



## MEMORANDUM

date: June 20<sup>th</sup>, 2019  
to: Jason Brolund, Fire Chief, West Kelowna Fire Rescue,  
cc: Steven Gubbels, Design and Inspection Technologist  
from: Michael Currie  
file #: 5901111  
subject: **Consultant Service to Review Proposed Temporary Fire Protection Response Re-alignment during Bridge replacement**

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Dear Chief Brolund,

The City of West Kelowna advised Fire Underwriters Survey of a bridge replacement project that would impact fire department response to one area of the community. The City requested that FUS conduct a brief analysis and comment on the impact on risk levels that the project would have. As requested, FUS has completed an analysis of the response impacts and options for minimizing those impacts resulting from the bridge replacement project on Gellatly Road in West Kelowna.

The findings of the risk assessment and conclusions are provided within this letter for your review. These findings are not comprehensive and provide a simple, high level view of the impact on risk and mitigation options relevant to this project and change in response routing.

Fire Underwriters Survey (FUS) is a national organization that evaluates public fire protection and emergency response for all Canadian communities and publishes its findings in the Canadian Fire Insurance Grading Index for use in statistical and underwriting evaluation by the Property and Casualty insurers. In addition to providing data to insurers, FUS provides information to municipalities and other interested parties on matters relating to fire risk and public fire protection on request.

Please let us know if there are any questions or comments relating to the findings described in this letter. Thank you for your proactive interest in public fire protection and risk management.

Michael Currie, P.L. (Eng), PMSFPE

Fire Underwriters Survey



## 1 Description

The City of West Kelowna notified Fire Underwriters Survey (FUS) that there will be a change to public fire protection response routing in the Gellatly Road area in the southern portion of the municipality as shown in Figure 1. The small bridge that normally provides access in and out of this area along the waterfront will be removed from service for several months while being replaced.

During the period of time that the bridge is out of service, access to the affected area shown in Figure 1 will be limited to one primary access road, the western portion of Gellatly road. Under normal conditions there would also be access in and out of the area via the eastern portion of Gellatly Road along the waterfront.

The City of West Kelowna has requested that FUS review the proposed temporary re-alignment of emergency response services and provide a quantification of the change in risk level as well as a review of options for dealing with the risk change.

## 2 Quantification of Risk Change.

The risk in the affected area is quantified as follows:

- Approximately 200-300 buildings, mostly single family residential (SFR)
- Waterfront SFR notably large scale and high value
- Waterfront SFR not hydrant protected
- Canyon Park SFR – closely spaced and large dwellings (larger than typical dwellings)
- Some multi-family residential (MFR) buildings
- Some commercial (ex. Cove Resort, Yacht Club, marina)
- Some critical infrastructure (ex. Wastewater Treatment Plant)
- Population of area is not known, but estimated at under 1,000 at any given time

With respect to fire, the primary changes in risk levels resulting from the bridge closure relate to:

1. The change in response time for the risks in the affected area.
2. The change in available emergency evacuation routes for occupants of affected area.



**Legend**

- Road
- ▨ Affected Area
- Parcel

Figure 1 - Primary Area Affected by Bridge Closure

Scale = 1:2,500

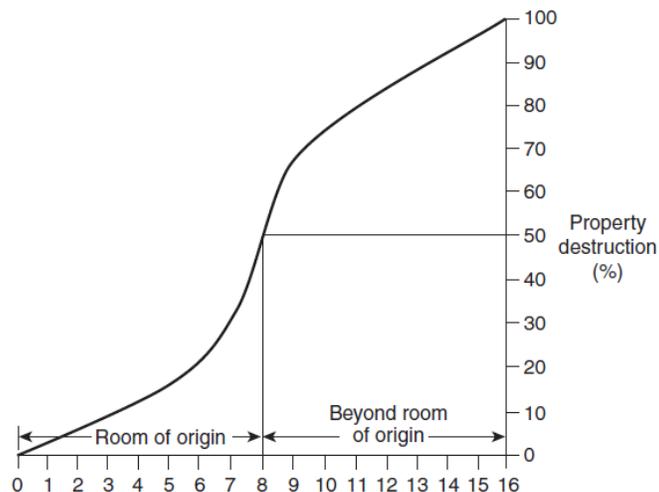




## 2.1 Fire Propagation and Property Damage

Every fire propagates at a different rate and the speed of propagation is influenced by many variables. However when looking at large numbers of dwelling fires the National Fire Protection Association has developed the following fire propagation curve which is referenced for career fire department responses to dwelling fires.

Figure 2 Fire Propagation Curve for Typical Dwelling



Although some fires may burn more quickly than the one illustrated in Figure 2 other fires may burn more slowly. However the fires that are robust enough to become fully involved structure fires will generally follow a propagation curve that is similar to this. The curve is useful when considering probable impact on property damage as a result of changes to initial response times. Depending on how close the fire is to flashover (the almost vertical portion of the propagation curve), the percentage of property destruction could be less than 10 % for an increase of 2 minutes in response time or property damage could be increased by 20% for an increase in response time of 1 minute at, or near, the time of flash over.

As the proposed changes in response routes are considered and quantified in increased minutes for initial response, consideration should be given to this figure and potential impact on property destruction for any given fire that may occur.

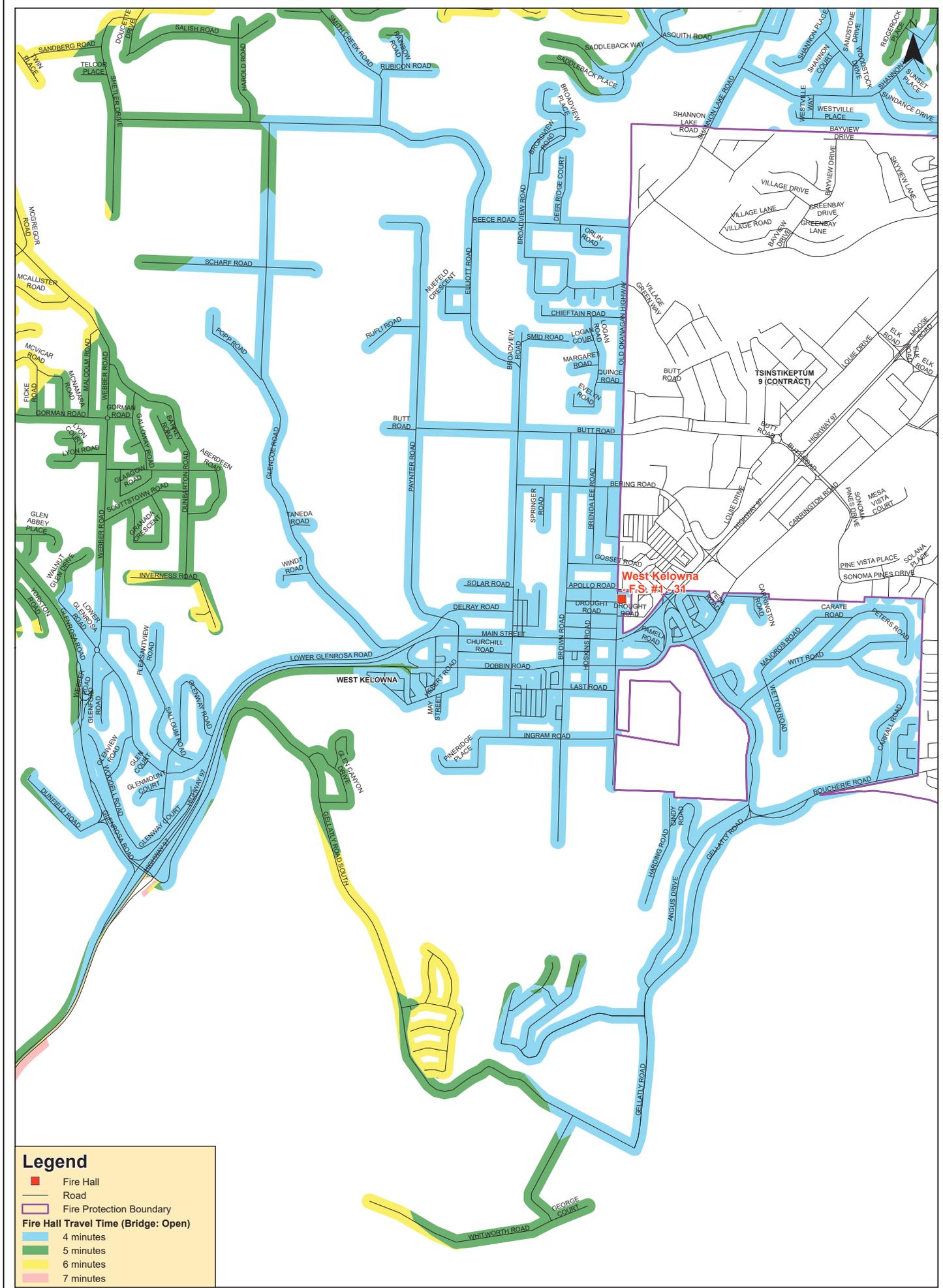
## 2.2 Issue 1 – Change in Emergency Response Times

When fire department response times increase, particularly with respect to initial response, then damages and risk of injuries also increase. This applies to calls for fires, medical response and other types of incidents such as motor vehicle accidents.



The response times for the first responding Fire Hall (31) to the affected area can be compared and contrasted between the bridge being in service (normal routing) and the bridge being out of service (routing that does not go across the bridge) in Figures 3 and 4.

In Figure 4, the response route for apparatus companies responding from FH31 are routed around to the west as the bridge is removed from service.

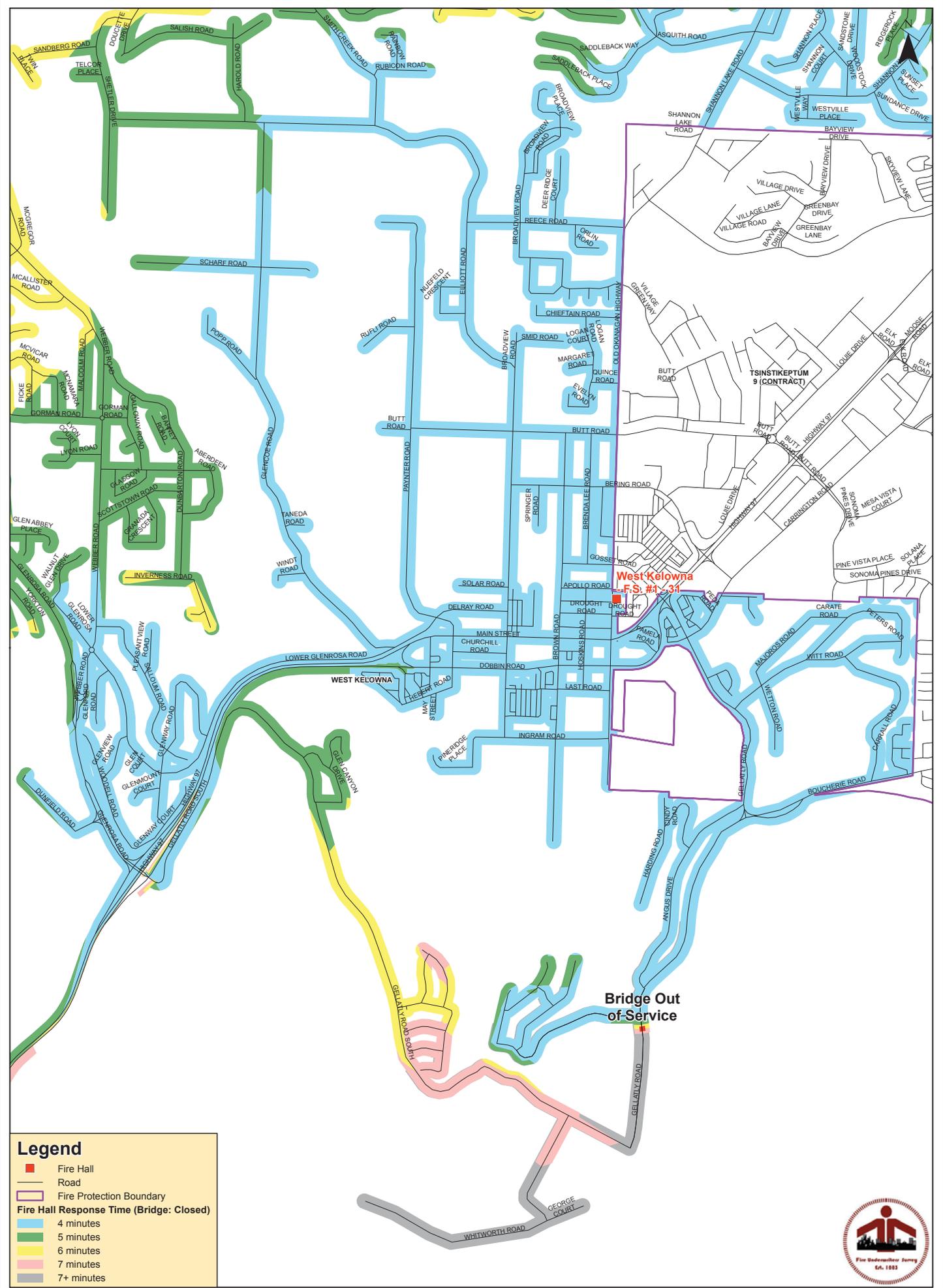


**Legend**

- Fire Hall
- Road
- ▭ Fire Protection Boundary

**Fire Hall Travel Time (Bridge: Open)**

- 4 minutes
- 5 minutes
- 6 minutes
- 7 minutes



**Legend**

- Fire Hall
- Road
- ▭ Fire Protection Boundary

**Fire Hall Response Time (Bridge: Closed)**

- 4 minutes
- 5 minutes
- 6 minutes
- 7 minutes
- 7+ minutes



Figure 4 - Response Time Coverage with Bridge Out of Service



## 2.3 Issue 2 Change in available evacuation routes

The affected area has two primary ways in and out. Gellatly Road services the area in the shape of a “V” with “in” and “out” access in the north west and north east directions. The proposed bridge replacement would eliminate access to the north east evacuation route, leaving only the north west evacuation route for all properties and occupants in the affected area. The north west route is significantly exposed to wildfire risk in the Goats Peak Park and if this area has a significant wildfire, then moving all occupants out of the area may be challenged.

## 3 Options

Several options have been considered to deal with the proposed bridge closure and resulting altered emergency response times to the affected area.

- Option 1) Replace bridge with temporary bridge. Fully mitigate the risk. This option would be to build a temporary bridge that would ensure the same level of emergency response access throughout the project. This option would ensure that all emergency response times would remain the same during the project as at other times. Also, this option would maintain two primary access routes in and out of the area. The advantage of this option is that there is no increased risk. However, there is significant added cost with this option.
- Option 2) Do not replace the bridge or make other alternative arrangements. Accept the increased risk. This option would be to accept the risk of taking the bridge out of service. This would result in increased response times for fires, medical responses, motor vehicle accidents and other types of responses. The increase in initial response time would be in the order of 1-4 minutes in most cases. This option would also result in there only being one primary access route in or out of the area. The advantage of this option is that there is no added cost. However there is significant added risk with this option. If this option is selected, then careful advance planning should be undertaken to quickly evacuate the area if a wildfire grows in the Goats Peak Park Area.
- Option 3) Use alternate private road access. A property in the affected area (the Bennett property) has a small private road and bridge that could potentially be used as an alternative route during the time period where the bridge is out of service. This option would require that steps be taken to ensure that the private road and bridge are accessible and can successfully bear the appropriate loads for the fire apparatus that would use this route.



This option would incur some costs as the property owner may need to be compensated for maintaining this access as well as setting up signage etc., to reduce the risk of accidents or damage on the private property.

This option would result in the occupants of the area having a secondary evacuation route for use during emergencies as well as the fire department having access for initial response that does not require a significant increase in response distance.

Option 4) Store a fire engine/pumper at the Yacht Club parking lot and have fire fighters drop their primary apparatus at bridge, walk across and pick up temporary apparatus, then continue responding. See

- a. Keep engine in Yacht Club parking area at north end (short walk estimated 75 +/- 15 second delay)
- b. Keep engine in Yacht Club parking area at south end (longer walk estimated 150 +/- 30 second delay)

Although not ideal, the fire department could make arrangements to store an apparatus at the Yacht club parking lot for the duration of the project. With this option, fire fighters would respond from Fire Hall 31 normally, but would park their apparatus at the out of service bridge, then walk across (assumption that walk across access can be maintained throughout the project). If the fire department is able to temporarily store that apparatus at the north end of the Yacht Club Parking Lot, the walk across would be short, however it is unlikely this would be possible as it would interfere with boat launch access. Parking an apparatus at the south end of the parking lot would result in fire fighters having to make a longer trek from where they drop off the apparatus to where they pick up the temporarily stored apparatus, resulting in increasing delays to response times.

The “walk across” option would likely incur costs for the temporary use of a portion of the Yacht club parking area, however such costs would likely be low. There would be an increased risk of damage to apparatus resulting from mischief and vandalism if the apparatus is stored in the open as it is an attractive nuisance. Should this option be selected, consideration should be given to setting up a temporary shed/garage to protect the apparatus from the public.

The walk across option would limit the increase in response times, however, would not provide for a secondary emergency route out of the area in case the primary route becomes compromised. If this option is selected, then careful advance planning should be undertaken to quickly evacuate the area if a wildfire grows in the Goats Peak Park Area.

To give an estimate of the range of changes in response times for each of the options, the following risk example locations were selected to be analysed.



- Gellatly Place
- The Cove Resort
- Wastewater Treatment
- 2583 Whitworth Rd
- Canyon Ridge
- 2990 Seclusion Bay Rd

See Figure 5.

Total Response times were estimated using

- 1.5 minutes for call handling (includes alarm handling and dispatch)
- 2 minutes for career response turn out time (Fire Halls 31 and 32)
- 7 minutes for volunteer / paid on call response turn out time
- Travel time from wheel start to wheel stop using the insurance industry formula:

$$T(\text{min}) = 0.65(\text{min}) + 1.065(\text{min}/\text{km}) \times D(\text{km})$$

- The travel time formula considers an average speed during trip of 56km/hr and applies a constant (.65 min) for acceleration and deceleration during trip
- Note fire detection time is not factored in

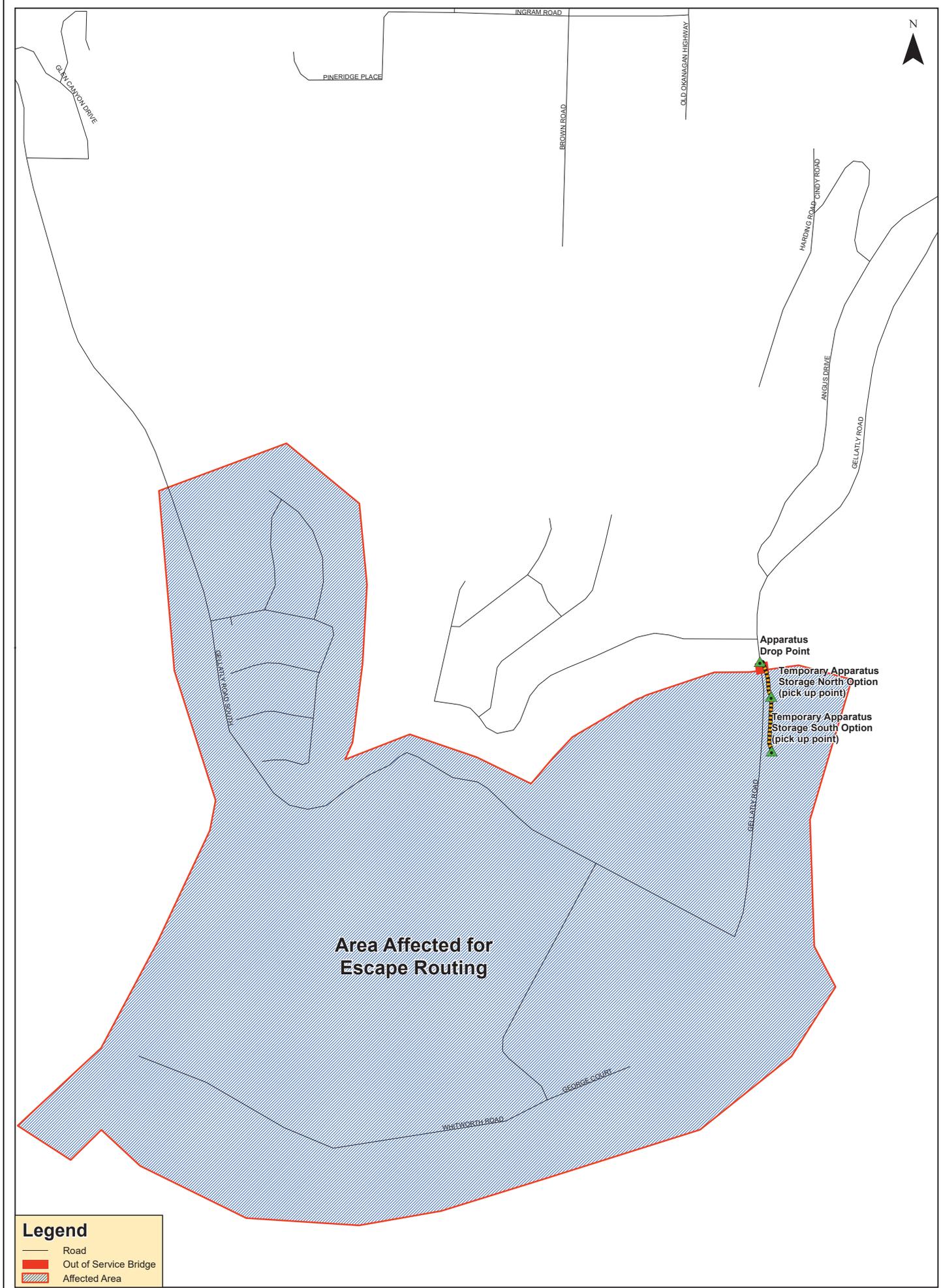
The difference in Total Response times from each of the respective firehalls to each of the selected representative risk locations is shown in Figure 7 through Figure 11.

Note that the Total Response times using the Options 4A and 4B shown in the figures as “Walk across” methods are only shown for responses from Fire Hall 31 as this option would include a single apparatus on the far side of the bridge so only Fire Hall 31 would use this option.

Note that the second option for each of these figures is “Using bridge out of service” which refers to the travel route where the bridge is out of service so the apparatus must travel around using the alternate route.

The third option shown in each figure refers to Option 3, the use of the private road (Bennett property).

The final two options shown in each figure refer to options 4A and 4B where the FH 31 responders would drop their apparatus off at the bridge, walk across and pick up a stored apparatus from the north or south end of the yacht club parking area.



**Legend**

- Road
- Out of Service Bridge
- Affected Area

**Area Affected for  
Escape Routing**

**Apparatus  
Drop Point**

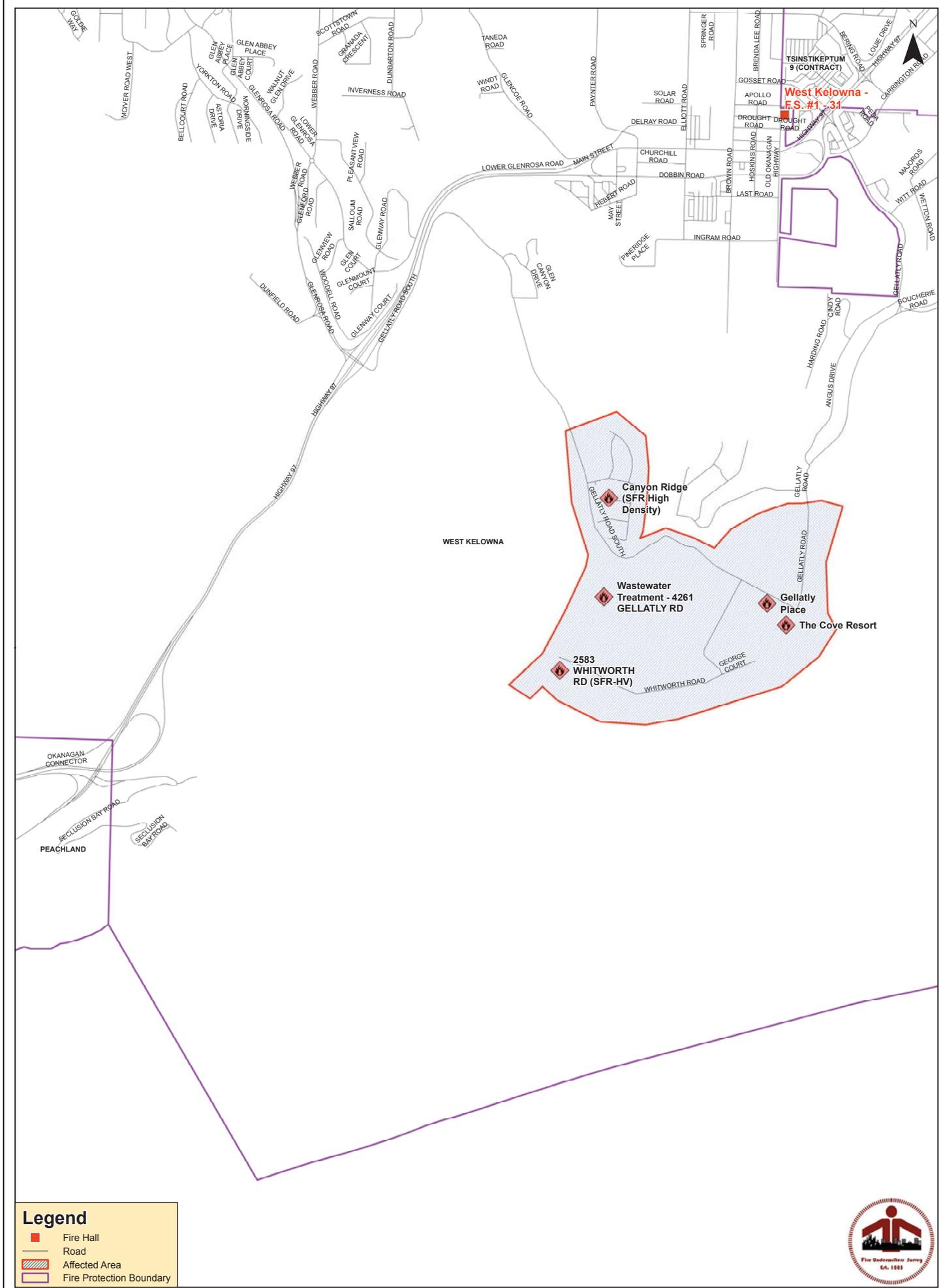
Temporary Apparatus  
Storage North Option  
(pick up point)

Temporary Apparatus  
Storage South Option  
(pick up point)

Figure 5 - "Walk Across" Options

Scale = 1:2,000





West Kelowna -  
F.S. #1 - 31

Canyon Ridge  
(SFR High Density)

Wastewater  
Treatment - 4261  
GELLATLY RD

Gellatly  
Place

The Cove Resort

2583  
WHITWORTH  
RD (SFR-HV)

WEST KELOWNA

**Legend**

- Fire Hall
- Road
- Affected Area
- Fire Protection Boundary





Figure 7



Figure 8

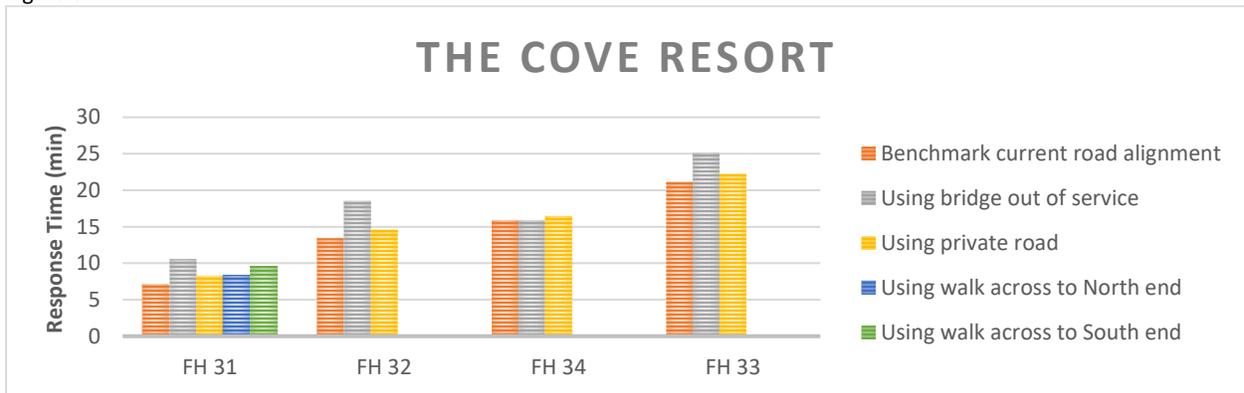


Figure 9

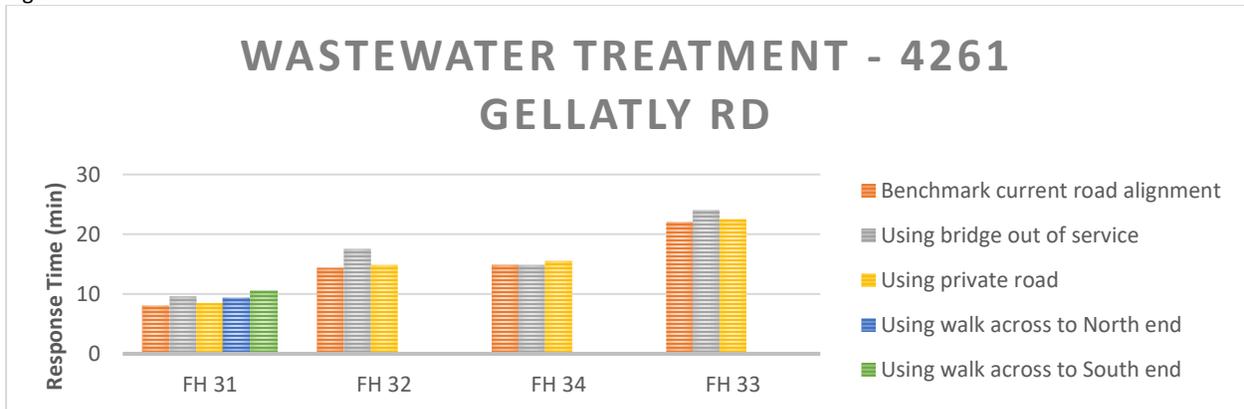




Figure 10



Figure 11

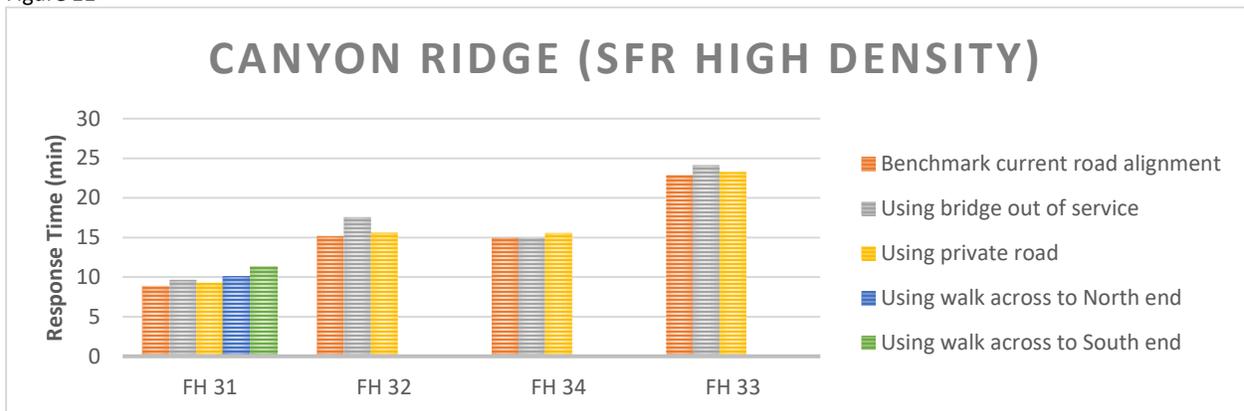


Figure 7 through Figure 11 illustrate the differences in minutes for Total Response times to each of the selected representative risk locations. To further clarify and more clearly compare the differences in Total Response times Figure 12 through Figure 16 have been created to show the percent difference in total response time of the different options. The percent difference is determined by comparing the benchmark, or “normal Total Response time” with the bridge in service, to the altered response time for the option considered.

For example, if the normal Total Response time was 10 minutes and the altered total response time was 14 minutes, the percent difference would be 40% increased.

Note that for some alternate response options, there is no change in response time, so the percent difference is shown as 0. Also note that the walk across options are only displayed for Fire Hall 31.



Figure 12

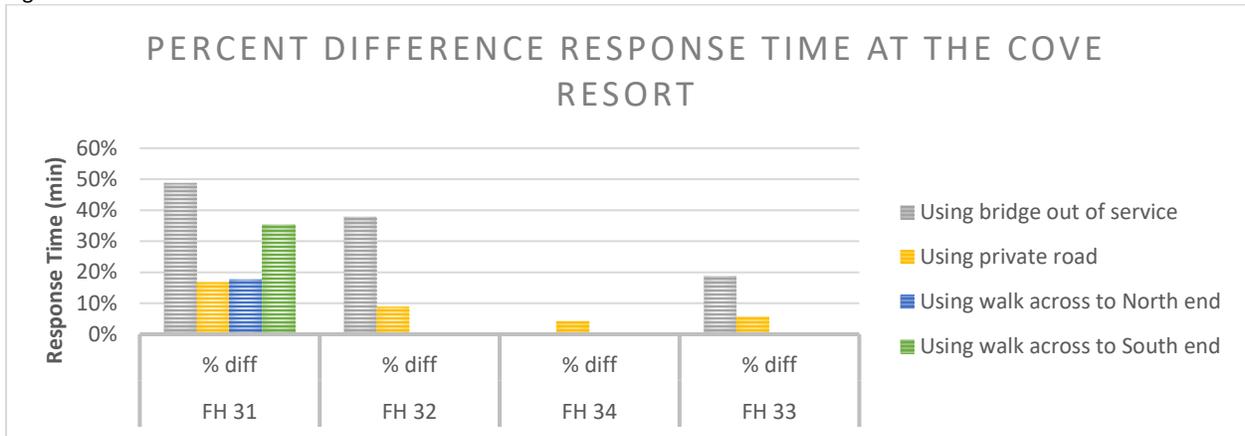


Figure 13

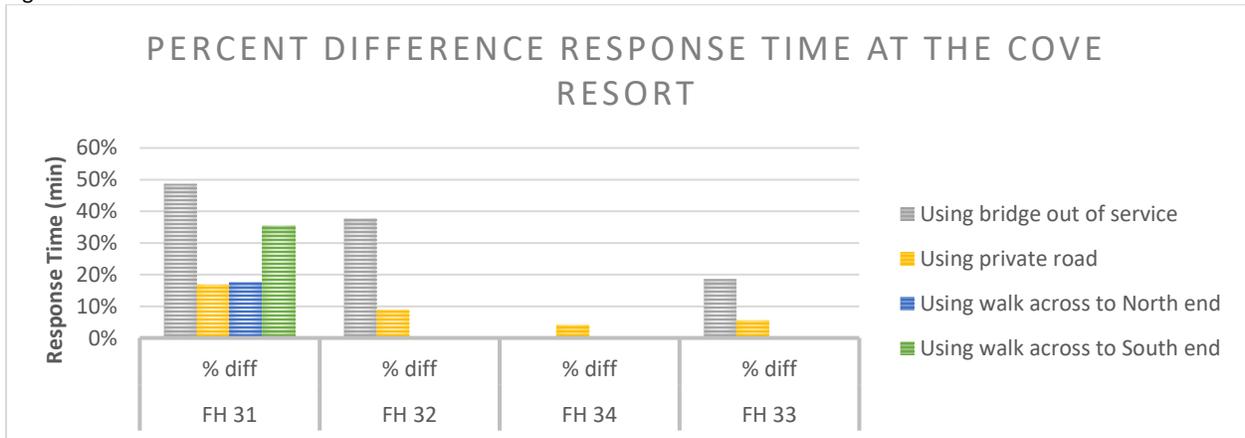


Figure 14

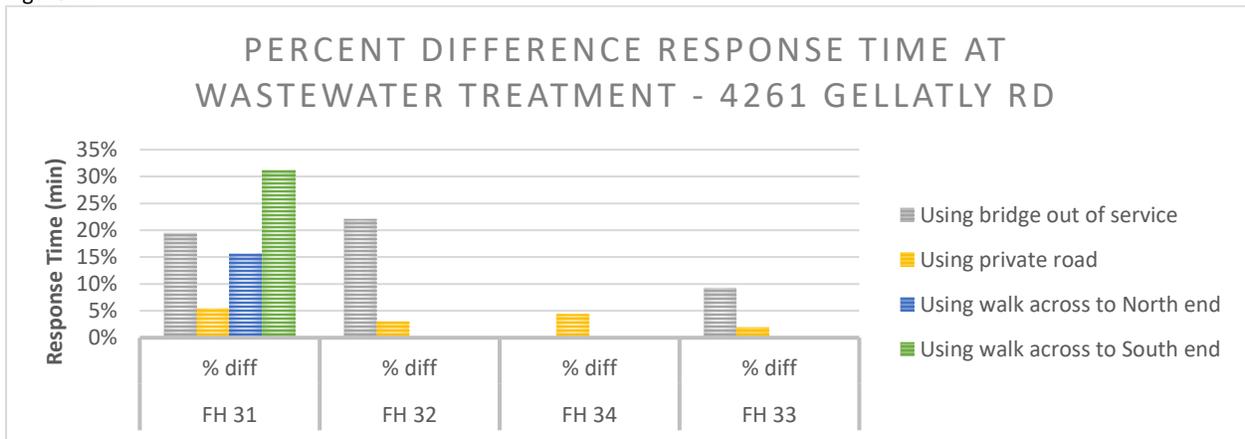




Figure 15

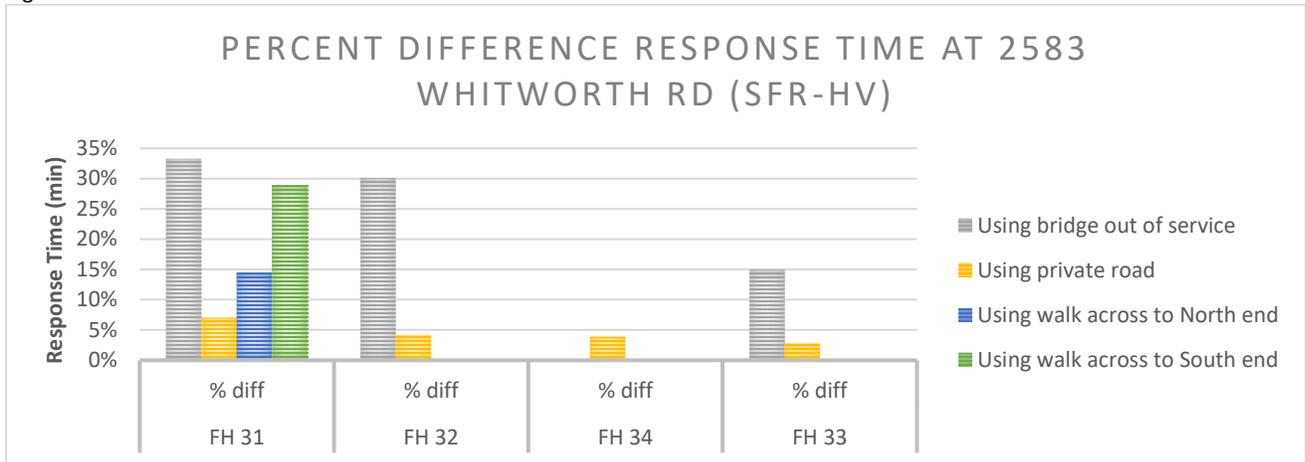
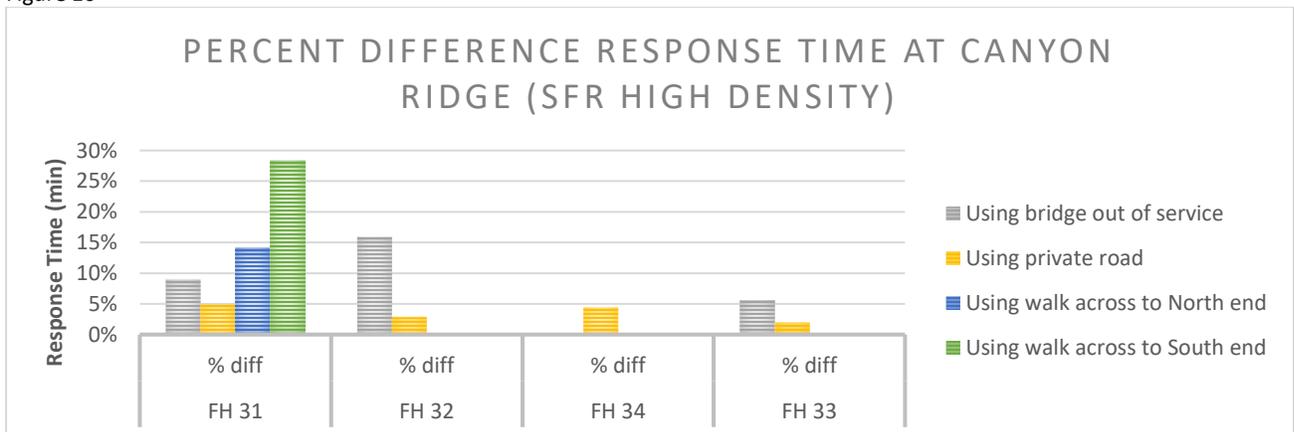


Figure 16



## 4 Conclusion

Based on this analysis, the impact to response times for initial response from Fire Hall 31 to properties in the affected area, vary by up to 50%. It is difficult to quantify exactly what this means in terms of dollar values, however each additional minute that a structure fire burns prior to intervention significantly increases property damage and the risk of injury to occupants and fire fighters responding. Review



Figure 2 Fire Propagation Curve for Typical Dwelling for a rough idea of the possible ranges of property destruction change per minutes in increased initial response time.

In NFPA 1710, the Standard for Career Fire Departments published by the National Fire Protection Association, the response standard of 4 minutes travel time, 2 minutes turn out time and 90 sec call handling time is the benchmark that should be achieved 90% of the time for typical dwellings.

Responses from Fire Hall 31 are the most impacted by the project as this Fire Hall is generally the first responding to the affected area. The first responding fire hall has the greatest impact on the severity of damage for structure fires.

Weighing the advantages and disadvantages of each of the options considered, **Option 3 is recommended as it results in the least impact on response times and provides a secondary evacuation route out of the area** in case of a severe emergency that limits access out of the area using the western portion of Gellatly Road.

Using Option 4, the walk across method, and storing an apparatus at the Yacht club parking lot does not significantly improve response times as compared to driving around and does not mitigate the secondary evacuation route issue.

Regardless of option selected, due care should be given to the creation of an evacuation plan in the case of wildfire.