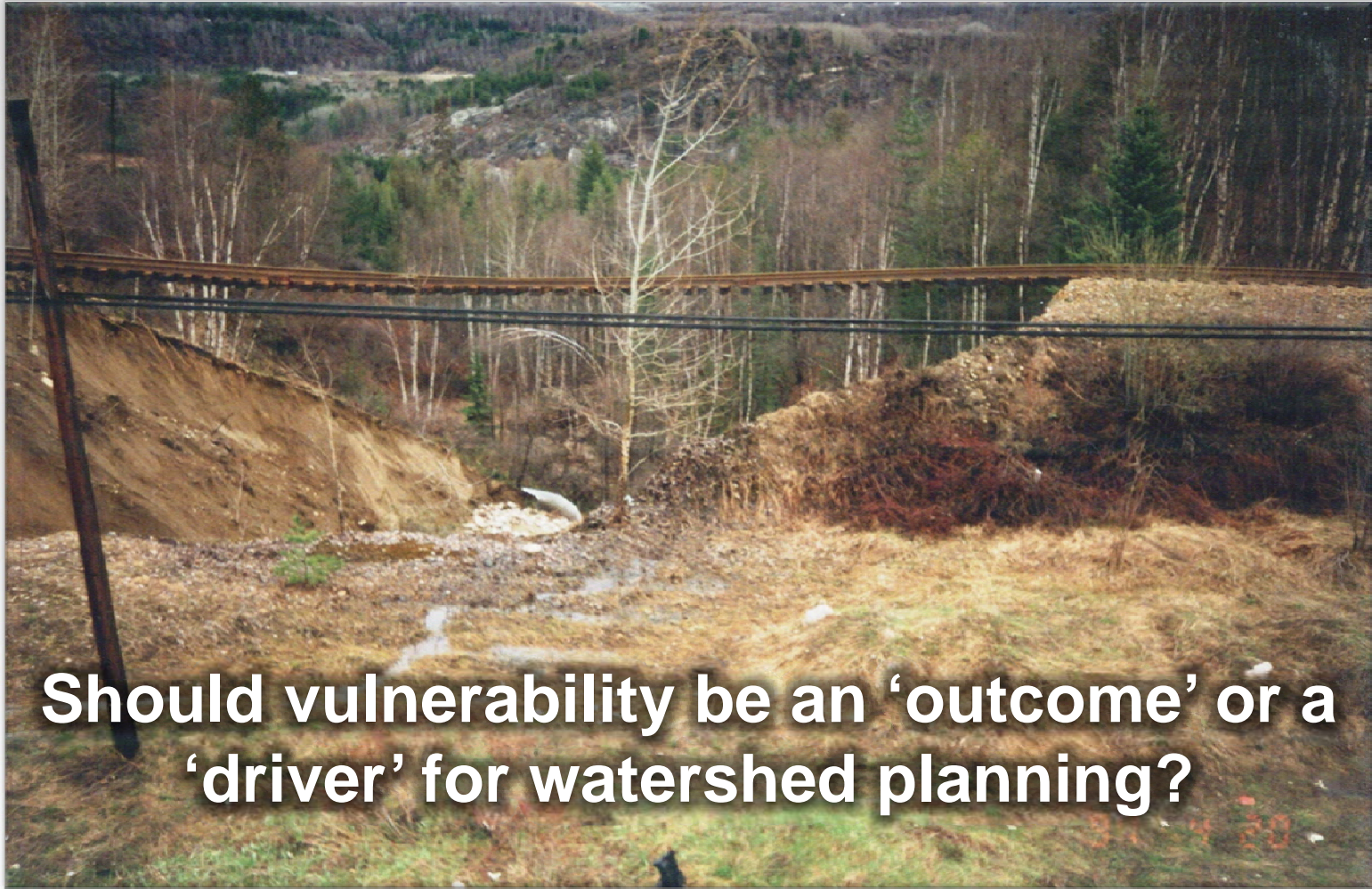




# Stormwater and Watershed Vulnerability: Connecting Rural and Urban Risks Using PIEVC

# “Vulnerability”





# Project Origin

- Engineer’s Canada
  - “Mandate” RE: PIEVC
  - “Case Studies”
- Columbia Basin Trust
  - Climate Change Adaptation
- City of Castlegar
  - Progressive Planning and Useful Action Steps
  - Municipal Leadership
- Urban Systems Ltd.
  - Preferred Consultant



# The Team



CASTLEGAR

URBAN SYSTEMS®



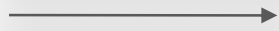
URBAN SYSTEMS®



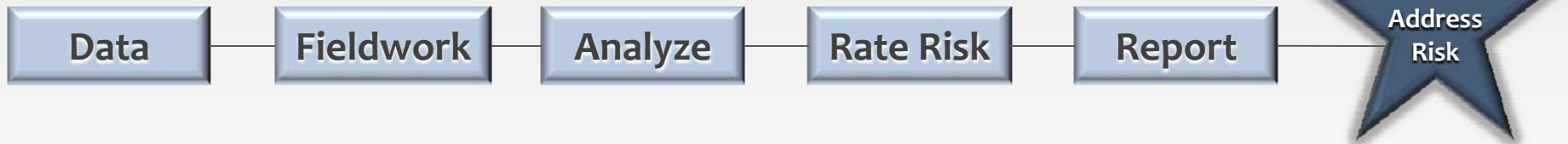
# Where are we?



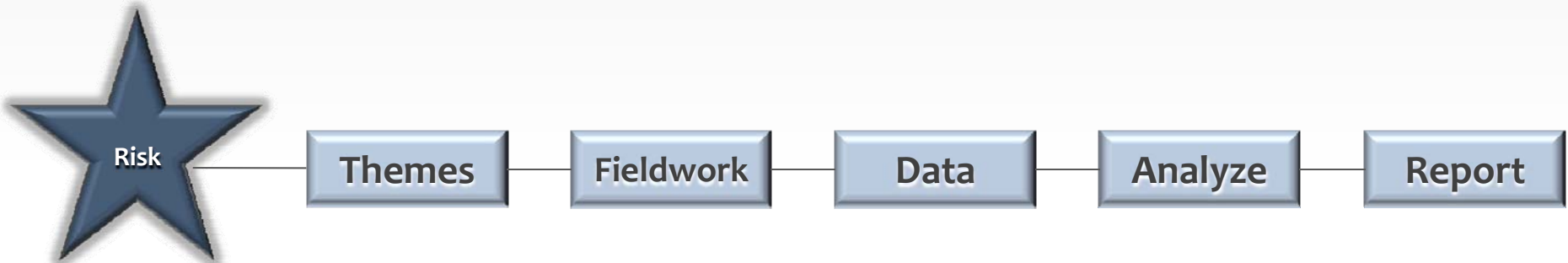
# Project Origin



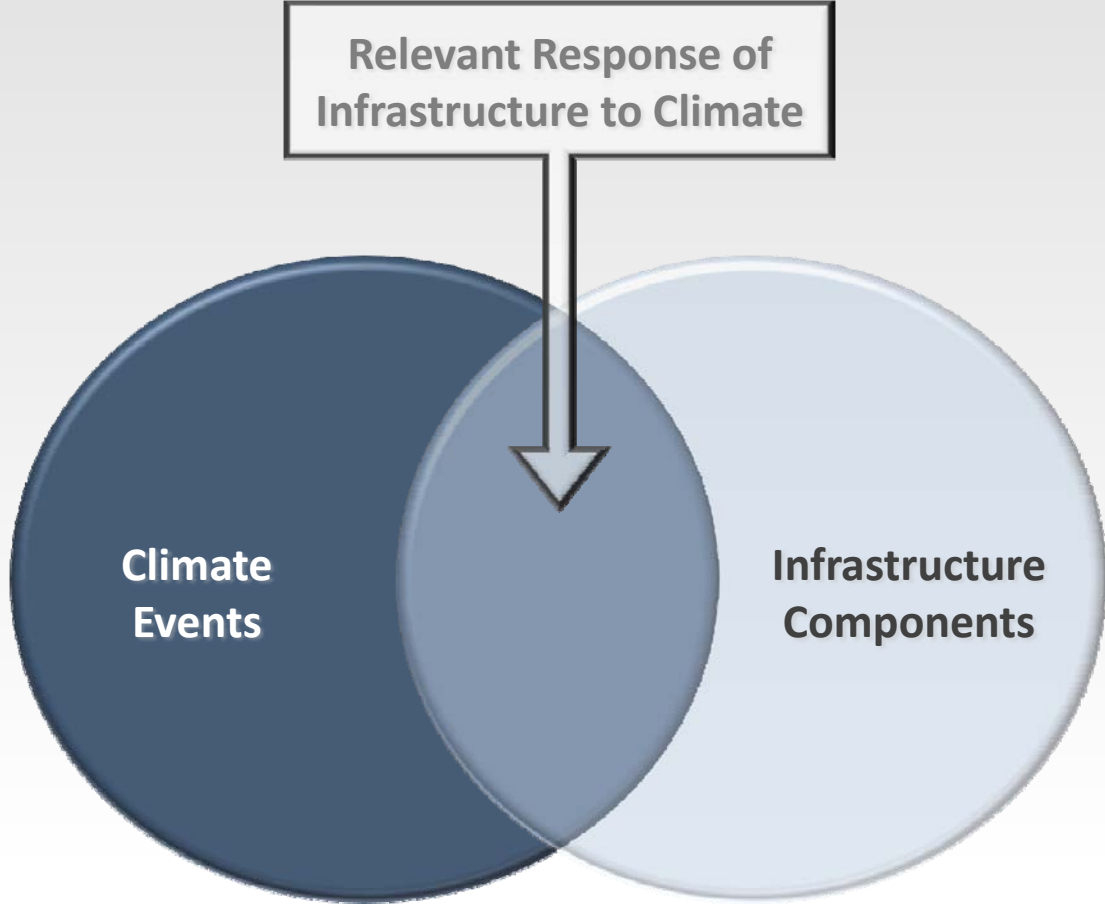
## Vulnerability Paradigm



## Progressive → PIEVC



# Climate and Infrastructure





# Defining Risk

Risk = Probability of  
Occurrence x Consequence  
(severity)



# Project Initiation





# Infrastructure Vulnerability

1. Support for a 'Known' issue
2. Defining vulnerability in a changing climate
3. Stepping-stone project that builds confidence
  - For Castlegar
  - For other Columbia Basin Communities

(Castlegar is better able to adapt to climate change)



# Infrastructure Vulnerability

Support for a known issue

- What does the buzzword “climate change” mean to the City?
- Connecting climate and runoff
- Connecting the urban and rural watershed overlap



# Infrastructure Vulnerability

Defining vulnerability in a changing climate

- What do we mean by “climate change”?
- What are the vulnerabilities today and tomorrow?
- How resilient is the infrastructure?



# Conclusions

The City 's stormwater systems will be vulnerable to climate change.

*Temperature* - Annual and seasonal mean temperatures will increase with the potential for more precipitation falling as rain and less as snow.

*Precipitation* – More rain, less snow with an increased risk of more extreme precipitation events such as extreme rainfall could result in more frequent and larger high flow events in streams and storm sewer systems.



# Conclusions

*Wind* –There may be an increase in the maximum wind velocity and higher frequencies of non-prevailing wind direction events with the potential for increased risk of debris blocking culverts and storm sewers.

*Wildfire* –There will be an increased wildfire risk due to the death of the mature lodgepole pine in the catchments.

## *Outcomes*

- 385 interactions were defined, of which 313 were assessed.
- 24 infrastructure elements were of medium risk and 10 were high risk.



# Conclusions

High risk infrastructure requires immediate action based on the recommendations to reduce or mitigate the risk.

The medium risk infrastructure may benefit from further engineering analysis to clarify their vulnerability.

A wildfire, depending upon the severity of the wildfire, could increase the risk to infrastructure to high.



# Recommendations

1. The City should review the 10 high risk infrastructure elements and prepare an action plan to address each high risk item as funding permits.
2. The City should explore funding opportunities with the province that would permit it to address the high risk items as soon as possible.
3. The City should conduct periodic inspections of potential debris loads within the upper catchment streams.
4. The City should develop a strategy to engage PCIC to complete the downscaling of the defined climate events so that they are better defined for further Engineering Analysis.





# Recommendations

5. The City should carry out engineering analyses of the medium risk infrastructure components to clarify the vulnerability of each item to climate change.
6. In the event of a wildfire the City should request that the Ministry of Forests and Range complete a *post wildfire risk analysis* of the burned area to determine the change in risk to downstream infrastructure.
7. The issues and risks identified in this study should be incorporated into the next stormwater management plan that the City of Castlegar prepares.



# Summary

- The climate is changing.
- The changes will impact infrastructure.
- Challenges to determine appropriate risk.
- The PIEVC protocol presents a robust and rigorous methodology to integrate climate change.
- Focus community efforts on adaptation.
- The Protocol is applicable to all infrastructure.
- Communities interested in climate change adaptation should consider attending a workshop on the PIEVC Protocol to learn more.



# Questions

