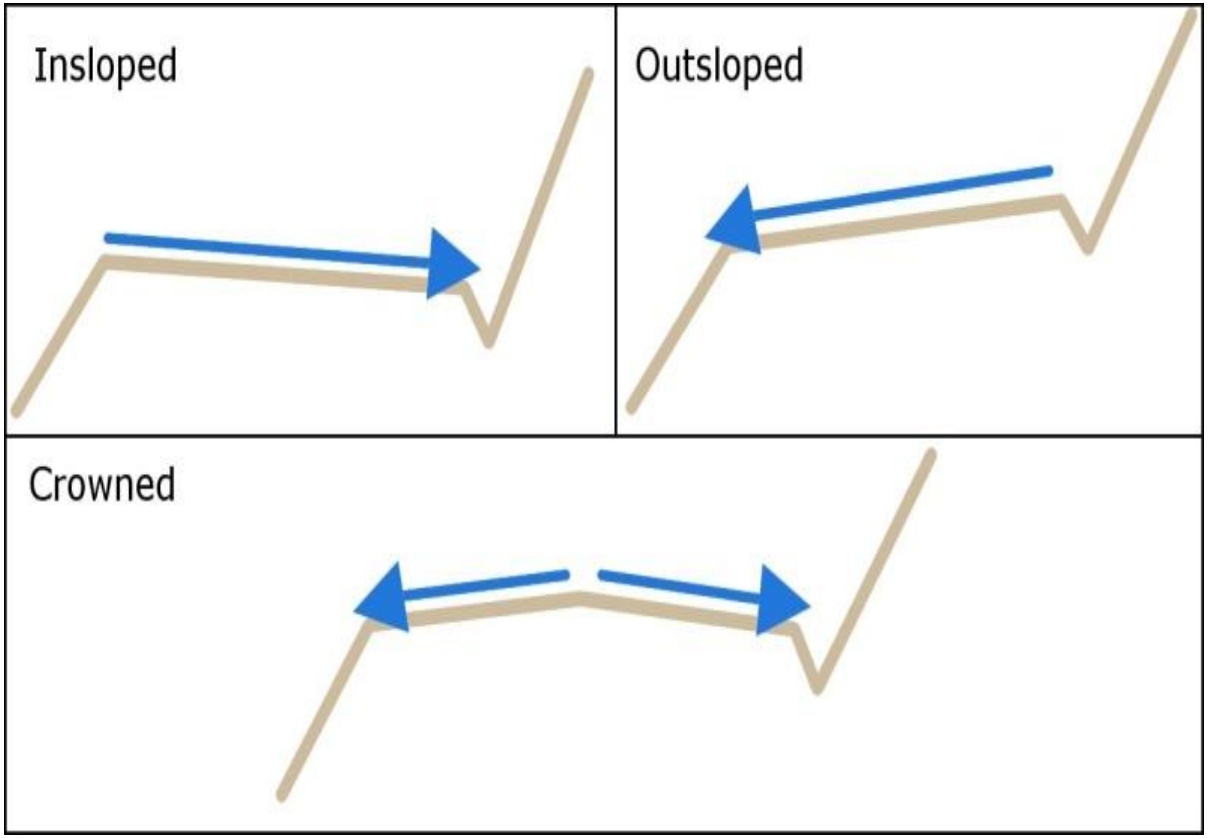
The Geomorphic Road Analysis and Inventory Package (GRAIP) Data Collection Method

Tom Black, Charlie Luce, And Richard Cissel

The Road



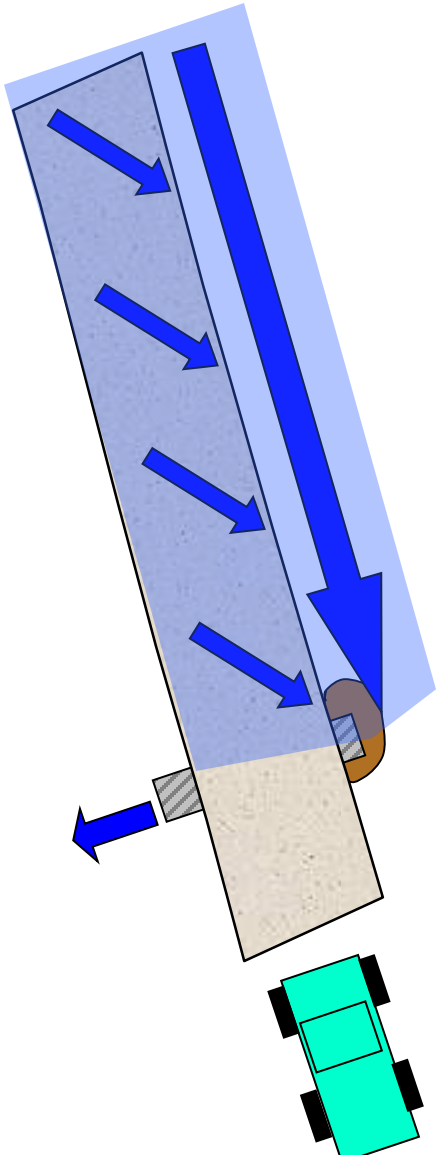
Road Cross Section



Drainpoints and Watersheds

- A drain point is where water leaves the road tread
- Each drain point defines a watershed
- Describe the attributes of the drain point
- Describe the attributes of the watershed in the road line
- Associate the points and lines using the time of collection CTime

Drain Point Defines a Watershed



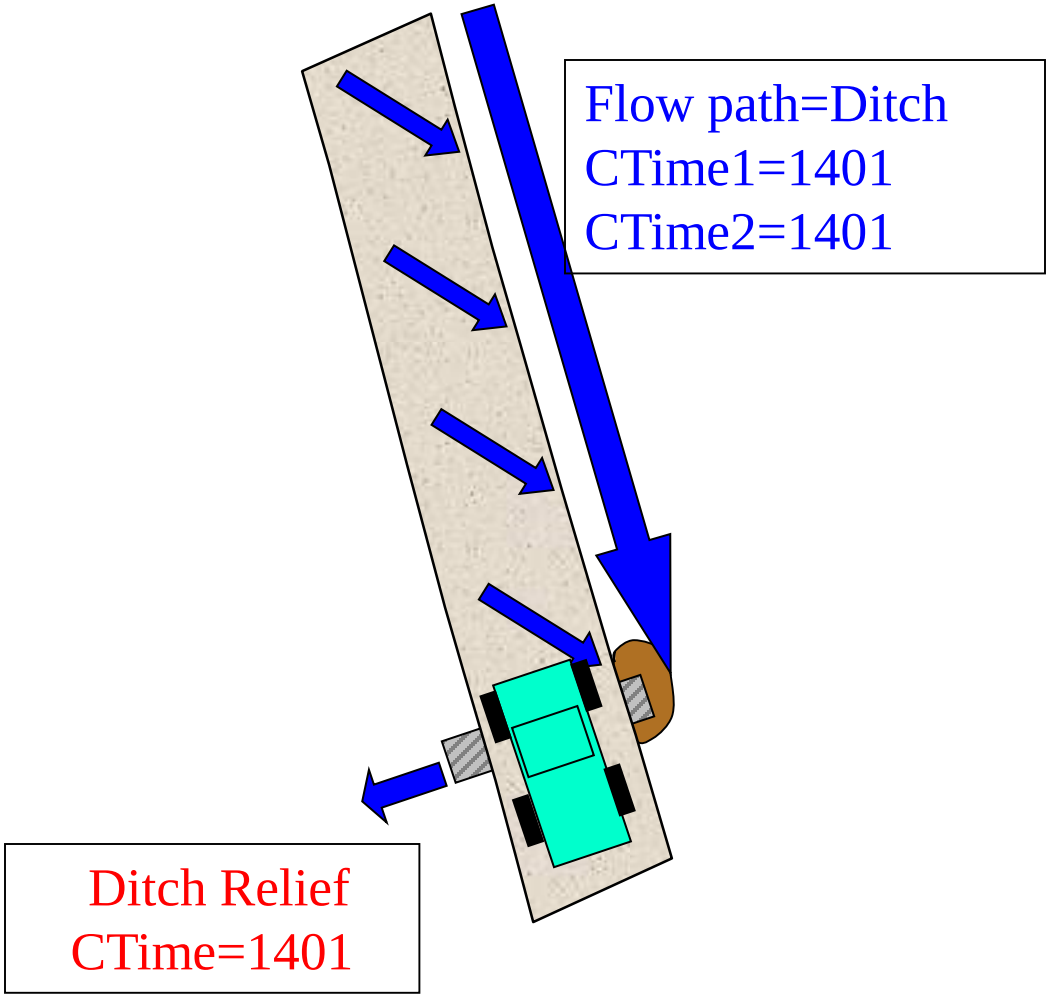
Procedure at a Drain Point

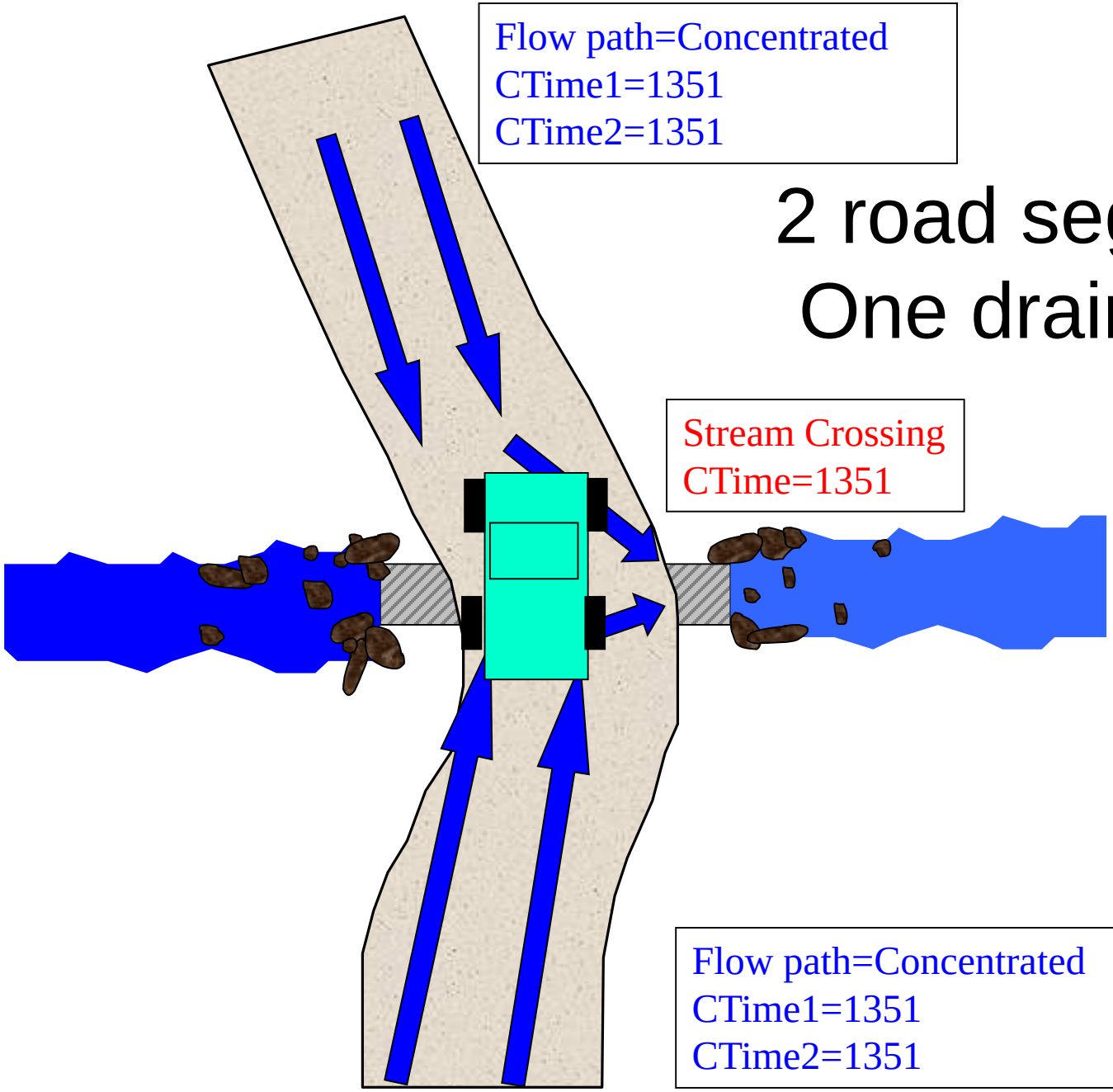
- Locate the GPS at a drain point
- Select the drain point type from the drop down list
- Measure the required attributes of the feature
- Enter the data into the drop down menu
- Collect 60 GPS positions
- Record the drain point type and CTIME value in field notes
- Close the point

Procedure for a Line

- Begin a line at the lower end if possible
- Open a road line
- Enter the attributes of the road
- Enter the CTime values from the drainage point that receives water from each flow path
- End the road when:
  - New drain point
  - Top of hill
  - Road attribute changes classes

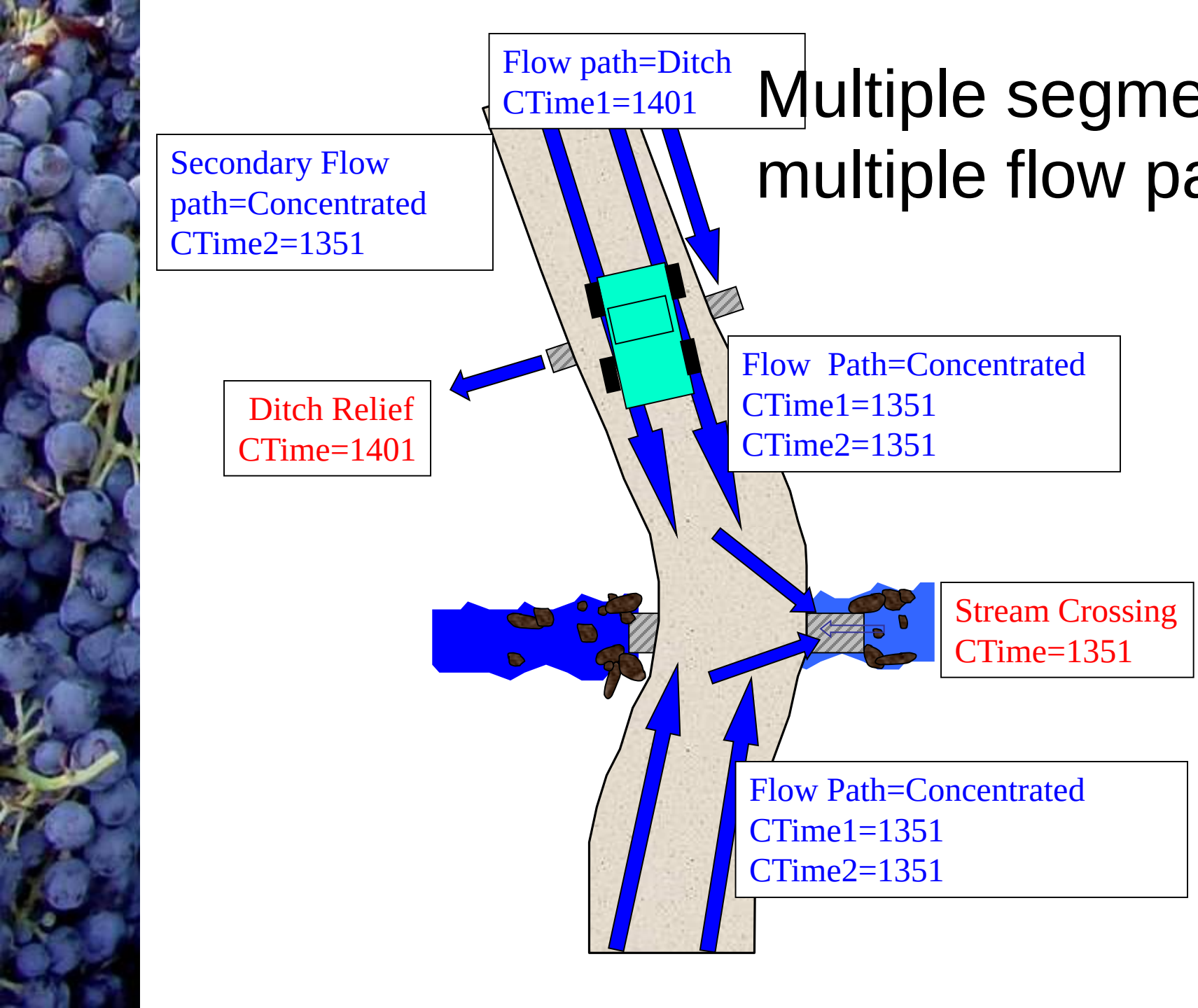
One road segment 1 flow path





2 road segments
One drain point

Multiple segments, multiple flow paths



Drain Points

TerraSync

Data | 6.09m 7

Collect | Options | Close

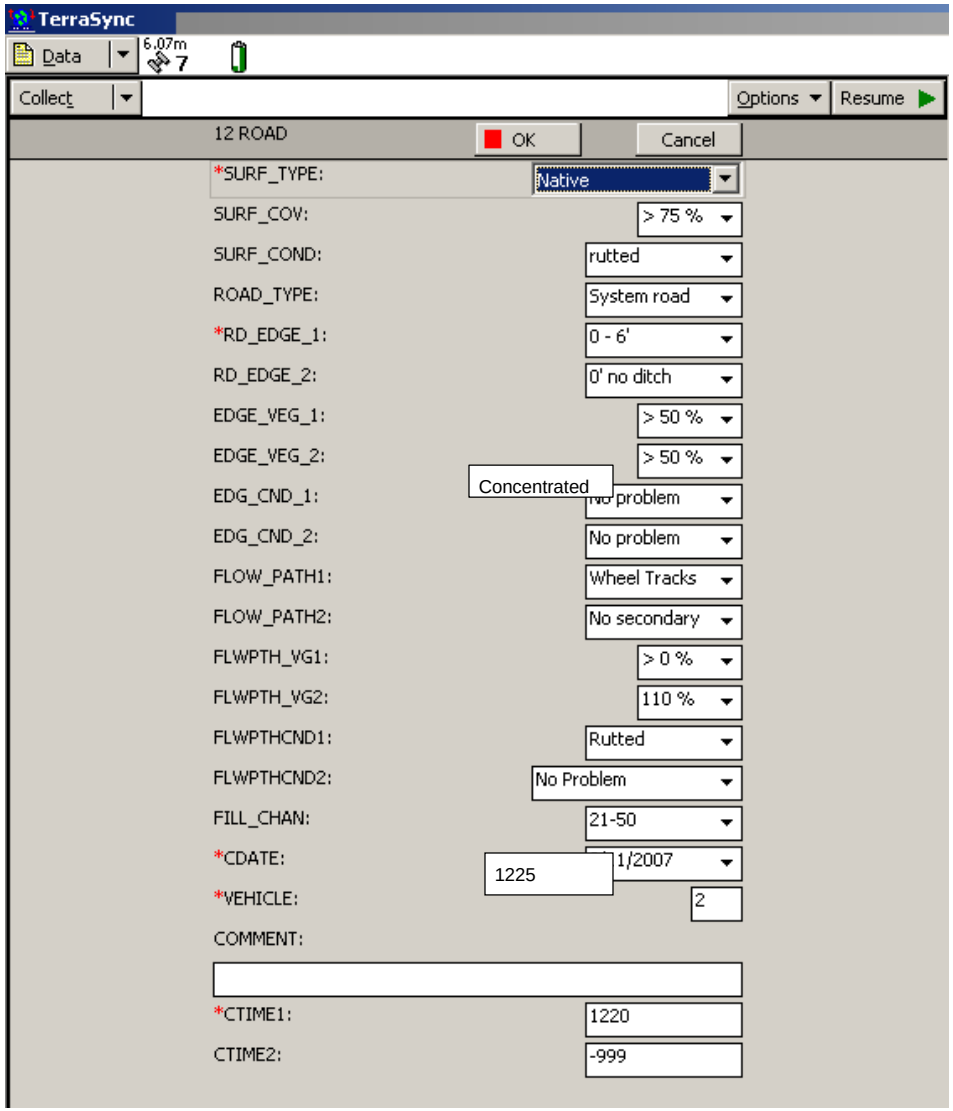
File: R091111A

Choose Feature:

Create

Type	Feature Name
	ROAD
	TRAIL
	DTCH_RELI
	STRM_CROSS
	LEAD_OFF
	WATER_BAR
	BBASE_DIP
	NON_ENGIN
	SUMP
	DIFF_DRAIN
	ROAD_CLSD
	GATE
	ROAD_HZRD
	END_RD
	LANDSLIDE
	GULLY
	REVISIT
	PHOTO
	Point_generic
	Line_generic
	Area_generic

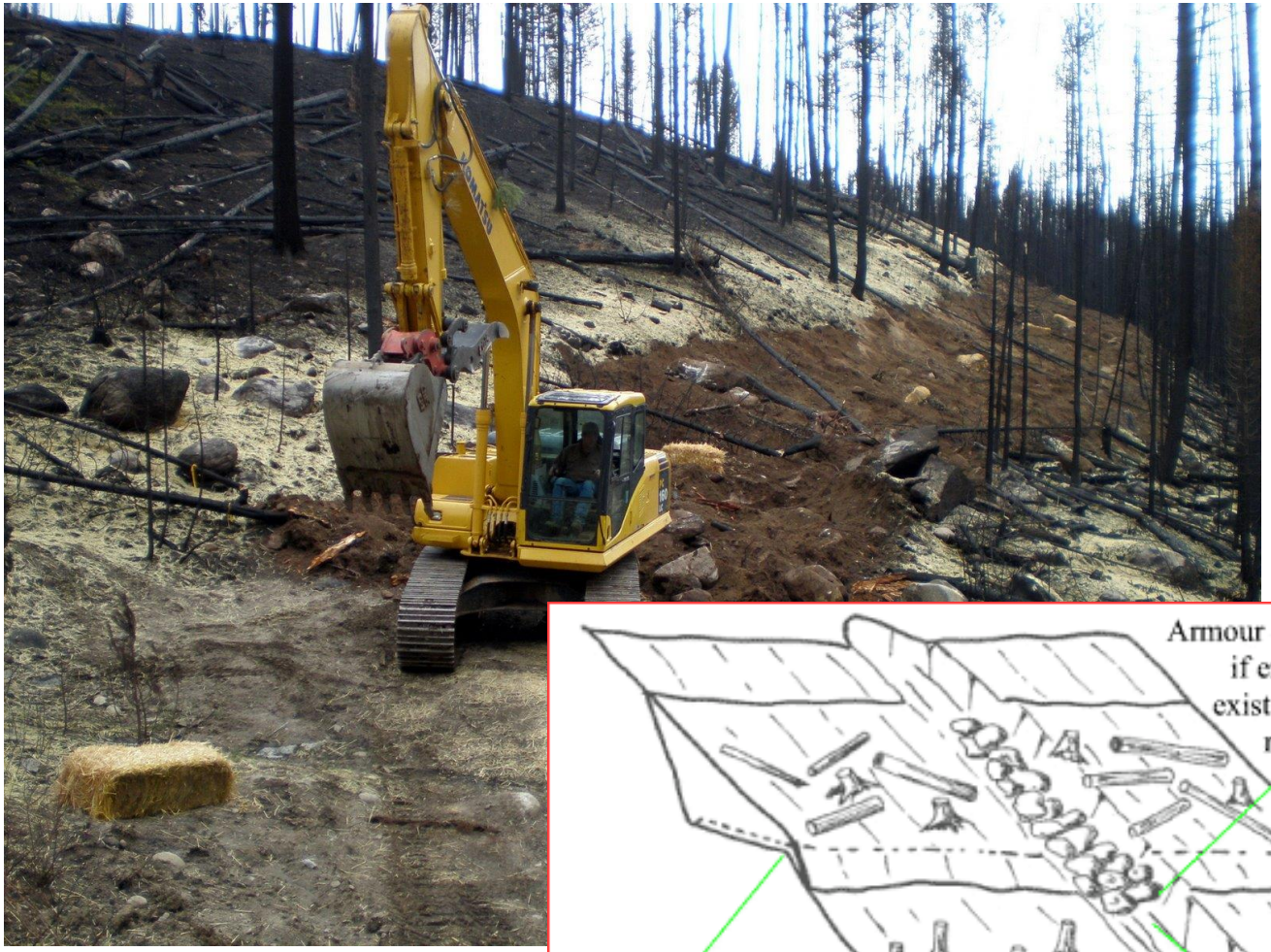
The Road Line



Road Line

- Road Number
- Surface Type
- Surface Cover
- Surface Condition
- Road Type
- Fill to Channel
- Traffic
- Road Edge 1&2
- Edge Veg 1&2
- Edge Condition 1&2
- Flow Path 1&2
- Flow Path Vegetation 1&2
- Flow Path Condition 1&2
- Flow Path 1&2 Gully Volumes
- CDate
- Vehicle ID
- Comment
- CTime1
- CTime2

Re-contoured Roadbed



Tilled Surface

Tilled Surface

Ripped Surface

Potholed

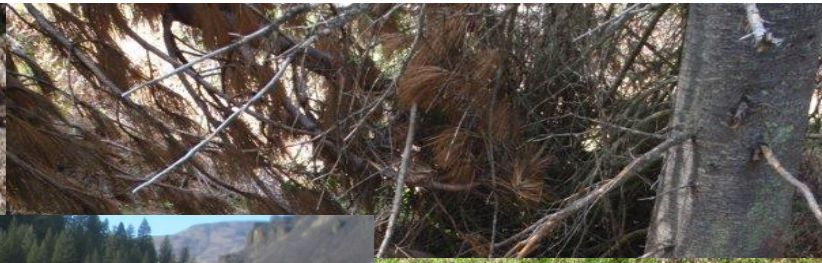
Drain Point Attributes

- Slope Shape
- Discharges to
- Stream Connection
- Fill Erosion
- Obstruction
- Orphan
- Link Cascade
- In Stream Xing Fill
- Vehicle
- Comment
- CTime

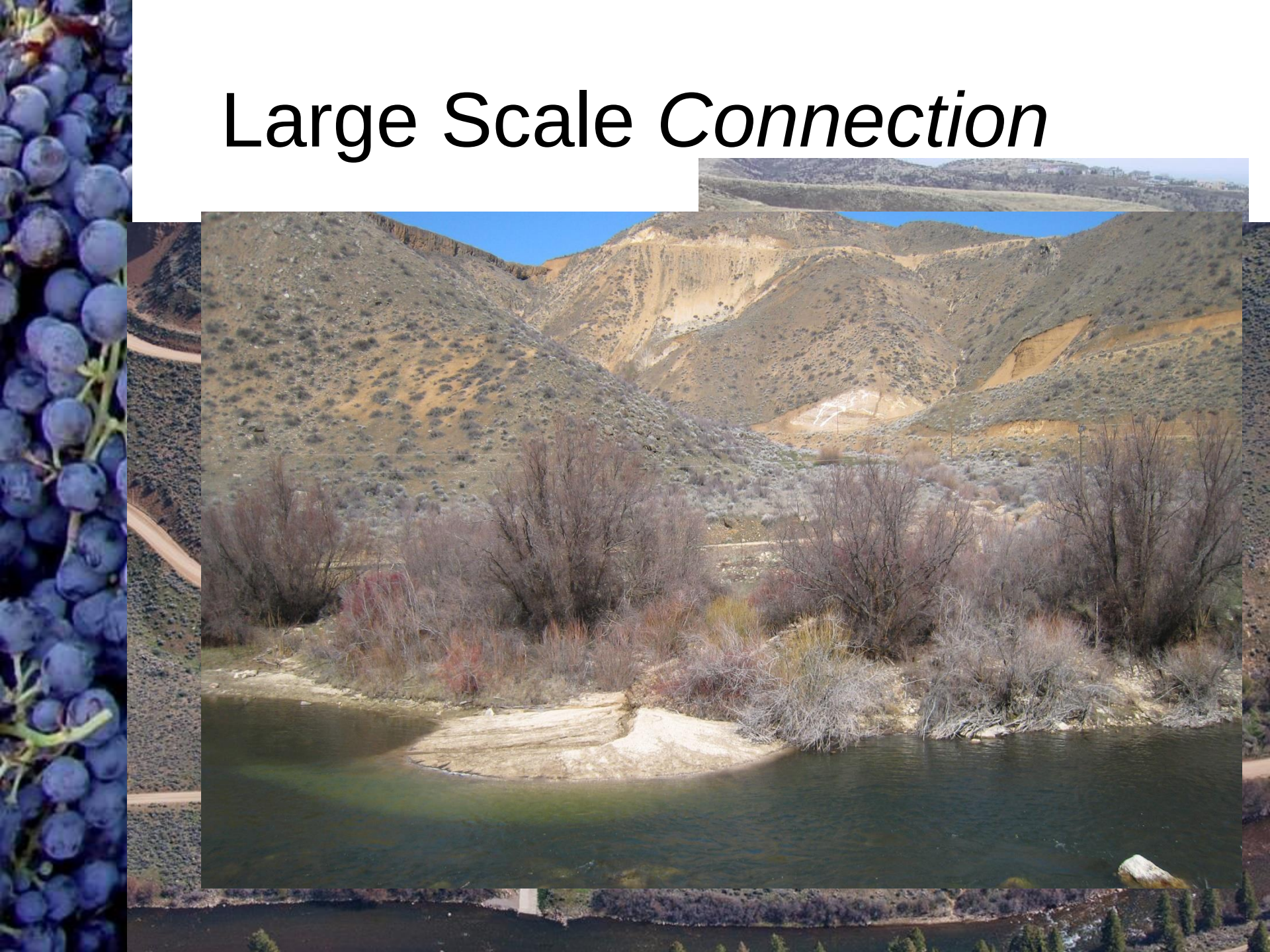
Drain Point *Connection*

- Evidence of flowing water
- Sediment in transport
- Scour
- Moved vegetation
- Beer cans

Drain Point *Connection*



Large Scale *Connection*



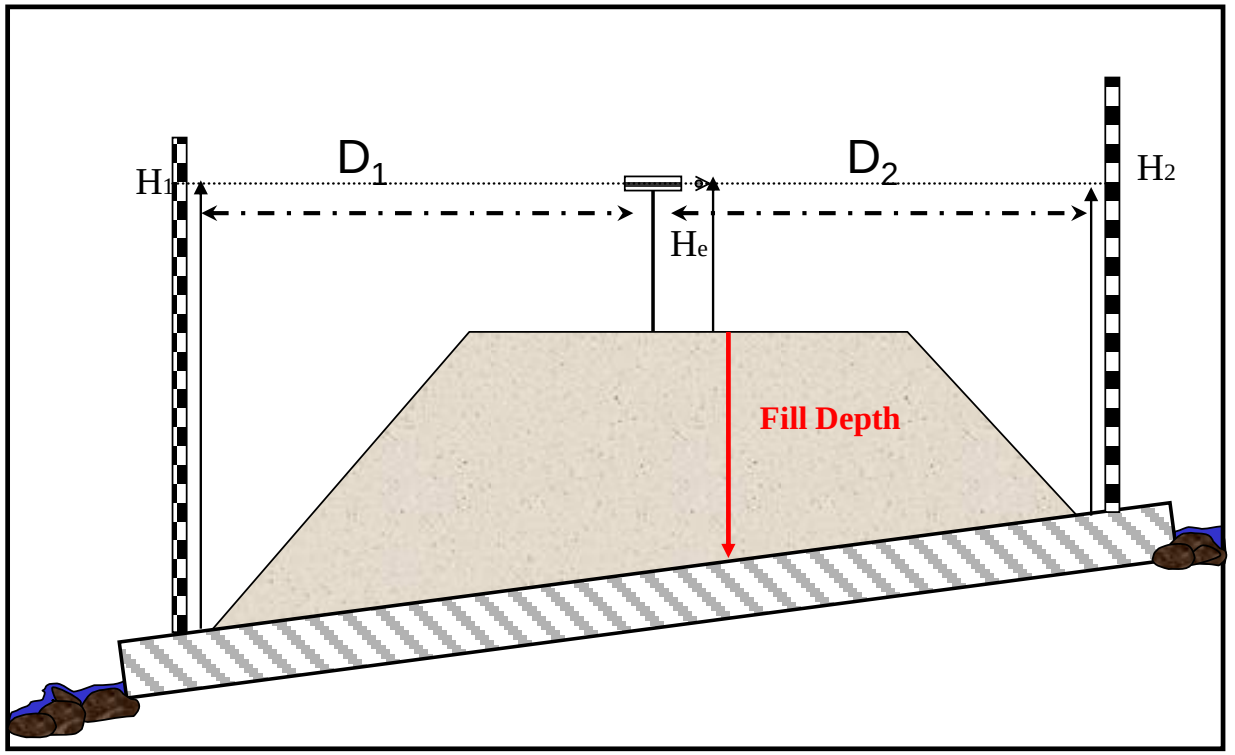
Stream Crossing Attributes

- **Type** of stream crossing
- **Round Pipe Diameter** in inches
- **Oval Pipe diameter** in inches
- **Pipe Length** in feet
- **Channel Width** In feet
- **Pipe Number**
- **Fill Depth** Feet of fill above top of pipe
- **Condition**
- **Channel Angle**
- **Blockage Type**
- **Outlet Drop** Measured below pipe in feet and tenths

Stream Crossing Attributes

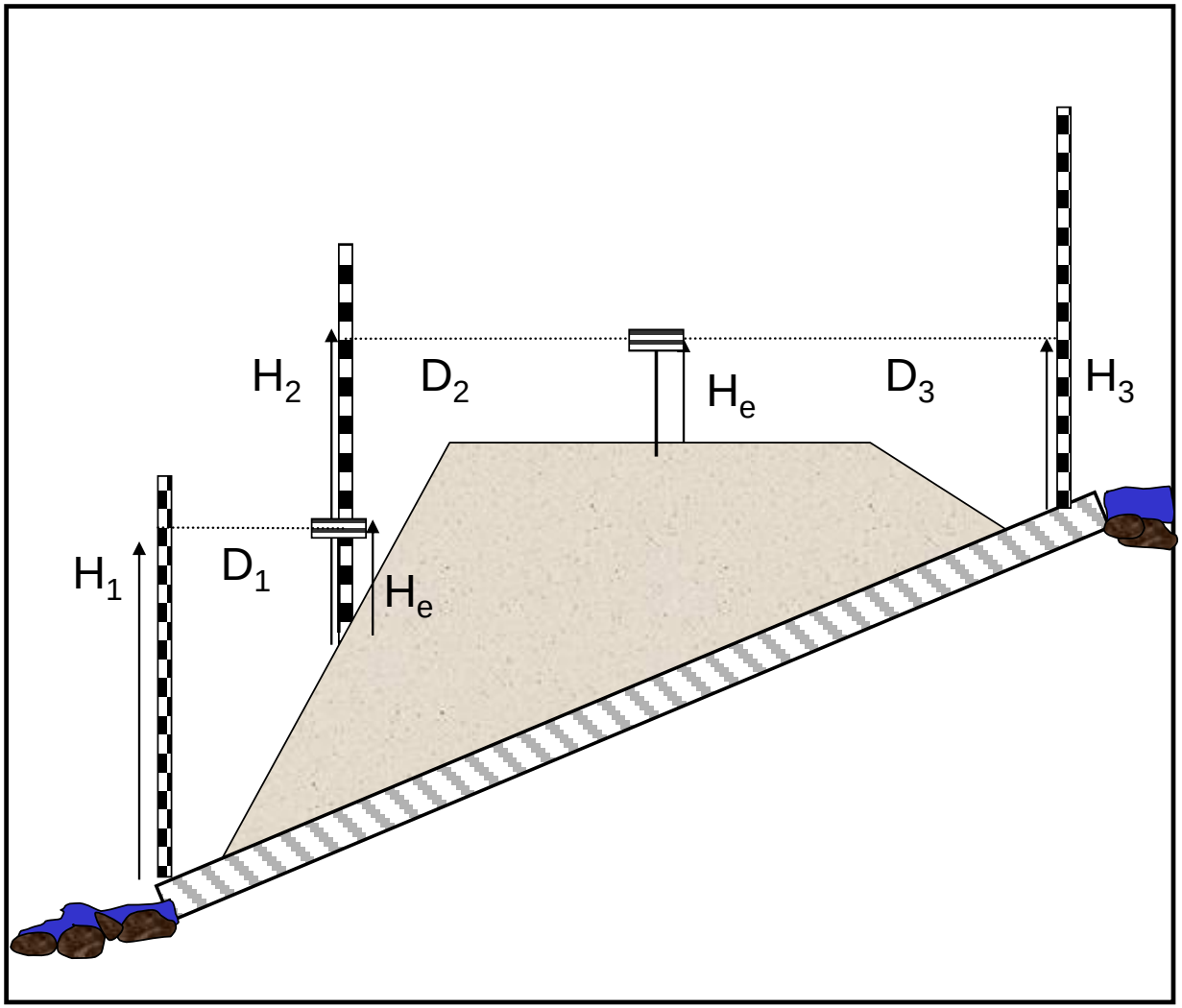
- **Pool Depth** Max. pool depth in feet and tenths
- **Pipe Grade** Measured in % slope
- **Substrate** Crossing material
- **Debris Flow** Evidence of past events
- **Diversion** directions if pipe is occluded
- **Comment** Is it on the TauDEM stream network?

Stream Crossing Survey



Pipe Slope=$(H_2-H_1)/(D_1+D_2)$

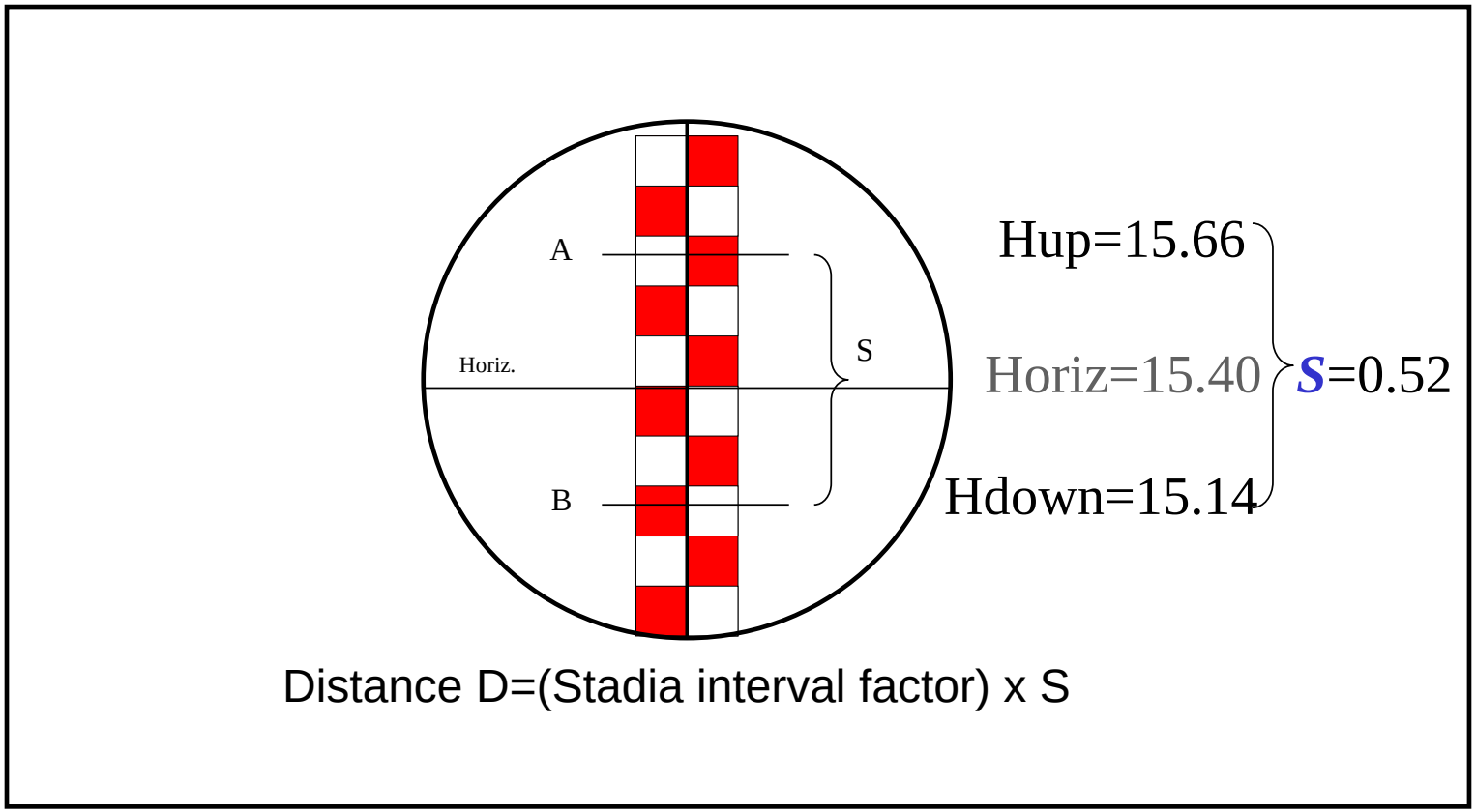
Fill Depth=$((H_1+H_2)/2)-H_e+(P_{dia}/12)$



Pipe Slope = $((H_3-H_e) - (H_2+H_1-2*H_e)) / (D_1+D_2+D_3)$

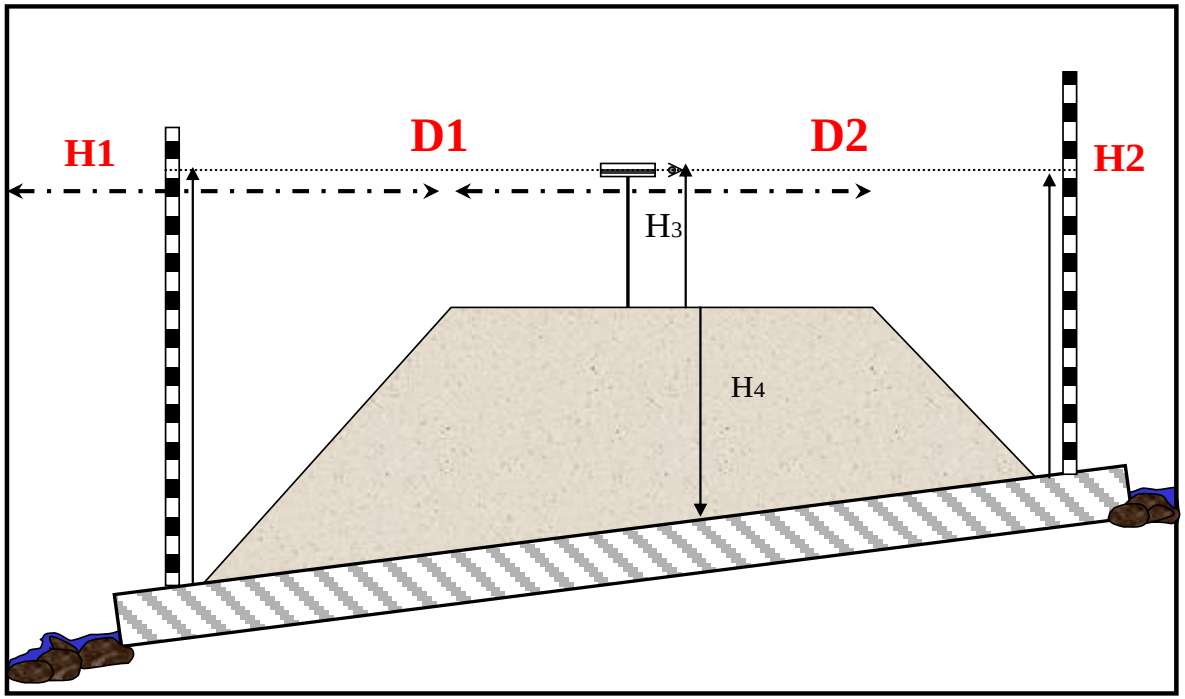
Fill Depth=$((H_3-H_e) + (H_2+H_1-2*H_e))/2 + (P_{dia}/12)$

Stream Crossing Pipe Length



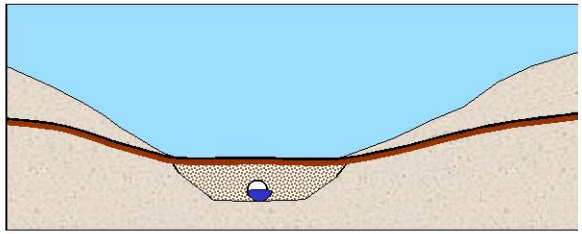
D_1=100 x 0.52=52 feet

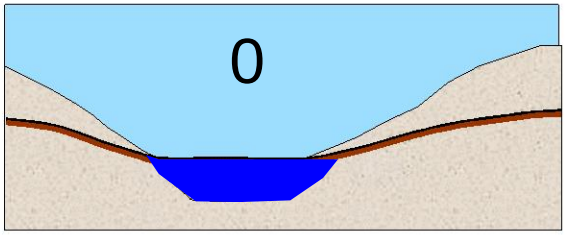
Stream Crossing Slope

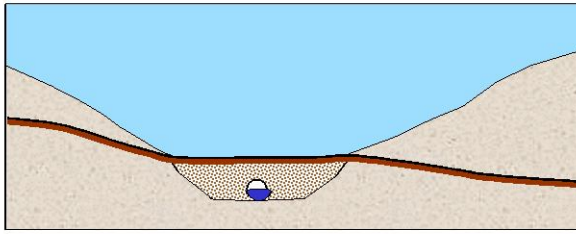


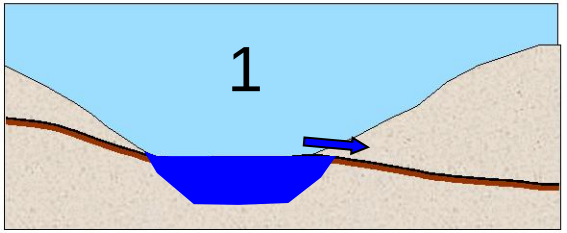
Slope=(H2-H1)/(D1+D2)

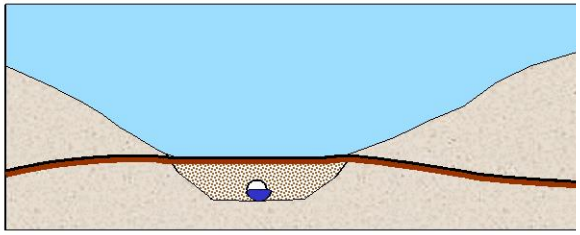
Stream Crossing Diversion Directions

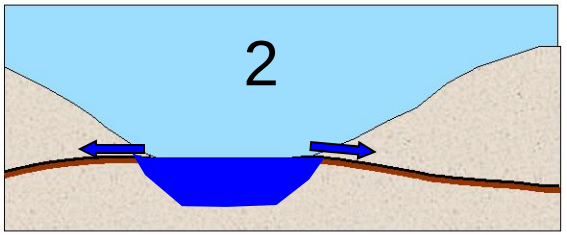


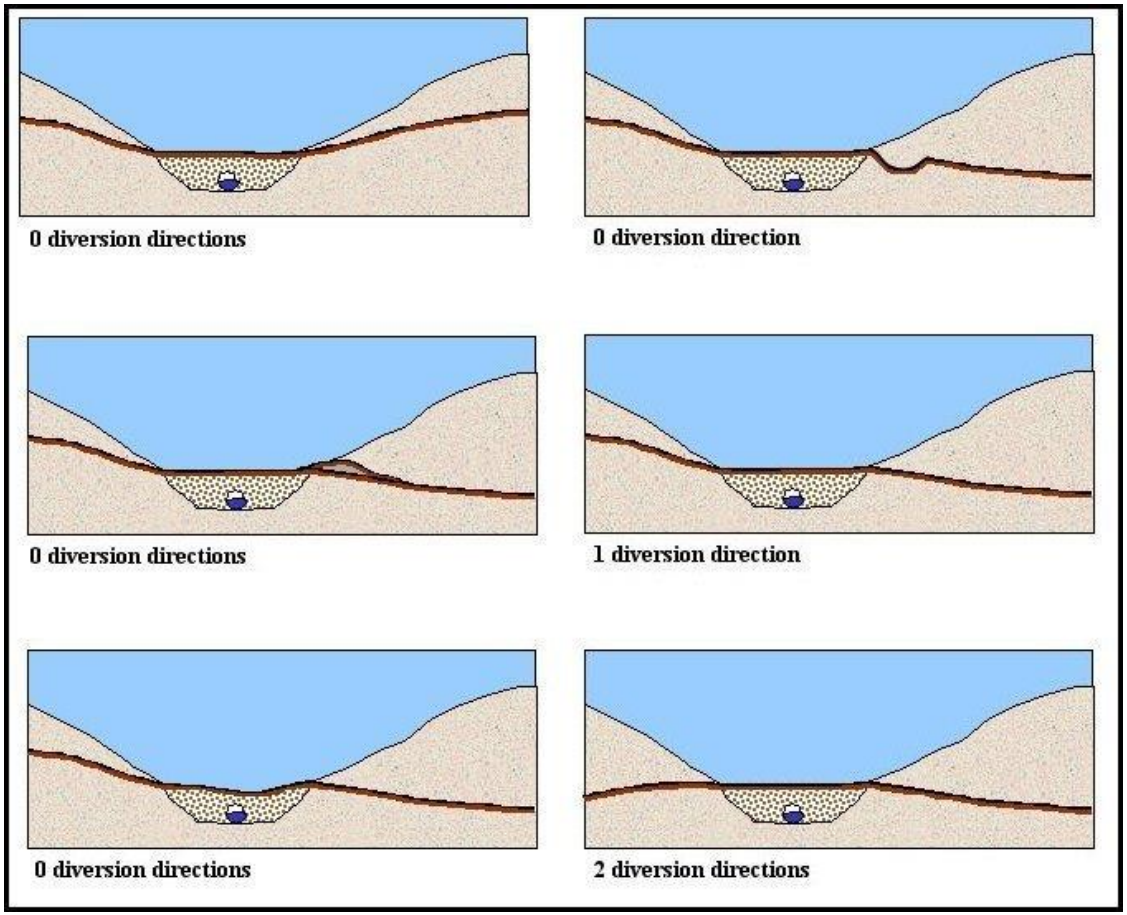




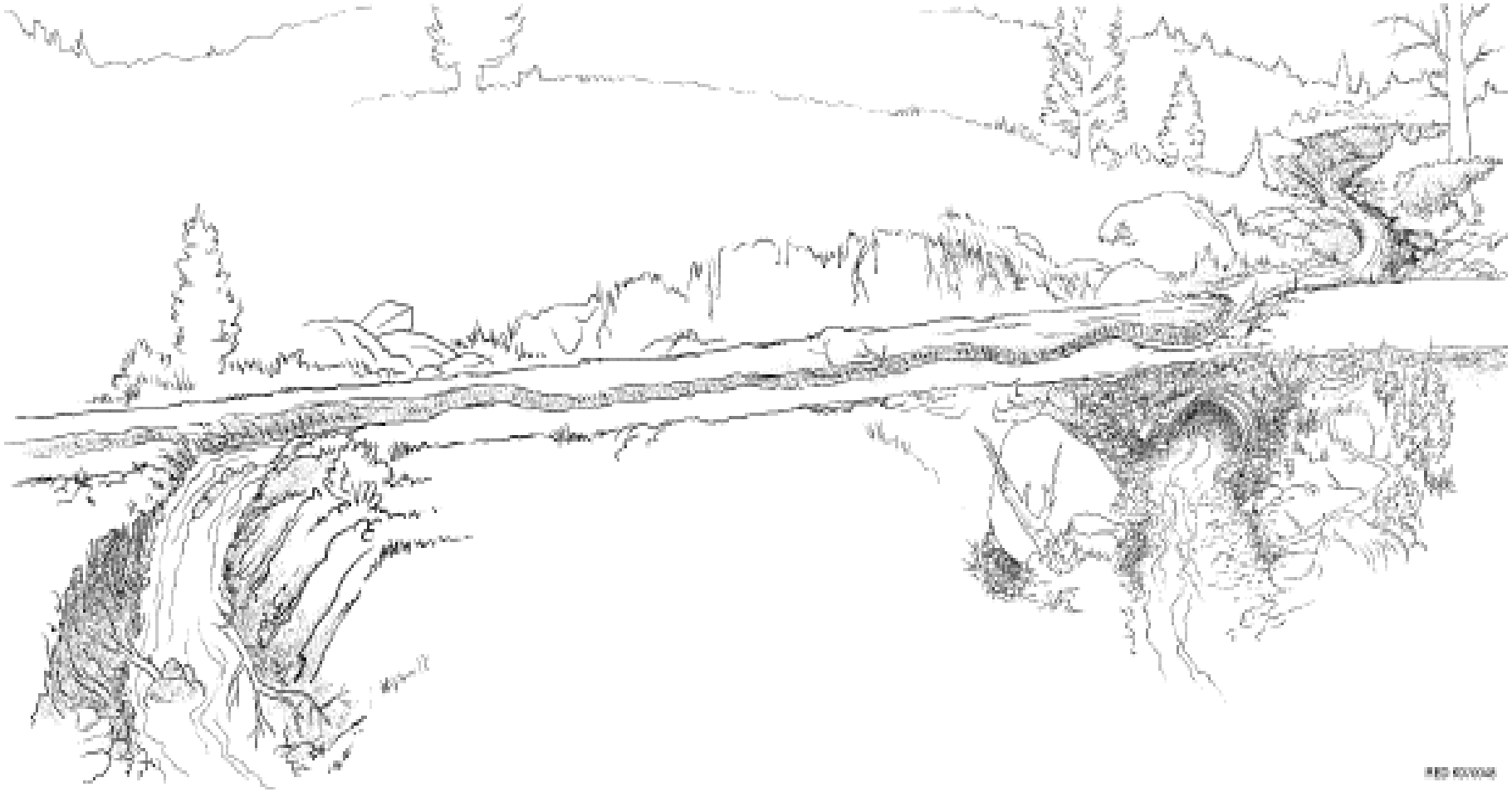







0 diversion directions
0 diversion direction
0 diversion directions
1 diversion direction
0 diversion directions
2 diversion directions

What We're Trying to Prevent



Stream Crossing Blockage and Failure Risk

Risk of Stream Crossing Blockage by Wood

- W*= Culvert diameter/channel width

  W*<.5 = 3

  .5<W*<1 = 2

  W*>1 = 1

- Pipe skew angle

  <45 degree =1

  >45 degrees =0

From Flanagan et. Al. 1998

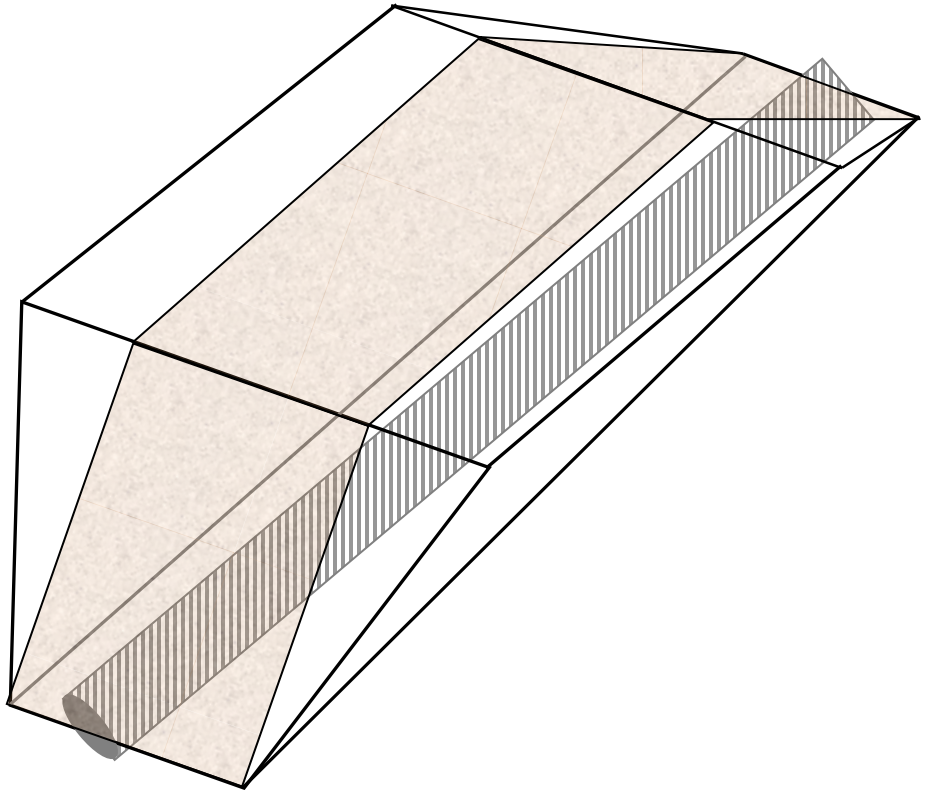
Stream Crossing Failure Volume Channel

V_c =Volume over channel

C =Channel width

A_l =Lower area

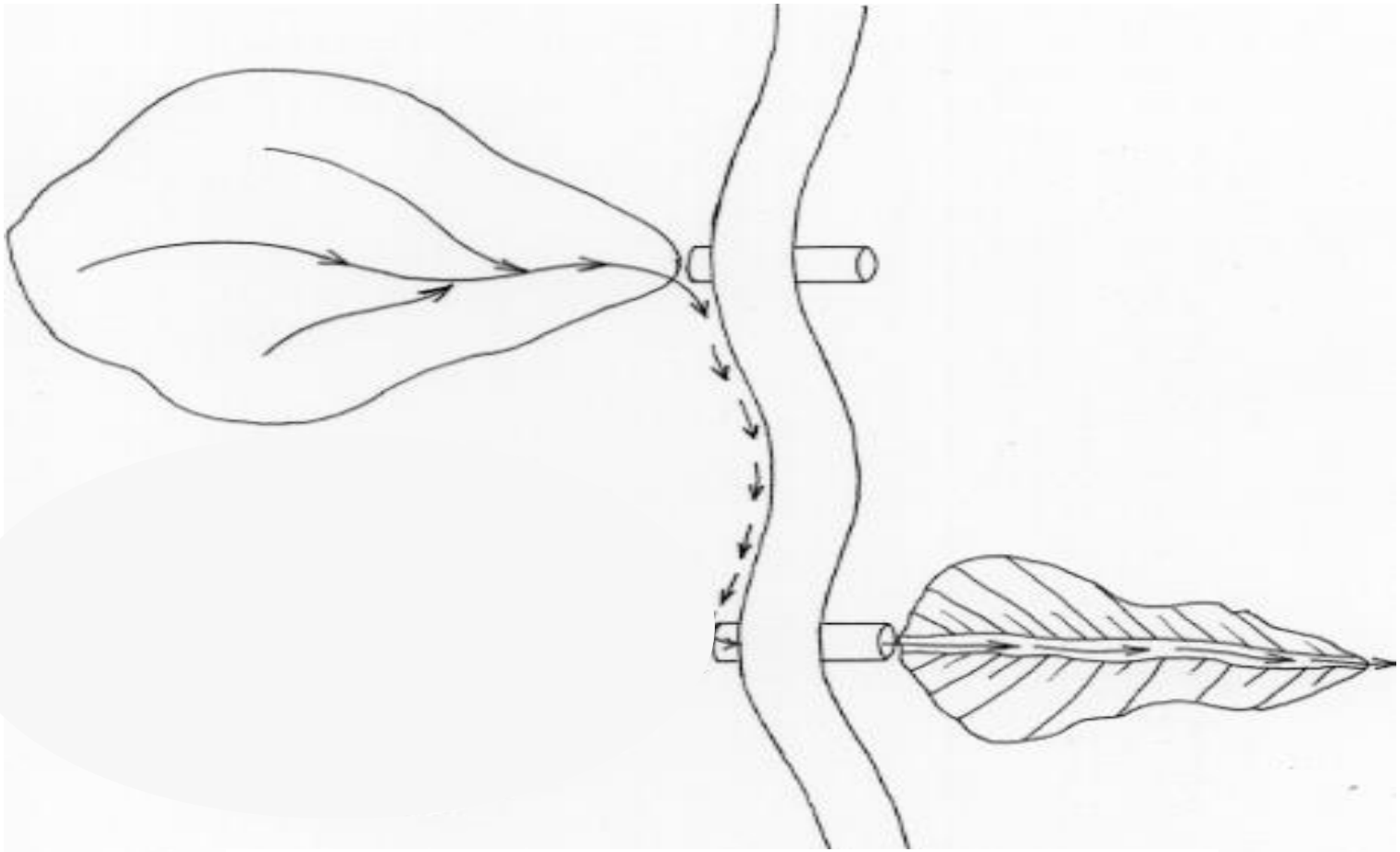
$$V_c = 1.2 A_l C$$



Ditch Relief Culvert

- SIZE Diameter in inches
- PIPE LENGTH In feet
- TYPE Material
- CONDITION Sediment occlusion %, damage
- FILL EROSION Erosion below pipe, 5 ft^3
- FLOW DIVERSION Evidence of historic flow diversion to pipe
- FLOW DIFFUSER

Historic Flow Diversion



DITCH RELIEF FLOW_DIVER

Evidence of Flow Diversion

FLWPTHCND1

"No Problem", default

"Gullied"

"Buried"

"Rutted"

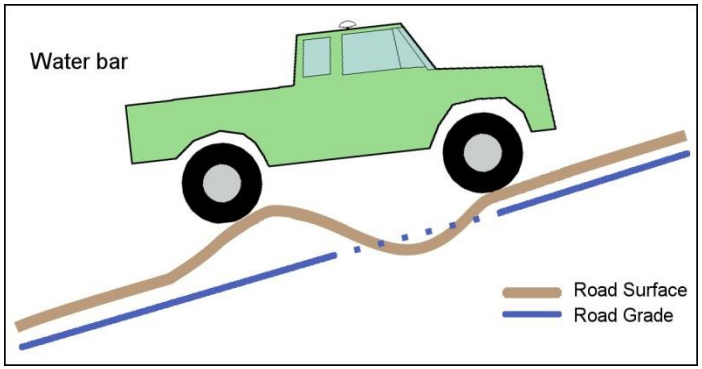
"Blocked"

"Stream course"

Lead Off Ditch

- **Condition:** Excess deposition

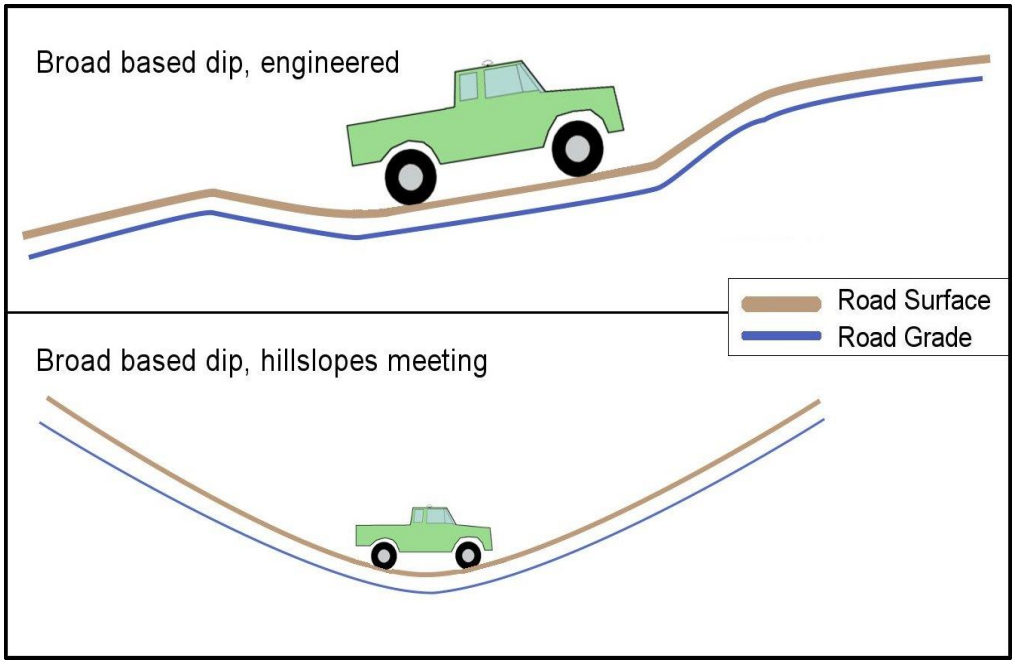
Water Bar



Broad Based Dip

Type Grade Reversal, Flat Ditch, Constructed

Material from which constructed



Non-Engineered

- Slope Shape
- Discharge to
- Stream Connection
- Fill Erosion
- Condition
  - Blocked Ditch
  - Diverted Wheel tracks
  - Broken Berm
  - Gully crosses road
  - Outsloped
- Obstruction CDate, Vehicle, CTime, Comment

Sump

- **Condition**
  - **No problem**
  - **Fill saturation**
  - **Puddles on road**

Diffuse Drainage

Excavated Stream Crossing

Attributes

- Channel slope
- Constructed channel slope
- Bank slopes
- Wollman pebble count above and in new channel
- Volume of any failed fill or channel scour
- Take images and make a sketch map of crossings with issues

Landslide

- Road Caused
- Type
- Position
- Max Length
- Max Width
- Avg Depth
- Age
- Confidence
- Stream Connection
- Mass Present
- Link Cascade
- Activity


10 12:44 PM


10 10:37 AM


10 12:46PM

Gully

- Road associated
- Active
- Length
- Width
- Depth
- Minimum
  - 10 ft long
  - .5 ft deep
- Stream Connection
- Clinometer Slope
- Link Cascade

Flow Distance Measurement

- Drain Type
- Stream Connection
- CTime
- Sediment Distance
- Sediment Path Type
- Flow Distance
- Flow Path Type
- Slope
- Spring
- Wet Swale
- Ends In Stream
- Comment
- CDate
- Vehicle ID

Field Data Log

GPS File Name	Forest Name	Road Number	Treatment Category	Crew/vehicle	Allegro or Laptop	Preprocessed?	Comments
R09125A2	Siuslaw	5087220	decom	2	Laptop	No	gravel, driveable, abundant waterbars, W most section in clearcut, some parts of rd are slightly slumpy, ridegetop and near-ridgetop, diffuse, wheel tracks, ditch
R091309A2	Siuslaw	5087220	decom	2	Laptop	No	same
R091410A2	Siuslaw	5087220	decom	2	Laptop	No	same
R091411A2	Siuslaw	5087	decom	2	Laptop	No	gravel, good shape, ditch, tracks, some diffuse, ridgetop and near ridgetop, some grade reversals, short cuts (if any)
R091416A2	Siuslaw	3484	decom	2	Laptop	No	solid-ish rd, grassy, ditch, waterbars, hard to find (look where pavement ends), large fill stream x that is failing

QA/QC

- Plots
- Ride along
- Calibration of veg cover
- Random plots
- SDRR pre/post file review
- Control repeats

- Minimu eet
- Easiest
- Start ar
  - Flag y
- Be awa bility

Safety

- Work as a team
- Be alert near logging activity
- High-use roads
  - Pull to the right to collect points
  - Use a beacon
  - Stay alert
  - Stay to the right!!!
- Plan around traffic cycles


25 12:18PM

Blacks Creek Road

South on Broadway
8.8 miles SE on HWY 84
Exit at Blacks Creek
Meet at the end of the pavement