

ROADS TO HEAVEN, TO HELL, AND BACK, SOMEWHAT



About 1922 - Photo courtesy of Edward Fenn



Recall from [the site history](#), that Ed Fenn bought property along Mr. McKiernan's road astride Charlie Martin's road from Glenwood. This is that latter road as it passed in front of Ed's house (note the *Vinca major* on the bank behind the car). Typical road construction back then was with dynamite, shovels, and horse-drawn grading blades. Slopes receiving the fill were not cleaned or benched and the fills were not compacted. If it slid, they fixed it. What few culverts were installed were wood. In the winter, the surface was mud.

The original roads in these mountains were built during the famed California Gold Rush. The rate of growth of the State's population was such that roads were desperately needed. The State didn't have the money to do it. So the people's representatives passed a statute giving permission to private companies to build monopoly toll roads. Roads then went in fast and cheap.

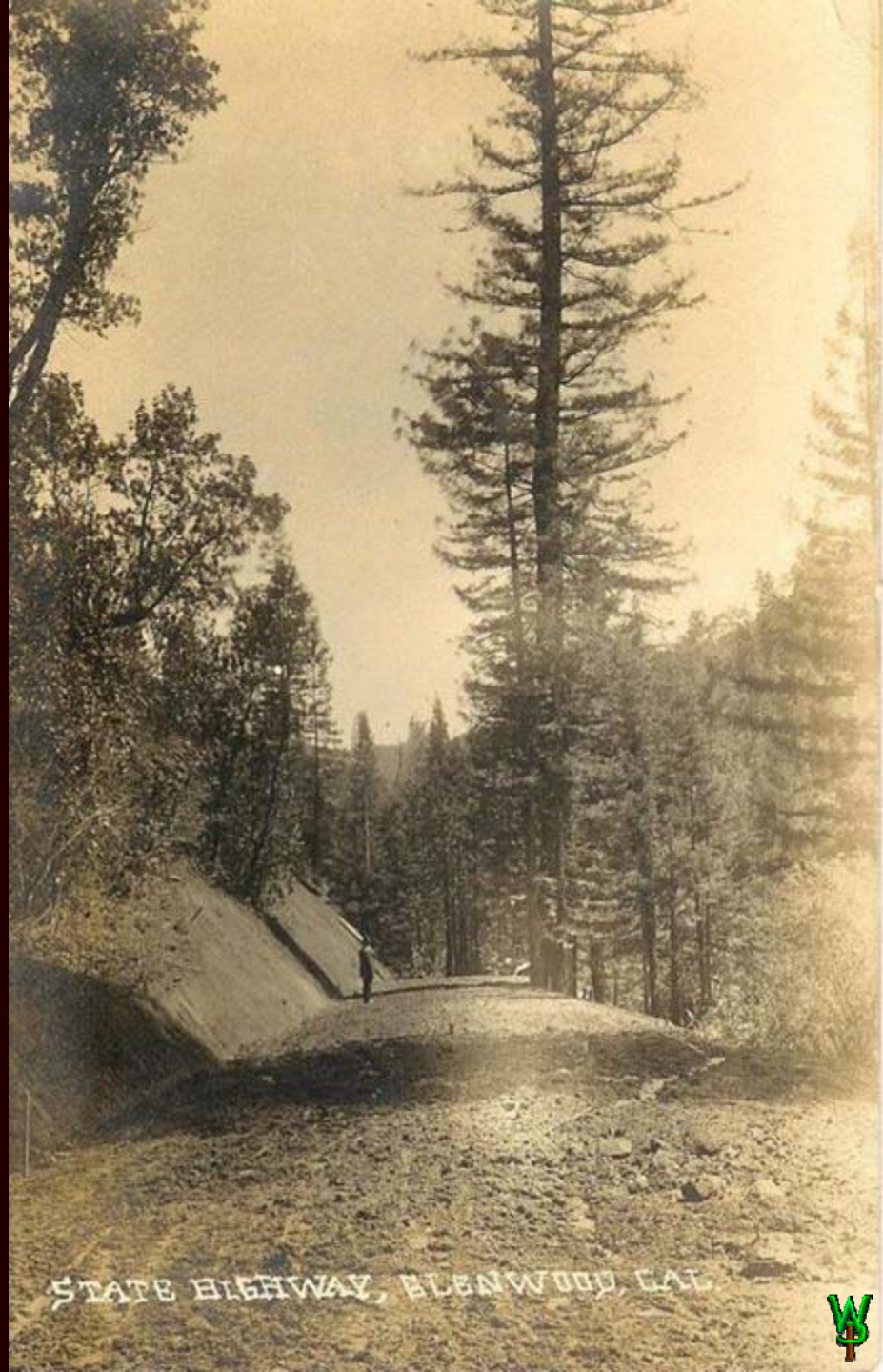
Grades for the original dirt roads around here were designed with so that they sloped inward so that horse wagons with iron "tires" would not slide off the mountain in the winter. That required a deep notch that destabilized the steep bank above.

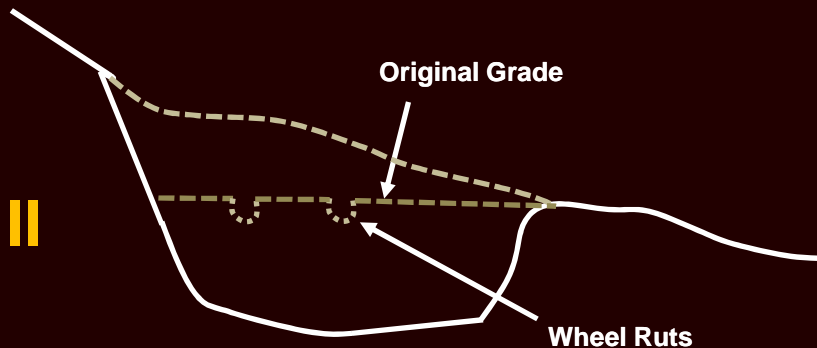
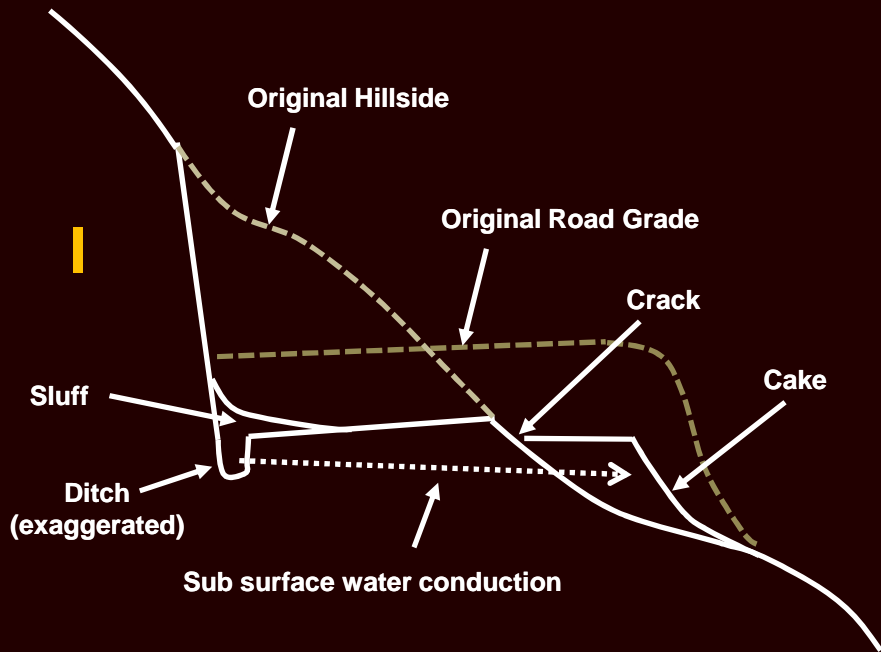
As you will recall from the site history, Charlie Martin finally persuaded the State to build the Glenwood Highway to his town, such that he could get out from under paying Mr. McKiernan for the use of his toll road and maintaining the access adjoining our property. It was completed about the year 1915 (right).

Channels on the inside of roads with in-sloped grading capture all the water runoff from the long and steep slopes above them. That water then collects into a torrent. When water runs fast, it can carry more suspended sediment. That does one or (usually) both of two things: It either cuts a ditch on the inside of the road adding more sediment, or, if it hits an obstruction such as a fallen log or a minor slide off that steep embankment, it then kicks to the outside of the road. In those days, the outsides of roads were made of loose and uncompacted fill which did what loose fills do when torrents of water come across them. The result was called a "wash out."

As you saw in the [chapter on drainage](#), collected water has to go somewhere and usually that is a drainage. The drainages are then incised deeper and more rapidly because of the extra flow and the mass of the abrasive slurry. Incision destabilizes whole slopes that can then fail in massive landslides.

Bad road design and construction causes big problems. The answer starts with improving infiltration in soil where the rainfall lands to reduce and spread out the peak flow of said torrent and build roads that dissipate the energy of those flows. That takes management.





So, roads interfere with drainage and erosion processes, they are a conduit for weeds, they change wildlife migration patterns, but most important of all, **where they go and how big they are has a lot to do with the value of the surrounding real estate.** Which roads get fixed then has everything to do with whether or not there is money to be made. Hence, a lot of them go unfixed until they fail.

With more powerful earth-moving equipment, it became easier to piece together a wider road elsewhere than to fix these old ones. In general, as the resulting new roads were built, they received better paving and drainage. Yet still, we are left with these old legacy roads with a great deal of expensive housing along them.

It is difficult and expensive to do road work on rugged terrain. Rarely can one simply build a detour. People (and especially real estate agents with campaign cash) howl when a road is closed. Where those original one-lane roads were routed is often not amenable to widening. There are relatively few expensive houses along them and the resulting tax base is small. As a result, they are usually badly maintained and sitting on wholly unacceptable substrates.

There are two major types of road failures around here. As you saw in the prior slide, the outside embankment was originally loose or poorly compacted fill on a “slip” of decaying organic matter that was the surface soil of the original slope (above). I call this soil mass a “cake.” When (not if) the inside ditch fills in a storm, the water kicks out and encounters said fill. The result can take the cake. I call these impending disasters a **“Type I”** road failure.

Most **Type II** cases developed before there was pavement where the road went through a long “cut” with banks on both sides or where the slope they traversed was shallower. The water then proceeded along the length of the road, cutting it ever deeper. Even on a relatively flat surface, simple wheel ruts could enlarge and turn the dirt road into a muddy creek.



Here is a pending Type I failure. When Charley McKiernan blasted out the rock and pushed it aside to make the road, the fill was neither benched nor compacted. The cake was simply loose fill. The loads were light and Charlie had plenty of dynamite to make more fill if he needed it. After all, this whole 25 mile road was built in two years for only \$6,000.

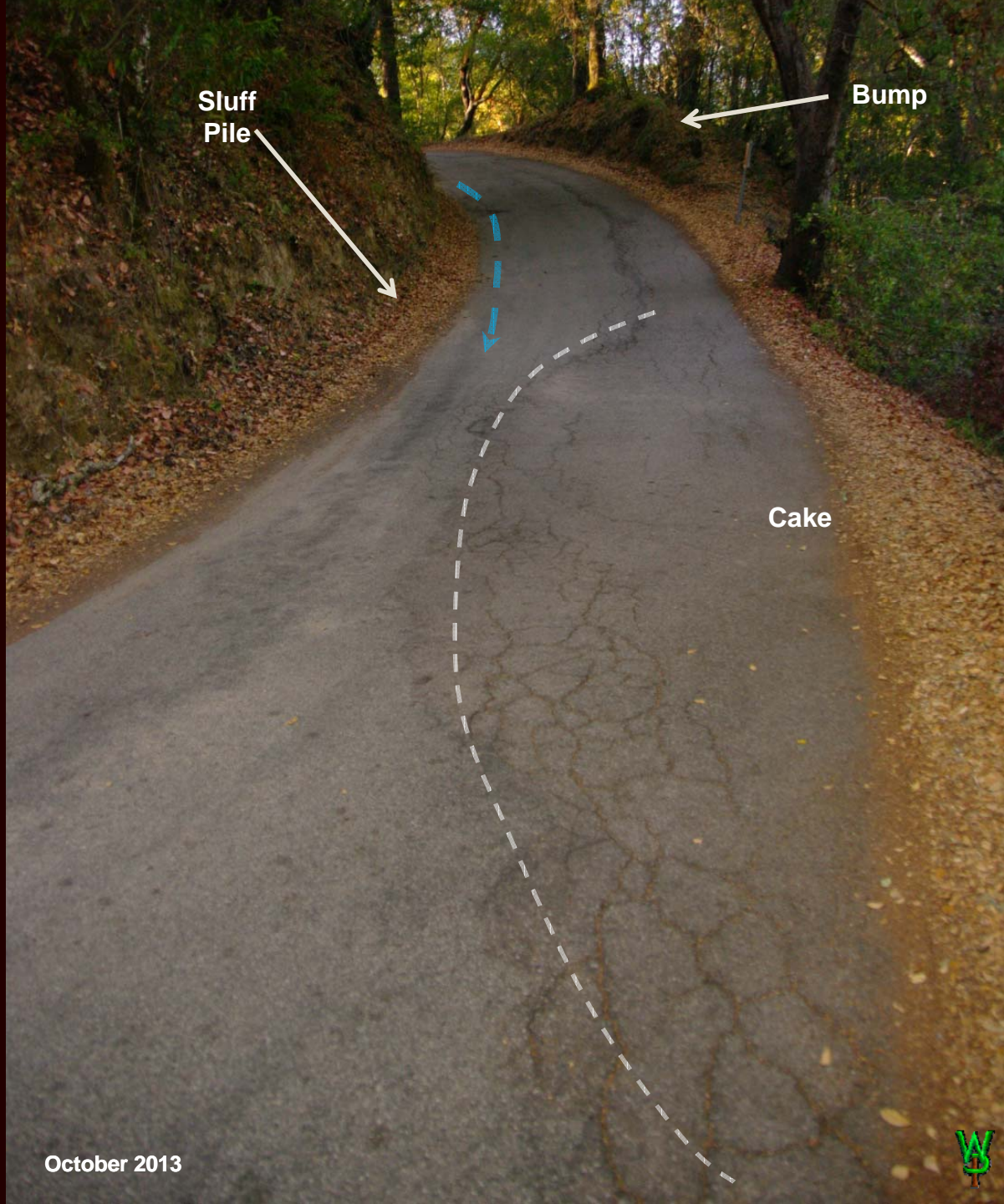
It does not take much sluff to kick out a flow in a case like this. With enough rain, the flow is high enough to develop enough momentum around this corner to kick out on its own unless the ditch is maintained perfectly, even during the storm because, the slope on the left is obviously steep enough for water to dislodge and carry loose material in a heavy rain.

Accordingly, this ditch can fill so fast that one cannot expect the County to prevent it. The problem is road design. In this case, reducing the rainfall collection area and losing the flow before it gets here by taking off the bump on the top and sloping the road outward at the top would prevent a failure on the existing grade in all but the most extreme cases.

Nothing is perfect, but this is a lot cheaper and less interruption than rebuilding the whole slope from below. It also makes a turnout at the top of a blind one-lane corner.

Now, is all this just begging for government protection against a *potential* problem?

Well, not exactly.





October 2013

A few feet farther down from the prior photo, the road suffered a Type I failure: In-sloped grades collected water that ran down the ditch to where it kicked out due to accumulated sediment. It then ran down the surface away from the ditch, hit the corner (above), kept going, and just took the cake. From here, they should just chew into the hillside to move the road to the inside of the turn and with which to make the fill as it is only 30 feet to the top. You will also note that this blind, one lane turn that the remaining cake has slumped far enough that the road surface is sloped off the turn. We have had two instances of a bleeding driver coming down our driveway after having rolled their cars off that edge. Would you like to be on a bicycle coming the other way? They do.





October 2013

Unfortunately, despite my offer to reseed it with native grass for free, the County chose to hydro-seed it with Italian rye and soft chess; i.e., the usual. Now the runoff will carry those non-natives down the slope. You do what you can, not what you can't. It is just as true for the County as it is for me. OK, so let's move on to a Type II case.



About 1922 - Photo courtesy of Edward Fenn

The watershed area behind Fenn's house was considerable, but the runoff no longer came down this draw to the right behind the house because the road from above collected runoff from the slopes, conducted it to the left (behind the house), hit a switchback, and came back to the right in front of the house. In the background are eucalyptus planted here possibly to stabilize the original channel. Today, those trees are 150' tall with 4' trunks, while the hilltop is a long abandoned Christmas tree farm, with pines over 100' tall.



Water goes
this way

Road goes
this way



October 2013

To reduce erosion on the road below I had to reduce the flow of water onto it at the entrance and then distribute the rest. The first step was to divert what was coming off the County road into the eucalyptus stand. This entailed a requirement for sufficient capacity to take all the water coming down the County road for nearly a quarter mile in the event that but a single County culvert plugs (it's happened). That collection area is 5-6 acres because so many landowners along that stretch dump their water onto the County road... because it is **a commons**. It was already coming down this road entry so I simply made the best of things. I need to clean it out too.



October 2013

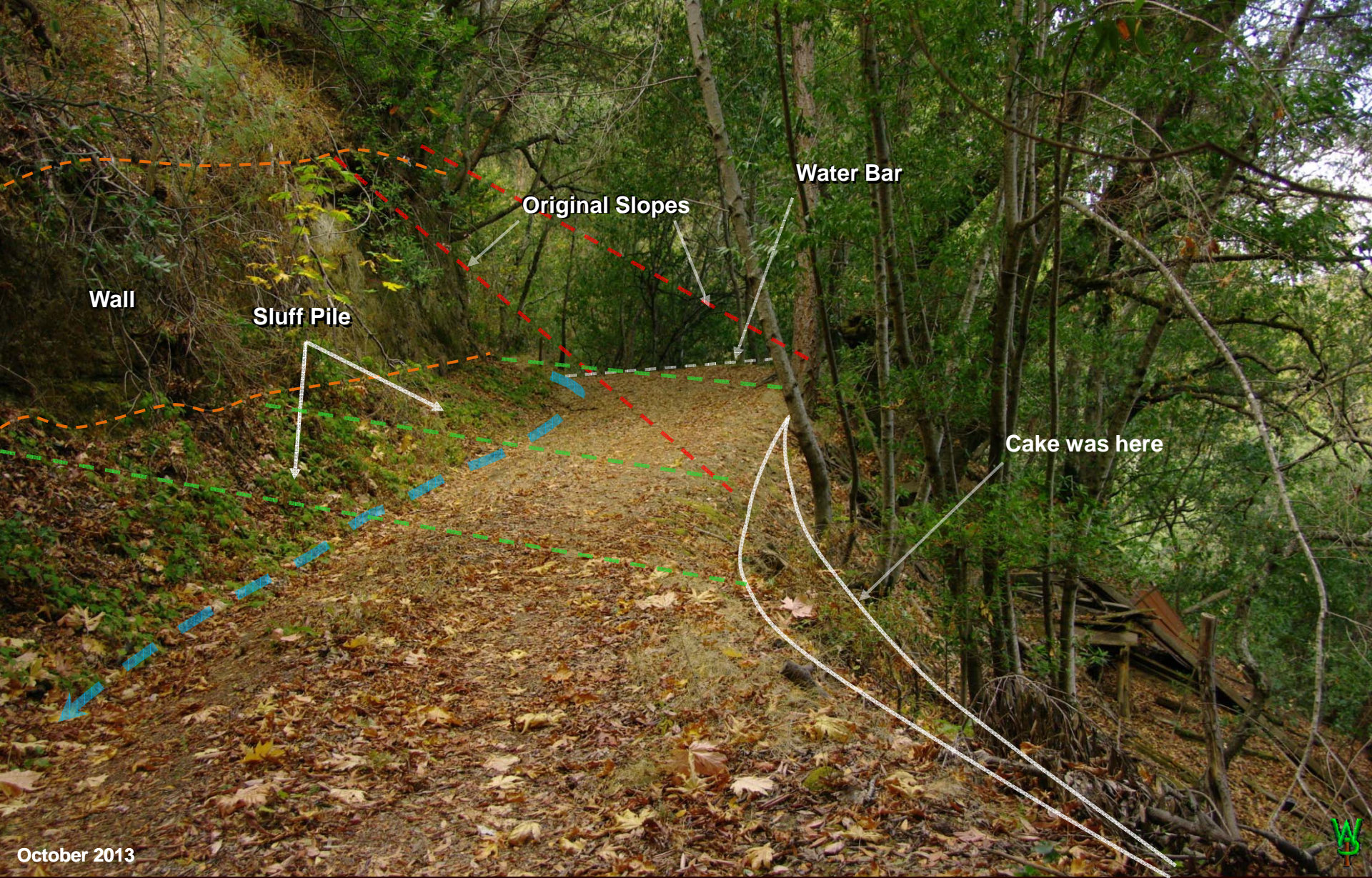


Then I filled in this long abandoned road segment (arrow) where the water originally entered Fenn's road. This was a Type II case turned into a useless gully. So, I retired it in 2003 by having the County fill it with ditch cleanings and then I graded it out. This kind of thing takes a lot of fill, 6-8 dump trucks worth. The County lawyers ordered the Department of Public Works not to do this because somebody sued them for fill contaminated with wood (despite having signed a release agreement to take it as is). The lawyers said that Public Works must truck the fill some 20 miles to a landfill and I have a harder time getting fill with which to fix old problems.



October 2013

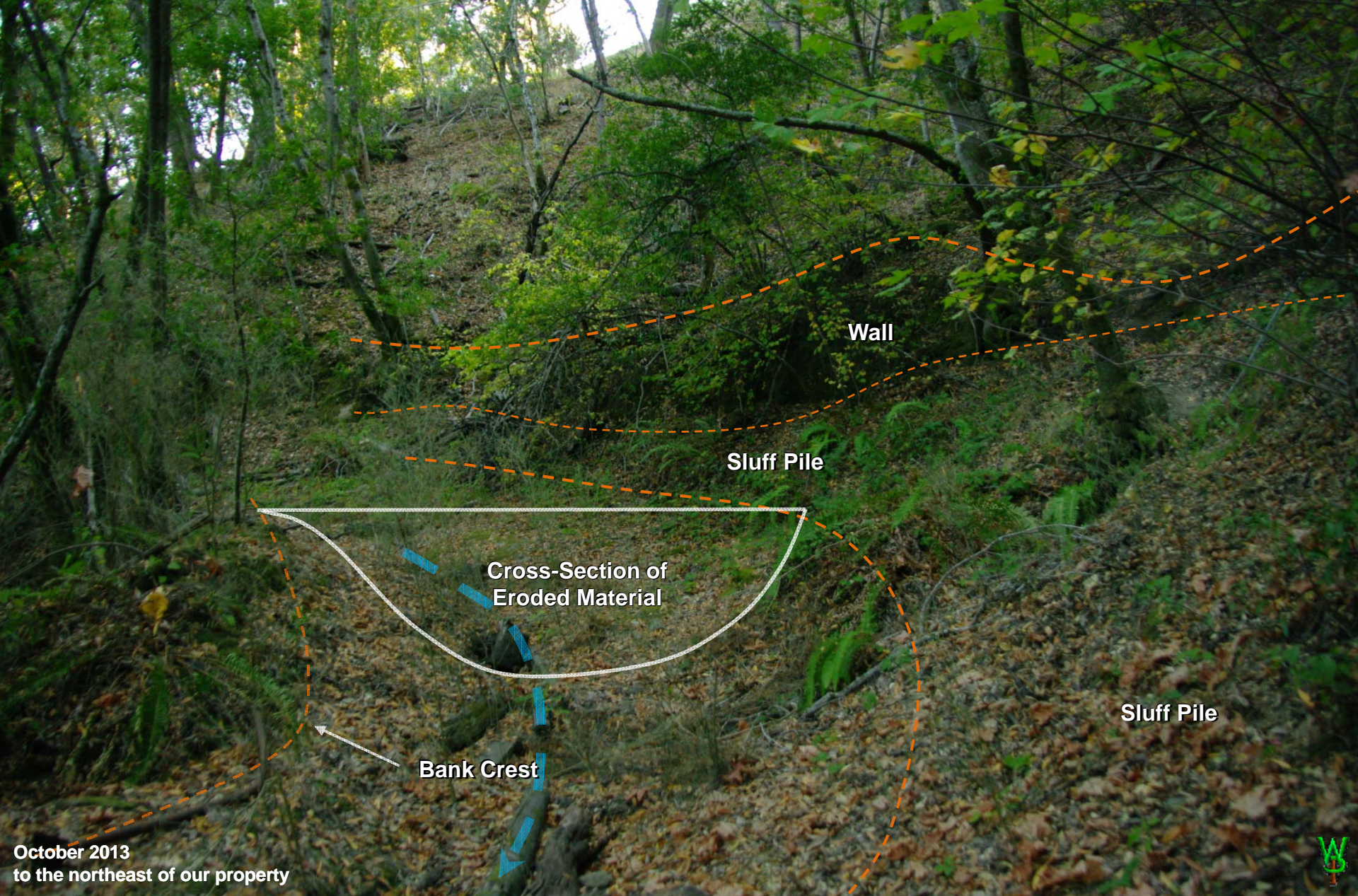
Down the road, I installed and maintain 2 concrete culverts (concrete burns less easily) with water-bars behind them in case they plug (the culvert at left is above the water bar). I also had other out-sloped water-bars made to shed the water at outside corners (right). These drainage improvements are separated by less than 100 feet. As long as the culverts are maintained, and we install a gate to keep idiot joy-riders from tearing up the water bars in the winter, this is stable. If and when I come up with more material, I can then reinforce the water bars and build more of an out-sloped configuration which will eliminate these concentrated flows.



October 2013

Before I put in the water bars, the flow came this way (blue). Here, this upper section of Fenn's road suffered a minor Type I failure: Runoff from above added to the flow that came down the in-sloped road from the entry until the combined flow ran to the outside, and just took the cake. All that is left of the road is cut rock. It will take thousands of yards of fill to slope this outward (the ideal grade is in green), but as long as the water bars work, fill material will slowly accumulate as it has on the left. Over the years, I will dress what comes down as I can and deposit what fill I have available starting behind the water bar and working downward.





October 2013
to the northeast of our property

This is farther down, off our property. In the old days, if the surface got rough or the shoulder washed away, they just cut the road deeper into the existing grade... and deeper, and deeper... Here, grading left an embankment on the left that channeled the water running down the middle of Fenn's road below said switchback. It then suffered a Type II failure. This is no longer cutting because of how we did the diversion above. My estimate is that the loss of material from the original road grade is 3-4 feet deep here.





About 1922 - Photo courtesy of Edward Fenn

To the right of Ed Fenn's house in the last old photo was his chicken coop. Below it you can see the outside of his road to Glenwood (arrow). There was probably no outside shoulder; rutting probably started what you are soon to see. What happened in this spot is representative of what we see elsewhere with old roads all over the American West.



October 2013

This is a view of that same spot today from closer to the edge (because of vegetation) and without benefit of the height of the porch. Obviously, it would be easier to see what happened without all that broom. I'll see what I can do to get a better image after the property owner and I cut some trees. The channel to which I returned the water is indicated in blue.



About 1922 - Photo courtesy of Edward Fenn

Returning to the original photo, what developed in front of the house was a Type II failure. The road was graded level across from the slope above. It then rutted and eroded as the water channeled down the surface to the right. The former creek channel is to the right of the stairs in the right front foreground. Despite the diversion above, the collection area is still substantial. Please note the blackberry shrubs on the slope in the foreground, the eucalyptus behind, and the stairs to the right front.



October 2013

Yes, there is no doubt that this is the same spot. I found the old root cellar dug into the hill that Ed Fenn told me would be behind where the house had once been. The redwood “sleepers” that once formed the house foundation are still there.



About 1922 - Photo courtesy of Edward Fenn

They unloaded the car here in front of the house....



W

About 1922 - Photo courtesy of Edward Penn

After assisting the lady, Ed parked under the tree on the right.
Note the stairs on the left under the horse's chest. This is the same spot.



October 2013

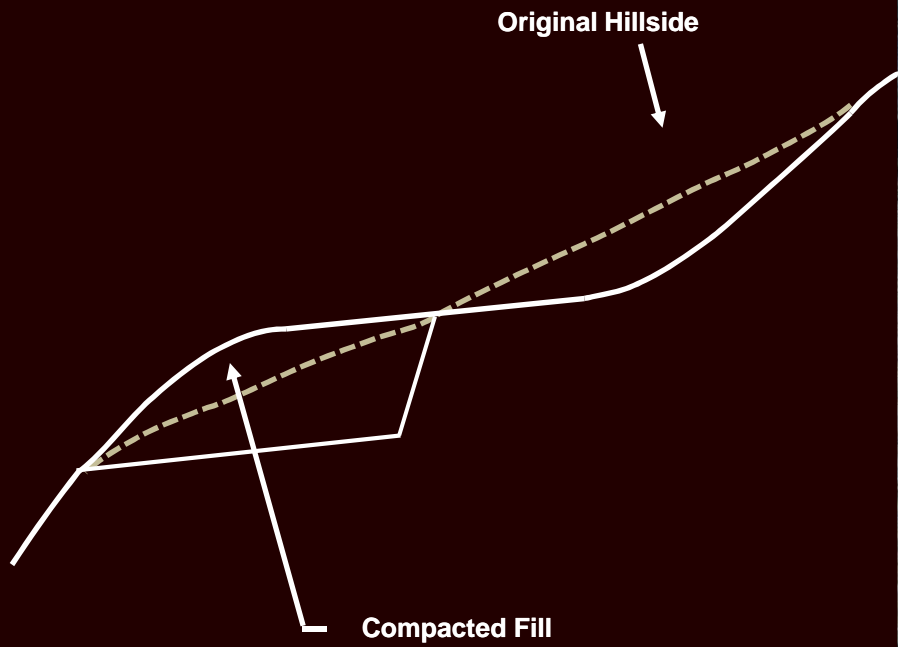


Here is the repeat cross-section (although I would need a ladder for the original perspective). Altogether, I estimate that over 2,000 cubic yards of material have been lost from in front of this old house site. I have had a County planner tell me with a straight face that "The County wants these old roads to go back to Nature." From its appearance, don't you think we've lost a fair bit of "Natural" subsoil already? Do you really think this situation would have corrected on its own or, if I hadn't diverted that water at the top, would the stream have just kept cutting? Yet this is not our property. Did I do the right thing? Does our planner know what he's talking about?



October 2013


Here is where the water now comes out of the eucalyptus grove that Fenn probably planted to reduce erosion. If so, it quite apparently did its job, as there is little apparent channel incision here after 23 years at full flow except at the very bottom where there are no trees. Effectively, my diverting the water at the top into that original channel and diffusing the rest arrested the channeling of the road surface. It's a fixable situation now. Do you see the material available to do slow it down even more? Yes, eucalyptus logs work fine for that. It is dense, rots slowly, and is obviously plentiful, although it is a problem in other respects. Slow the water with eucalyptus logs, replace the eucalyptus with redwood, and we could have the best of both worlds. The good news is that the new landowner is amenable to such a plan. So, in your opinion, should he be forced to hire the County's expensive experts, inspectors, and consultants, paying probably \$50,000 for a permit or should we be allowed to proceed on our own? Wouldn't it be even better if he could sell that redwood as a return on his investment in removing the eucalyptus, and planting the redwood? Well, the environmentalists' County agents won't allow him do that and even if he could the State would make him spend ANOTHER \$50,000. I hope you aren't expecting the County to *make* the landowner fix it; as they have already made this problem worse than it had to be. More to the point, they are already busy enough with their own problems, many of *their* own making. And no, they have not learned their lesson.



October 2013



This old road on my place was reshaped in 2006. It is typical of the design for timber haul roads today. This section of the road is out-sloped, wide, and maintenance free. This kind of road is particularly resistant to gopher damage, because there is not enough water at any one point to enter a hole and turn it into a trench. So, why don't I do it elsewhere? I don't have the fill material I need, yet.



“Strategically placed
branches” direct flow
over this stump hump

October 2013

This road is the backup drainage for a flat that occasionally spills off one end. The narrow ridge has impossibly steep sidewalls; so there is really no good place to drop the water off to the sides. So what I did is run the water down the spine of the ridge while slowing and retaining it with strategically placed branches, losing altitude until the grade into the channel was much more gradual. The presumption is that the ridges are of harder material than the gullies (that may not be true). Still, the propensity for a convex surface is to break up the flow into smaller and more chaotic flows, thus reducing surface wear. The branches last about 15 years.





September 2004

This old road was re-graded to get equipment in and material out for forest thinning or brush and weed control. To that end, I changed the grade from an in-sloped to an out- sloped drainage configuration, thus eliminating the need for culverts. It has worked beautifully to reduce the flow in the channel below, and has required no maintenance at all other than weeding. The two fir trees on the right are there to be gin-poles for purpose of high-lead yarding redwood logs out of the stand. The deck of skinny logs at the end of the road are for future corral posts or a pole barn should the need arise. I can't sell them to anyone with a better use.



Old Culvert Ditch
(now filled)

New Drain Inlet

October 2013



Above and behind the fence, there is a curb (blue line) at the lower edge of the driveway to protect the near-vertical embankment of fill upon which it is sitting, now undermined by County ditch cleaning. The curb and the road collect over an acre of rainwater runoff and concentrate it here at the corner. Here, the grade of the road used to tilt to the side opposite where there was a culvert. When the culvert plugged, the water went down the embankment on the right and washed the soil away. I know, you see soil here. I fixed it.



September 2002

I cleared the vegetation (the tree went that day). The County dumped in ditch cleanings as fill. I had it packed and shaped. I rocked in the old culvert ditch on the opposite side. The County paved it next time they came in with a patch crew, making a spot where cars could pass each other at the corner. I got free fill dirt to repair the damage the culvert had done; they saved money on trucking dirt and reinforcing the road. Everybody wins, right? Well, the lawyers have made such a project impossible now. No, this is not as good as “engineered fill.” It is not as good as digging it all out and compacting it to specification. It has settled a little, which was expected. I have a supply of material nearby with which to fill those few spots that will need it. Slowly it will stabilize and for far less money.



Tree was removed

September 2002



Once I had the fill, I sowed it with hand-collected native grass seed. But I needed one more thing to complete the revegetation to hold the seed. I needed mulch and I could not import straw because it would contaminate the area with new weeds. Little did I know.



Culvert
Valve



October 2013

This was another one of those “things you learn along the way.” Every year, just before it rains, I clean almost four truckloads of leaves off my driveway and out of the drainage system. So, rather than import non-native straw for my seeding projects, I planned to use that oak leaf litter as the protective mulch for the seed to keep the surface moist and reduce erosion due to rain impingement. Well, it did all of that, but it also brought me a crop of exotic large seeded rattlesnake grass (*Briza maxima*) a patch of which had been not far uphill from the top of the driveway. I learned right there that the old maxim about ‘what goes downhill’ applied to seed too. I’ve since prioritized my native grass reestablishment projects from the top-down in the same manner. Since then, the leaves have been clean.



Wire Grass

Santa Barbara Sedge



October 2013

I transplanted our friend Santa Barbara sedge (*Carex barbarae*) at the drain outlet to dissipate the energy. Below it, wood steers the separated flows to minimize incision. Below that is another tough riparian plant, wire grass (*Juncus patens* - not really a grass but a rush). The functional difference between the rush and the sedge is that the wire grass is better at collecting sediment but does not lay down flat under water flow like the sedge does. It also grows in clumps, not making as continuous a surface as the sedge. I hope to have a lot more coverage in this drainage now that I thinned it this year, with more to come in the winter of 2013 (I'll probably get rid of the coyote brush). **The channel that once ran down the middle of this drainage below was then three to four feet deep.** I chocked that with wood and filled it. So with rot and compaction I may yet need to bring in a little more fill and transplant more sedges. Yes, I did all this work to deal with a runoff problem caused by my neighbor and the County long ago. It's cheaper than fighting over it.



October 2002

'We just can't have people doing this on their own. Shouldn't fixing old unstable roads be left to the professionals, the engineers and contractors who **know** how to make better roads?' Welllllll there's a little problem with that. It costs too much for what you get as they have a rather well established record of interest in making those few jobs they get anymore cost a bundle. Consider: In what was likely a craven act of political corruption to please said contractors, quarries, bureaucrats, and engineers, you know, the "stakeholders" in roads (as if taxpayers didn't have one), the County now requires 12" of Class II base-rock and 2" of asphalt for private driveways that are used almost exclusively by automobiles and light trucks. They want 12 inches of rock on timber haul roads used only in summer every 10-15 years! They require turning space on said driveway for a hook and ladder fire truck that could not make it up the County road to said driveway even if they had one. They require that culverts be buried at least 12" below the base grade (before adding the base-rock). Now, look at the above photographs. This was the County culvert this "amateur land-hobbyist" replaced. It was AT MOST 10 inches below the pavement, which was less than 1 inch of oil and screens on bare dirt with heavy trucks driving it daily. The road has been here for over 100 years. Yes, the culvert needed replacing, but guess why that doesn't happen? The County is a prisoner of their own planners' specifications. Equal "protection" of the lawyers, again. They make great road managers, don't they?



October 2013

But are all my roads perfect? No! There are some that could be better, particularly in how they collect water. The problem with this culvert is that the east facing slope on the northern half of this place (down to the left) is so steep, there is no good place to run the water down it. Sometimes you have to make one, as we did in the case of the rock drainages you have seen. That just takes time and money to get done. I've done one channel every several years with the one below here left to do. Hopefully I will have the situation corrected within my lifetime. In any case, this one gets its ditch cleaned and a bigger water-bar as soon as I get to...



Stump



October 2013

...this. This is a different type of problem, one that is **going** to happen, since made more complex by lawyers. The original problem is the stump. Although I removed the weight of the tree, it was doomed to slide. However, it slid a LOT sooner because the County cleans the ditches (since filled with sluff) to keep the water off the pavement. Ditch cleaning undermined the slope by digging the blade into the hillside and allowed water to seep *under* the pavement, thus making it crack. The County lawyers have spoken: 'There shall be no water on pavement,' because they don't want to be sued. The problem with that "logic" is that anybody stupid enough to drive fast enough to hydroplane on this single-lane, treacherous, windy road deserves what they will get. The ditch fills within a couple of months anyway, and the water runs on the pavement anyway. What to do?



Head of Slide



October 2013

Here is a view from the other side. As the stump slid, the roots tangled with other stumps started to pull the top off the whole slope. The reason I am making a point of this is that the customary landowner practice is to wait for a storm and allow the stump to fall and block the road. Then the County comes along (after dealing with probably bigger problems elsewhere) and cleans it up for free. Then they hydro-seed the whole slope with exotic grasses and hope it doesn't fail. I can't let that happen. So the Department of Public Works gave me a permit (free) to get rid of this mess. I'll reslope the whole bank and you will get to see a revegetation project like no one has ever seen. After all, innovative process development using native plants is what this place is all about. We'll see if it works.



Grade



November 2013

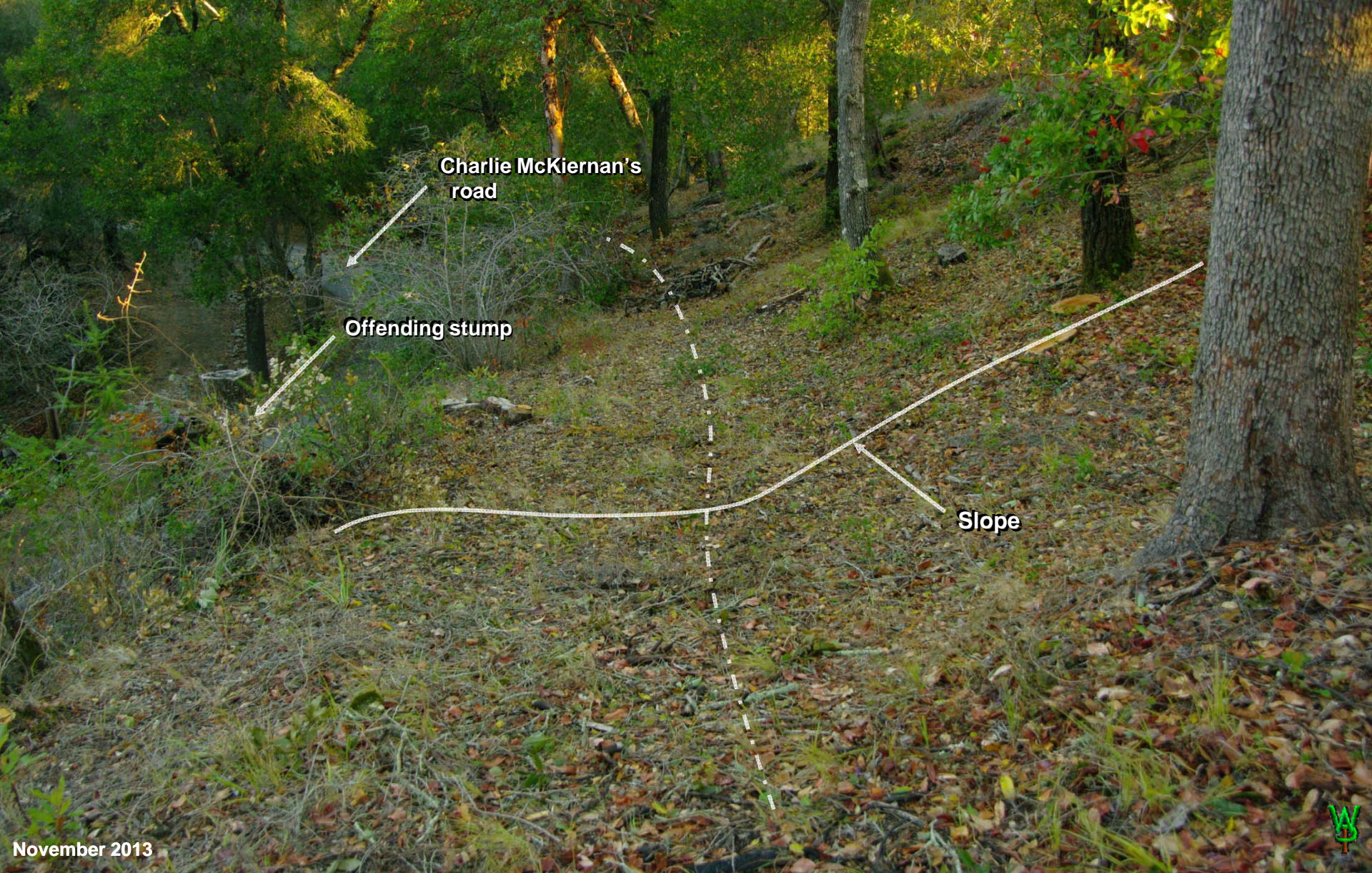
Yet there was a minor complication to beginning the job to which you are now a witness, one that required a bit of extra documentation for posterity because of [the site history](#) you have already read. Note that the grade on the side opposite the line becomes almost flat across the slope. Note also how this flat section follows roughly the same course as the county road below.



November 2013

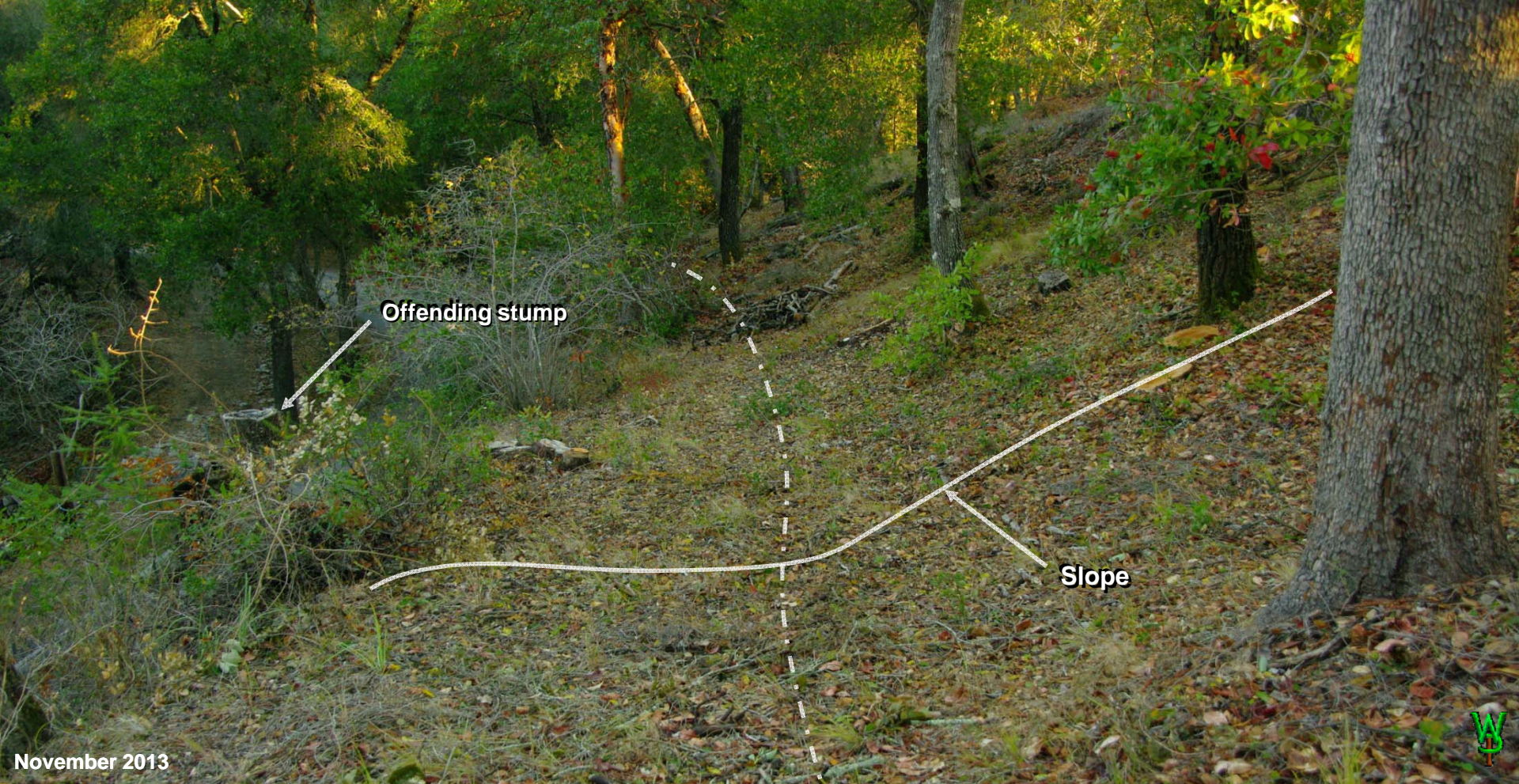
Here we are just to the south and above the prior slide at what will be the beginning of where I will be cutting into the slope to reshape it. The track is about six to eight feet wide, too narrow for a car, or even most wagons. Even without Mr. McKiernan's road below, the original slope would never have been level across it as it is here. It is almost as if this was an even older road, one made long ago, except that the only "older road" made before Charley McKiernan built his toll road in the 1850s, was the path made by the Indians of Mission Santa Clara for the Spanish in August of 1791.





November 2013

Accordingly, it seems likely that this may indeed be that old Spanish track. Unfortunately, the repair to reslope this overhanging embankment will remove just about all of the old road. What to do? Get the permit, document it for the archaeological record, check it with a metal detector, scrape off the surface to stockpile native grasses and save the topsoil for the revegetation job, and fix it. It is saddening to take out this likely vestige of the mission era, and it does cause one to ponder what the Indians had to do to build it or how the land might have looked to the Spanish when they passed by this very spot 200 years ago, but it's just how things have to be.



Offending stump

Slope

November 2013



The point of all this ranting about roads is that YOU, “General Public,” have been in command of this situation. Your agents at the State asked investors to build toll roads because General Public wouldn’t pay the State or County enough to do it. Your agents gave a monopoly to Mr. McKiernan, forcing Charlie Martin to snake Fenn’s road up here. You, General Public, didn’t ask how the builders would manage the risks or specify those construction methods. Then your State agents helped the railroads gain rights of way that put the toll roads out of business. You “bought” those toll roads for \$0.10 on the dollar. Then your agents built another highway and ignored that old County road. Today your agents whine about the mess and lack of “funding” to fix it. Some of these old problems, like Fenn’s road, are on private property. I am not asking you to fix those. I **am** asking you to leave those of us who *want* to fix those old problems for free, FREE to do that work on our *private* property and without your permission. None of that can happen as long as your government agents cling to the power to extort a series of ridiculous payoffs to supposedly supervise and protect a flimsy claim of public health and safety without *any* responsibility for the outcome. That bureaucratic claim to manage all risk, supposedly on behalf of you General Public, is what makes these technical issues essentially political even on private land. It’s not working.

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