Adapting to Change
Water Quality @Water Crossings

CWRA CONFERENCE
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RED DEER

Introduction

- Environmental change
  - Increasing populations place demands on our infrastructure and resources
  - Energy intensity worldwide increasing
  - Layered on this, are the impacts of climate change which may be unknown or speculative in nature
- With respect to water bodies
  - We will have more crossings
  - If we do not change how we approach water crossings, we will continue to see accidents and slow responses
  - And our limited fresh water will degrade in quality

Rail accidents make good news photos …

Source : NOAA, https://www.flickr.com/photos/noaa_response_restoration/12685687094/

Source: Bob Elderberry, https://www.flickr.com/photos/4880137071/

Water crossings

- Defined – anything that crosses a water body
  - But in a Prairie setting we normally exclude crossing by water e.g. ferries
- Pipeline crossing
  - Many ways to have a pipeline cross a water body – not all look like the open cut methods
- Rail crossing
- Truck crossing – open to all traffic
  - Bridges, culverts
  - There are few restrictions
    - The Glenmore Reservoir is one with an exception for biohazardous waste
- Rail and road will have volumetric limitations on how much can be spilled

Water quality at a crossing

- Water quality can be impacted by many factors
  - Anthropogenic
    - Contaminations
    - Disturbed sediments
    - Disturbed riparian areas
    - Thermal regimes
    - Animals
  - Natural events
    - Sedimentations
    - Erosion
    - Animals

Closer to home

- TSB of Canada

- Calgary flood
- City bridge
- Derailed cars included ethylene glycol and diluent (A very light crude oil)
- Nothing was spilt
- Both products almost impossible to recover from water with current technologies

Another recent event

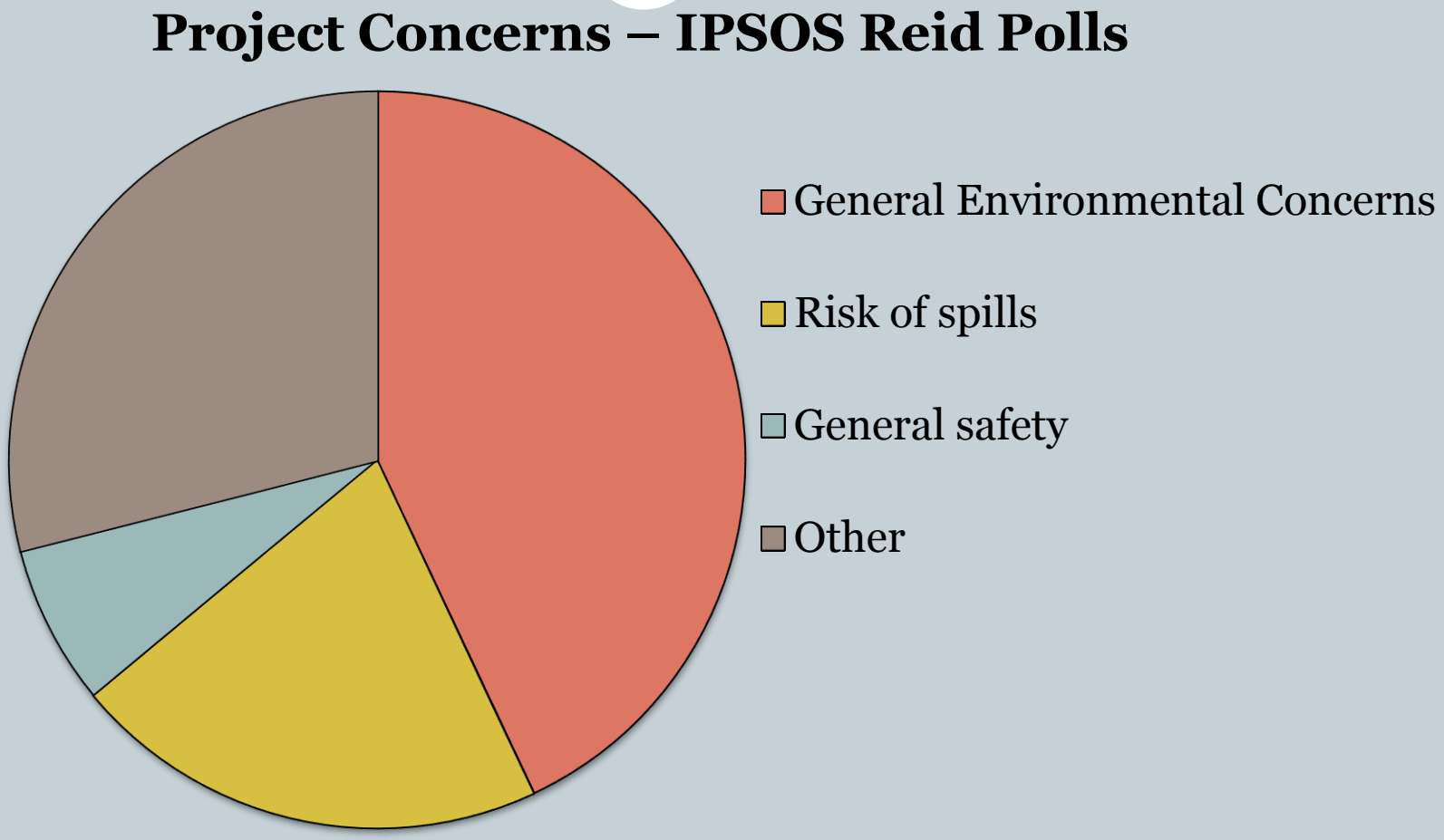
- The spill in English Bay, Vancouver prompted a number of organizations to comment including this from the David Suzuki foundation:

- *"our scenarios show that oil spills on the B.C. coast can be very difficult to deal with, and even with the best response only 15 per cent of the spill would likely be recovered. In the past 24 hours the response from the Coast Guard, Port Metro Vancouver and other agencies hasn't demonstrated that we have the world class oil spill response promised by the federal government."*

English Bay

Photograph by: By @missmusing.ca, Instagram.co

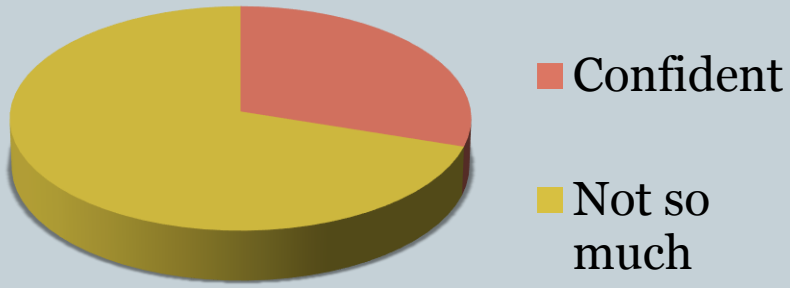
Northern Gateway



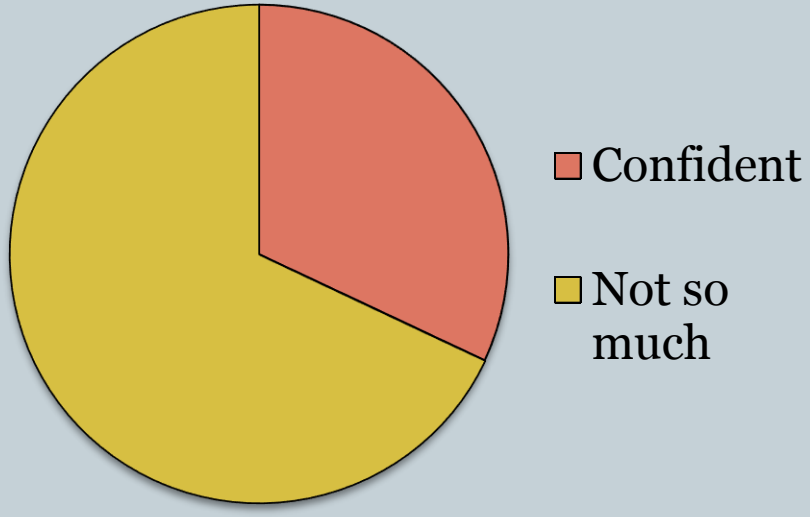
Confidence…by mode

Harris-Decima Poll Confidence in Federal Government to Respond to a Spill

Water

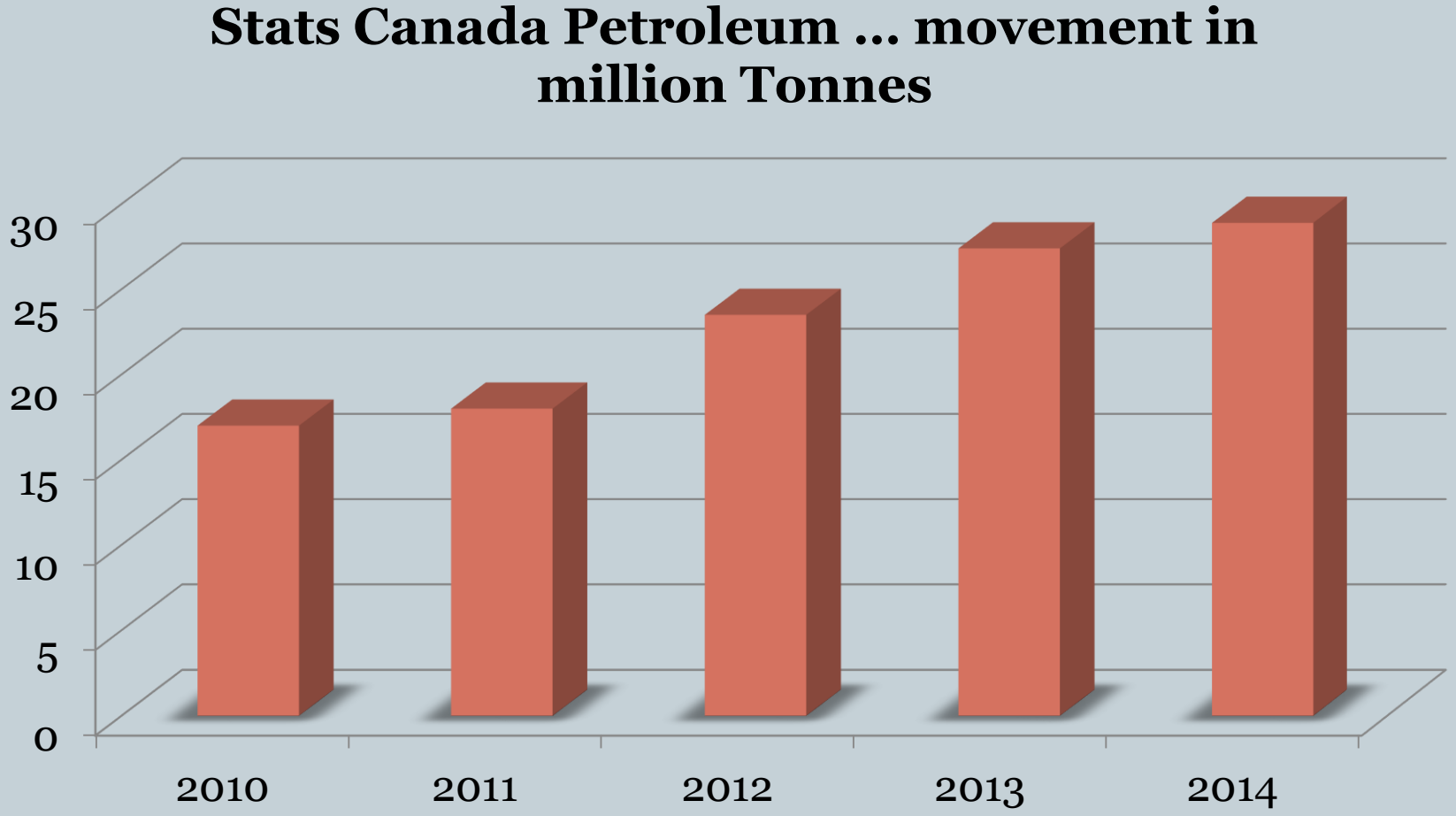


Land



Trends are hard to read …

Rail Movement



Perspective

Source	Pipelines / Rail
IEA	1:2 to 1:6 ratio of spills pipelines to rail
NEB	Varies between 1 and 2 incidents per 1000 kilometers of pipeline year over recent time periods
ERCB as reported when they were called the EUB	1.5 incidents per 1000 kilometers of pipeline averaged over several years

Challenges include differing reporting requirements

Gaps?

- So where does this data lead us to?
  - There is a confidence gap
  - While the problem does not appear to be out of control, spills continue to happen
- We need to close the confidence gap
  - Better record keeping and consistent reporting across jurisdictions
  - Better emergency response
  - Better baseline data

World Class Response

- Easy to say, but what do we need to do?
  - Response
  - Baseline water data
  - Transported element data
  - Water crossing and downstream physical qualities
  - Receptors

Accessibility

- A key element of reducing damage in a spill to water is the speed that a response can be mounted
- So it is helpful to ask, how easy is it to get to the spill?
  - Road bridges have by nature road access
  - Rail?
  - Pipelines?
    - Pipelines may have the least accessibility and may need alternate transportation methods

Speed of Response

- How far away is the spill response equipment?
- How far away are trained responders?
- Does the proponent have contracts in place with the responders?
- How available are trained responders?
- How accessible is the crossing?
  - How accessible is downstream of the crossing?
- Do responders have a good map?

More Response Time Factors

- How available are trained responders?
- Capability of first responders
  - Police and fire are really there to protect the public
- Capability of response team
  - Trained
  - Exercised
- Ability to store wastes
- Availability of secondary resources

Dealing with volunteers …

Sensitivity

- All water is worthy of protection
- But some may have a higher priority
- Need to identify the higher priority
  - Water intakes
  - Nesting grounds
  - Beaches
  - Recreation activities
  - Boating
- In order to provide timely protection, these sensitive receptors need to be identified prior to an even occurring

Qualities of the spilt materials

- Need to know these qualities in order to conduct post spill testing and also for the safety of the responders and the public
- Several factors should be considered:
  - What is the fluid? – need this right away. Not 24 hours into the spill
    - Toxicity
    - Salinity
    - Density
    - Viscosity
    - Ability to separate
    - Colour/odour

Water Quality

- We need to understand some qualities about the water body as well before hand:
  - Water velocity
  - Flow – models are often looking for this, but velocity is the key
  - pH of water
  - Temperature
  - Turbidity
  - Salinity – If the spilt product was saline, we need to be able to compare post to pre water quality
  - Metals may have a similar concern

Hydrologic Properties

- Velocity (flow may be calculated)
  - The spill may not mix homogenously and therefore velocity may be more helpful to determine how far the spill will travel
- Flow pattern
  - Spills follow patterns of water movement.
    - Eddies
    - Tides
    - Sand bars
    - Rapids

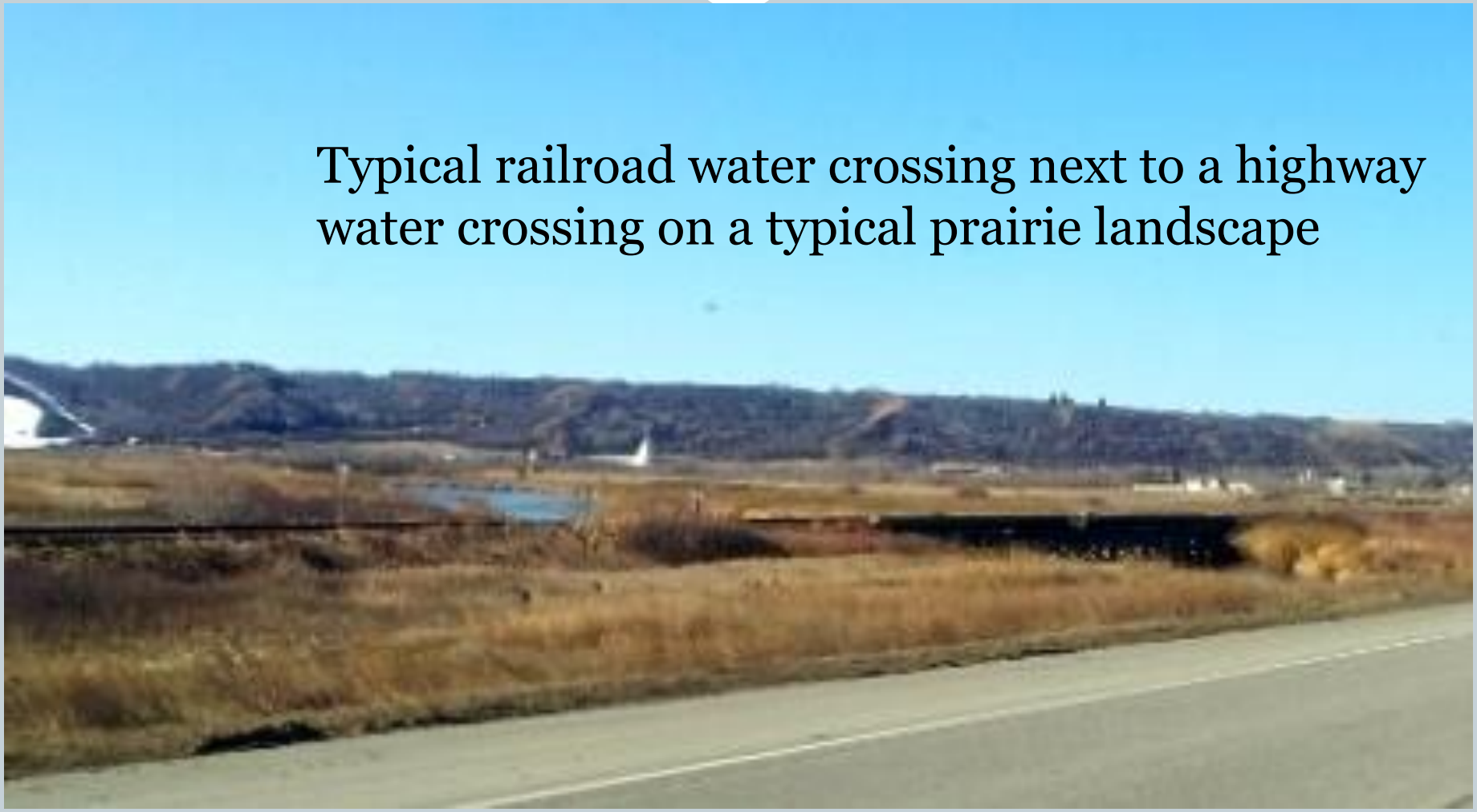

Sand bar
Nesting

Physical

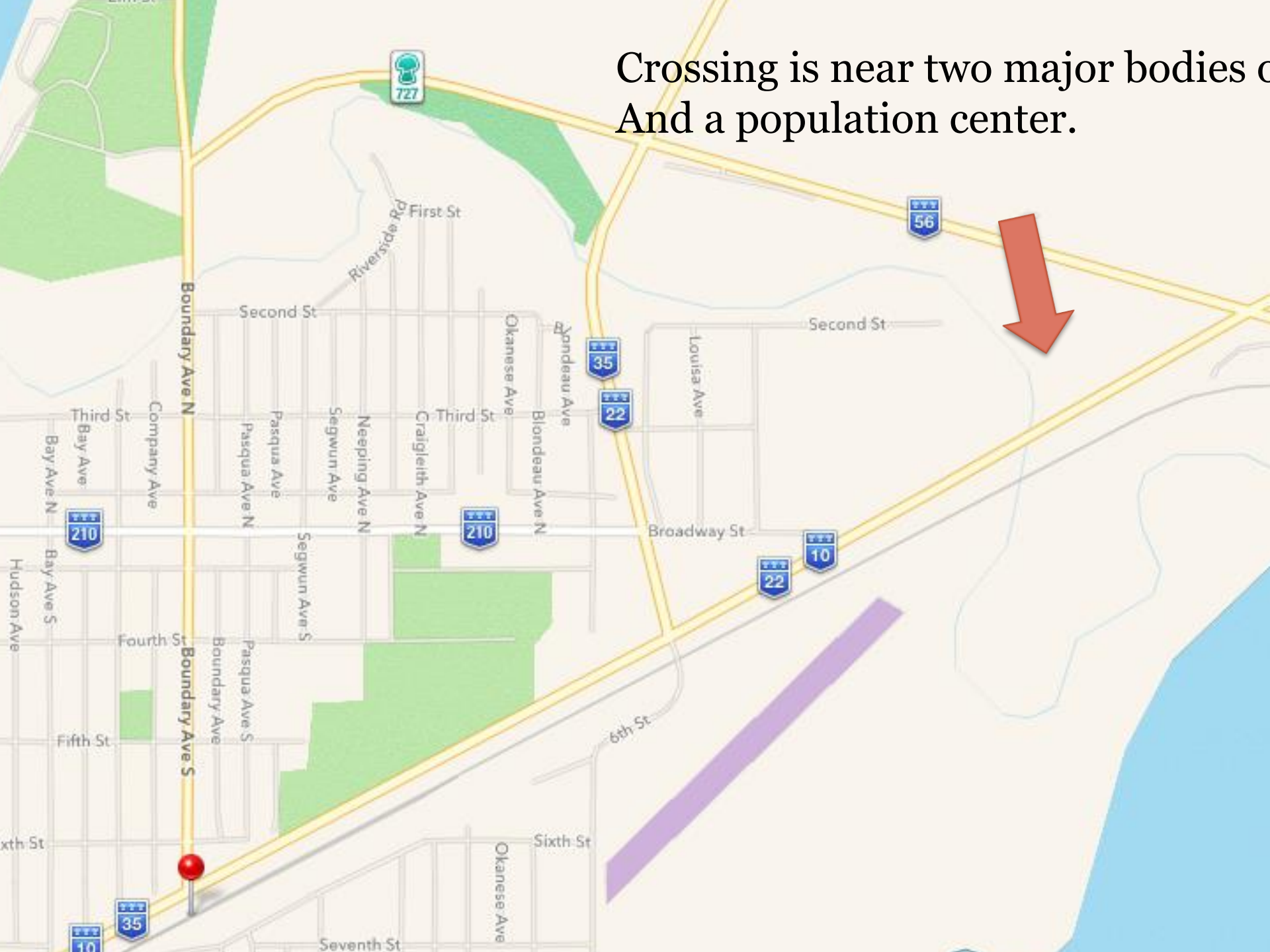
- The water crossing and a reasonable downstream distance needs to have physical conditions documented.
  - Orthographic air photos
  - Other air photos – drones
  - Navigation Charts – for larger water bodies
  - Topographic maps
  - Anthropogenic feature maps
  - Tide tables for coastal areas
  - Photos of riparian zones
  - Launch points
  - Control points

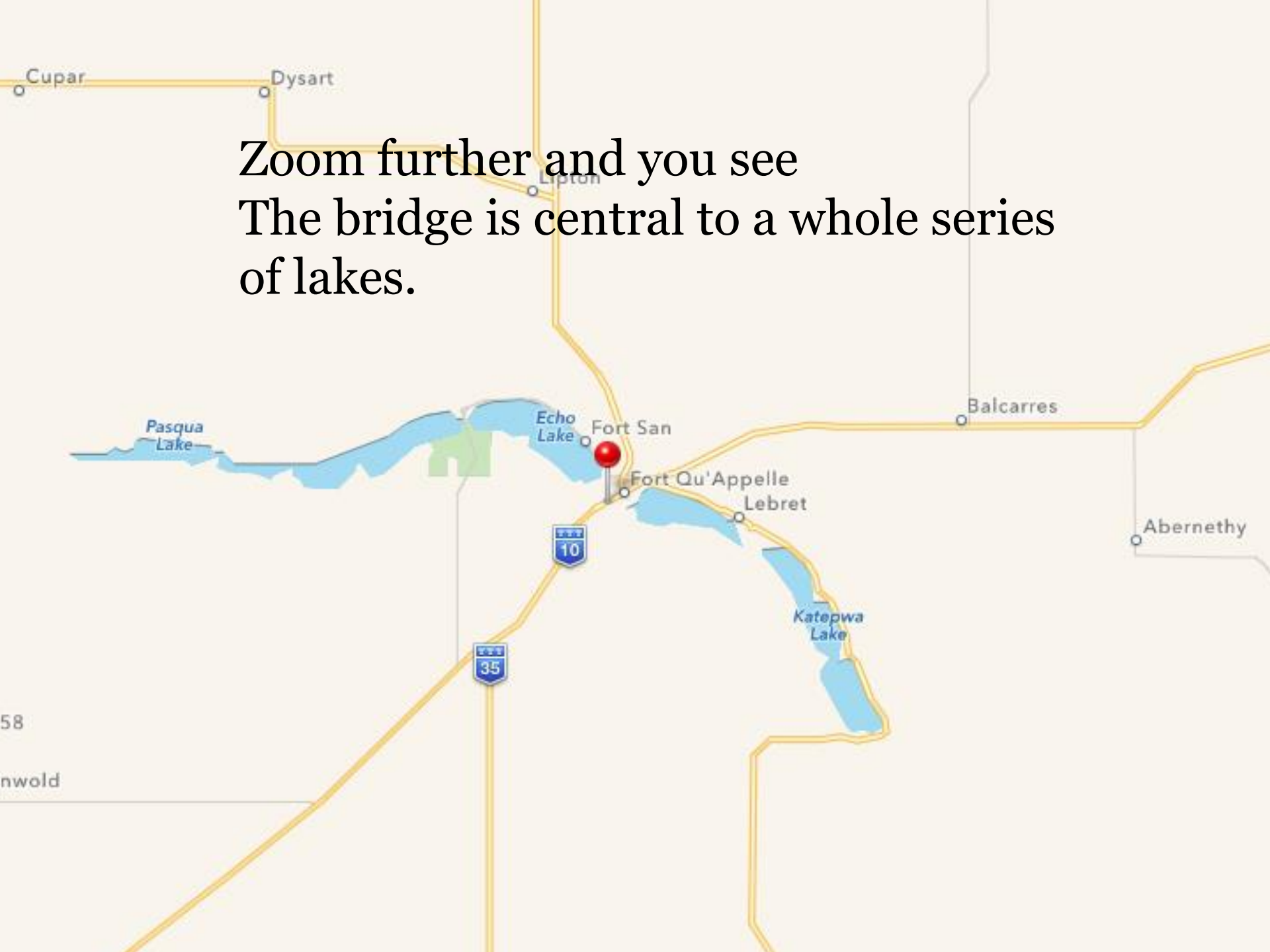
How do we deal with a spill at this point?

Fort Qu'Appelle



Typical railroad water crossing next to a highway water crossing on a typical prairie landscape


Crossing is near two major bodies o
And a population center.
727
56
35
22
210
10
First St
Second St
Third St
Fourth St
Fifth St
Sixth St
Seventh St
Broadway St
Boundary Ave N
Boundary Ave S
Riverside Dr
Bay Ave
Bay Ave N
Bay Ave S
Company Ave
Pasqua Ave
Pasqua Ave N
Pasqua Ave S
Segwun Ave
Segwun Ave S
Neeping Ave N
Craigleith Ave N
Okanese Ave
Okanese Ave N
Blondeau Ave
Blondeau Ave N
Louisa Ave
Hudson Ave
6th St


Zoom further and you see
The bridge is central to a whole series of lakes.
Cupar
Dysart
Lipton
Pasqua Lake
Echo Lake
Fort San
Fort Qu'Appelle
Lebret
Balcarres
Abernethy
Katepwa Lake
10
35
58
nwold

World Class

- To prepare for a spill, we need many things
  - Responders need to be trained, exercised and equipped with the appropriate equipment
  - We need to know the materials being transported in order to do point 1
  - We need to understand the water course, in order to have responders in the right spot
  - We need to understand the pre-disturbance water characteristics and its environment in order to understand if a significant change has occurred
  - We need to be able to know what we are trying to protect in order to have the “right stuff”

Conclusion

- Transport of fuels, feedstocks and chemicals is inevitable
- Equally inevitable, they are going to cross water bodies
- But that does not relieve us of the responsibility of crossing the water safely and planning for the worst
- And if our goal is world class response – we need to prepare
- It is possible!

Questions?