John Counter Blvd Improvements

Risk Assessment: A Case Study

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Presentation Highlights

- Project Description
- Project Complexities
- Dealing with Alternatives in RA
- Risk Assessment Process - ***RECAP***
  - **Differences between *RECAP* and WDOT**
  - **Integration of VE into Risk Assessment**
- Results of the Risk Assessment
- Suitability to Municipal Projects

Project Description

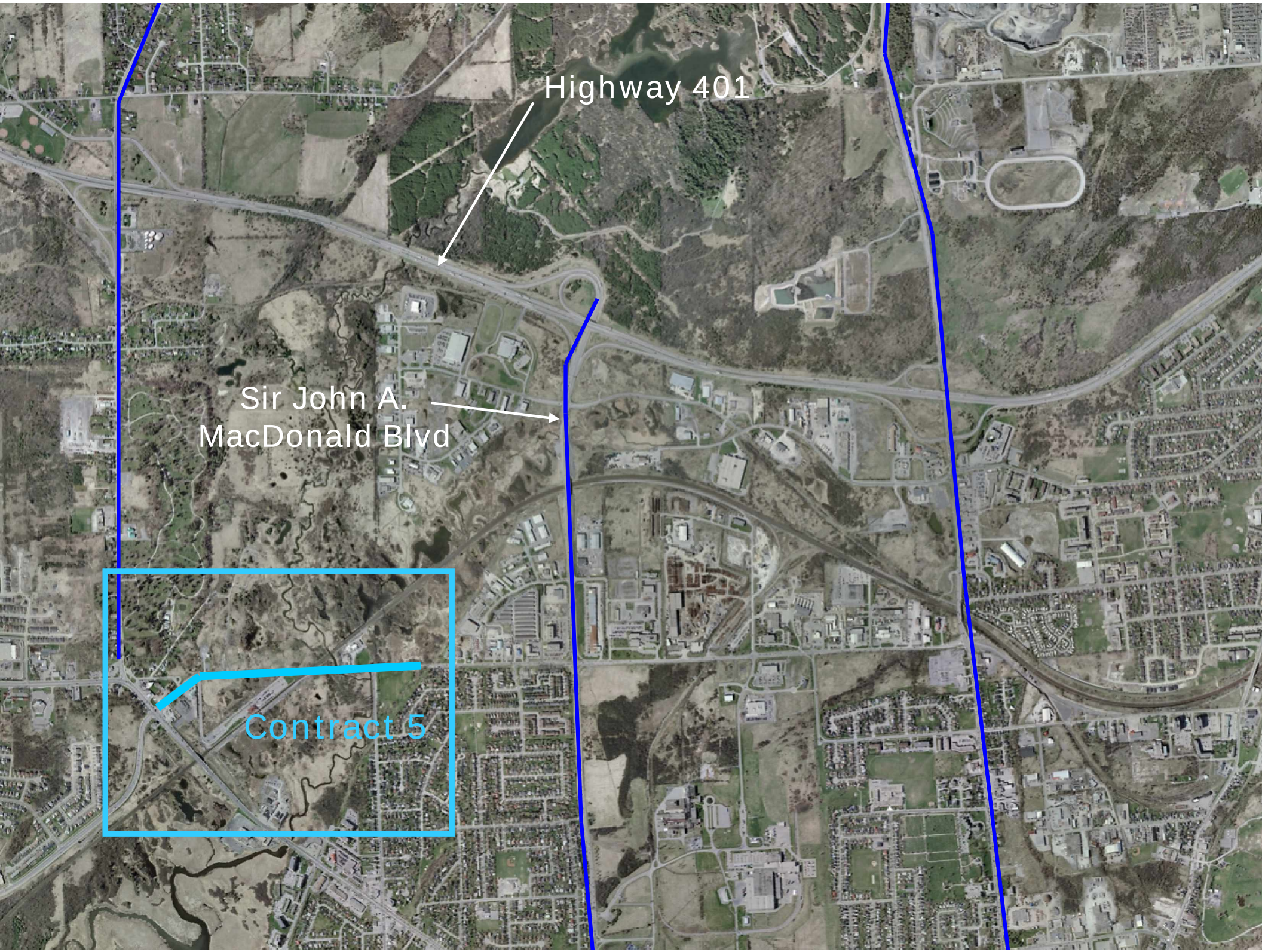
- Existing 2 lane rural roadway section to be reconstructed to 5 lane section
- Cycle lanes to be added throughout
- Turning lanes to be added at selected intersections
- 3.6 km in length
- Grade separation added at CN Rail crossing
- MRC retained for Preliminary and Detailed Design Services

Purpose of the Project

- To address current operational and safety needs
- Consider the needs of other modes of transportation
- Accommodate planned regional growth across the Cataraqui River screen line

Sydenham Street
Division Street
Highway 401
Sir John A. MacDonald Blvd
Future Crossing of the Cataraqui River
John Counter Blvd
Project Limits
Recent Improvements
Further Improvements / Crossing

Highway 401
To Be Constructed in 5 Contracts Over 5 Years
To be Funded Through Development Charges
Sir John A. MacDonald Blvd
Contract 1
Contract 2
Contract 3
Contract 4
Contract 5


Highway 401
Sir John A.
MacDonald Blvd
Contract 5

Little Cataraqui Creek
Existing At Grade Crossing
Station Exit
Portsmouth Ave.
Via Rail Station

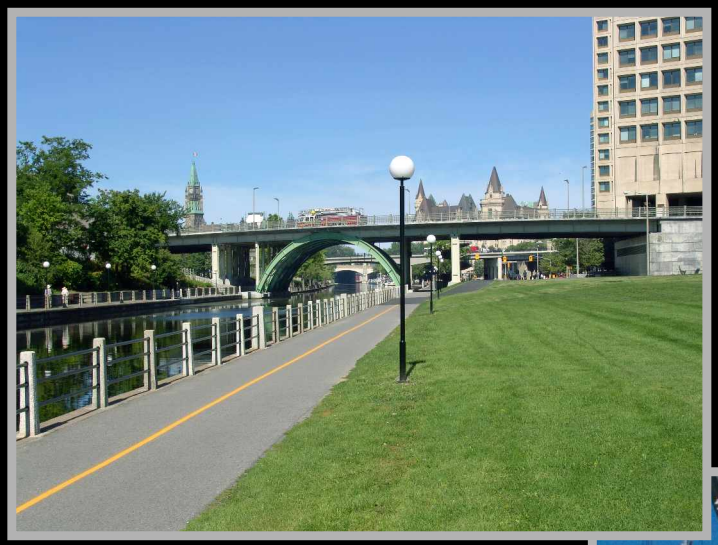
DODGE
4X4

Site Complexities
Wetlands with Poor Soils Conditions
Auto Body Shop
Car Rental
Known Contaminated Site
Access to be Maintained
CN Rail
Potentially Contaminated Sites

Embankment Construction in Difficult Soil Conditions

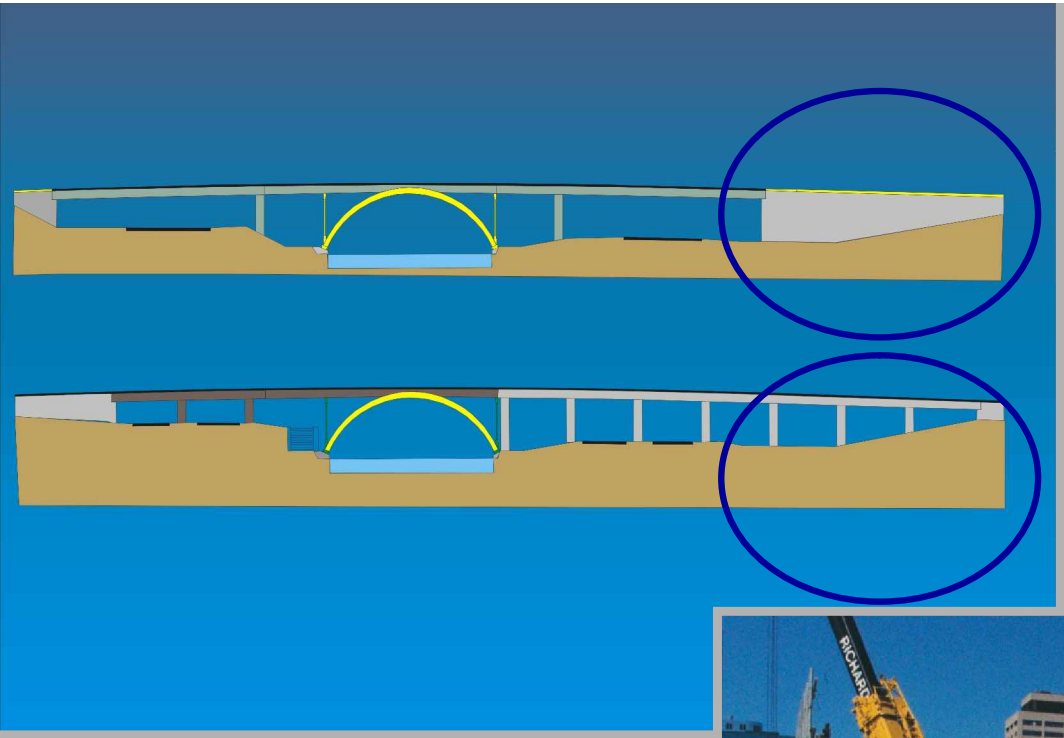
- Settlement and Capacity Concerns
  - Preloading
  - Wick Drains
  - Light-Weight Fill Materials
    - Slag
    - Expanded Polystyrene (EPS – Styrofoam)
  - Minimize Embankment Height
    - Over-span the structure
    - Reduce superstructure depth
  - Combinations of any of the above

Embankment Pre-Loading,
QEW/Red Hill Creek Interchange



Laurier Avenue Bridge, Ottawa

Embankment Construction Using EPS (Styrofoam)



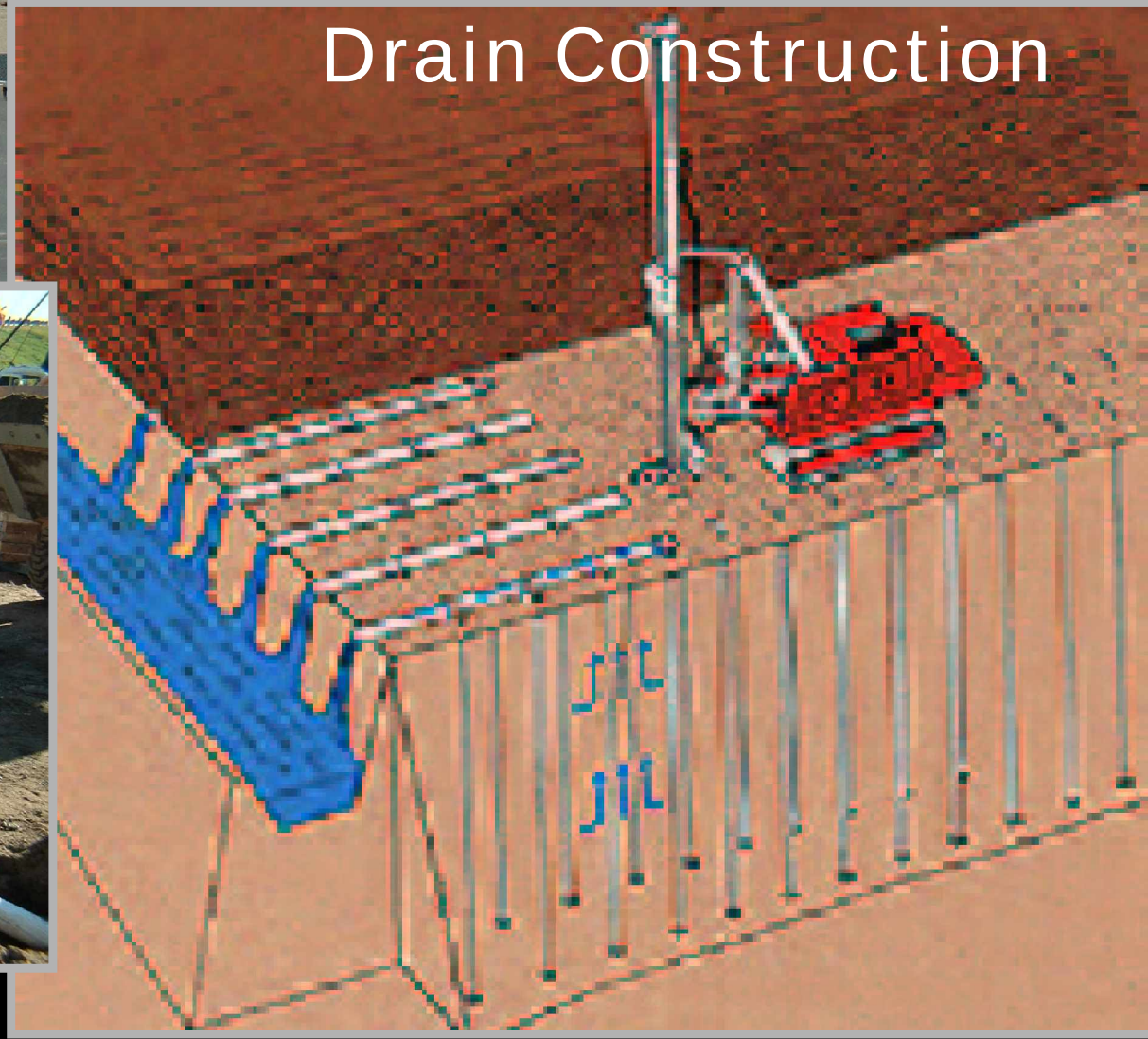
After

Before

Embankment Construction Using EPS (Styrofoam)

Blue Water International Bridge Truck Ramp

Embankment / Wick Drain Construction



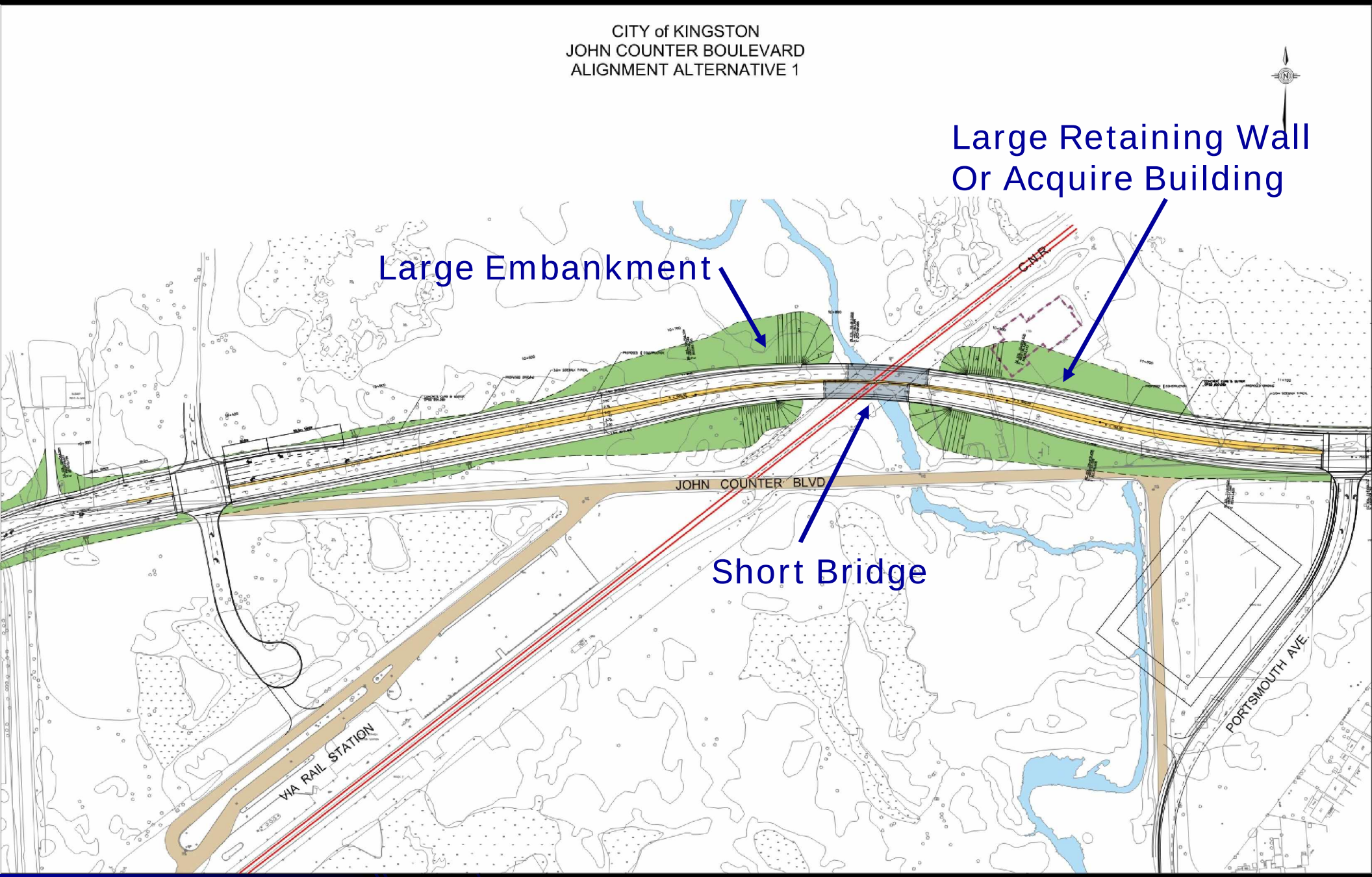
Alignment and Bridge Alternatives

- Embankment costs are very sensitive to the volume of fill in the embankment
- Volume is directly related to:
  - Width of the cross-section & side slopes
  - Profile of the roadway
  - Overall length of the structure
- Profile is function of structure depth
  - Depth is a function of span and bridge type

Alignment and Bridge Alternatives

- EA identified a “preferred alignment”, profile and bridge type
- Preliminary design team saw an opportunity to optimize these variables
- Created 3 new alignments with 2 bridge types and spans for each alignment
  - A total of 6 new alternatives

CITY of KINGSTON
JOHN COUNTER BOULEVARD
ALIGNMENT ALTERNATIVE 1



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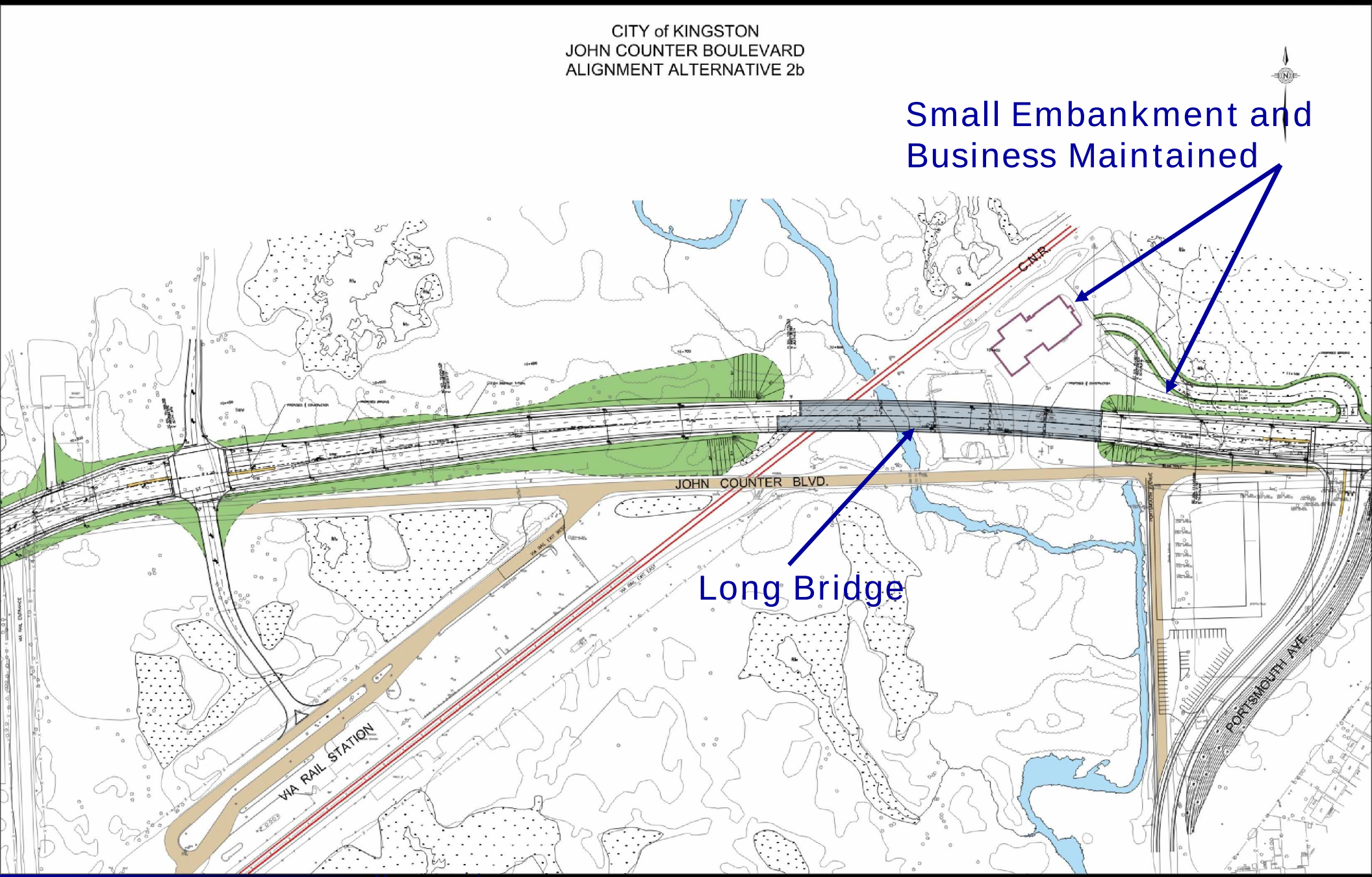
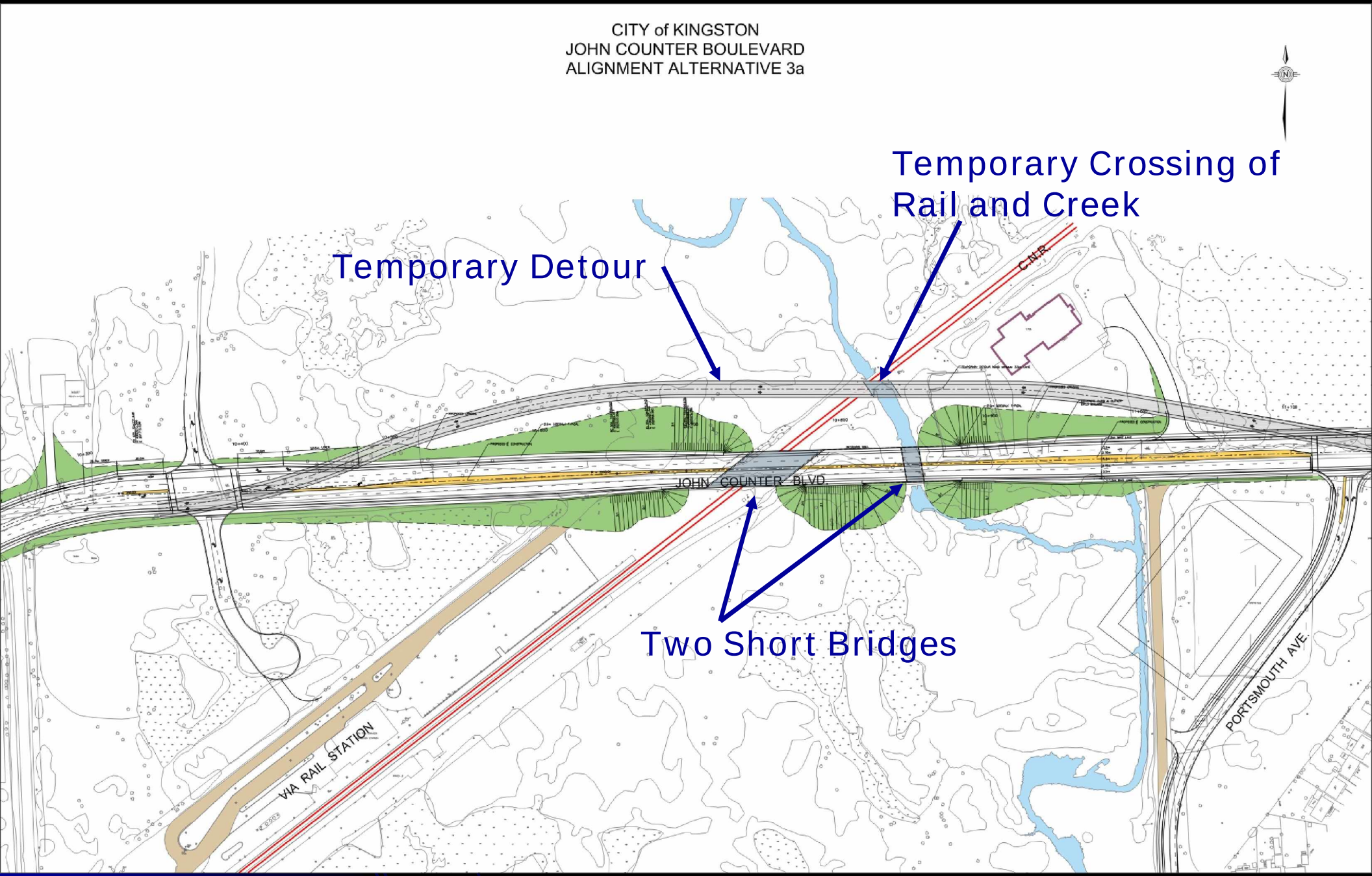
ALIGNMENT ALTERNATIVE 2b



CITY of KINGSTON
JOHN COUNTER BOULEVARD
ALIGNMENT ALTERNATIVE 3a



Dealing with Alternatives in Risk Assessment

Dealing with Alternatives in Risk Assessments

- Alternative designs, alignments and profiles may exist at the time of a Risk Assessment Workshop if carried out early in the Project
- A range of costs encompassing all alternatives could be generated and then included in a single risk assessment
- Alternatively, risk assessments could be run for each of the different alternatives that exist
  - This is only practical if there are only a few alternatives and they that don't interrelate with each other

Dealing with Alternatives in Risk Assessments

- Risk Workshop presented an opportunity to assist the Project Team with the selection of a new “preferred alternative”
- Qualitative and Quantitative approach was used
- Costs for all alternatives were validated and base costs established
- Qualitative assessment involved listing and comparing the advantages and disadvantages of each alternative
- A new “preferred alternative” was identified
  - Cost Risk Assessment done on the new preferred alternative AND the modified EA preferred alternative

Risk Assessment Process

Risk Assessment Process

- MRC's ***RECAP*** Process Invoked
- ***RECAP*** - Based on WDOT Process
  - ***R*** isk
  - ***E*** valuation and
  - ***C*** ost
  - ***A*** ssessment
  - ***P*** rocess
- Quantitative, time-based analysis of financial risks to projects including environmental, political/social, administrative, engineering, economic, construction & safety issues

Differences between ***RECAP*** and WDOT

- Very few differences – ***RECAP*** was developed using WDOT as a base
- Methods for building the Risk Register differ slightly
  - Rapid-fire Brainstorming Session introduced early in the workshop
    - Ideas are elicited early
    - Provokes and expands group thought basis
    - Plants seeds for further risk elicitation
    - Provides some focus for break-out groups

Differences between *RECAP* and WDOT (Cont'd)

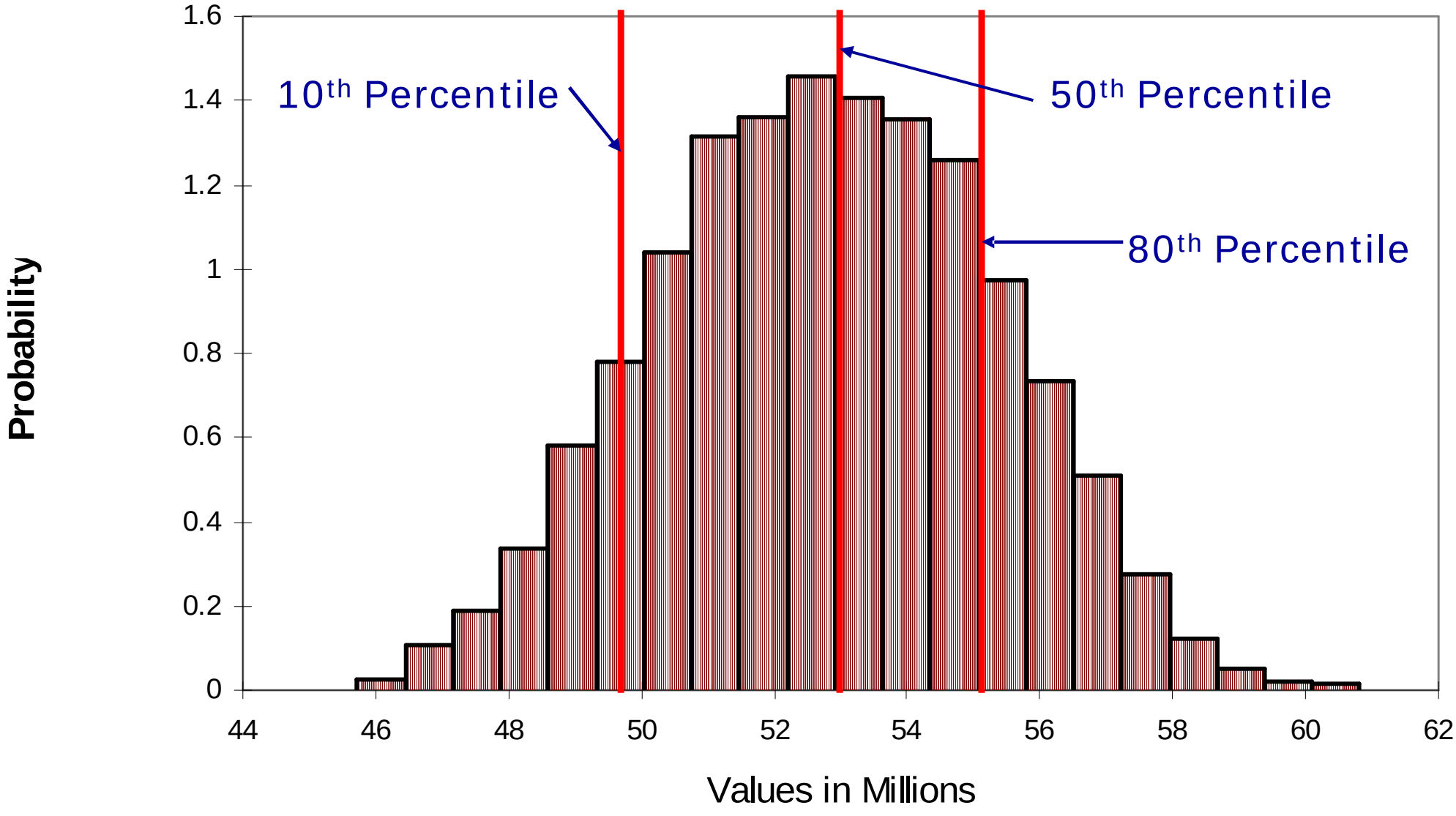
- Risks and opportunities identified during the brainstorming session are initially ranked using a qualitative process
  - Prioritizes risk and opportunities
  - Focuses the team on the most significant risks
  - Results in a more efficient use of time in the workshop

Results

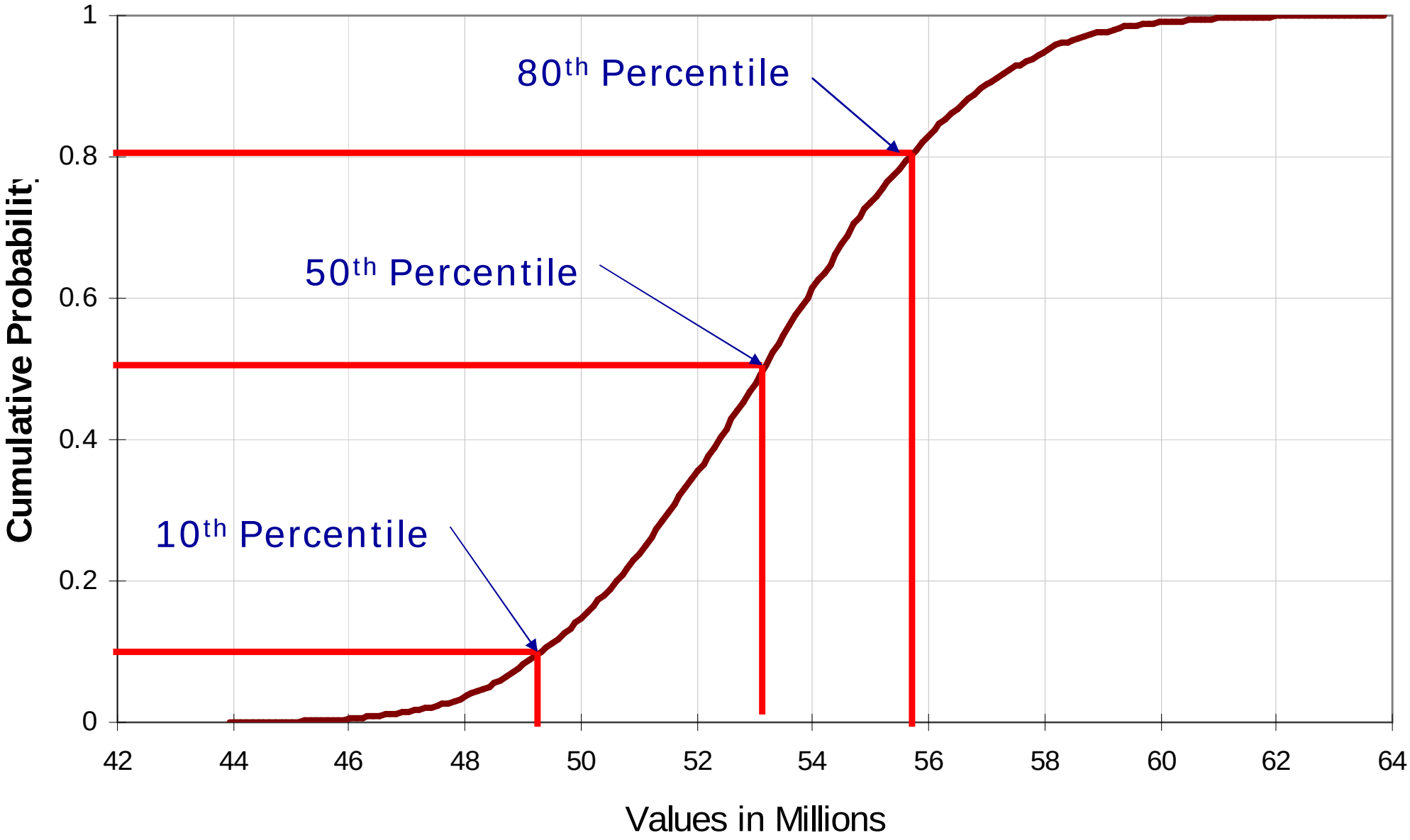
Cost Comparison Summary

	Alternative No. 1 Modified ESR Align.	Alternative No. 2B Middle Alignment
10th Percentile:	$ 49.5 M	$ 49.3 M
50th Percentile:	$ 52.8 M	$ 53.1 M
80th Percentile:	$ 55.0 M	$ 55.7 M
Base:	$ 47.1 M	

Distribution for Overall Project Costs - ESR Alternative (Alignment 1) - 2007$



Cumulative Distribution for Alternative 2B - 2007$



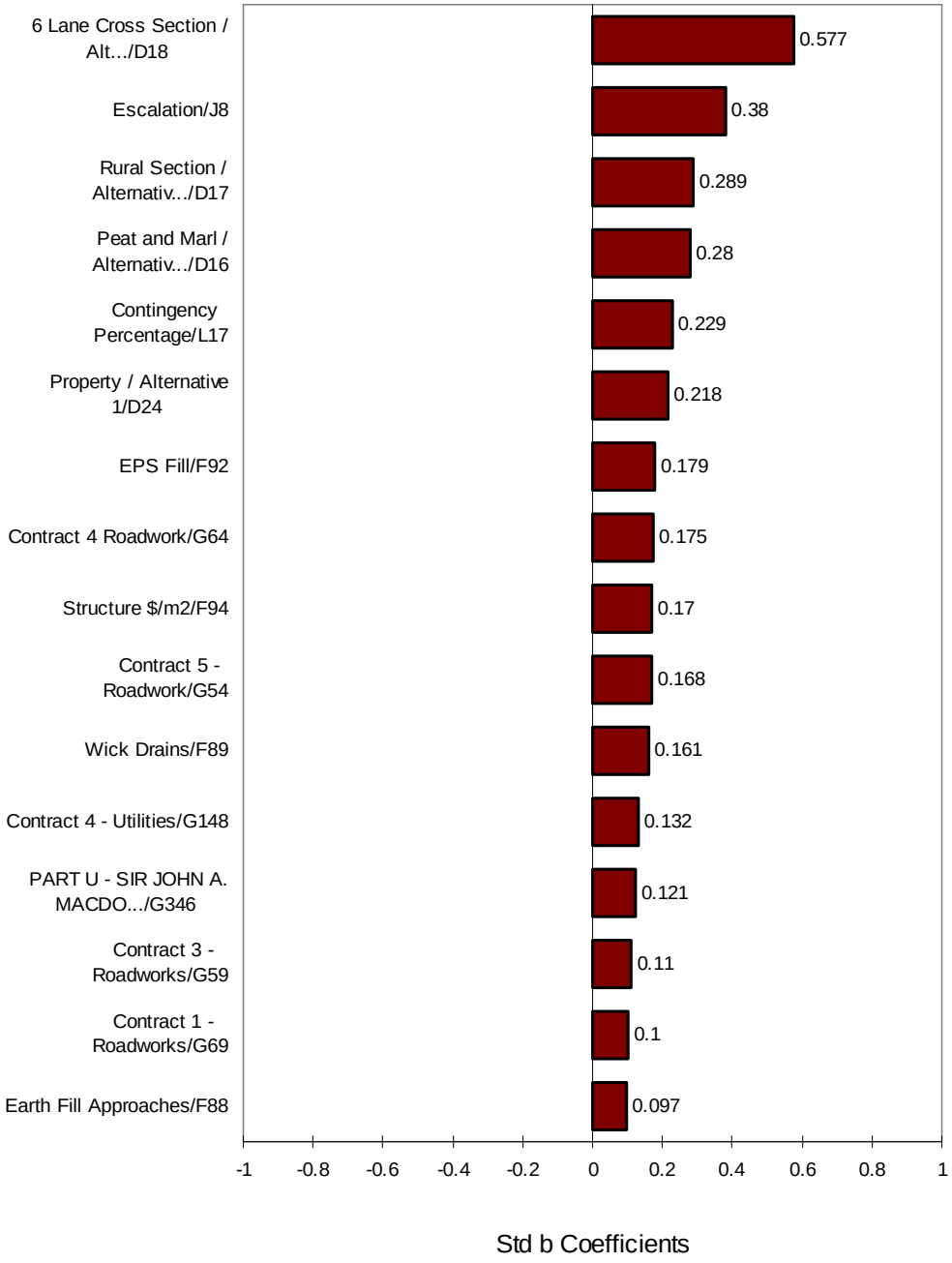
Cost Comparison Summary

Alternative No. 1 Modified ESR Align.	Alternative No. 2B Middle Alignment
Low $ 45.7 M	$ 43.9 M
High $ 60.6 M	$ 63.9 M

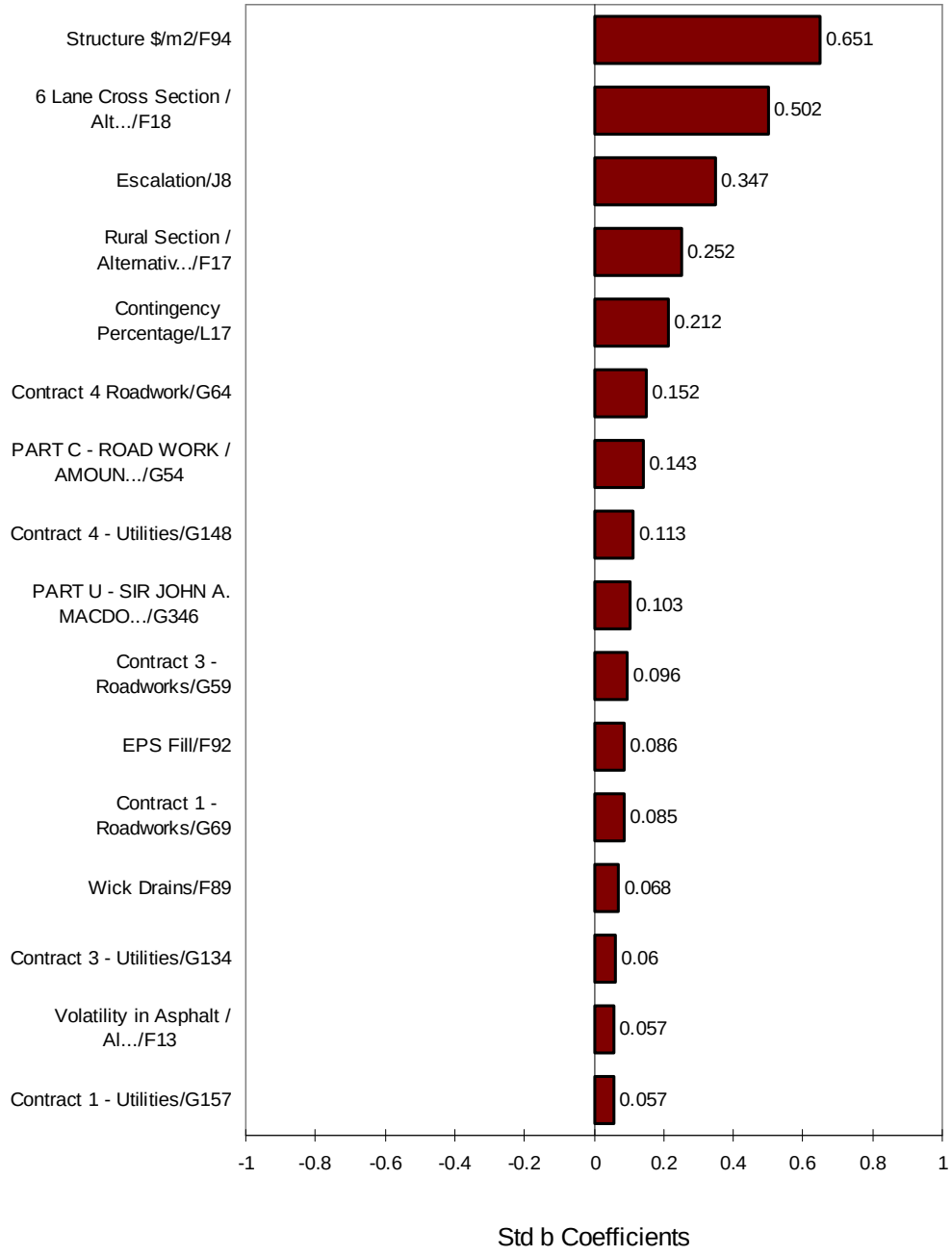
Cost Variation Drivers

- Need for 6 lane c/s at grade separation
- Use of a rural c/s at grade separation
- Extent of peat and marl
- Property costs
- Volatility in EPS costs
- Structure costs per square metre
- Wick drain costs
- Utility relocation costs

Regression Sensitivity for Overall Project Costs
ESR Alternative (Alignment 1)



Regression Sensitivity for Overall Project Costs
Alternative 2B



Schedule Comparison Summary

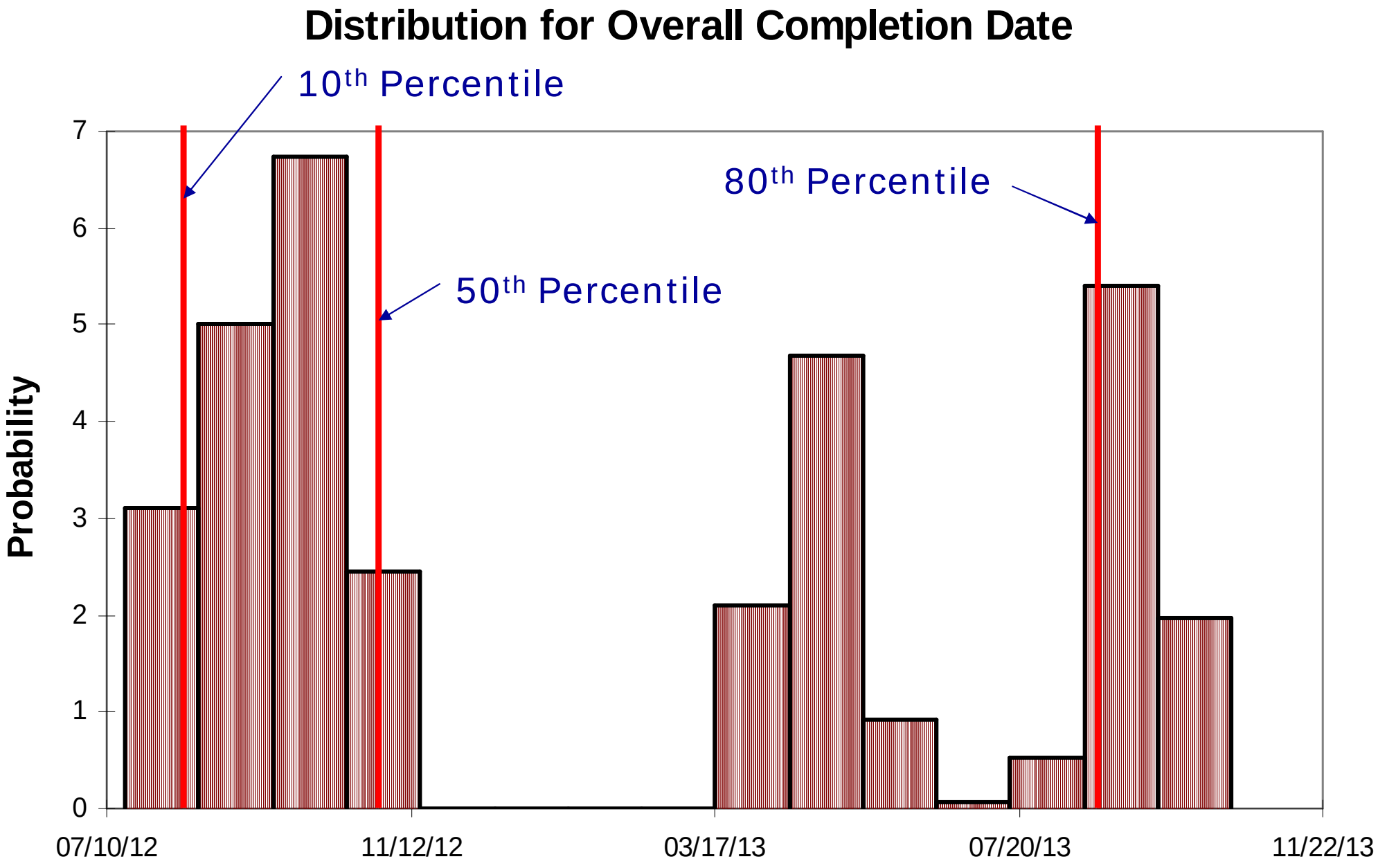
- Base Schedule
- Contract 1
  - Start March 2008
  - Finish Oct 2008
- Contract 2
  - Start July 2008
  - Finish Nov 2009
- Contract 3
  - Start April 2009
  - Finish August 2009
- Contract 4
  - Start June 2010
  - Finish April 2011
- Contract 5
  - Start June 2011
  - Finish Nov 2012

- Validated Base
  - Start Oct 2008
  - Finish Aug 2009
  - Start Oct 2008
  - Finish April 2010
  - Start April 2010
  - Finish Nov 2010
  - Start April 2011
  - Finish Nov 2011
  - Start June 2010
  - Finish Aug 2012

RECAP Schedule Summary

- Completion of Contract 5
- 10th Percentile: August 2012
- 50th Percentile: November 2012
- 80th Percentile: September 2013

- Base: August 2012


Distribution for Overall Completion Date
10th Percentile
80th Percentile
50th Percentile
Probability
7
6
5
4
3
2
1
0
07/10/12
11/12/12
03/17/13
07/20/13
11/22/13

Major Risks Identified

Major Risks Identified

- Contaminated Soils
  - Extent and clean-up costs unknown
  - Contaminates are on private property
  - Some potential for movement of contaminates into the roadway through groundwater
- Budget
  - Estimated costs greatly exceed those in ESR
  - Insufficient funding in the City's existing budget
  - To be funded through development charges
  - Costs could exceed development charge funding stream
  - Scope may have to be curtailed or schedule lengthened

Major Risks Identified

- Property Requirements
  - Not yet well defined or finalized
  - Not all property required has been purchased
    - Property may be required from utilities
    - Utilities may require relocation
    - Schedule impacts
  - Some potential for expropriation
  - Loss of parking spaces in adjacent commercial development
  - Ability to sustain business operations on a smaller property may require relocation of businesses

Major Risks Identified

- Railway Embankment and Roadway Construction Costs
  - Soils conditions at west end very poor
  - Light weight fill costs very volatile as they are tied to the price of oil
  - ESR identified need to construct to 6 lane cross-section in bridge embankments at time of initial construction
    - Very significant costs to do so
    - There is an opportunity to save money if only 4 constructed

Major Risks & Mitigation

- Cost Sharing Agreements with railways and developers not in place
  - Could impact schedule
- Compensation for loss of Wetlands
  - Extend and requirements unknown
  - Land availability for compensation uncertain
- Risk Team developed and documented many mitigation measures
  - These are not presented here for brevity

Integration of Value Engineering into Risk Assessment

Mitigation and VE

- Value engineering brainstorming session held at the end of the workshop is a natural progression of risk mitigation
  - Normally in risk assessment you are constrained by the parameters of the Project
  - Can’t or don’t change the “rules” / scope
  - Integrating some value engineering into the process generates further opportunities for cost savings

Integration of Value Engineering

- Valuation Engineering introduced into the workshop at the request of the client
  - Not normally done
  - Compresses the timelines for the workshop or extends its duration
- Cost and schedule ranges are to reflect risks and opportunities
  - Best opportunities are sometimes outside the scope of the defined project and hence are often not included in the risk assessment

Integration of Value Engineering (Cont'd)

- Risk Assessment and Value Engineering compliment each other
  - More recent Value Engineering Workshops are incorporating some risk assessment
  - Risk Assessments can benefit from some inclusion of value engineering since the experience of the Risk Team is often similar to that of a Value Engineering Team
- A brief value engineering brainstorming session was introduced late in the workshop

VE Integration

- Much longer workshop would be required to fully integrate the two processes
- For subject Project, the workshop was not extended
  - Left up to the design team to flush out the ideas generated and to cost them
  - Places higher demands on the design team and adds costs to the design
    - Engineering costs are not just those associated with the workshop

Integration of Value Engineering (Cont'd)

- The Project Team and the Client must accept / approve the identified opportunities before they become part of the Project
  - It is not appropriate then to include them in the validated base estimates
  - Instead, integration of VE should expand the range of the estimated Project cost and schedule

Suitability to Municipal Clients

- Much to be gained from risk assessment on major or complex projects
- Many such projects are undertaken at the municipal level
  - Municipalities want cost certainty
    - No such thing but they still want to make informed decisions with respect to capital budgets
  - Smaller overall budgets are impacted more by changes or extra work
  - Reinforces the need for risk assessment

Suitability of Risk Assessment to Municipalities

Suitability to Municipalities

- Municipal governments vary significantly in size and extent of in-house resources
  - Smaller municipalities with only a few large or complex projects may find the additional up-front costs of a risk assessment daunting
  - Important to realize the “Value” in engineering and risk assessment
    - Suitability of budget identified early
    - Early identification of risks permits mitigation

Value of Risk Assessment

- Focuses the design team effort early in the Project
  - Forces the team to develop budgets and schedules earlier for use by the owner
  - Identifies design areas that could be problematic
  - Removes bias from the Project Team
  - Reinforces the concept that …….

A COST ESTIMATE

IS NOT A

SINGLE NUMBER