

## Emergency Access Road (EAR) Analysis

April 2022

### Analysis Objective

The objective of this analysis is to evaluate and prioritize Emergency Access Road (EAR) options that are available to the Genesee Fire Protection District (GFPD). Ideally, this analysis will help determine which options, if any, merit additional attention including funding for an engineering study now or at some time in the future.

### Rationale

The residents within the GFPD have limited evacuation options. Essentially all evacuation roads eventually lead north to the I-70 corridor through two capacity-limiting intersections south of I-70 at exits 254 and 256. Given that any major fire impacting the GFPD is most likely to come from the direction of the prevailing winds (southwest or west), it is fortunate that the GFPD's sole egress direction is to the north and the I-70 corridor. However, should access to the I-70 corridor be unavailable in an evacuation due to a chemical spill, arson, accidental fire, lightning generated fire, traffic, or a road accident, residents may be unable to evacuate and emergency responders may be unable to enter the community. [Because wind direction is generally away from the GFPD for fires in the I-70 corridor, and numerous roads allow firefighters rapid access to most areas around I-70, the likelihood of a wildfire cutting off access to the I-70 corridor is considered to be lower than many other fire scenarios. That said, the more catastrophic potential of such scenarios and higher frequency of fires in the I-70 corridor (roughly one per year) merit concern].

Recognizing this risk, the GFPD's 2008 Community Wildfire Protection Plan (CWPP) made "viable emergency secondary access" its second greatest area of concern. Ever since, numerous Genesee Foundation (GF) boards have attempted to find an additional EAR without success. More recently, the current 2021 CWPP demonstrated that overall traffic capacity of the existing evacuation options was also an issue. The CWPP modeled that it could take between 155 to 280 minutes to evacuate the GFPD even without accidents, reduced visibility, or cars stopping to take pictures - once again highlighting the GFPD's evacuation shortcomings.

### Key Challenge -- Why is constructing an additional egress route so difficult?

What makes constructing an additional egress route so difficult? The two main obstacles are: 1. elevation and 2. the need to get approvals from private property owners.

**Elevation** -- The Genesee Foundation and much of the GFPD were developed in part for their scenic views. The elevations that create those views are problematic for egress routes. High elevations mean many EAR options require long roads with numerous expensive switchbacks that can slow traffic, reduce road capacity, and disrupt picturesque views. For example, the southern part of Montane Drive

is the lowest elevation main road in the GFPD. However, it is still 400 feet above HWY 74. To go down 400 feet, a road would need to be over 5000 feet long if were at a constant 8% gradient.

**Private Property** -- The second major obstacle is that most evacuation options go through private property. In fact, many options go through several private lots, in which case all the owners would need to agree to any and all road construction and fire mitigation plans. Getting one, let alone several, private landowners to agree to a new egress road has historically been difficult.

### **Background and Creation of the GFSC Working Group**

In 2020, a member of the Genesee Foundation (GF) board, who was also a member of GF's Genesee Fire and Safety Committee (GFSC), began evaluating a potential egress route through the Genesee Water and Sanitation District (GWSD) property.

By summer of 2021, a feasibility study of the GWSD option (funded jointly by GF and GFPD) was completed by a local engineering firm and the GWSD option appeared to be reasonably viable. However, since no comprehensive study of all the GFPD's options had been completed since 2013, the GFSC felt it prudent to create a working group to explore alternatives to the GWSD option to see if that is indeed the best option.

### **Matrix Analysis of Six Emergency Access Road Options**

As part of that evaluation process, the GFSC developed a matrix in order to be able to evaluate the options in a more methodical (and hopefully less subjective) fashion.

The matrix is a high-level preliminary analysis and not a survey. It is solely designed to compare the benefits and challenges of the various options available to the GFPD, so the GFPD and GF can prioritize where to put their resources going forward. There was no budget for or spending on this analysis. The purpose of the matrix is to determine which options, if any, might warrant spending on an engineering study, now or in the future.

The matrix is not designed to determine whether or not an option is worth the cost. Cost numbers are very rough. Should one or more options be worth pursuing in the future, much more detailed and accurate cost numbers will be required.

#### **Matrix Design**

There are three sections to the matrix – Resident Evacuation Value, Fire Protection Value, and Probability of Success.

1. The **Resident Evacuation Value** section looks at which potential routes are best solely from an evacuation perspective. It explores the evacuation benefits of the road and not the likelihood of being able to build or improve the road.

2. The **Fire Protection Value** (FPV) section looks at the fire protection benefits of each option. It is not well known, but the same road that can be used to evacuate residents may give firefighters greater mobility, access, response times and other benefits which can be significant in some fire scenarios.
3. Finally, there is the question of feasibility. The **Probability of Success** section evaluates how hard it may be to get the necessary approvals to build the road. Given GF's long history of unsuccessfully pursuing additional egress routes, some consider this to be the most important section.

So, the plan was to have three discrete sections that evaluated each area independently.

### **Who Filled Out the Matrix**

The criteria in the matrix were developed from previous analyses of egress routes, the current and past CWPP's, discussions with Jefferson County, the civil engineering firm which did the preliminary GWSD feasibility study, a civil engineer familiar with road costs and construction, and numerous discussions with the fire department and fire chief Jason Puffett.

Criteria were designed to reflect the strengths and weaknesses of each EAR option. However, since some criteria can be significantly more important than other criteria, the criteria are weighted so that more important criteria receive higher value.

While the GFSC spent a lot of time and effort trying to replace opinion with facts by developing the matrix, the infinite number of fire and evacuation scenarios means that there is still a considerable amount of subjectivity in filling out the matrix.

In order to limit subjectivity as much as possible, the GFPD fire chief formed a small panel of experts to fill out the FPV and evacuation sections of the matrix and weight the criteria for the level of importance. The GFSC filled out the Probability of Success section since the criteria are less subjective and the subject matter did not require fire mitigation and evacuation expertise. Probabilities do not require weightings, so this section is not weighted.

The panel consisted of:

- 1) Jason Puffett – Genesee Fire Protection District Fire Chief
- 2) Pete Anderson – Retired Chief of West Metro Fire Rescue, founder of Jeffco Incident Management Team with 30 years of wildland experience. He is also building the evacuation plan for Evergreen.
- 3) Paul Admundson – Battalion Chief with DFPC with over 20 years of wildland experience, including serving as the Wildland Captain for Evergreen Fire and Incident Commander for the Elephant Butte fire.

### **Explanation of Resident Evacuation Value Criteria**

An ideal evacuation road should:

- 1) **Be a high capacity road.** Low-capacity roads can help, but will have a much more limited effect. For example, in the “worst case” scenario, the CWPP (Community Wildfire Protection Plan) estimates that 3744 cars will require evacuation. This assumes that residents of every household are home and take 2 cars. (Every household includes all residents of The Village, Chimney Creek, Genesee Mountain, Genesee Foundation and Riva Chase). If an improved jeep trail can evacuate 150 cars per hour (cph) and it is the only egress because the I-70 corridor is unavailable due to fire, traffic, or accidents, it would take 25 hours to evacuate under this worst case scenario.
  
- 2) **Avoid the GFPD’s two limiting traffic bottlenecks.** From an evacuation perspective, all the GF, The Village, Riva Chase, Chimney Creek and Genesee Mountain residents (with the possible exception of some Riva Chase residents who may exit South to Hwy 74 via Shingle Creek) will evacuate through the two capacity-limiting intersections just south of I-70 at either exit 256 or exit 254. Everyone must go through these intersections to get to either I-70, Hwy 40, or Grapevine. In essence, all current roads eventually lead to these two intersections. Building or improving a road that leads to these intersections may increase the flexibility and redundancy of the GFPD’s road network (see point 3 below), but will not improve the time it takes to get the last car out of the GFPD. For example, if 3744 cars must be evacuated from the GFPD and the intersections near Exits 254 and 256 can each only handle 500 cph (cars per hour), it will take  $3744 / (500+500)$  or 3.74 hours to get the last car out of Genesee. A new or improved route that connects the front side of Genesee to the back side of Genesee, but still requires residents to go through one of these exits, does not change this math. Only roads that allow residents to avoid these two key intersections will improve the time to get the last car out of the GFPD.

Note: the 500 car per hour number is for illustrative purposes only. The actual capacity will depend on things such as the amount of smoke, the traffic pattern, and whether or not a Jeffco sheriff is directing traffic through the stop sign.

- 3) **Reduce the GFPD’s exposure to the loss of a key road, intersection or area.** More simply put, when it comes to egress, the GFPD has too many eggs in one basket (or more accurately two baskets).
  - A) Basket 1- The first is the I-70 corridor (I-70, Hwy 40, Genesee Ridge and Northern Grapevine which are all in close proximity to each other). Currently, the only way in and out of the GFPD is to the north via the I-70 corridor. If the I-70 corridor is not available for any reason (such as fire, accidents, chemical spills, arson or traffic), there is no way for residents to get out or for emergency responders to get in.

Therefore, connecting to the I-70 corridor is less desirable. For example, the King Ranch option avoids exits 254 and 256, but still goes to the north and connects to I-70. By

avoiding exits 254 and 256, it could improve evacuation times significantly for a fire coming from the south when I-70 is functioning normally. However, the road would do little to mitigate the GFPD's overdependence on the I-70 corridor. (Note: Detailed descriptions of each EAR option are available in the Appendix.)

- B) Basket 2 – The second unfortunate area of logistical concentration is the intersection of Genesee Vista and Genesee Trail and the intersection of Genesee Vista and Genesee Ridge. The 2008 CWPP found these intersections to be in such near proximity to each other (640 ft) that much of the GFPD “has essentially a single egress route.” It is preferred that EAR options are not in close proximity to these two intersections.
- 4) **Not go into the direction of the prevailing winds.** Fires that threaten the GFPD are most likely to come from the direction of the prevailing winds (southwest or west). Therefore, EARs that go into the direction of the prevailing winds have a lower probability of being useful in an evacuation, although these same routes may have a higher probability of being useful from a fire protection perspective.
- 5) **Avoid areas that go through or connect to other areas where one can get lost in the smoke and confusion of a wildfire.** Similarly, areas that are or connect to roads that are narrow, have hairpin turns, and/or lack shoulders or guard rails along steep slopes are much less desirable because of the increased risk of accidents.

### Explanation of the Fire Protection Value (FPV) Section

This section evaluates the EAR's benefits for firefighters and emergency responders including:

- 1) **Response Times** - There are an infinite number of fire scenarios and most EARs improve emergency response times under some of them. However, some EARs are much more likely to impact response times materially more than others. For example, the only way in and out of the GFPD at present is from the north. This limitation impacts fire response in several ways. First, for fires that initiate close to the GFPD perimeter in directions other than from the north, it makes it difficult to respond rapidly to attack a fire when it is small and more containable, for example, after a lightning strike. Second, it takes longer for mutual aid firefighter units from the south and southwest to respond to a fire in or approaching Genesee. Finally, it makes it difficult for the GFPD to respond rapidly to support other fire districts, particularly in the south and southwest when they require assistance. (Note: Faster response times to other districts by the GFPD may improve the odds that a fire is halted in those districts and that the fire does not advance towards the GFPD.)
- 2) **Areas of Strategic Fire Protection Value** - There are areas around the GFPD's perimeter that, if the GFPD or other fire-fighting units could safely get to and safely retreat from, could be very valuable for the GFPD's fire defense. A few EAR options provide access to such areas. For example, the King Ranch has a clearing with a gully that has a small stream running through it. Currently the area of dense woods to the east of the gully and lack of a safe way to withdraw from the area make a defense of the area problematic. Mitigation of the wooded area and an

EAR would significantly enhance the ability to defend the area and protect the GFPD's western flank.

- 3) Fire breaks** – A fire break is a natural or constructed barrier that removes all vegetation and organic material down to bare soil. Fire breaks are used to slow or stop wildfires. While all roads have at least some small potential as a firebreak, the potential of some roads is greater than others due to location, direction of the road, nearby vegetation, gradients, the direction of the prevailing winds and other factors.

### **Explanation of the Probability of Success section**

There is a gauntlet of approvals that must be overcome to make an EAR option a reality. The Probability of Success section evaluates the odds of getting those approvals in the short to medium term. Two of the most significant criteria are:

- 1) The number of property owners that would need to grant easements** - It is an unfortunate reality that most EAR options go through private property. It is probably not surprising to hear that private property owners can be extremely reluctant to grant an easement to build a 20 ft wide road through their property. Unfortunately, 100% of the owners of the underlying land must grant their approval.
- 2) The number of private property owners that would need to mitigate** – Panelist Pete Anderson said it best when he wrote:

“You need to prepare your citizens to have fire on the ground during their evacuation. Then prepare your escape routes for them to be caught and survive the fire”.

Evacuation routes must be survivable and therefore sufficiently mitigated. So, the probability of all private property owners mitigating sufficiently is considered here by looking at the number of private property owners that would need to mitigate their properties. This number includes the property owners who own the land under the EAR and property owners of smaller roads or private drives that connect to the EAR.

In addition, there is a criteria to reflect that most road construction will require county approval and steeper road gradients can make obtaining that approval more uncertain. Finally, EAR options where the private property owners are very likely to tie approval of a road on their property to plans for residential development of their property have more obstacles to overcome and are likely to take much longer to come to fruition in a short or even intermediate time frame.

Cost and the aesthetic impact of the road were not considered in this section. Cost was not considered since:

- 1) Value, not cost, is likely to be the key metric that the community uses to evaluate any EAR proposal.
- 2) No EAR option is cost prohibitive or out of line with other recent community spending (such as new pools or water filtration equipment).
- 3) Our cost estimates are too rough to accurately differentiate between options. (See appendix).

While the aesthetic impact of the road on the surrounding area is an important consideration, and a poorly located road may generate some community opposition, the impact of a road's aesthetics on this section of the matrix proved too difficult to appraise. Metrics such as how many people would see the road were deemed inadequate, particularly when the exact routes for many EAR options and hence their visibility to GFD residents is unknown. That said, the GFSC recommends that the visual impact be considered when selecting the exact route for any EAR.

### **Numbers vs Descriptions to Quantify Probabilities**

Ideally, one would use mathematical probabilities to determine the probability that any EAR option can secure the necessary approvals. Unfortunately, while we may know from past experience that the odds, for example, of getting four land owners to approve placing a road on their property is low, we do not have enough data to know if that number is 10% or 30%. This means that using precise mathematical numbers in this section would mislead the reader into thinking the accuracy of this analysis is much higher than it truly is. Therefore, the Probability of Success section uses terms like Low, Very Low and High instead of precise numbers.

### **Adjustments to the Matrix by the Panel**

Given the importance of creating defensible space along the route, proper mitigation is a requirement for all EAR's and not optional, so it was considered a Probability of Success question which was not evaluated by the panel.

However, two of our panelists felt the question of mitigation could not adequately be handled by a simple question of how many people would need to mitigate. Fortunately, the GFSC made clear that the panel could adjust their answers as necessary to make sure the matrix reflected their true recommendation. Both Paul Admundson and Pete Anderson took advantage of this option to not strictly follow the criteria. Paul did this selectively. Pete did this much more broadly.

For example, Paul Admundson occasionally gave Pine Drop and King Ranch lower ratings than the criteria would suggest because he considered it unlikely that they could be sufficiently mitigated (by 200 feet on each side) to be of use. He also questioned Pine Drop's potential to be useful to emergency responders as an improved one lane jeep trail.

Pete's top two criteria are survivability of evacuees on the road if surrounded by fire and the time it takes to build a road, both of which were not well represented in the two sections of the matrix Pete filled out. Therefore, Pete only gave points to the two options that he thought could truly meet those goals.

Therefore, while the matrix was designed to isolate the probability of sufficiently mitigating EAR options from the FPV and evacuation value sections of the matrix, there is some overlap between the three sections. In addition, our panelists took advantage of their ability to adjust their answers to make them reflective of their true opinions.

### **Why the Analysis has a GFPD versus a GF perspective**

This analysis takes a broad Genesee Fire Protection District perspective (GFPD), not just a Genesee Foundation (GF) viewpoint even though the GFSC is a GF committee. The GFSC believes that the larger focus is necessary because:

- 1) All GFPD communities and Riva Chase are essentially in the same boat. We all must go through the same two capacity-limiting intersections south of exit 254 and 256. One cannot look at a GF evacuation in isolation from that of other neighboring communities.
- 2) While the GFSC tends to be more focused on GF, the GFSC would like to make a difference to life safety wherever it can, particularly with neighboring communities. All GFPD residents can benefit from an additional EAR whether from improved fire protection benefits or more egress options. For example, if an arsonist sets fires by both exit 254 and 256 during a red flag warning with winds from the northwest, GFPD residents near I-70 can clearly benefit from any additional egress route that avoids these two exits. (Note: That is not to say everyone or even anyone will benefit in every fire scenario. Like a health insurance policy where the policy holder does not get sick, EARs are like a Life Safety Insurance Policy that may have no value in some fires).
- 3) The GFPD clearly looks at an EAR from a GFPD perspective. Taking a GFPD perspective allows the GF to better understand, coordinate, and align with GFPD's goals.



## Matrix Summary Page

The summary page from the matrix is below.

### Summary of Benefits For Potential Emergency Access Roads

	<u>Choke Cherry</u>	<u>Daisy Lane</u>	<u>East Mont.</u>	<u>GWSD</u>	<u>King Ranch</u>	<u>Pine Drop</u>	<u>Shingle Creek</u>
Resident Evacuation Value - Paul Admundson	20	160	60	160	30	20	20
Resident Evacuation Value- Jason Puffett	20	140	80	140	90	80	50
<u>Resident Evacuation Value - Pete Anderson</u>	<u>0</u>	<u>72</u>	<u>0</u>	<u>72</u>	<u>0</u>	<u>0</u>	<u>0</u>
<b>Average Resident Evacuation Value</b>	<b>13</b>	<b>124</b>	<b>47</b>	<b>124</b>	<b>40</b>	<b>33</b>	<b>23</b>
Fire Protection Value - Paul Admundson	0	130	110	130	10	60	0
Fire Protection Value - Jason Puffett	30	140	30	140	40	50	20
<u>Fire Protection Value - Pete Anderson</u>	<u>0</u>	<u>88</u>	<u>0</u>	<u>88</u>	<u>0</u>	<u>0</u>	<u>0</u>
<b>Average Fire Prevention Value</b>	<b>10</b>	<b>119</b>	<b>47</b>	<b>119</b>	<b>17</b>	<b>37</b>	<b>7</b>

#### SUMMARY

Average Resident Evacuation Value	13	124	47	124	40	33	23
<u>Average Fire Prevention Value</u>	<u>10</u>	<u>119</u>	<u>47</u>	<u>119</u>	<u>17</u>	<u>37</u>	<u>7</u>
<b>Total Benefit Score</b>	<b>23</b>	<b>243</b>	<b>93</b>	<b>243</b>	<b>57</b>	<b>70</b>	<b>30</b>
<b>Probability of Success</b>	Very Low	Low	Very Low	Medium	Low	Very Low	Very Low

Detailed descriptions and some discussion of each EAR option are in the Appendix. A PDF version of the entire report is available at the GF website as is a blank excel version so residents have the opportunity to fill out the matrix with their own scores. The entire matrix is also in the Appendix of this report.

## **Discussion, Conclusions and Recommendations**

The matrix shows the GWSD and Daisy Lane options are the best options based on the information we know today. Daisy Lane is the road to the east of the GWSD district and both connect to Hwy 74, so it is not surprising that it received similar scores. Several options for two lane EARs around Daisy Lane are possible. The matrix assumed a two lane road west of Daisy Lane coming off the cul de sac, but other options are possible and may be preferred.

### **Why GWSD and Daisy Lane?**

The GWSD and Daisy options lead in all three categories – Evacuation Value, Fire Prevention Value and Probability of Success (although Daisy Lane’s Probability of Success score is lower since the cul de sac option requires 4 homeowners to mitigate). They check most of the boxes. They are high-capacity, two lane paved roads that avoid the GFPD’s current traffic bottlenecks that limit evacuation times. Their direction to the south to Hwy 74 gives the entire GWSD an evacuation option should the I-70 corridor be lost to fire or accident. The southern access also allows for a more rapid response for firefighters and emergency responders located south of the GFPD and it improves the GFPD response times to support fire-fighting districts to the south or southwest.

Both options have potential to be valuable as a fire break and would provide rapid access to the strategic grassy section of the hill below Montane and above Hwy 74 in case of a fire from the south. (A fire break is a natural or constructed barrier that removes all vegetation and organic material down to bare soil. The appendix discusses the fire protection value in more detail).

Both should be able to be designed with reasonable (<10%) gradients.

The Genesee Water and Sanitation District is the only non-GF property owner who would need to grant easements for the GWSD option and most Daisy Lane options only require GF approval for construction. That said, it would still be prudent to coordinate with the GWSD on any Daisy Lane option since most go near the GWSD’s property and the GWSD is considering expanding their upper reservoir near most of these routes.

The GWSD option does have an edge when it comes to mitigation (and hence the Probability of Success Section). Only the wooded area around the upper GWSD facility and some GF open space would need further mitigation to make the area safer for cars should they get stuck on the road due to traffic or an accident. Most Daisy Lane options will require some resident and GWSD mitigation, lowering its Probability of Success Score.

As for cost, the GWSD option may have an edge given that it starts from a lower elevation. However, more engineering analysis will need to be performed to determine if that is indeed the case.

### **What are these options missing?**

On the downside, these options are not perfect. One would prefer that an EAR be farther to the east than both of these options, so as to be farther away from the most likely direction of a fire (southwest or west). Less visibility to residents is always preferable as well. Finally, discussions with the GSWD have progressed slowly as of this writing and there are concerns about the GSWD option's proximity to the GWSD dam and buildings.

### **GSWD vs Daisy Lane**

The GFSC believes that it is too early to definitively recommend one option over the other at this time. While a feasibility study has been completed for the GSWD option, which looks favorable, there are still many unknowns that can affect cost, road performance, aesthetic impact. Some feasibility concerns remain as well. There has been no comparable engineering study of the Daisy Lane options. The volunteer civil engineer working with the GFSC advised us that since the cost to do some additional high level engineering work is small in comparison to the total cost of the project, the money spent for additional engineering work by looking at all options in the GSWD/ Daisy Lane corridor might be more than offset by construction cost savings. For example, if it costs \$1.5Million to build one of these options, a 1% savings is worth \$15K. For comparison, the cost for the preliminary engineering study of the GSWD was \$6K.

### **Other Options**

This conclusion does not mean that all other options should be discarded and forgotten. In general, the more EAR options that are available to the community, the safer the community. That said, the community has limited resources and the CWPP points to several other areas that require attention. Therefore, the GFSC recommends that other options should be looked at opportunistically in the future when they might be achieved for lower cost than today. The most likely reason for lower costs would be that road construction costs are tied to development actions and not significantly borne by the GF or GFDP.

For example, if the owners of the King Ranch ever develop it, Jeffco will require that the area be mitigated and the development should come with roads that meet county egress codes. The King Ranch exits in the likely direction of a fire (west) and then north which means it is less likely to be utilized for evacuation in a fire. That said, it could be very valuable for an evacuation from a fire to the south or for fire protection from a western fire. (King Ranch uses exit 252, thus avoiding the GFDP's bottlenecks at exit 254 and 256, so could significantly help egress times if the I-70 corridor was functioning well). Indeed, the owners discussed developing the property with GF two years ago and then again with the GSWD recently.

Similarly, if the East Montane area is ever developed, an access road should be explored. While not ideal because of its steep gradient and path through Idledale, it could be a reasonably high-capacity road to the east and can be fully mitigated. If it looks like the Shingle Creek property owners will

significantly mitigate the road and other obstacles look surmountable, then that should be explored further at that time.

### **Should the GF and GFPD wait to see if the King Ranch is developed?**

One can make a sound argument that the GF and GFPD should wait for development of the King Ranch to bring an egress route to the community for a more reasonable cost in the future. The counter to this argument is that the King Ranch has significantly fewer benefits (see the matrix) than the GWSD/Daisy Lane options making it a much better complement to and not a replacement for the GWSD or Daisy Lane options. For example, for a fire from the north or west, King Ranch would have little evacuation value, while a GWSD/Daisy Lane option could have enormous value. For a fire from the south, the opposite is likely to occur.

The second thing to consider is there isn't a lot the GF or GFPD can do to make a King Ranch EAR happen. The GF has been working with the owners of the King Ranch to get an egress and to get it mitigated for at least 10 years. However, this property is very large (250 acres) and very valuable. It was recently put up for sale in 2021 for \$7.5 million. Developing it optimally will take a significant amount of time and effort from the owners of the property who have other competing interests for their time. While the owners are sympathetic to the GF and GFPD's efforts to get an egress route, if they develop the property, they will do it on their schedule and not that of the GFPD or the GF.

In short, hopefully the King Ranch will one day be mitigated and provide a complimentary gated emergency-only egress route to the GWSD/ Daisy Lane options. It is unclear when that day will be or what can be done to expedite that process. In the meantime, the GF and GFPD should monitor development activity of the King Ranch and work with the owners to make such a route a reality. However, the GFSC believes it would be unwise to halt work on the GWSD/Daisy Lane options in the hopes that this road materializes anytime soon.

In summary, the GWSD and Daisy Lane options are the best all-around options and can be developed now. However, the more distant future may eventually bring additional opportunities for evacuation and fire protection at reasonable costs that could complement the GWSD option and existing evacuation routes.

### **Alignment of recommendations with the expert panel**

The experts that participated in the matrix panel are highly aligned with the GFSC's recommendation to pursue something immediately in the GWSD/ Daisy Lane corridor. Once the GFPD has a solid safe EAR that does not lead to the I-70 corridor, the experts are also highly aligned with the idea to pursue options like the King Ranch and/or East Montane routes if they can be built for free or on a more cost-effective basis because they are combined with residential development at some time in the future. The thinking is the more EAR options the better, but the cost should be weighed against other GFPD priorities when considering weaker EAR options in addition to a GWSD/ Daisy Lane EAR.

There are some slight differences of opinion. At the right cost, Paul Admundson would pursue the East Montane option for its FPV value, but is unsure if it would ever be prudent to place evacuees on Grapevine and through Idledale. Pete Anderson likes the idea of having the option available for both FPV and evacuations even though he also has concerns about placing evacuees on Grapevine and through Idledale.

In summary, our experts are in strong alignment with the GFSC's recommendation, but there are some subtle differences.

## Appendix

### **Additional Recommendation - Communications**

The GFSC recommends that the Board hold a meeting with all residents in the vicinity of the GWSD/ Daisy Lane corridor in the near future. Once resident concerns are understood, the Board will be better able to balance the cost, capacity, safety, and aesthetic tradeoffs of the various options.

### **Further Analysis – Road Capacity**

As a reminder, the purpose of this analysis is to prioritize which EARs, if any, might merit additional attention or some engineering spending. This study is not designed to determine if any route is worth the cost. That decision will require additional information such as a detailed engineering study. Another thing that would be prudent to understand is an EAR's capacity under various conditions. Road capacity calculation is a specialty discipline and requires knowing the specifics of a road's design. This section discusses how to obtain such information.

#### **Background**

Traffic can significantly impact a road's capacity. Under some fire scenarios an EAR may connect to a road that is completely empty. In other scenarios, that road may be completely clogged and limit the EAR's capacity.

Ideally, one would have an extremely complex model evaluate the infinite number of fire and evacuation scenarios and the probabilities of those scenarios, so that one could better understand the probability of various traffic levels and the impact on an EAR's capacity. Unfortunately, this sort of analysis is well beyond the capabilities of the evacuation model used in the CWPP. (The CWPP used a high level model originally designed for tidal wave evacuations. It cannot determine road capacities based on things like curves, stop signs, or incorporate emergency responders directing traffic or probabilities in general. The CWPP used a separate model to evaluate fire behavior.)

In fact, the GFSC questions (but does not know for sure) if such a complex fire and evacuation combination model exists and questions if there would be any benefit to attempting such complex modeling given the infinite number of scenarios.

#### **Alternatives to a complex evacuation model**

Fortunately, complex evacuation modeling may not be necessary. Given that the two leading options both connect to Hwy 74 and the intersections are frequently what limits a road's capacity and not the road itself, an analysis of the capacity of an intersection that connects an EAR to Hwy 74 when there is no traffic may be sufficient to understand the capacity potential of the leading candidates. The reasons behind the "no traffic" suggestion are:

- 1) When the GFPD really needs the EAR's capacity the most, the "no traffic" assumption for Hwy 74 may be reasonably representative. This is because emergency managers will attempt to prioritize evacuation of those who are at the highest risk. This means if Genesee residents are most at risk, emergency managers will attempt to direct traffic to prioritize the GFD. (Note that the opposite is likely to occur when the GFD is less at risk. For example, Evergreen residents can and should receive priority when they are most at risk.)
- 2) If a road does not have sufficient capacity under ideal "no traffic" conditions, there is no reason to build it.
- 3) Specialists can readily perform this calculation.
- 4) The answers will be similar for all five of the seven EAR options that eventually connect to Hwy 74.

The four specific calculations that we recommend are:

- 1) The road capacity of the intersection with 74 assuming **a right turn and no emergency responder** directing traffic through the stop sign.
- 2) The road capacity of the intersection with 74 assuming **a left turn and no emergency responder** directing traffic through the stop sign.
- 3) The road capacity of the intersection with 74 **if an emergency responder stops other traffic** and prioritizes the GFD traffic onto one lane of 74.
- 4) The road capacity of the EAR and intersection with 74 **if both lanes of the EAR and both lanes of Hwy74 are used for GFD egress** with the help of multiple emergency responders.

### **Other benefits of this analysis**

Hopefully, understanding the limits of the egress route will be enough to determine if the EAR is worth pursuing. It would also be beneficial for emergency management to be aware of how much capacity increases by positioning an emergency responder to waive people through a stop sign or if both lanes of Hwy 74 and the EAR are used for evacuation.

Finally, knowing the capacity of the intersection to Hwy 74 may help engineers design the road or even determine whether Daisy Lane or GWSD is optimal. Road capacity is determined by the most capacity-limited point of the road, which is frequently the intersection to another road. Once the capacity of the intersection is known, designers will know how sharp curves can be before they reduce road capacity below what the intersections can handle.

(Note: a specialist will also likely know if there are any complex evacuation models that could be helpful and what they might cost.)

### **Other Related Analysis**

If the GF/GFD choses to consult a traffic expert to evaluate an EAR's road capacity, it could be valuable to have them look at the road capacity of the GFD's existing evacuation routes so that the

importance of getting an emergency responder to assist in getting traffic through the exit 254 and exit 256 intersections is fully understood. A calculation of the additional capacity gained by putting both lanes of Genesee Ridge and/ or Genesee Trail into egress mode might also be beneficial to understand.

## EAR Descriptions and Details

### **Warning**

If there is a need to evacuate the GFPD (due to a fire or other emergency), **PLEASE ONLY USE THE EVACUATIONS ROUTE(S) AS DIRECTED BY EMERGENCY PERSONNEL.** Please do not try to use any of the proposed routes described in this document. They do not exist, are not navigable, are not safe to use in an evacuation, and/or may be in the direction of the fire. You could be stuck in an area that is nonsurvivable. Emergency personnel will be managing the evacuation and going door-to-door to be sure everyone has evacuated. They may not be available to rescue you if you get into trouble.

### **GWSD**

This would be a southern purpose-built road connecting the Genesee Water and Sanitation campus from Bitterroot to Hwy 74. A feasibility study of this road has been completed and is on the GF website. Details of the exact route have not been finalized. From the GWSD campus, the road would go across the property owned either by Genesee Foundation (Open Space) or GWSD. Significant mitigation would be required in the GWSD area as well as some on GF property, but the majority of the road would go through unwooded areas. It tied for the highest matrix scores with the Daisy Lane option. The probability that it can get the necessary approvals to be constructed is the highest of all options. Its advantages and disadvantages are discussed on page 10 of this analysis.

### **Daisy Lane**

This would be a purpose-built road connecting to Hwy 74. Daisy Lane is a residential, county road just to the east of the GWSD district. There are several options for where an EAR might go. Two options start at the cul-de-sac. One goes east of Daisy Lane to Hwy 74 and one goes west. A third option starts at Montane Drive and goes between Daisy Lane and the GWSD. All routes can be 100% on GF property. The two routes that start from the cul-de-sac would require some mitigation by the four property owners on Daisy Lane that reside prior to the cul-de-sac, the completion of which is considered a "Low" probability. These cul-de-sac options were evaluated in the matrix. The third option, starting at Montane Drive, would likely require less (or perhaps no) mitigation on residences given they are uphill, but that has not yet been determined. Therefore, the third option is likely to be



more likely to get the necessary approvals. Unfortunately, the third option's added distance and elevation relative to Hwy 74 makes it likely that it is somewhat more expensive relative to the cul-de-sac options.

No engineering studies have been performed and some or all of these options may prove too difficult to construct after further analysis. The option to the east of Daisy, in particular, has some rock formations that may eventually eliminate it from consideration. As it is right next to GWSD, its matrix scores parrot that of the GWSD option. For further discussion, please see page 10 of this analysis.

## **East Montane**

This would be an eastern purpose-built road connecting lower East Montane Drive to Clarence Lane. Clarence Lane connects to Grapevine Road, which could be taken north to I-70 at exit 256 or south to Hwy 74 through Idledale.

### **Positive Attributes**

- 1) It would be a high capacity road that can avoid the I-70 corridor and exits 254 and 256 if evacuees go south to Hwy 74. There is no improvement in the GFPD's evacuation time if evacuees go north to I-70 at exit 256.
- 2) It evacuates to the east away from the most likely direction of a fire, making it more probable that it can be used in fire evacuations.
- 3) Most of the property that the road would traverse is owned by two related families, one of whom has expressed interest in working with GF/GFPD and appears to speak for both families. The owner is open to the extensive mitigation of the property that would be required, but no specifics have been discussed.
- 4) There was some interest in this route for its fire protection value, particularly by expert Paul Admundson.

### **Negative Attributes**

- 1) While the beginning of the route has very reasonable grades, the final quarter of a mile is in a ravine with very steep gradients of around 14%, which is far from ideal. In general, the county limits road gradients to 8% or 10% if southern facing. It is unclear if the county would approve this road. It is also unclear to the GFSC how a 14% gradient could limit use of the road by heavier vehicles like fire trucks loaded with water and how much the probability of accidents increases with such a high gradient.
- 2) The road requires three homeowners to mitigate and three to approve building a road on their property. (This assumes Clarence Drive is widened for two lane operations. Only two owners must approve road construction for a one lane road. The two related families are considered as one homeowner for this calculation).
- 3) The intersection of Clarence Drive and Grapevine Road is extremely sharp for right turns. This intersection, the generally poor condition of Grapevine Road, and going through Idledale may constrain the EAR's effective capacity.
- 4) Finally, the experts were united in their concern about putting evacuees onto Grapevine Road and through Idledale. Paul Admundson would use the East Montane option for its FPV value,

but is unsure if it would ever be prudent to place evacuees on Grapevine and through Idledale. Pete Anderson has similar concerns, but likes having the option for evacuations in limited circumstances and for its PFV value. The road through Idledale has many curves, has homes very close the road, is poorly maintained, and was built long before current safety standards were required.

## **Pine Drop**

This would be a southern route that would require maintaining the current one-lane dirt jeep trail that goes from the end of Pine Drop Lane to Hwy 74. The owner of the dirt trail is not interested in improving the road by making it a 2-lane dirt or paved road, but would consider making minor improvements that might make it passable to residential vehicle traffic. We have been unable to schedule a time to walk this trail as of the time of this writing with the necessary parties to verify that it can be improved enough for evacuations.

### **Positive Attributes**

- 1) The route avoids the I-70 corridor and avoids the GFPD's exit 254 and 256 bottlenecks.
- 2) Road improvements for this improved jeep trail should be considerably less expensive than new two lane paved options such a GWSD, Daisy Lane, King Ranch and East Montane Drive.
- 3) The owner is doing considerable mitigation of the area making the GFPD's southern flank safer as well as this part of the route.

### **Negative Attributes**

- 1) The trail is unlikely to have enough capacity to significantly improve evacuation times.
- 2) The trail is more into the direction of the prevailing wind than all options except King Ranch and perhaps Choke Cherry.
- 3) To get to the jeep trail, you would have to drive down Pine Drop Lane, the entirety of which is considered "non-survivable" in the CWPP. Pine Drop is on a ridge with steep inclines on both sides of this one lane private drive. To become survivable, all 6 homeowners on Pine Drop would have to do very extensive mitigation. The GFSC considers the odds of getting this mitigation completed to be very low. In addition, the costs to do all this mitigation is likely to be very high (in the \$100K to \$400K range).
- 4) The nonpaved nature of this EAR option means that the road would require significantly more maintenance expense and monitoring than its paved competitors to make sure it is passable after any heavy rain.
- 5) One lane roads cannot allow residents to exit and emergency responders to enter simultaneously and are at a higher risk of an accident, stranding evacuees.

## **King Ranch**

The King Ranch is 250 acres of heavily wooded and unmitigated property directly to the west of the GFPD at Tamarac Drive. This would be a purpose-built road that would leave from Tamarac Drive and cross Genesee Open Space before entering King Ranch. It would end at Cold Spring Gulch Road and access I-70 at exit 252. There are other options from Holly Court and Northridge Drive, but they are

considered less optimal. The Kings are pro fire safety, but all efforts over the last decade to mitigate the property and build an EAR have failed to sustain traction.

### **Positive Attributes**

- 1) Only one private property owner (the Kings) needs to approve construction on their property.
- 2) It has a lower elevation differential and length, so it may be somewhat cheaper than other two lane options.
- 3) It avoids the bottlenecks of exits 254 and 256, so it will improve evacuation times for the GFPD.
- 4) Mitigation of the King Ranch is a high priority of the GFPD.
- 5) There is a clearing and a gulley with a small stream running through it that has some strategic fire protection value if the woods were completely mitigated on the King property and a road allowed for rapid access and retreat from the area.
- 6) It is likely that any road development will be tied to residential development at some time in the future. If so, road construction and mitigation costs may not be significantly borne by GF or the GFPD.

### **Negative Attributes**

- 1) The EAR will not reduce the GFPD's dependence on the I-70 corridor. All evacuation routes in the GFPD will still go to the north.
- 2) The road goes west into the direction of the prevailing winds, limiting the probability that the road will be of value in an evacuation.
- 3) The experts have some concerns about the connecting roads near Exit 252 in terms of getting lost in the smoke and confusion of a wildfire and survivability in a wildfire.
- 4) If the Kings tie road development to residential development, the date for completion of the road is likely to be significantly extended. The GF has been working with the owners of the King Ranch to get an egress and to get the ranch mitigated for at least 10 years. However, this property is very large (250 acres) and very valuable. It was put up for sale in 2021 for \$7.5 million. Developing it optimally will take a significant amount of time and effort from the owners of the property who have other competing interests for their time. While the owners are sympathetic to the GF and GFPD's efforts to get an egress route, if they develop the property, they will do it on their schedule and not that of the GFPD or the GF. It is unclear when and if any residential development project will ever happen.
- 5) It has a relatively low FPV.

Additional information is included in the body of this report and on page 12 in particular.

### **Choke Cherry**

Choke Cherry connects to Genesee Springs Road which is a 0.6 mile long narrow single lane, mostly dirt road. It is gated at both ends. Genesee Springs Road connects to Genesee Avenue, which is a 0.3 mile coarsely paved single lane road, which connects to Genesee Mountain Road. Genesee Mountain Road is a 1.6 mile long public 2 lane paved road that connects to I-70 at exit 254.

The project would be to work with the loose confederation of property owners that own the dirt road part of Genesee Springs Road to ensure that it is reliably passable for most types of cars in an

emergency. The property owners around Genesee Springs Road, Genesee Avenue, and Genesee Mountain Road would need to mitigate the roads sufficiently to be survivable in a wildfire.

### **Positive Attributes**

This road could be an option for Genesee Mountain residents to evacuate should a fire or accident cut them off from exit 254 and I-70. It could also be of some value as a way for southern (or back side) residents of the GFPD to get to exit 254, if the two intersections - Genesee Vista with Genesee Trail and Genesee Vista with Genesee Ridge - are impassable. These two intersections are the only way for the people from southern side of the GFPD to get to the northern side and vice versa. The 2008 CWPP found these intersections to be in such near proximity to each other (640 ft) that much of the GFPD “has essentially a single egress route.” This route, like all except EAR options except Shingle Creek, would be a way to avoid these intersections.

### **Negative attributes**

Outside of the two positive attributes above, this option is the poster child for what one does not want in an EAR including:

- 1) Genesee Spring Road and Genesee Avenue are low capacity single lane roads that requires going through capacity-limited exit 254, so it will not improve overall community egress times if other main egress roads are functioning.
- 2) It does not avoid the I-70 corridor.
- 3) It goes mostly west into the likely direction of a fire.
- 4) It is very narrow and needs guard rails in some sections.
- 5) Evacuees that are unfamiliar with the area could get lost in the smoke and confusion of a wildfire. Google maps is not entirely accurate in this area.
- 6) It has very little FPV per our experts.
- 7) It needs extensive and expensive mitigation from roughly 10 to 15 property owners to be safe (which includes some very overgrown areas on Genesee Mountain Road).
- 8) Genesee Springs Road would need to be monitored after heavy rains and maintained periodically.

The one lane nature of this road is particularly problematic. These roads are so narrow (roughly 11 feet wide) that cars usually have to back up to find a place wide enough to let someone by in the other direction. If any significant number of residents who live on Genesee Mountain decide to go in the opposite direction of the majority, there could be gridlock. Widening the road could alleviate this problem, but requires the agreement of over a dozen property owners. Widening is also likely to be very expensive given the abundance of rock formations that would need to be removed on Genesee Springs Road.

### **Shingle Creek**

This would be an eastern evacuation option to Grapevine Road. Shingle Creek Road consists of two public sections of paved road that are connected by roughly 1200 feet of a rutted one lane private dirt road. Shingle Creek eventually intersects with Grapevine Road.

In an evacuation, cars that go south on Grapevine to Hwy 74 avoid the capacity-limiting bottleneck at exit 256 and improve egress times. Cars that go north do not improve evacuation times.

**Positive Attributes**

The road can lead to Hwy 74 and avoid the GFPD's bottlenecks. Construction cost to improve the existing one lane dirt road would be much less than new 2 lane paved road options.

**Negative Attributes**

While the initial cost to make the road passable would be small, it is unclear how long the improvement would last before heavy rains make it impassable. Paving and some irrigation would help make the improvements last but likely triple the cost. However, the largest cost is likely mitigating the road, so that it is survivable if evacuees get stuck on the road. The road is overgrown and surrounded by heavily wooded areas that have never been mitigated. (This assumes you could get the 15 to 20 residents required to sufficiently mitigate, which is thought to be a very low probability). It connects to Grapevine Road and goes through Idledale, both of which our experts and previous studies recommended avoiding if at all possible. Grapevine connects right by the Genesee Ridge and Vista intersection which is also a concern as previously discussed. Finally, it has small FPV. The EAR's poor showing in the matrix reflects these and other concerns.

Three to four homeowners would need to grant easements for the road to be improved, which makes it less probable as well. The fire department has contacted a key resident about improving the road and general mitigation of the property, but the option is not progressing at this time. There is some optimism that there will eventually be some progress some day.

**Summary of Benefits For Potential Emergency Access Roads**

	<b>Choke Cherry</b>	<b>Daisy Lane</b>	<b>East Mont.</b>	<b>GWSD</b>	<b>King Ranch</b>	<b>Pine Drop</b>	<b>Shingle Creek</b>
Resident Evacuation Value - Paul Admundson	20	160	60	160	30	20	20
Resident Evacuation Value- Jason Puffett	20	140	80	140	90	80	50
<u>Resident Evacuation Value - Pete Anderson</u>	<u>0</u>	<u>72</u>	<u>0</u>	<u>72</u>	<u>0</u>	<u>0</u>	<u>0</u>
<b>Average Resident Evacuation Value</b>	<b>13</b>	<b>124</b>	<b>47</b>	<b>124</b>	<b>40</b>	<b>33</b>	<b>23</b>
Fire Protection Value - Paul Admundson	0	130	110	130	10	60	0
Fire Protection Value - Jason Puffett	30	140	30	140	40	50	20
<u>Fire Protection Value - Pete Anderson</u>	<u>0</u>	<u>88</u>	<u>0</u>	<u>88</u>	<u>0</u>	<u>0</u>	<u>0</u>
<b>Average Fire Prevention Value</b>	<b>10</b>	<b>119</b>	<b>47</b>	<b>119</b>	<b>17</b>	<b>37</b>	<b>7</b>

**SUMMARY**

Average Resident Evacuation Value	13	124	47	124	40	33	23
<u>Average Fire Prevention Value</u>	<u>10</u>	<u>119</u>	<u>47</u>	<u>119</u>	<u>17</u>	<u>37</u>	<u>7</u>
<b>Total Benefit Score</b>	<b>23</b>	<b>243</b>	<b>93</b>	<b>243</b>	<b>57</b>	<b>70</b>	<b>30</b>

<b>Probability of Short Term Success</b>	<b>Very Low</b>	<b>Low</b>	<b>Very Low</b>	<b>Medium</b>	<b>Low</b>	<b>Very Low</b>	<b>Very Low</b>
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The matrix has 3 sections. The Resident Evacuation Value section evaluates the evacuation benefits of each option. The same road that can be used to evacuate residents may give firefighters greater mobility, response times and other benefits, which can be significant. The Fire Protection Value (FPV) section looks at these fire protection benefits. Finally the Probability of Short Term Success section looks at the probability of getting the necessary approvals to build and mitigate the road in the near to medium term. **Note: A high Total Benefit Score does not mean there is a high Probability of Short Term Success. For example, Daisy Lane has 243 for a Total Benefit Score because there are a lot of benefits from this route. Unfortunately, there are a lot of approvals required that mean it may not happen, so it gets a "Low" Probability of Short Term Success Score.** These scores are independent.

The individuals above are the firefighter experts who filled out the those sections of the matrix. Please read the " MatrixIntroduction&Discussion" file to fully understand the matrix.

Resident Evacuation Value - Paul Admundson

Criteria	Pts	Unweighted Score						Weight	Weighted Score								
		Choke	Daisy	East	King	Pine	Shingle		Choke	Daisy	East	King	Pine	Shingle			
		Cherry	Lane	Mont.	GWSD	Ranch	Drop		Creek	Cherry	Lane	Mont.	GWSD	Ranch	Drop	Creek	
<b>1) Provides an alternative evacuation route if 70 is unusable and/ or access is blocked by accident or fire*</b>	Pts																
A) Road provides direct access to 74	4																
B) Road provides indirect access to 74	2	0	4	0	4	0	0	0	10	0	40	0	40	0	0	0	0
C) Road does not provide an alternative to 70	0																
<b>2) Is a high capacity road that avoids the GFDP's two critical traffic bottlenecks **</b>	Pts																
A) Is a two lane road that avoids existing Exit 254 and 256 bottlenecks	4	0	4	4	4	2	0	0	5	0	20	20	20	10	0	0	0
B) Is a one lane road that avoids existing Exit 254 and 256 bottlenecks	2																
C) Does not avoid Exit 254 and 256 bottlenecks	0																
<b>3) Avoids Genesee Trail/Vista and/or Ridge/Vista intersections which, if made impassable by fire would trap large numbers of residents ***</b>	Pts																
A) Route is greater than 0.5 miles from these intersections	4	0	4	2	4	0	0	0	5	0	20	10	20	0	0	0	0
B) Route is 0.2 to 0.5 miles from these intersections	2																
C) Route is less than 0.2 miles from these intersections	0																
<b>4) Provides an alternative emergency responder ingress so that both lanes of Genesee Ridge and/ or Trail (GFDP's current main evacuation routes to I-70) could be used for resident evacuation.****</b>																	
A) Yes	4	0	4	2	4	0	0	0	5	0	20	10	20	0	0	0	0
B) Yes, but with slower response times for the majority of nearby units	2																
C) No	0																
<b>5) Goes through or connects to areas where residents can easily get lost in the smoke or confusion of a wildfire. *****</b>																	
A) No	4	4	4	4	4	4	4	4	5	20	20	20	20	20	20	20	20
B) Yes	0																
<b>6) The road is and/or connects to roads that are narrow, have harpin turns, lack shoulders and/or guard rails along steep slopes that may increase the likelihood of accidents.</b>																	
A) No	4	0	4	0	4	0	0	0	5	0	20	0	20	0	0	0	0
B) Yes	0																
<b>7) The road does NOT go into the most likely direction of the prevailing winds (west or southwest)*****</b>																	
A) Yes	4	0	4	0	4	0	0	0	5	0	20	0	20	0	0	0	0
B) No	0																
<b>Total Score</b>		<b>4</b>	<b>28</b>	<b>12</b>	<b>28</b>	<b>6</b>	<b>4</b>	<b>4</b>		<b>20</b>	<b>160</b>	<b>60</b>	<b>160</b>	<b>30</b>	<b>20</b>	<b>20</b>	<b>20</b>

\* I70 could be unusable due to fire crossing the highway, smoke, accidents, chemical spills, traffic etc. Additionally, access to our current evacuation routes could be blocked by fire trapping residents who can no longer reach I70.

\*\* Currently, the intersections near Exits 254 and 256 are the GFDP's capacity limiting bottlenecks. All GFDP traffic must go through a capacity reducing stop sign to exit the GFDP. Any new or improved road that leads to these bottlenecks can provide flexibility and redundancy for movement within the GFDP, but it will not improve the time it takes for the last resident to evacuate the GFDP.

\*\*\* The Genesee Ridge/Vista and Genesee Trail/ Vista intersections are not capacity limiting bottlenecks for the GFDP under normal circumstances since they have only half the traffic of the intersections south of 70 at Exits 254 and 256. However, the two intersections are only 640 ft apart. The 2008 CWPP considered them to be so close that much of the GFDP has "essentially a single egress route." A fire starting at or near these intersections could trap large numbers of residents. Alternative routes that are further from these intersections are more beneficial.

\*\*\*\* Under extreme circumstances, emergency managers can opt to make both lanes of a two-way road available for evacuation.

\*\*\*\*\* This risk might be mitigated to some extent by additional signage, but the smoke and confusion of a wildfire could undermine the usefulness of such signage

\*\*\*\*\* There is a much higher probability that fires that threaten the GFDP will come from the direction of the prevailing winds.

Resident Evacuation Value - Pete Anderson

Criteria	Pts	Unweighted Score						Weight	Weighted Score								
		Choke	Daisy	East	King	Pine	Shingle		Choke	Daisy	East	King	Pine	Shingle			
		Cherry	Lane	Mont.	GWST	Ranch	Drop		Creek	Cherry	Lane	Mont.	GWST	Ranch	Drop	Creek	
<b>1) Provides an alternative evacuation route if 70 is unusable and/ or access is blocked by accident or fire*</b>																	
A) Road provides direct access to 74	4																
B) Road provides indirect access to 74	2	0	4	0	4	0	0	0	3	0	12	0	12	0	0	0	0
C) Road does not provide an alternative to 70	0																
<b>2) Is a high capacity road that avoids the GFPD's two critical traffic bottlenecks **</b>																	
A) Is a two lane road that avoids existing Exit 254 and 256 bottlenecks	4	0	4	0	4	0	0	0	3	0	12	0	12	0	0	0	0
B) Is a one lane road that avoids existing Exit 254 and 256 bottlenecks	2																
C) Does not avoid Exit 254 and 256 bottlenecks	0																
<b>3) Avoids Genesee Trail/Vista and/or Ridge/Vista intersections which, if made impassable by fire would trap large numbers of residents ***</b>																	
A) Route is greater than 0.5 miles from these intersections	4	0	4	0	4	0	0	0	1	0	4	0	4	0	0	0	0
B) Route is 0.2 to 0.5 miles from these intersections	2																
C) Route is less than 0.2 miles from these intersections	0																
<b>4) Provides an alternative emergency responder ingress so that both lanes of Genesee Ridge and/ or Trail (GFPD's current main evacuation routes to I-70) could be used for resident evacuation.****</b>																	
A) Yes	4	0	4	0	4	0	0	0	5	0	20	0	20	0	0	0	0
B) Yes, but with slower response times for the majority of nearby units	2																
C) No	0																
<b>5) Goes through or connects to areas where residents can easily get lost in the smoke or confusion of a wildfire. *****</b>																	
A) No	4	0	4	0	4	0	0	0	3	0	12	0	12	0	0	0	0
B) Yes	0																
<b>6) The road is and/or connects to roads that are narrow, have harpin turns, lack shoulders and/or guard rails along steep slopes that may increase the likelihood of accidents.</b>																	
A) No	4	0	4	0	4	0	0	0	3	0	12	0	12	0	0	0	0
B) Yes	0																
<b>7) The road does NOT go into the most likely direction of the prevailing winds (west or southwest)*****</b>																	
A) Yes	4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
B) No	0																
<b>Total Score</b>		<b>0</b>	<b>24</b>	<b>0</b>	<b>24</b>	<b>0</b>	<b>0</b>	<b>0</b>		<b>0</b>	<b>72</b>	<b>0</b>	<b>72</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

\* I70 could be unusable due to fire crossing the highway, smoke, accidents, chemical spills, traffic etc. Additionally, access to our current evacuation routes could be blocked by fire trapping residents who can no longer reach I70.

\*\* Currently, the intersections near Exits 254 and 256 are the GFPD's capacity limiting bottlenecks. All GFPD traffic must go through a capacity reducing stop sign to exit the GFPD. Any new or improved road that leads to these bottlenecks can provide flexibility and redundancy for movement within the GFPD, but it will not improve the time it takes for the last resident to evacuate the GFPD.

\*\*\* The Genesee Ridge/Vista and Genesee Trail/ Vista intersections are not capacity limiting bottlenecks for the GFPD under normal circumstances since they have only half the traffic of the intersections south of 70 at Exits 254 and 256. However, the two intersections are only 640 ft apart. The 2008 CWPP considered them to be so close that much of the GFPD has "essentially a single egress route." A fire starting at or near these intersections could trap large numbers of residents. Alternative routes that are further from these intersections are more beneficial.

\*\*\*\* Under extreme circumstances, emergency managers can opt to make both lanes of a two-way road available for evacuation.

\*\*\*\*\* This risk might be mitigated to some extent by additional signage, but the smoke and confusion of a wildfire could undermine the usefulness of such signage

\*\*\*\*\* There is a much higher probability that fires that threaten the GFPD will come from the direction of the prevailing winds.



Resident Evacuation Value - Jason Puffett

Criteria	Pts	Unweighted Score							Weight	Weighted Score												
		Choke	Daisy	East	King	Pine	Shingle	Choke		Daisy	East	King	Pine	Shingle								
		Cherry	Lane	Mont.	GWSD	Ranch	Drop	Creek		Cherry	Lane	Mont.	GWSD	Ranch	Drop	Creek						
<b>1) Provides an alternative evacuation route if 70 is unusable and/ or access is blocked by accident or fire*</b>	Pts																					
A) Road provides direct access to 74	4																					
B) Road provides indirect access to 74	2	0	4	2	4	0	2	2	5	0	20	10	20	0	10	10						
C) Road does not provide an alternative to 70	0																					
<b>2) Is a high capacity road that avoids the GFDP's two critical traffic bottlenecks **</b>	Pts																					
A) Is a two lane road that avoids existing Exit 254 and 256 bottlenecks	4	0	4	4	4	4	2	2	5	0	20	20	20	20	10	10						
B) Is a one lane road that avoids existing Exit 254 and 256 bottlenecks	2																					
C) Does not avoid Exit 254 and 256 bottlenecks	0																					
<b>3) Avoids Genesee Trail/Vista and/or Ridge/Vista intersections which, if made impassable by fire would trap large numbers of residents ***</b>	Pts																					
A) Route is greater than 0.5 miles from these intersections	4	2	4	4	4	4	4	0	5	10	20	20	20	20	20	0						
B) Route is 0.2 to 0.5 miles from these intersections	2																					
C) Route is less than 0.2 miles from these intersections	0																					
<b>4) Provides an alternative emergency responder ingress so that both lanes of Genesee Ridge and/ or Trail (GFPD's current main evacuation routes to I-70) could be used for resident evacuation.****</b>																						
A) Yes	4	2	4	2	4	2	4	2	5	10	20	10	20	10	20	10						
B) Yes, but with slower response times for the majority of nearby units	2																					
C) No	0																					
<b>5) Goes through or connects to areas where residents can easily get lost in the smoke or confusion of a wildfire. *****</b>																						
A) No	4	0	4	0	4	4	0	0	5	0	20	0	20	20	0	0						
B) Yes	0																					
<b>6) The road is and/or connects to roads that are narrow, have harpin turns, lack shoulders and/or guard rails along steep slopes that may increase the likelihood of accidents.</b>																						
A) No	4	0	4	0	4	4	0	0	5	0	20	0	20	20	0	0						
B) Yes	0																					
<b>7) The road does NOT go into the most likely direction of the prevailing winds (west or southwest)*****</b>																						
A) Yes	4	0	4	4	4	0	4	4	5	0	20	20	20	0	20	20						
B) No	0																					
<b>Total Score</b>		<b>4</b>	<b>28</b>	<b>16</b>	<b>28</b>	<b>18</b>	<b>16</b>	<b>10</b>		<b>20</b>	<b>140</b>	<b>80</b>	<b>140</b>	<b>90</b>	<b>80</b>	<b>50</b>						

\* I70 could be unusable due to fire crossing the highway, smoke, accidents, chemical spills, traffic etc. Additionally, access to our current evacuation routes could be blocked by fire trapping residents who can no longer reach I70.

\*\* Currently, the intersections near Exits 254 and 256 are the GFDP's capacity limiting bottlenecks. All GFDP traffic must go through a capacity reducing stop sign to exit the GFDP. Any new or improved road that leads to these bottlenecks can provide flexibility and redundancy for movement within the GFDP, but it will not improve the time it takes for the last resident to evacuate the GFDP.

\*\*\* The Genesee Ridge/Vista and Genesee Trail/ Vista intersections are not capacity limiting bottlenecks for the GFDP under normal circumstances since they have only half the traffic of the intersections south of 70 at Exits 254 and 256. However, the two intersections are only 640 ft apart. The 2008 CWPP considered them to be so close that much of the GFDP has "essentially a single egress route." A fire starting at or near these intersections could trap large numbers of residents. Alternative routes that are further from these intersections are more beneficial.

\*\*\*\* Under extreme circumstances, emergency managers can opt to make both lanes of a two-way road available for evacuation.

\*\*\*\*\* This risk might be mitigated to some extent by additional signage, but the smoke and confusion of a wildfire could undermine the usefulness of such signage

\*\*\*\*\* There is a much higher probability that fires that threaten the GFDP will come from the direction of the prevailing winds.

Fire Protection Value - Paul Admundson

Criteria	Pts	Unweighted Score							Weight	Weighted Score										
		Choke	Daisy	East	King	Pine	Shingle	Choke		Daisy	East	King	Pine	Shingle						
		Cherry	Lane	Mont.	GWSD	Ranch	Drop	Creek		Cherry	Lane	Mont.	GWSD	Ranch	Drop	Creek				
<b>1) The road has the potential to be a additional firebreak based on: (1) its location; and/or (2) the ability to lengthen and/or widen the firebreak by backburning and other emergency firefighting techniques *</b>																				
A) The road is well located to be a firebreak and firefighters can lengthen and widen the firebreak in an emergency for additional fire protection value.	4																			
B) The road is well located but cannot be lengthened or widened easily by firefighters.	2	0	2	2	2	0	0	0	5	0	10	10	10	0	0	0	0	0	0	0
C) The road is located where it is unlikely to have much value as a fire break.	0																			
<b>2) Provides rapid access to a strategic location that otherwise could not be defended without the new road</b>																				
Yes	4	0	4	2	4	2	2	0	5	0	20	10	20	10	10	10	0	0	0	0
Yes, but substantial mitigation is required	2																			
No	0																			
<b>3) Allows the GFPD rapid access to higher risk areas (southern or western perimeter) to put out fires when they are small and containable. **</b>																				
Yes	4	0	4	2	4	0	2	0	5	0	20	10	20	0	10	0	0	0	0	0
Yes, but to a limited extent	2																			
No	0																			
<b>4) Allows non GFPD emergency responders (including mutual aid fire fighters) to enter the GFPD faster by creating an additional access point.***</b>																				
Significantly	4	0	4	4	4	0	2	0	5	0	20	20	20	0	10	0	0	0	0	0
Moderately	2																			
Negligibly	0																			
<b>5) Improves firefighter safety by creating an alternative escape route should their primary escape route be cut off. ****</b>																				
Significantly	4	0	4	4	4	0	2	0	5	0	20	20	20	0	10	0	0	0	0	0
Moderately	2																			
Negligibly	0																			
<b>6) Allows the GFPD to provide faster mutual aid to other fire districts (and indirectly defend Genesee from a nearby fire) when traffic is heavy on I-70</b>																				
Significantly	4																			
Moderately	2	0	4	4	4	0	2	0	5	0	20	20	20	0	10	0	0	0	0	0
Negligibly	0																			
<b>7) Enhances protection for critical infrastructure *****</b>																				
Significantly enhances fire fighters' ability to protect critical infrastructure	4																			
Moderately enhances fire fighters' ability to protect critical infrastructure	2	0	4	4	4	0	2	0	5	0	20	20	20	0	10	0	0	0	0	0
Does not enhance fire fighters' ability to protect critical structure	0																			
<b>Total Fire Protection Score</b>		<b>0</b>	<b>26</b>	<b>22</b>	<b>26</b>	<b>2</b>	<b>12</b>	<b>0</b>		<b>0</b>	<b>130</b>	<b>110</b>	<b>130</b>	<b>10</b>	<b>60</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

\* A firebreak is a natural or constructed barrier where all vegetation and organic material have been removed down to bare soil. Firebreaks are used to slow or stop wildfires. While all roads have at least some small potential as a firebreak, the potential of some roads are much greater than others due to location, direction of the road, nearby vegetation, gradients, the direction of the prevailing winds and other factors. In addition, firefighters will want to make any road a much more formidable firebreak by widening and lengthening it if at all possible by backburning and other techniques.  
 \*\*Because of prevailing winds (out of the west or southwest), fires starting on the southern and western perimeter of the GFPD pose the greatest risk to the District  
 \*\*\* GFPD has mutual aid agreements with a number of local fire departments, almost all of which are to the south of the GFPD. That said, there are numerous fire departments on all sides of Genesee.  
 \*\*\*\* This also increases the ability of firefighters to safely stay and defend homes  
 \*\*\*\*\* Infrastructure includes things such as water and other utility equipment.

Fire Protection Value - Jason Puffet																
Criteria	Pts	Unweighted Score						Weight	Weighted Score							
		Choke	Daisy	East	King	Pine	Shingle		Choke	Daisy	East	King	Pine	Shingle		
		Cherry	Lane	Mont.	GWSI	Ranch	Drop		Creek	Cherry	Lane	Mont.	GWSI	Ranch	Drop	Creek
<b>1) The road has the potential to be a additional firebreak based on: (1) its location; and/ or (2) the ability to lengthen and/or widen the firebreak by backburning and other emergency firefighting techniques *</b>																
A) The road is well located to be a firebreak and firefighters can lengthen and widen the firebreak in an emergency for additional fire protection value.	4															
B) The road is well located but cannot be lengthened or widened easily by firefighters.	2	0	4	0	4	0	0	0	5	0	20	0	20	0	0	0
C) The road is located where it is unlikely to have much value as a fire break.	0															
<b>2) Provides rapid access to a strategic location that otherwise could not be defended without the new road</b>																
Yes	4	0	4	2	4	2	2	0	5	0	20	10	20	10	10	0
Yes, but substantial mitigation is required	2															
No	0															
<b>3) Allows the GFPD rapid access to higher risk areas (southern or western perimeter) to put out fires when they are small and containable. **</b>																
Yes	4	0	4	0	4	2	2	0	5	0	20	0	20	10	10	0
Yes, but to a limited extent	2															
No	0															
<b>4) Allows non GFPD emergency responders (including mutual aid fire fighters) to enter the GFPD faster by creating an additional access point. ***</b>																
Significantly	4	0	4	2	4	0	2	0	5	0	20	10	20	0	10	0
Moderately	2															
Negligibly	0															
<b>5) Improves firefighter safety by creating an alternative escape route should their primary escape route be cut off. ****</b>																
Significantly	4	0	4	0	4	0	0	0	5	0	20	0	20	0	0	0
Moderately	2															
Negligibly	0															
<b>6) Allows the GFPD to provide faster mutual aid to other fire districts (and indirectly defend Genesee from a nearby fire) when traffic is heavy on I-70</b>																
Significantly	4															
Moderately	2	4	4	2	4	4	4	2	5	20	20	10	20	20	20	10
Negligibly	0															
<b>7) Enhances protection for critical infrastructure *****</b>																
Significantly enhances fire fighters' ability to protect critical infrastructure	4															
Moderately enhances fire fighters' ability to protect critical infrastructure	2	2	4	0	4	0	0	2	5	10	20	0	20	0	0	10
Does not enhance fire fighters' ability to protect critical structure	0															
<b>Total Fire Protection Score</b>		<b>6</b>	<b>28</b>	<b>6</b>	<b>28</b>	<b>8</b>	<b>10</b>	<b>4</b>		<b>30</b>	<b>140</b>	<b>30</b>	<b>140</b>	<b>40</b>	<b>50</b>	<b>20</b>
<p>* A firebreak is a natural or constructed barrier where all vegetation and organic material have been removed down to bare soil. Firebreaks are used to slow or stop wildfires. While all roads have at least some small potential as a firebreak, the potential of some roads are much greater than others due to location, direction of the road, nearby vegetation, gradients, the direction of the prevailing winds and other factors. In addition, firefighters will want to make any road a much more formidable firebreak by widening and lengthening it if at all possible by backburning and other techniques.</p> <p>** Because of prevailing winds (out of the west or southwest), fires starting on the southern and western perimeter of the GFPD pose the greatest risk to the District</p> <p>*** GFPD has mutual aid agreements with a number of local fire departments, almost all of which are to the south of the GFPD. That said, there are numerous fire departments on all sides of Genesee.</p> <p>**** This also increases the ability of firefighters to safely stay and defend homes</p> <p>***** Infrastructure includes things such as water and other utility equipment.</p>																

Fire Protection Value - Pete Anderson

Criteria	Pts	Unweighted Score						Weight	Weighted Score											
		Choke	Daisy	East	King	Pine	Shingle		Choke	Daisy	East	King	Pine	Shingle						
		Cherry	Lane	Mont.	GWSD	Ranch	Drop		Creek	Cherry	Lane	Mont.	GWSD	Ranch	Drop	Creek				
<b>1) The road has the potential to be a additional firebreak based on: (1) its location; and/ or (2) the ability to lengthen and/or widen the firebreak by backburning and other emergency firefighting techniques *</b>																				
A) The road is well located to be a firebreak and firefighters can lengthen and widen the firebreak in an emergency for additional fire protection value.	4																			
B) The road is well located but cannot be lengthened or widened easily by firefighters.	2	0	4	0	4	0	0	0	4	0	16	0	16	0	0	0				
C) The road is located where it is unlikely to have much value as a fire break.	0																			
<b>2) Provides rapid access to a strategic location that otherwise could not be defended without the new road</b>																				
Yes	4	0	4	0	4	0	0	0	5	0	20	0	20	0	0	0				
Yes, but substantial mitigation is required	2																			
No	0																			
<b>3) Allows the GFPD rapid access to higher risk areas (southern or western perimeter) to put out fires when they are small and containable. **</b>																				
Yes	4	0	4	0	4	0	0	0	1	0	4	0	4	0	0	0				
Yes, but to a limited extent	2																			
No	0																			
<b>4) Allows non GFPD emergency responders (including mutual aid fire fighters) to enter the GFPD faster by creating an additional access point.***</b>																				
Significantly	4	0	4	0	4	0	0	0	5	0	20	0	20	0	0	0				
Moderately	2																			
Negligibly	0																			
<b>5) Improves firefighter safety by creating an alternative escape route should their primary escape route be cut off. ****</b>																				
Significantly	4	0	4	0	4	0	0	0	5	0	20	0	20	0	0	0				
Moderately	2																			
Negligibly	0																			
<b>6) Allows the GFPD to provide faster mutual aid to other fire districts (and indirectly defend Genesee from a nearby fire) when traffic is heavy on I-70</b>																				
Significantly	4																			
Moderately	2	0	4	0	4	0	0	0	1	0	4	0	4	0	0	0				
Negligibly	0																			
<b>7) Enhances protection for critical infrastructure *****</b>																				
Significantly enhances fire fighters' ability to protect critical infrastructure	4																			
Moderately enhances fire fighters' ability to protect critical infrastructure	2	0	4	0	4	0	0	0	1	0	4	0	4	0	0	0				
Does not enhance fire fighters' ability to protect critical structure	0																			
<b>Total Fire Protection Score</b>		<b>0</b>	<b>28</b>	<b>0</b>	<b>28</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>22</b>	<b>0</b>	<b>88</b>	<b>0</b>	<b>88</b>	<b>0</b>	<b>0</b>	<b>0</b>				

\* A firebreak is a natural or constructed barrier where all vegetation and organic material have been removed down to bare soil. Firebreaks are used to slow or stop wildfires. While all roads have at least some small potential as a firebreak, the potential of some roads are much greater than others due to location, direction of the road, nearby vegetation, gradients, the direction of the prevailing winds and other factors. In addition, firefighters will want to make any road a much more formidable firebreak by widening and lengthening it if at all possible by backburning and other techniques.  
 \*\*Because of prevailing winds (out of the west or southwest), fires starting on the southern and western perimeter of the GFPD pose the greatest risk to the District  
 \*\*\* GFPD has mutual aid agreements with a number of local fire departments, almost all of which are to the south of the GFPD. That said, there are numerous fire departments on all sides of Genesee.  
 \*\*\*\* This also increases the ability of firefighters to safely stay and defend homes  
 \*\*\*\*\* Infrastructure includes things such as water and other utility equipment.

**The Probability of Short Term Success**

(This section of the matrix attempts to evaluate the probability of overcoming key obstacles to building an EAR in the short or medium term)

Criteria	Key Definitions		Choke	Daisy	East	GWSD	King	Pine	Shingle	
			Cherry	Lane	Mont.		Ranch	Drop	Creek	
1) Number of property owners that would need to grant easements to improve or construct the road on their property *	Very High	0	Quantity Probability	6 Very Low	0 Very High	3 Low	1 High	1 High	2 Medium	3 Low
	High	1								
	Medium	2								
	Low	3								
	Very Low	4+								
2) The number of property owners that would need to agree to mitigation to make the road a safe evacuation option**	Very High	0	Quantity Probability	10 to 15 Very Low	4 Low	3 Medium	1 High	1 High	6 Very Low	15 to 20 Very Low
	High	1								
	Medium	2 to 3								
	Low	4 to 5								
	Very Low	6+								
3) Road is likely to require a waiver from the county for excessive gradients ***	Very High	< 10%	Gradient Probability	< 10% Very High	< 10% Very High	< 14% Medium	< 10% Very High	< 10% Very High	Unknown Unknown	< 10% Very High
	High	< 12%								
	Medium	< 14%								
4) Road Development is likely to be tied to eventual residential development ****	High	No	Probability	No Very High	No Very High	No Very High	No Very High	Yes Low	No Very High	No Very High
	Medium	Potential								
	Low	Yes								
<b>Total Probability ***** (See Below in Bold)</b>			<b>Very Low</b>	<b>Low</b>	<b>Very Low</b>	<b>Medium</b>	<b>Low</b>	<b>Very Low</b>	<b>Very Low</b>	

\* Answers were determined using Jeffco online plat maps which should be reasonably accurate. Professional surveys may be required to ensure required easements are obtained.

This also assumes that East Montane is a two lane road. Clarence Drive would need to be widened in that case. A single lane road may require one less easement.

\*\* While every wildfire is different, wildfires are unpredictable and can spread at very high speeds. Roadway traffic is also very unpredictable and accidents are always a threat.

Therefore, all routes must mitigated sufficiently to be survivable should the fire engulf the area around the road.

\*\*\* The GFSC believes a county waiver is required for gradients greater than 10%. It is unclear how hard it will be to get such a waiver.

\*\*\*\* This criteria describes the unique situation with the King Ranch. The Kings contacted GF in early 2020 about their interest in developing and mitigating the King Ranch. Joining GF was part of those discussions. While GF made clear that it had a strong interest in this idea, the Kings did not pursue the idea for reasons that are unclear to GF. In mid 2021, the property was put up for sale for \$7.5 Million. More recently, the owners contacted the GWSD about obtaining a lot more water taps than in their proposal in 2020. The Kings have not contacted the GF and the GFSC has been unable to get an update from the Kings. So while the exact status of any development is unclear, it is clear that road development is likely to be tied to residential development which will take a significant amount of time and add considerable uncertainty. The discussion section of the accompanying document discusses this further.

\*\*\*\*\* With probabilities, the "Total Probability" that everything happens can never be more than the probability of the lowest criteria. So if the probability of a single attribute is "LOW" and all other attributes are "Very High, then the Total Probability of them all happening is "Low". If two criteria are both "Low", the Total Probability of both happening is "Very Low" If there are two "Medium" probabilities, then the probability of both happening is "Low".