MANITOBA-MINNESOTA TRANSMISSION PROJECT

Clean Environment Commission Routing Methodology Workshop

January 19, 2017

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Outline

- Process and methodology overview
- Describe major steps in transmission line routing process
- Review the models used to guide decisions

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Agenda

- Process outline
- Part 1: Methodology Overview
- Part 2: Planning
- Part 3: Feedback and Analysis
- Part 4: Evaluation and Selection
- Part 5: Review of Rounds 1-3

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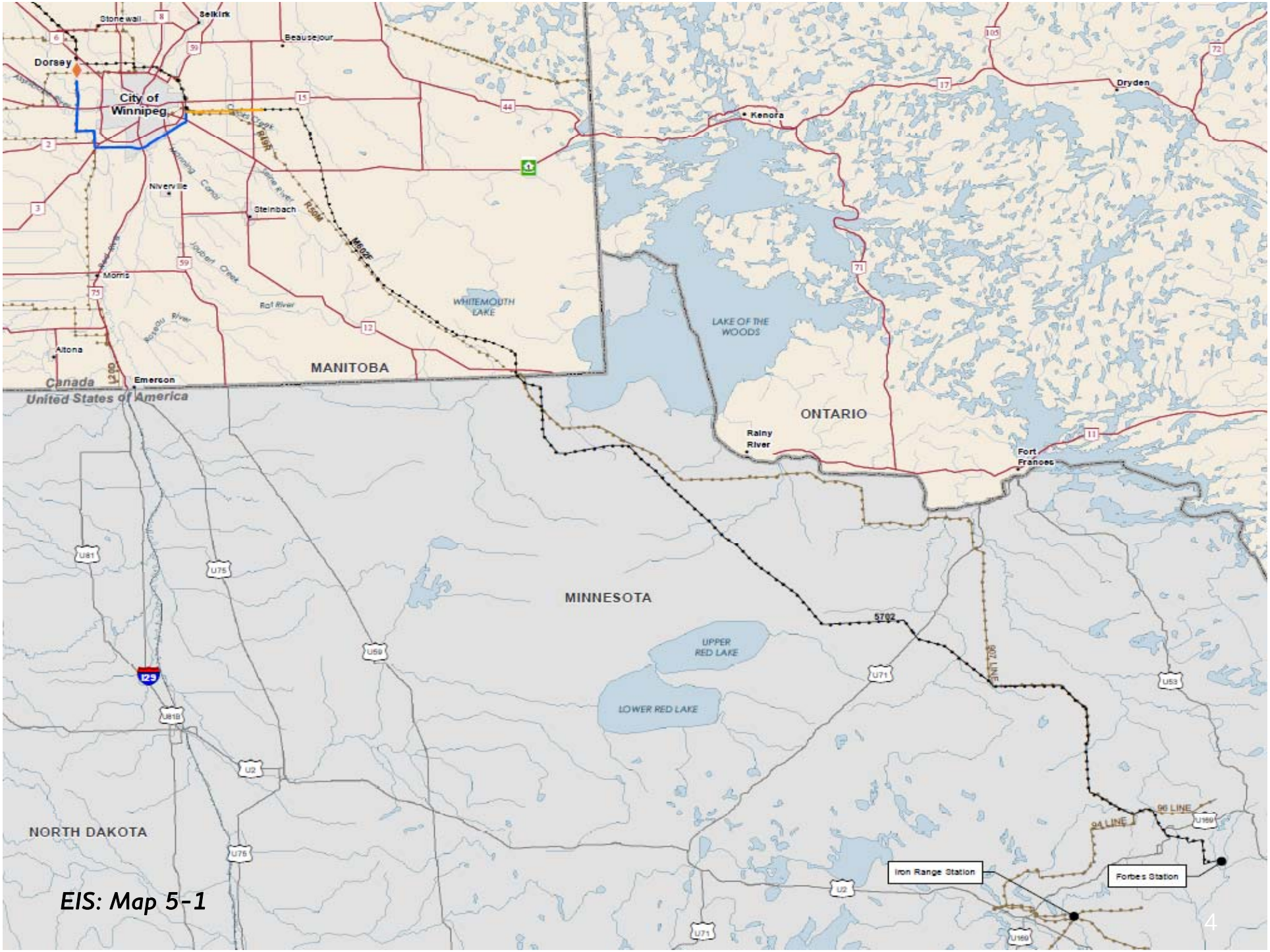
Stonewall
Selkirk
Beausejour
Dorsey
City of Winnipeg
Niverville
Steinbach
Morris
Altona
Emerson
Canada
United States of America
MANITOBA
WHITEMOUTH LAKE
LAKE OF THE WOODS
Kenora
Dryden
ONTARIO
Rainy River
Fort Frances
MINNESOTA
UPPER RED LAKE
LOWER RED LAKE
NORTH DAKOTA
Iron Range Station
Forbes Station
94 LINE
96 LINE
807 LINE
5702

EIS: Map 5-1

Scope

- Covered during todays workshop:
  - Routing methodology
  - How weightings and criteria were determined
  - How feedback from engagement was incorporated
- These will be covered during the hearing
  - Results and reasons for decisions taken
  - Route comparisons- why one was selected over another

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Goal of Transmission Line Routing

Determine a route for a transmission line

Limit overall effect

Balance multiple perspectives

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Approach to Routing

- Objective
- Balanced
- Transparent
- Incorporate local and traditional knowledge
- Mitigate concerns wherever possible

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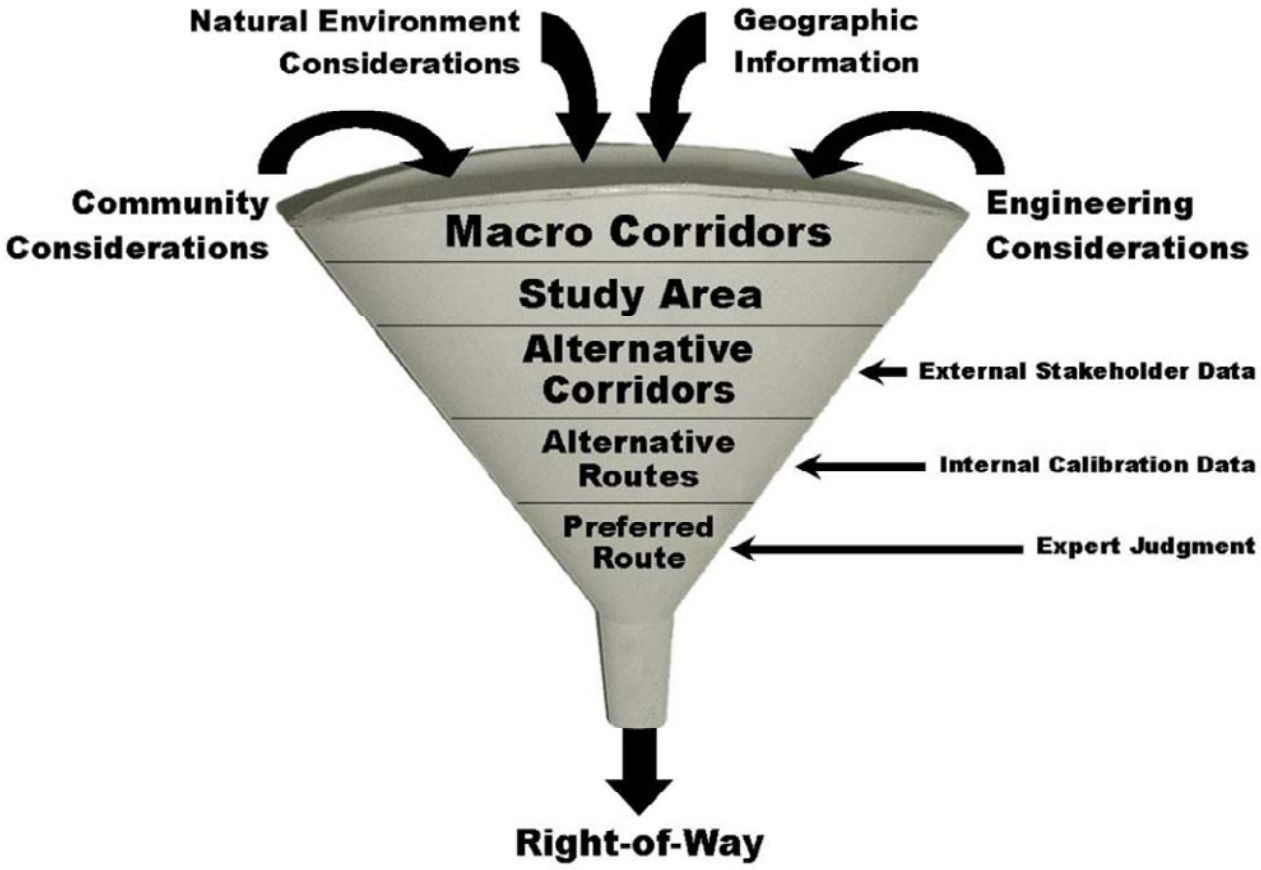
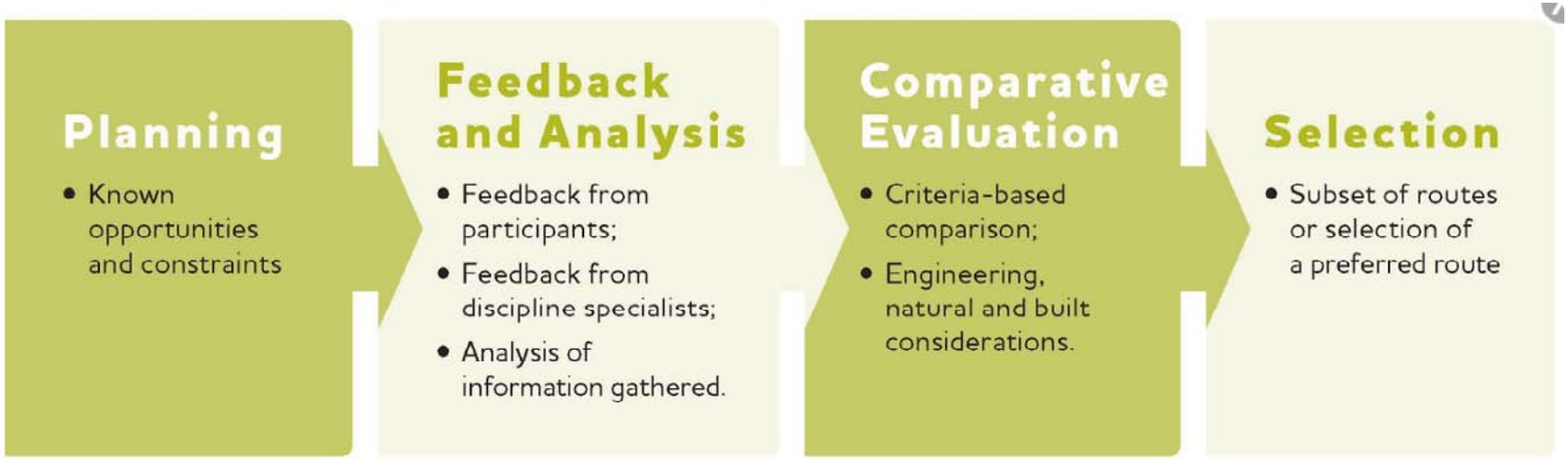
EPRI – GTC* Funnel



EIS: Figure 5-1; p5-3

*Electric Power Research Institute – Georgia Transmission

Steps of each stage of Routing



- Start and End Point
- Macro Corridors
- Alternate Corridors
- Route Development

- Public Engagement
- First Nations and Metis Engagement
- Field Studies
- Mitigative Segments

- Alternate Route Evaluation
- Preference Determination

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February 2012

Preliminary planning

Facility study and broad opportunities/constraints

Pre-engagement

Macro corridors → Route planning area → Alternate corridors

Initial communication to public

Fall 2013

Public engagement

	Planning	Feedback and analysis	Comparative evaluation	Selection
Round 1	**Select and negotiate border crossing for project**			
	• Alternate corridors • Alternative route development to three border crossing areas	• Community engagement • Analysis of new data collected from field studies (e.g. winter mammals survey) • Development of mitigative segments	• Alternative Route Evaluation Model (AREM) • Preference determination to explore strengths and weaknesses of routes and border crossings	• Preferred border crossing • Preferred alternative routes to border crossing
Spring 2014				
Round 2	**Evaluate alternative routes to selected border crossing**			
	• Windshield survey looking for new development • Alternative route development to selected border crossing • Electrical system planning studies	• Community engagement • Analysis of new data collected from field studies (e.g. birds and vegetation/wetland surveys) • Development of mitigative segments	• AREM • Preference determination	• Preferred route
Winter/Spring 2015				
Round 3	**Feedback and determination of a preferred route**			
	• Windshield survey looking for new development • Weather study • Electrical system planning studies	• Community engagement • Analysis of new data collected from field studies (e.g. visual quality/viewpoint studies) • Development of mitigative segments	• AREM • Preference determination	• Final preferred route and technical alignments for submission to regulators

EIS: Figure 5-52; p5-5

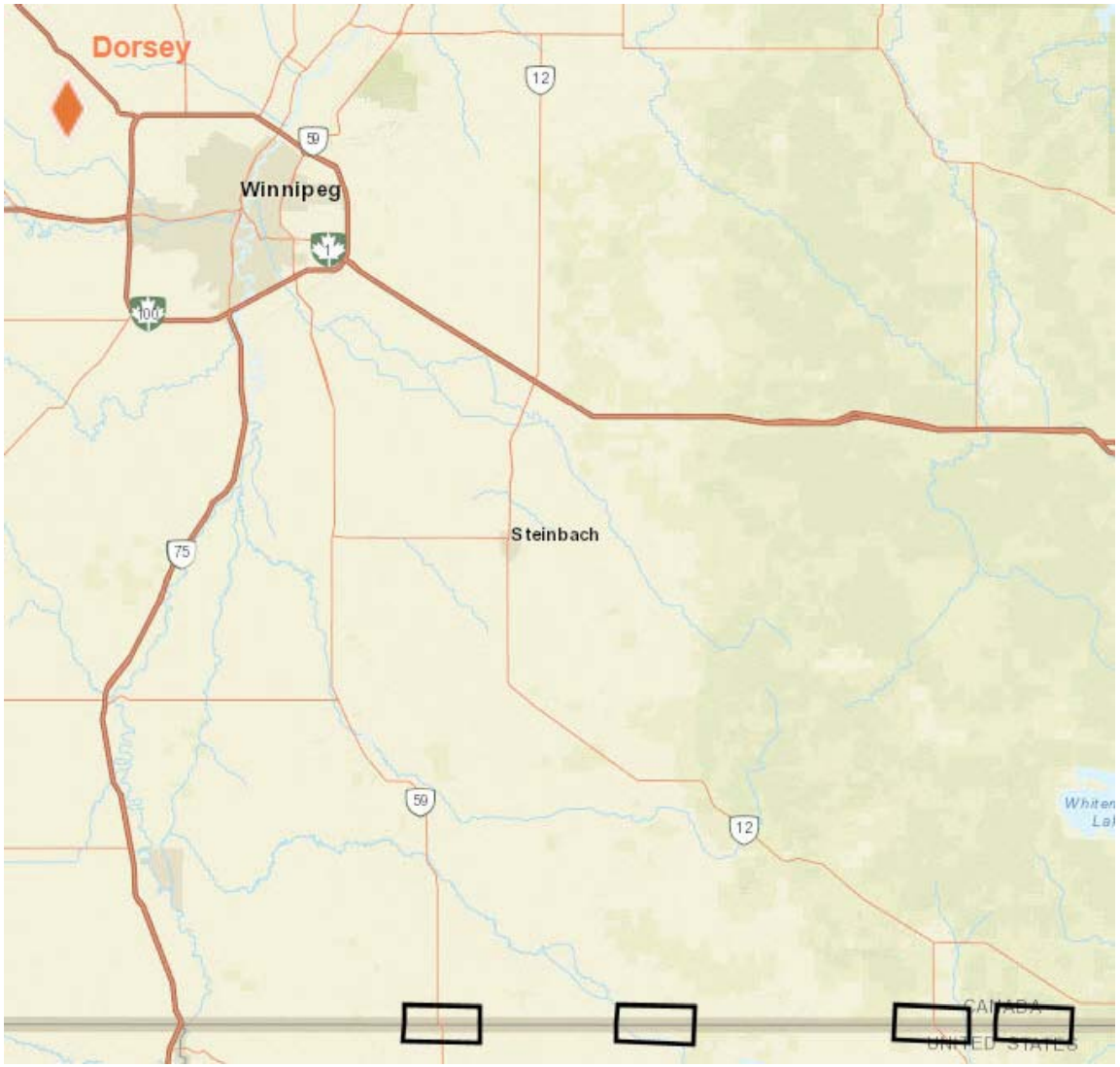
Summer 2015

Complete environmental assessment of final preferred route

Planning

- Known opportunities and constraints

Start and End Points



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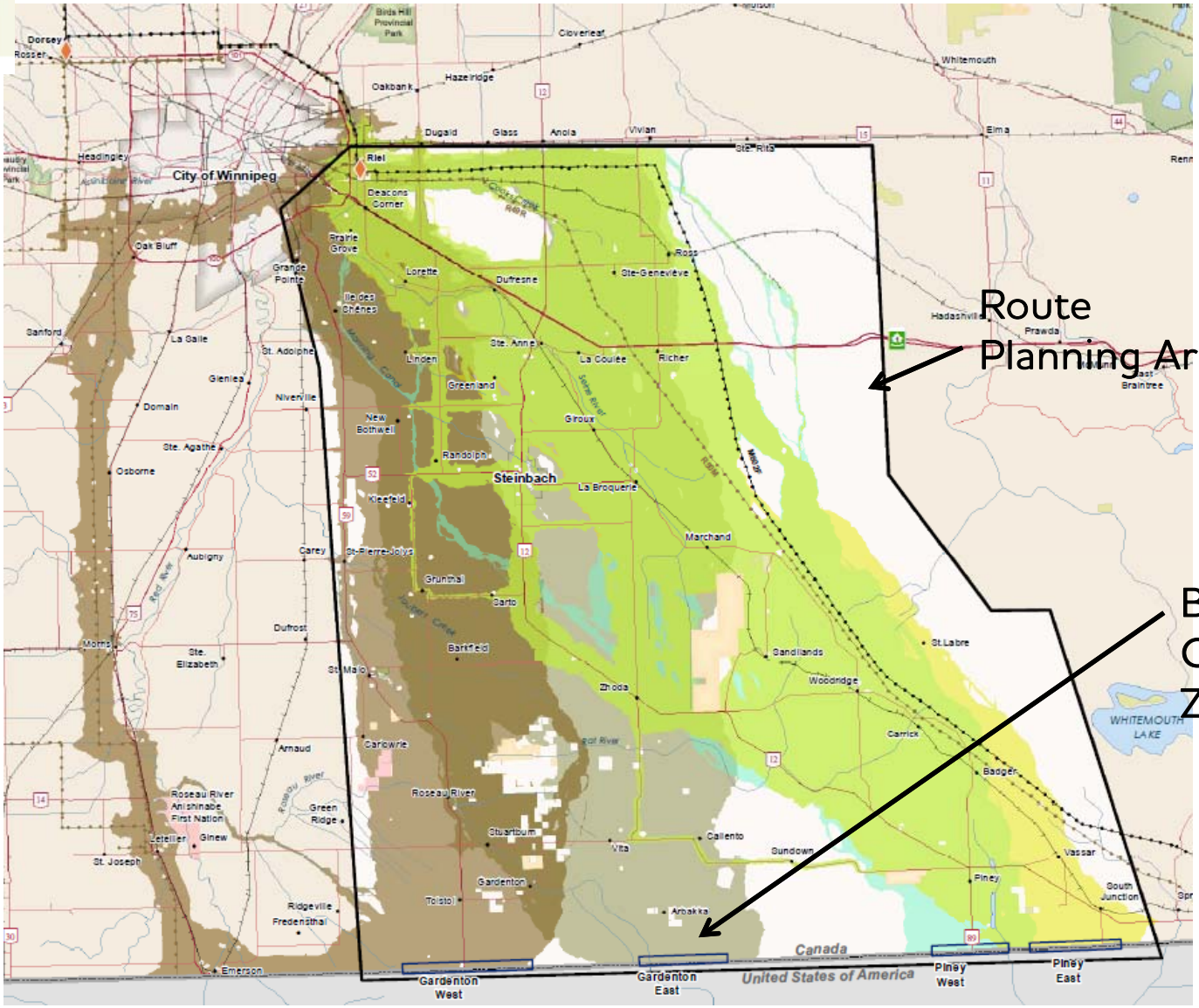
Planning

- Known opportunities and constraints

Route Planning Area



EIS: s5.3.2

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Macro Corridors

- Makes use of regional land cover spatial data
- Considers major constraints and opportunities
- Corridors are 'optimal paths' that follow one of three broad routing options
  - Parallel roads
  - Parallel transmission lines
  - Cross country (shortest, as the crow flies)

EIS: s5.3.2 , p5-14

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Planning
- Known opportunities and constraints

Macro Corridor Model

Feature	Cross Country	Roads	T/Ls
Agriculture	6	6	6
Forage Crops	6	6	6
Coniferous Forest	3	3	3
Coniferous - Dense	3	3	3
Coniferous - Open	3	3	3
Coniferous - Sparse	3	3	3
Deciduous Forest	3	3	3
Broadleaf - Dense	3	3	3
Broadleaf - Open	3	3	3
Mixedwood - Forest	3	3	3
Mixedwood - Dense	3	3	3
Mixedwood - Open	3	3	3
Mixedwood - Sparse	3	3	3
Named Roads and Highways	5	1	5
Barren Non-vegetated	1	2	2
Herb/Open/Shrub	3	3	3
Herb - Grassland	3	3	3
Water (Spannable)	7	7	7
Shrubland	2	2	2
Shrub Tall	2	2	2
Shrub low/forest cutblocks	2	2	2
Snow/Ice	9	9	9
Rock/Rubble	1	2	2
Transmission Corridor	5	5	1
Exposed Land (Urbanized)	9	9	9
Wetland	6	6	6
Wetland - Treed	6	6	6
Wetland - Shrub	6	6	6
Wetland - Herb	6	6	6

NOTE:
[1] Values range from 1 (most suitable) to 9 (least suitable).

EIS: Appendix 5A Table 5A-1

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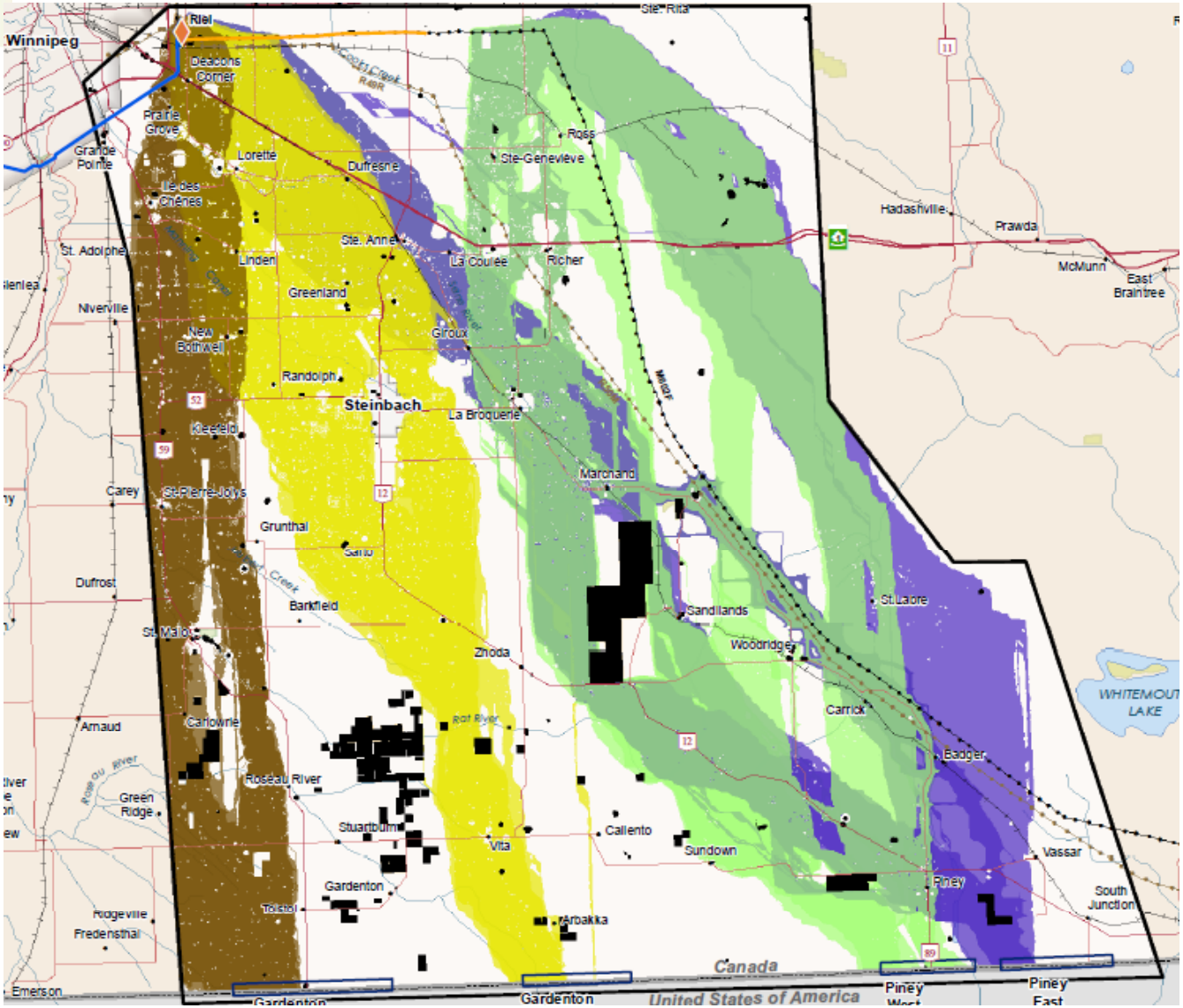
Planning

- Known opportunities and constraints

Alternate Corridors



EIS: Map 5-10

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Alternate Corridor Model

- Represents the suitability of features on the landscape in southern Manitoba for transmission line routing.

Grouped into 4 perspectives

- Built
- Natural
- Engineering
- Simple Average

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Model Calibration Process

- Calibrated to southern Manitoba landscape
- Requires geospatial data
- Southern Manitoba Transmission Line Routing Suitability Workshops

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The Workshop Process

- Three days, one for each 'perspective'
- Output:
  - Areas of Least Preference
  - Factors and associated weightings
  - Features and associated suitability
- Suitability values generated using a facilitated Delphi consensus process
- Weightings → analytical hierarchy process

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The Workshop Process

The stakeholders represented a broad range of interests including (exhaustive):		
ENGINEERING	**NATURAL**	**BUILT**

• Manitoba Infrastructure and Transportation
• Manitoba Hydro
  ○ TLine Design
  ○ Civil Design
  ○ TLine and Civil Construction
  ○ System Planning
  ○ Line Maintenance
  ○ Geotechnical Engineering
	• Fisheries and Oceans Canada
	• Ducks Unlimited
	• Nature Conservancy of Canada
	• Protected Areas Initiative
	• Parks and Natural Areas Branch (MCWS)
	• Wildlife Branch (MCWS)
	• Forestry Branch (MCWS)
	• Manitoba Woodlot Association
	• Manitoba Trappers Association
	• Bird Atlas
	• Manitoba Lodge and Outfitters Association
	• Manitoba Hydro
	• Manitoba Trappers Association
	• Seine-Rat River CD
		• KAP (Keystone Agricultural Producers)
		• University of Manitoba
		• Manitoba Aboriginal and Northern Affairs
		• Manitoba Agriculture, Food and Rural Initiatives
		• Manitoba Culture, Heritage and Tourism
		• Local Government Planners
		• Manitoba Aerial Applicators Association
		• Manitoba Hydro
		• Ruth Marr Consulting
		• Manitoba Trappers Association
		• City of Winnipeg - Planning Department

EIS: Appendix 5A Page 5A3-4

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Planning
- Known opportunities and constraints

Alternate Corridor Model

Engineering		Natural		Built	
Linear Infrastructure	**35.7%**	**Aquatics**	**10.0%**	**Proximity to Buildings**	**10.0%**
No Linear Infrastructure	1	No Aquatic Feature	1.0	> 800 m	1
Unutilized ROW (Manitoba Hydro Owned)	1.2	Ephemeral Streams (Non-Fish Bearing)	4.9	400 - 800 m	2.7
Parallel Existing Transmission Lines (<300kV)	3.8	Spannable Waterbodies (Lakes & Ponds)	6.1	100 - 400 m	6.5
Parallel Roads ROW	5	Ephemeral Streams (Fish Bearing)	6.3	ROW - 100 m	9
Parallel Provincial Highways ROW	5	Swamps	6.8	**Building Density**	**15.0%**
Parallel Oil / Gas Transmission Pipeline	7	Ephemeral Streams (CRA Fish Bearing)	6.9	< 1 Building / Acre (Rural Agricultural)	1.0
Parallel Railway ROW	7	Riparian Floodplain	7.1	1 Building per 1-5 acres	2.8
Future MIT Plans	7.8	Permanent Stream	7.5	1-3 Buildings/Acre (Rural/Residential)	3.7
>= 300 kV Transmission Line/Within Buffer	8.5	Bogs	7.7	3-10 Buildings / Acre (Suburban)	7.2
Within Road, Railroad, or Utility ROW	9	Fens	8.2	>10 Buildings / Acre (Urban)	9.0
Spannable Waterbodies	**10.4%**	Marsh	8.2	**Proposed Development**	**3.7%**
No Waterbody	1	Permanent Stream (CRA Fish Bearing)	9.0	No Proposed Development	1.0
Non-Nav. Spannable Waterbody (Standard Structures)	2.8	**Special Features**	**42.4%**	Proposed Development – Industrial	3.0
		No Special Land	1.0	Proposed Development – Agriculture	4.1
Nav. Spannable Waterbody (Standard Structures)	4.3	Managed Woodlots	5.4	Proposed Development - Commercial	5.1
		Crown Land With Special Code	7.0	Permitted Development	6.9
Non-Nav. Spannable Waterbody (Specialty Structures)	6	Community Pastures	7.3	Proposed Development - Rural Residential Zoning	6.9
Nav. Spannable Waterbody (Specialty Structures)	9	Flyways	7.5	Proposed Development - Urban Zoning	9.0
Geotechnical Considerations	**30.2%**	Areas of Special Interest (ASI)	7.8	**Soil Capability & Agricultural Use**	**11.9.%**
Rock	1	Recreation Provincial Park (Non-Protected Portions)	8.0	Other	1.0
No Special Geotechnical Considerations	1.3	Conservation Easements	8.0	Class 6 & 7 (Low Productivity)	3.3
100 Year Floodplain	6.6	Wildlife Management Area (Non-Protected Portions)	8.2	Organic Soils / Peat Bogs / Sod Production	3.9
Wetland / Peatlands	9	Proposed Protected Areas	8.6	Artisanal Farms / Wild Rice	4.3
Mining Operations / Quarries	**13.2%**	Heritage Rivers	8.7	Class 4 & 5 (Forages, Transitional)	5.9
No Mining Operation	1	Important Bird Areas	8.7	Class 1- 3 (Prime Ag./Cultivated Land)	9.0
Abandoned / Inactive Mines (Aggregate Piles, Pits, etc)	6.5	Heritage Marshes	8.9	**Land Use**	**16.0%**
		Conservation Lands	8.9	Forest	1.0
Mine-Owned Land	9	Natural Provincial Park (Non-Protected Portions)	9.0	Open Land (Sand & Gravel)	1.5
Slope	**5.4%**	**Land Cover**	**10.2%**	Industrial	1.6
Slope 0 - 15%	1	Exposed / Urbanized / Open Land	1.0	Burnt Areas	1.8
Slope 15 - 30%	3.1	Agricultural (Forage)	2.5	Active Forestry Operation	2.3
Slope > 30%	9	Agricultural (Crops)	2.8	Hunting / Trapping Locations	3.9
Proximity to Future Wind Farms	**5.1%**	Burnt Areas	4.9	Listed Trails (Existing & Planned)	4.6
500m - 10k	1	Grassland	5.0	Organic Farming	5.5
> 10k	9	Deciduous Forest	5.5	WMAs (Unprotected)	5.8
		Coniferous Forest	5.7	Agricultural (Forage)	4.9
		Mixed Forest	6.0	Out-of-Park Recreational Development	6.4
		Non-Developed Sand Hills	8.1	Agricultural (Crops)	6.6
		Native Grassland	9.0	Intense Development & Use	6.5
		Wildlife Habitat	**37.4%**	500m Buffer of Irrigated Land	6.6
		Other	1.0	Intensive Livestock	6.9
		Ungulate Habitat (High)	6.1	In-Park Recreational Development	7.9
		Waterfowl Habitat (High)	6.3	Institutional	7.4
		Waterfowl Paired Density (High)	6.9	Agricultural (Aerial Application)	8.9
		Waterfowl Hotspots (High)	7.0	Irrigated Land	9.0
		Grouse Lek Area	7.7	**National/Provincial/Municipal Historic Sites**	**12.0%**
		Rare Species Habitat	8.0	> 300 m	1.0

Areas of Least Preference
Wastewater Treatment Areas
Buildings
Oil Well Heads
Waste Disposal Sites
Towers and Antennae
Existing Wind Turbine
Military Facilities / Past Military Installations
Protected Areas
Special Conservation Areas/Ecological Reserves
Non-Spannable Waterbodies (>300 m)

EIS: Chapter 5, Table 5-3; Page 5-17 see also Appendix 5A

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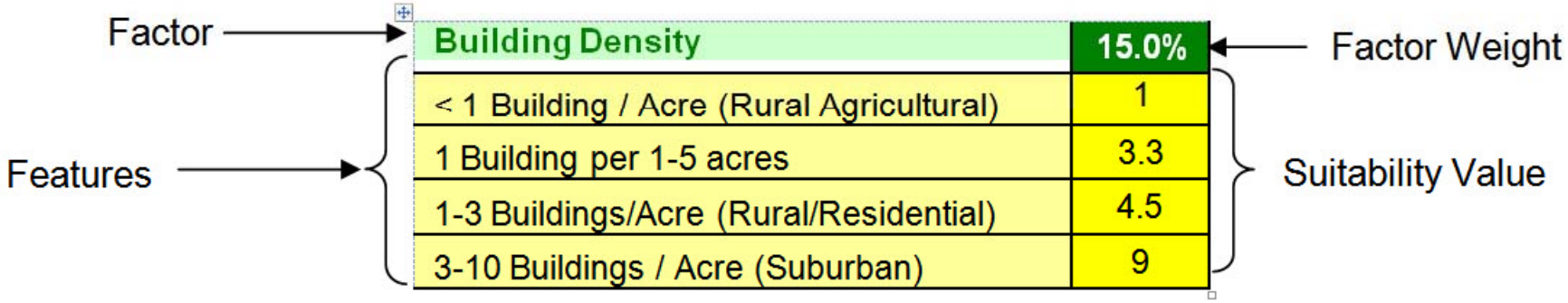
Planning
- Known opportunities and constraints

Alternate Corridor Model



Building Density	15.0%
< 1 Building / Acre (Rural Agricultural)	1
1 Building per 1-5 acres	3.3
1-3 Buildings/Acre (Rural/Residential)	4.5
3-10 Buildings / Acre (Suburban)	9

EIS: Appendix 5B, Section 5B.1.1

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Planning
- Known opportunities and constraints

Alternate Corridor Model Calibration

Engineering	
Linear Infrastructure	37.7%
Unused ROW (Manitoba Hydro owned)	1
Parallel Roads ROW	2.6
Municipal Road Allowances	3.1
Parallel Provincial Highways ROW	3.4
Parallel Existing Transmission Lines (<300kV)	3.8
No Linear Infrastructure	4.4
Rebuild Existing Transmission and Sub-Transmission Line	-
Parallel Oil/Gas Transmission Pipeline	5.6
Parallel Railway ROW	5.6
Future MIT Plans	-
>= 300 kV Transmission Line and Within Separation Buffer	8.5
Within Road, Railroad, or Utility ROW	9
Spannable Waterbodies	11.0%
No Waterbody	1.0
Non-Nav. Spannable Waterbody (Standard Structures)	-
Nav. Spannable Waterbody (Standard Structures)	9.0
Non-Nav. Spannable Waterbody (Specialty Structures)	-
Nav. Spannable Waterbody (Specialty Structures)	-
Geotechnical Considerations	31.9%
Rock	-
No Special Geotechnical Considerations	1.0
100 Year Floodplain	6.5
Wetland/Peatlands	9.0
Mining Operations/Quarries	14.0%
No Mining Operation	1
Abandoned/Inactive Mines (*e.g.*, Aggregate Piles, Pits)	-
Mine-owned Land	9
Slope	0.0%
Slope 0 – 1%	-
Slope 15 – 30%	-
Slope > 30%	-
Proximity to Future Wind Farms	5.4%
500 m – 10 k	1
> 10 k	9

EIS: Appendix 5A, Table 5A-5

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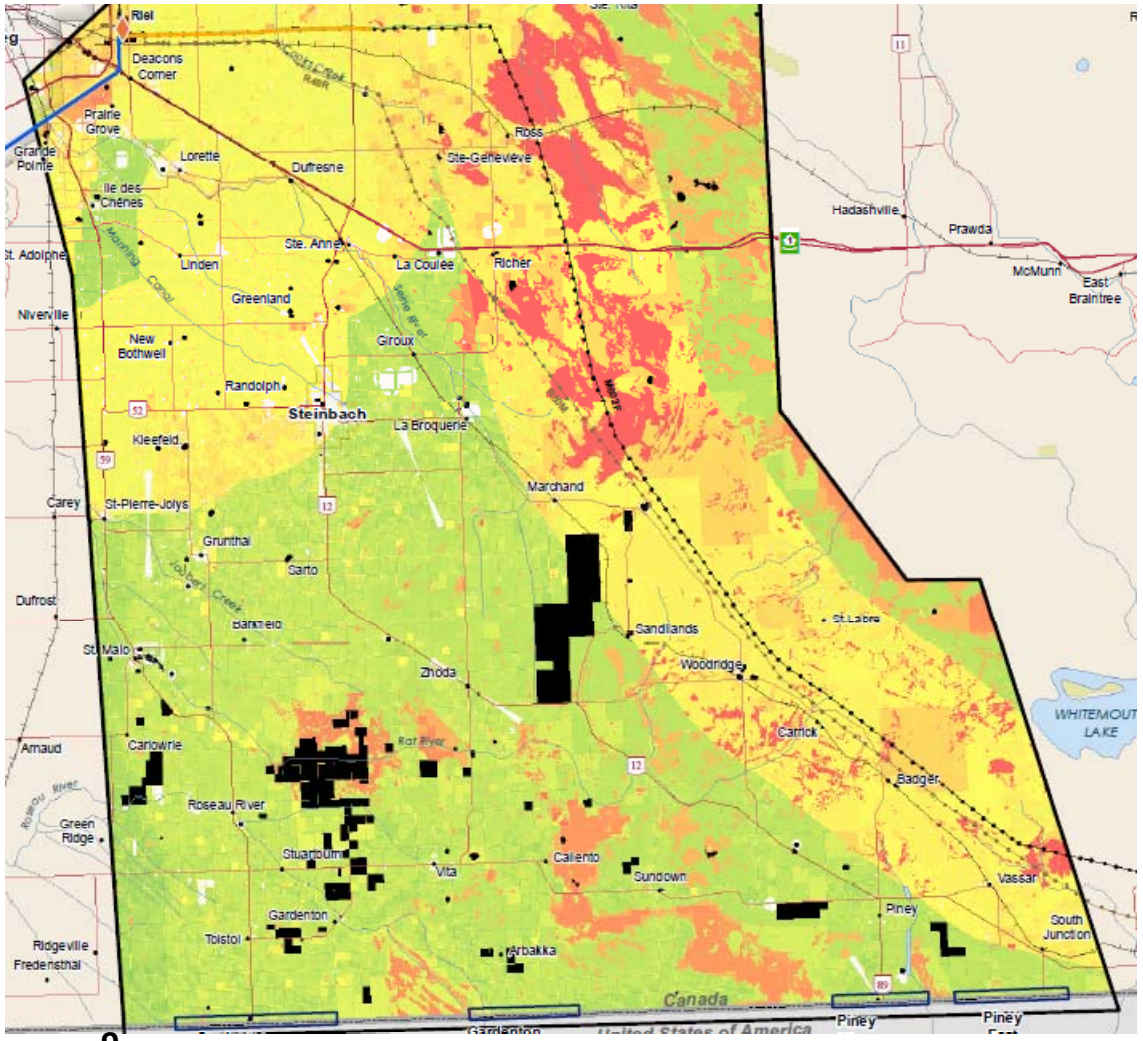
Planning
- Known opportunities and constraints

Suitability Surface (Engineering)



0 — 9

High — Low

EIS: Chapter 5, Map 5-5

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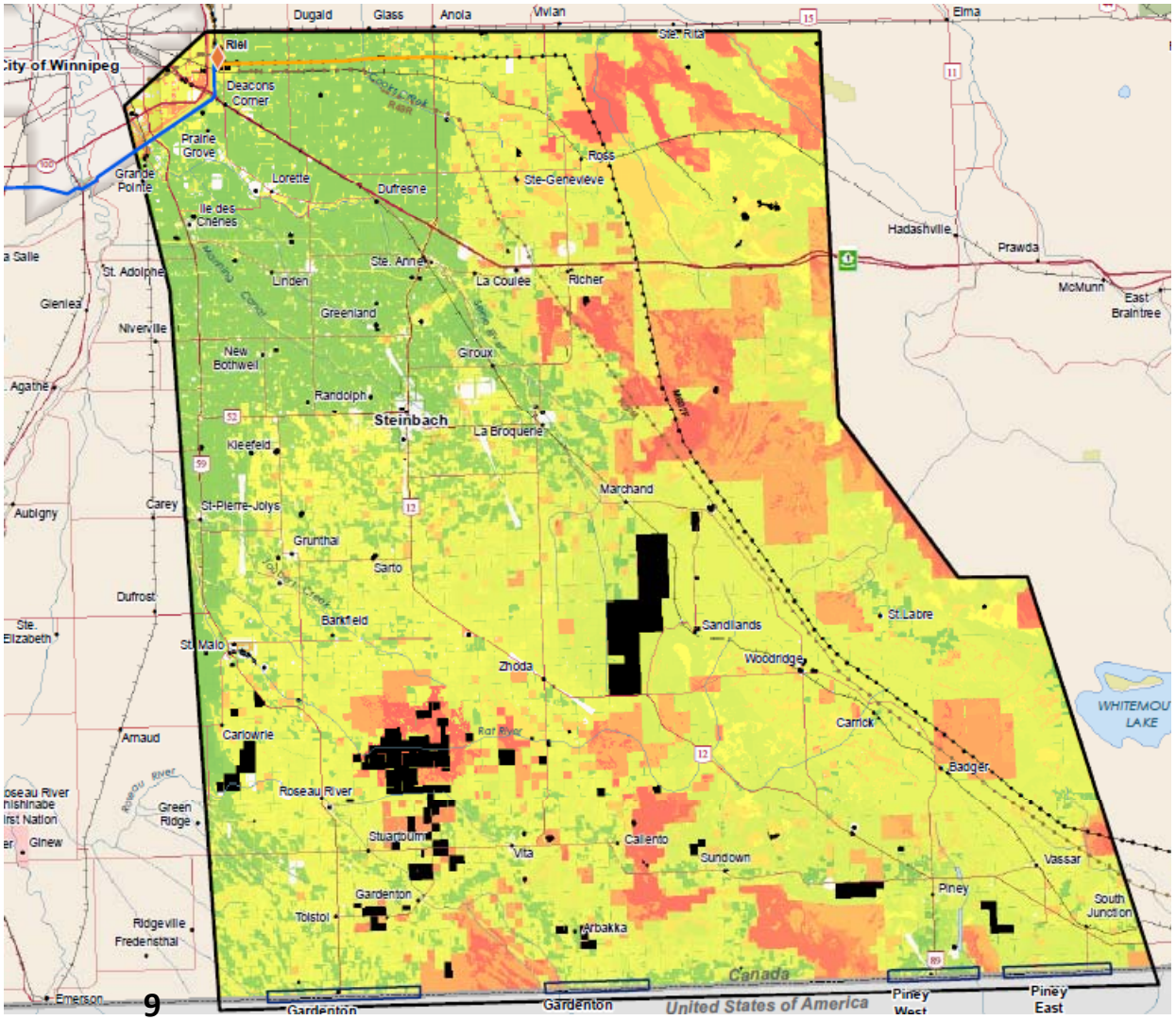
Planning
- Known opportunities and constraints

Suitability Surface (Natural)



0 — 9

High — Low

EIS: Chapter 5, Map 5-6

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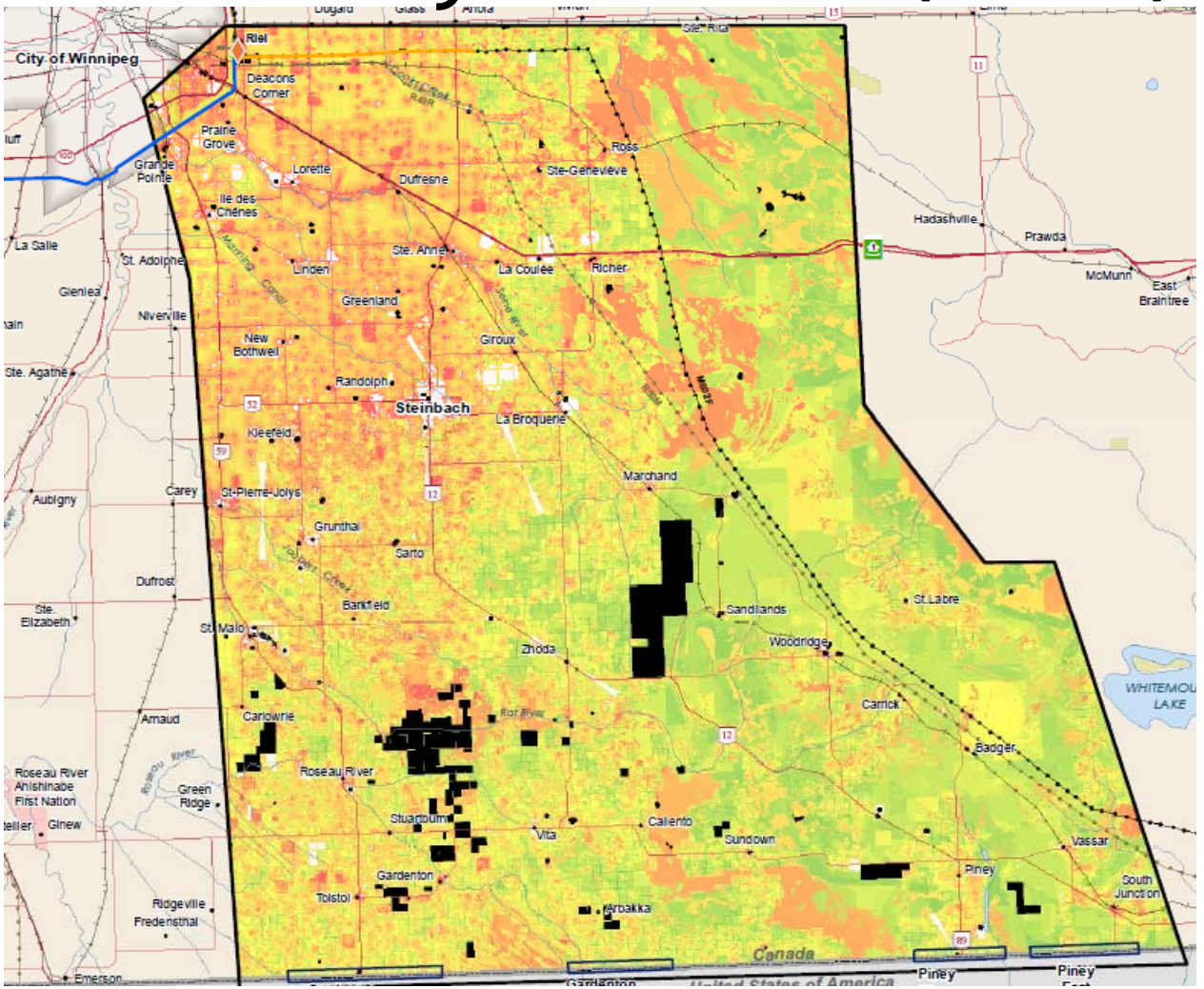
Planning

- Known opportunities and constraints

Suitability Surface (Built)



0 — 9

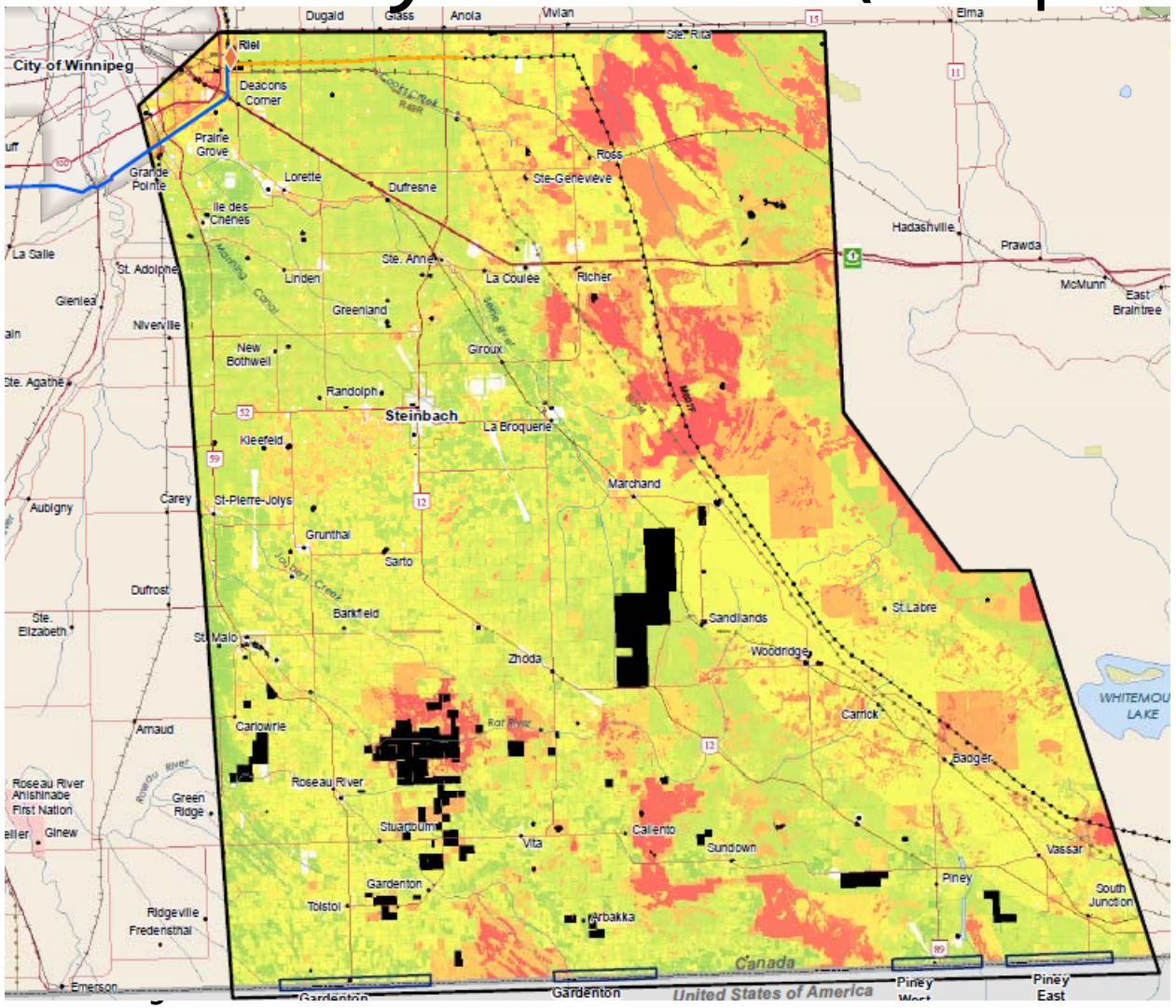
High — Low

EIS: Chapter 5, Map 5-7

Planning

- Known opportunities and constraints

Suitability Surface (Simple Avg)



0

High — Low

EIS: Chapter 5, Map 5-8

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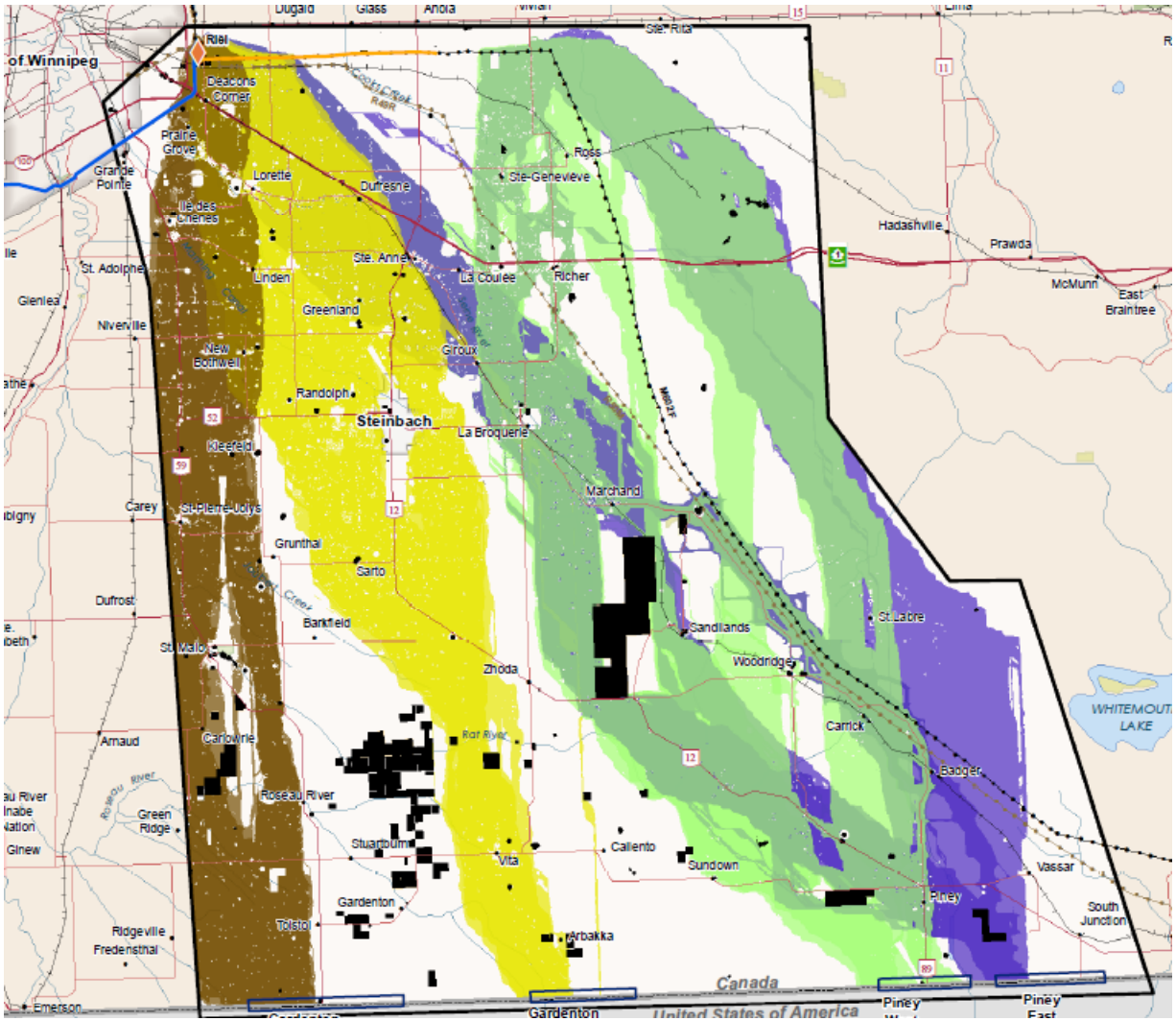
Planning
- Known opportunities and constraints

ACM: Composite Corridors



EIS: Chapter 5, Map 5-10

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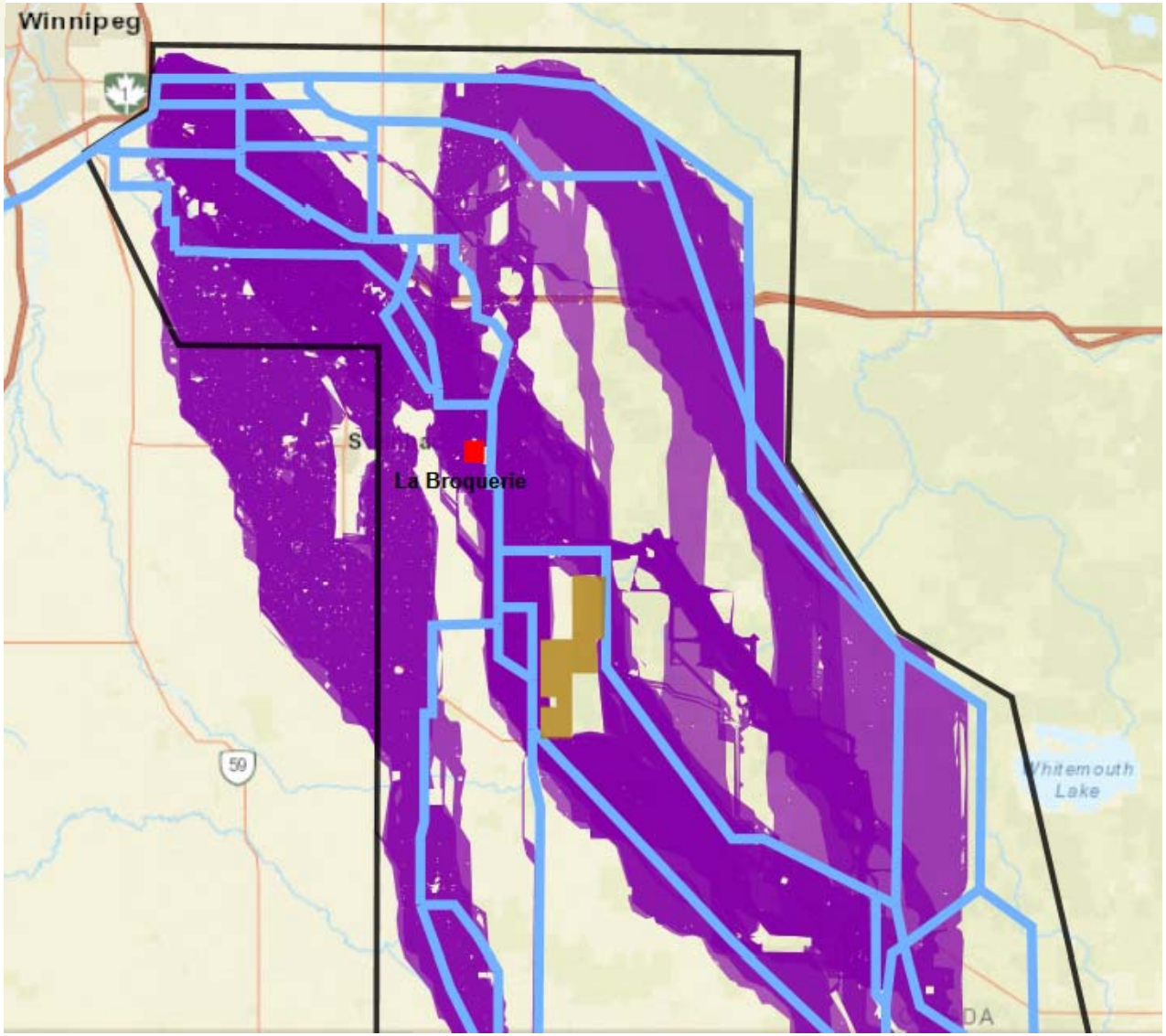
Questions?

Planning
- Known opportunities and constraints

Route Development



- Segments vs routes
- Constraints / Area of least preference
- Field alignment
- Angle towers

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Route Planning

- Consideration of constraints on landscape
- Stakeholder feedback
- Learning from past projects

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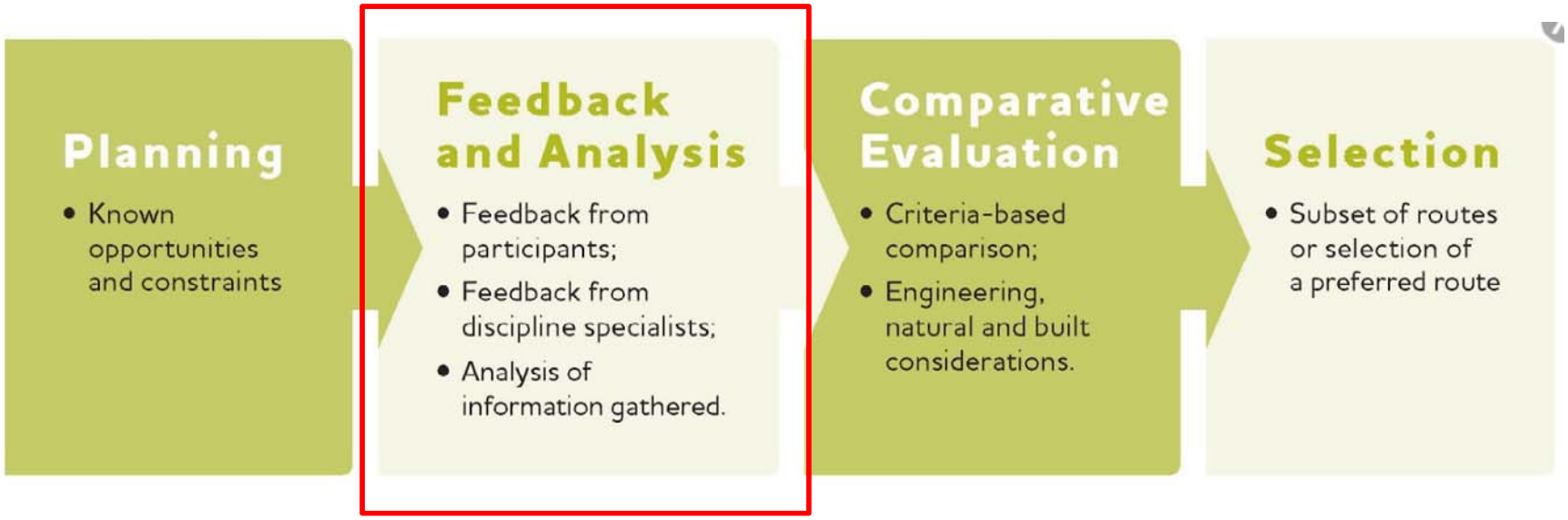
Planning
• Known opportunities and constraints
Feedback and Analysis
• Feedback from participants;
• Feedback from discipline specialists;
• Analysis of information gathered.
Comparative Evaluation
• Criteria-based comparison;
• Engineering, natural and built considerations.
Selection
• Subset of routes or selection of a preferred route

Engagement Activities

- Public engagement, First Nations and Metis Engagement
- Over 4 rounds spanning >3 years
- Over 1500 participants
- 13 First Nations, the MMF, and four Aboriginal organizations

See EIS: Chapter 3 & 4 for more detail

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Engagement Feedback

- Route segments are reviewed by public, First Nations, Metis, other interested parties, discipline specialists
- Feedback informed elements such as:
  - Routing Criteria / Weightings
  - Route segment locations (mitigative segments)
  - Route Decisions

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Mitigative Segments

- Mitigative segments are developed
  - In response to feedback / concerns
  - Direct recommendations
- Reviewed by Routing Team for viability
- Included analysis as part of set of Evaluative routes

See EIS: Tables 5-5, 5-23, 5-24 for more details

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Feedback and Analysis

- Feedback from participants;
- Feedback from discipline specialists;
- Analysis of information gathered.

Mitigative Segments

Figure 5-5 Example of a Mitigative Segment

(The preferred route (purple line) was adjusted (blue line) to avoid homes and eliminate two crossings of the Trans Canada Highway)

EIS: Chapter 5, Figure 5-5 p5-28

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Feedback and Analysis

- Feedback from participants;
- Feedback from discipline specialists;
- Analysis of information gathered.

Mitigative Segments

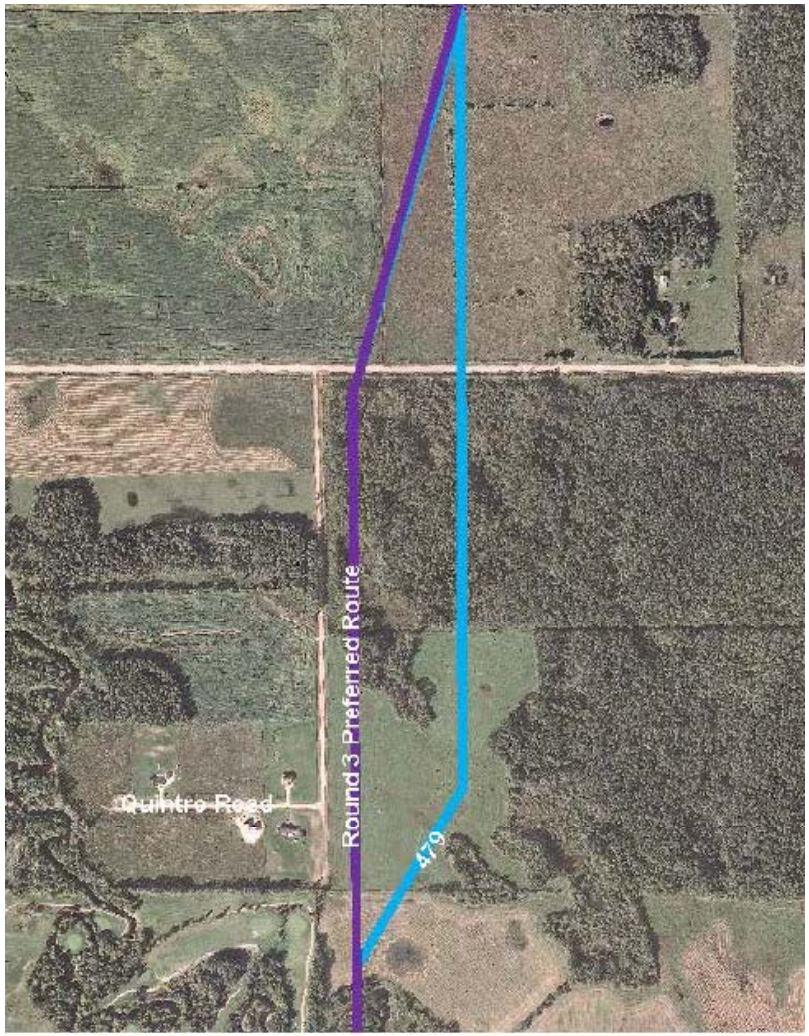

Figure 5-28 Segment 479 (blue line) was Created to Maintain Separation between Quintro Road and an Existing Subdivision to the East

EIS:s5.6.4 , p5-101

Feedback and Analysis

- Feedback from participants;
- Feedback from discipline specialists;
- Analysis of information gathered.

Mitigative Segments

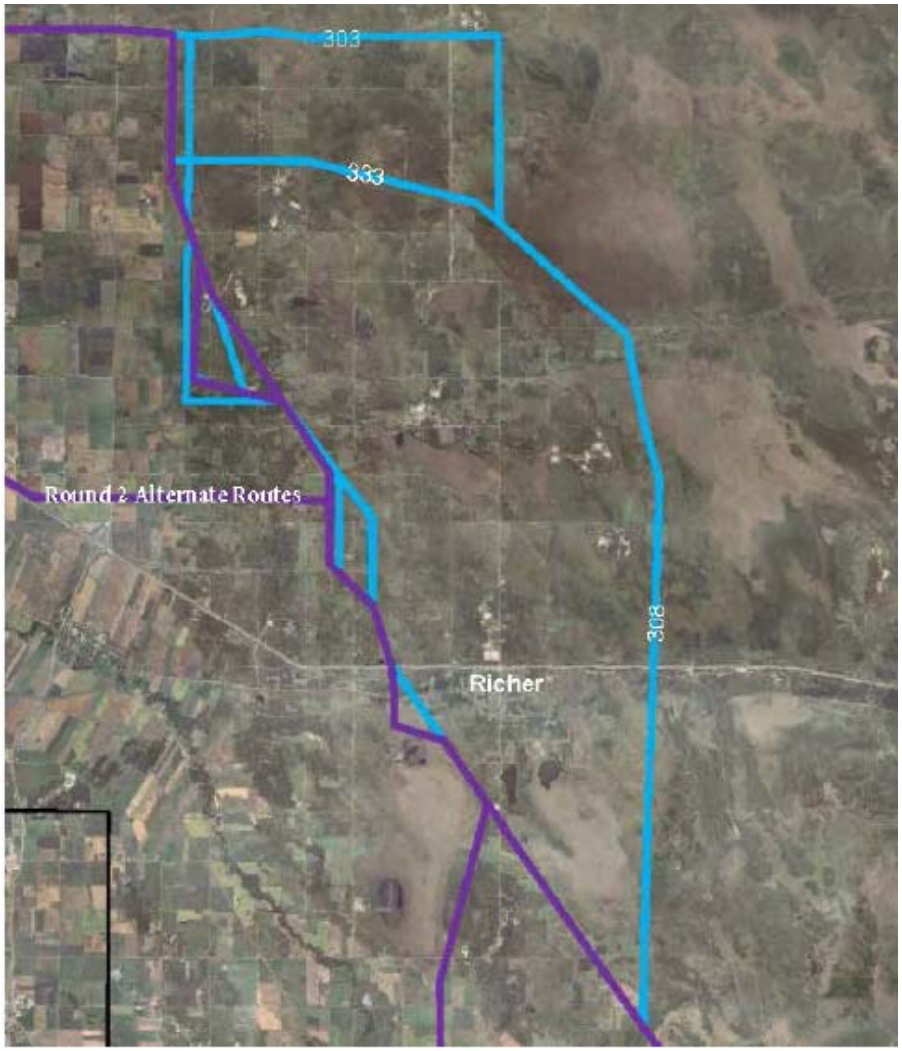

Figure 5-12 Segments 303/308/333 (blue lines) were part of an Alternative Proposed by Affected Landowners

EIS:s5.5.3 , p5-66

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Feedback and Analysis

- Feedback from participants;
- Feedback from discipline specialists;
- Analysis of information gathered.

Mitigative Segments

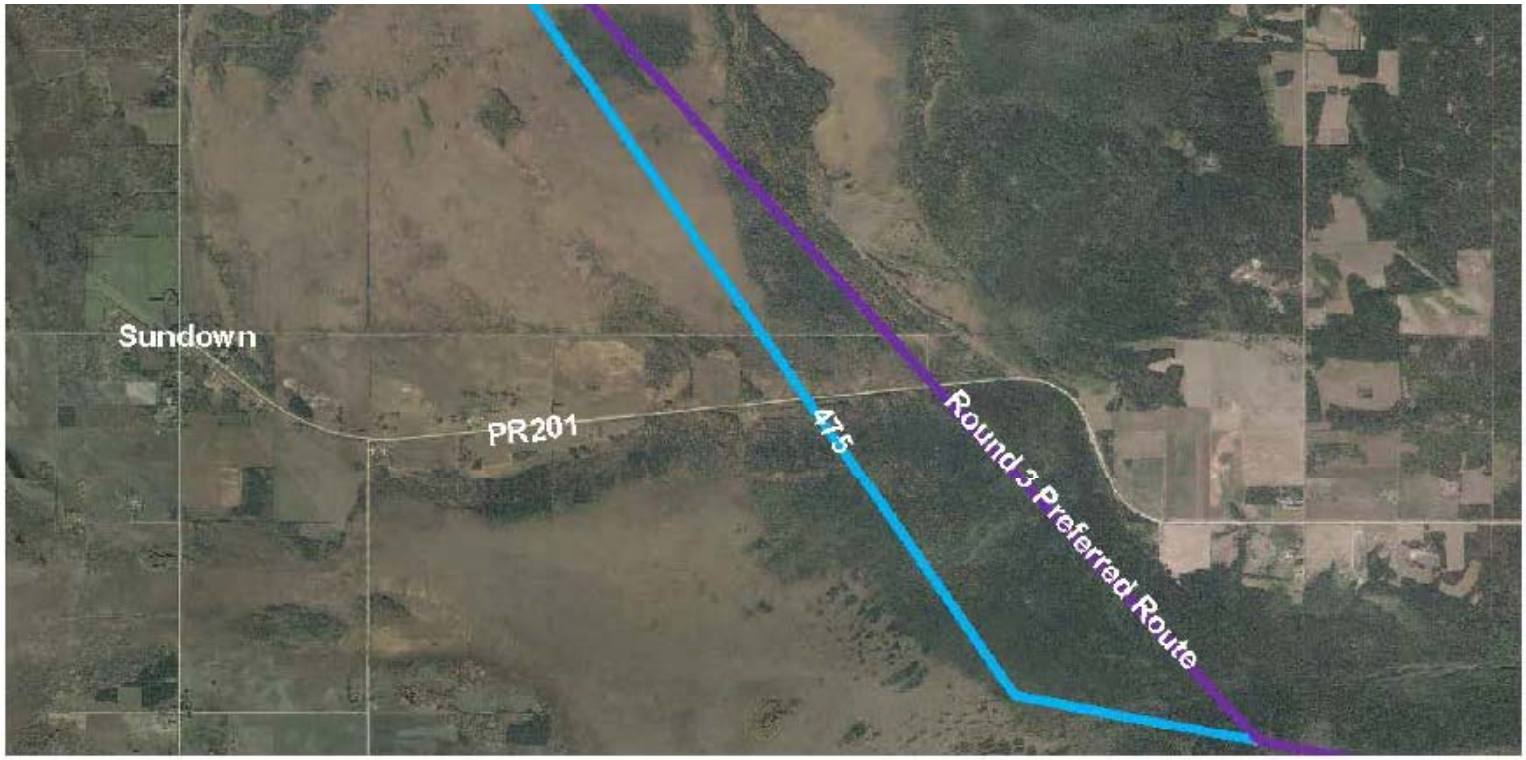

Figure 5-31 **Segment 475 (blue line) was Created to Address Concerns Raised Regarding First Nations Traditional and Cultural Land Use on Privately Held Property**

EIS:s5.6.4 , p5-104

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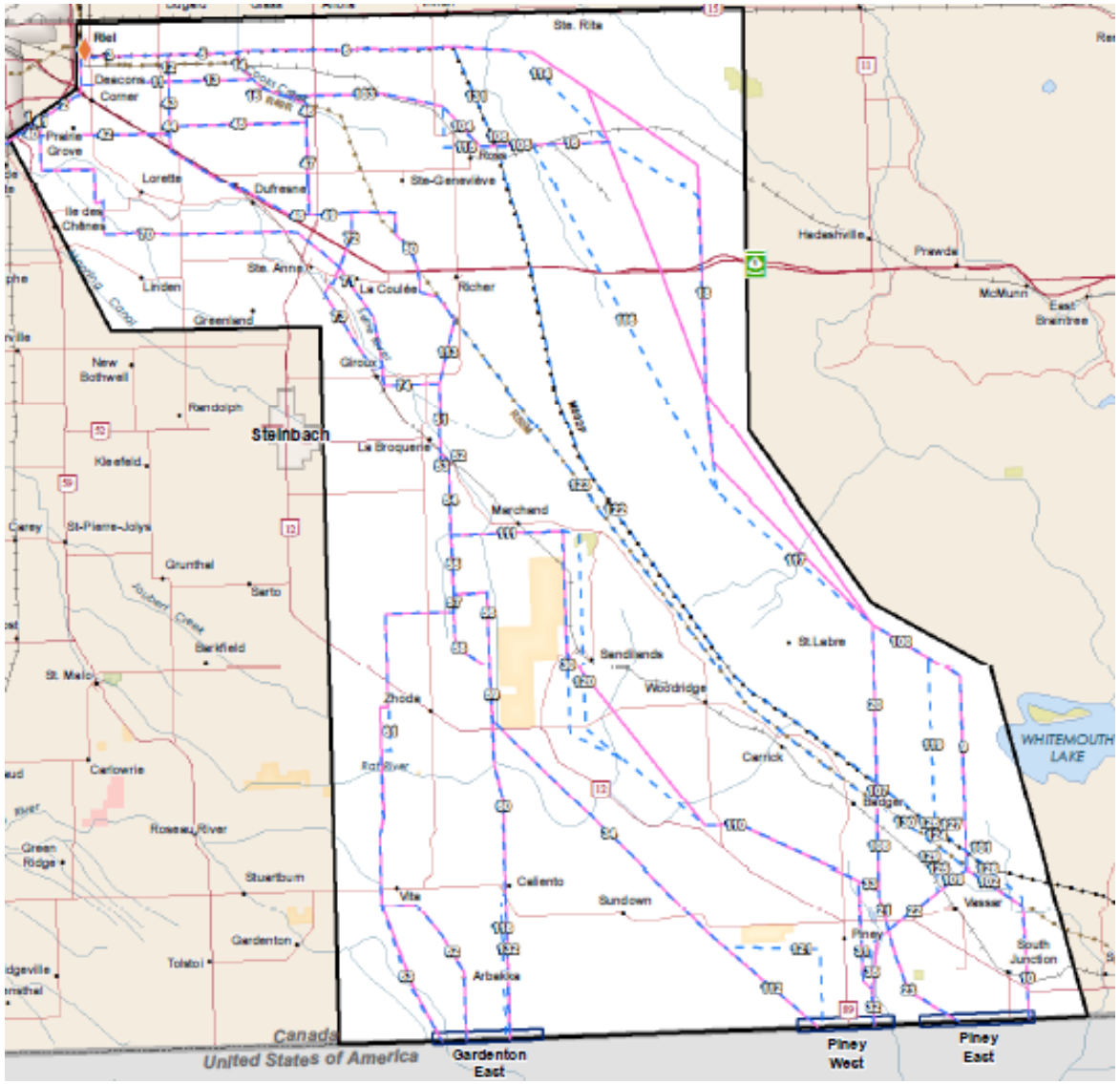
Evaluation Routes



Alternative route

Evaluation route

EIS: Chapter 5, Map 5-11

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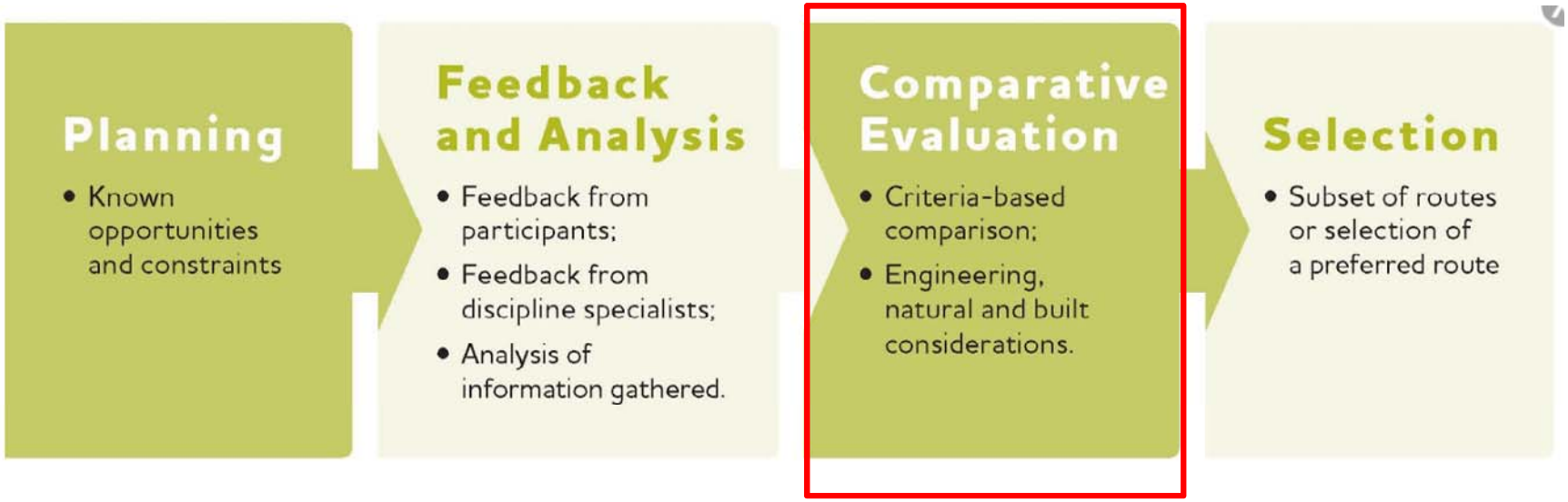
Planning
• Known opportunities and constraints
Feedback and Analysis
• Feedback from participants;
• Feedback from discipline specialists;
• Analysis of information gathered.
Comparative Evaluation
• Criteria-based comparison;
• Engineering, natural and built considerations.
Selection
• Subset of routes or selection of a preferred route

Comparative Evaluation Models

Alternate Route Evaluation Model (AREM)

- Review a large number of routes and select a subset for further consideration
- Considers 100,000s of options

Preference Determination Model (PDM)

- Select a preferred option from a subset of routes
- Considers 3-5 options

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Comparative Evaluation

- Criteria-based comparison;
- Engineering, natural and built considerations.

Alternate Route Evaluation Model

Criteria	Weight
Built	
Relocated Residences - Within ROW	27.1%
Potential Relocated Residences (75m) - Edge of ROW	17.1%
Proximity to Residences (75 - 250m) - Edge of ROW	6.4%
Proposed Developments - Within ROW	15.5%
Current Agricultural Land Use (Value) - ROW	4.4%
Land Capability for Agriculture (Value) - ROW	2.2%
Proximity To Intensive Hog Operations (Acres) - ROW	3.3%
Diagonal Crossings of Agriculture Crop Land (Km)	9.9%
Proximity to Buildings & Structures (100m) - EOROW	3.2%
Public Use Areas (250m) - EOROW	7.4%
Historic / Cultural Resources (250m) - Edge of ROW	1.8%
Potential Commercial Forest (Acres) - ROW	1.7%
Natural	
Natural Forests (Acres) - ROW	8.0%
Intactness	25.9%
Stream/River Crossings - Centerline	16.4%
Wetland Areas (Acres) - ROW	16.4%
Conservation & Designated Lands (Acres) - ROW	33.3%
Engineering	
Seasonal Construction & Maintenance Restrictions (Value) - ROW	16.5%
Index of Proximity to Existing 500kV Lines	29.5%
Accessibility	16.5%
Total Project Costs	33.0%
Existing Transmission Line Crossings (#)	4.5%

EIS: Table 5-6; p 5-30

Each perspective totals 100%

Manitoba Hydro

Comparative Evaluation

- Criteria-based comparison;
- Engineering, natural and built considerations.

AREM Outputs

FEATURE	Route JL	Route RG
Built		
Relocated Residences (Within ROW)	0	0
Normalized	0.00	0.00
Potential Relocated Residences (100m from EOROW)	14	16
Normalized	0.43	0.71
Proximity To Residences (100m - 400m from EOROW)	81	64
Normalized	0.74	0.29
Proposed Residential Developments - Within ROW	4	0
Normalized	1.00	0.00
Current Agricultural Land Use (Value)	800	771
Normalized	0.38	0.30
Land Capability for Agriculture (Value)	1560	1492
Normalized	0.68	0.40
Proximity To Intensive Hog Operations (Acres)	2623	1813
Normalized	1.00	0.26
Diagonal Crossings of Prime Agricultural Land (Acres)	62	51
Normalized	0.77	0.55
Proximity to Buildings & Structures (100m) - EOROW	14	11
Normalized	0.38	0.15
Public Use Areas (250m) - EOROW	20	14
Normalized	0.86	0.00
Historic Resources (250m) - EOROW	9	6
Normalized	1.00	0.00
Potential Commercial Forest (Acres)	28	50
Normalized	0.00	0.70
Natural		
Natural Forests (Acres)	239	278
Normalized	0.00	1.00
Intactness	351	342
Normalized	0.84	0.76
Stream / River Crossings - Centerline	15	11
Normalized	1.00	0.00
Wetland Areas (Acres) - ROW	211	228
Normalized	0.57	1.00
Conservation & Designated Lands (Acres)	165	223
Normalized	0.22	0.79

- Values normalized
- Range from 0-1
  0 = 'best'
  1= 'worst'

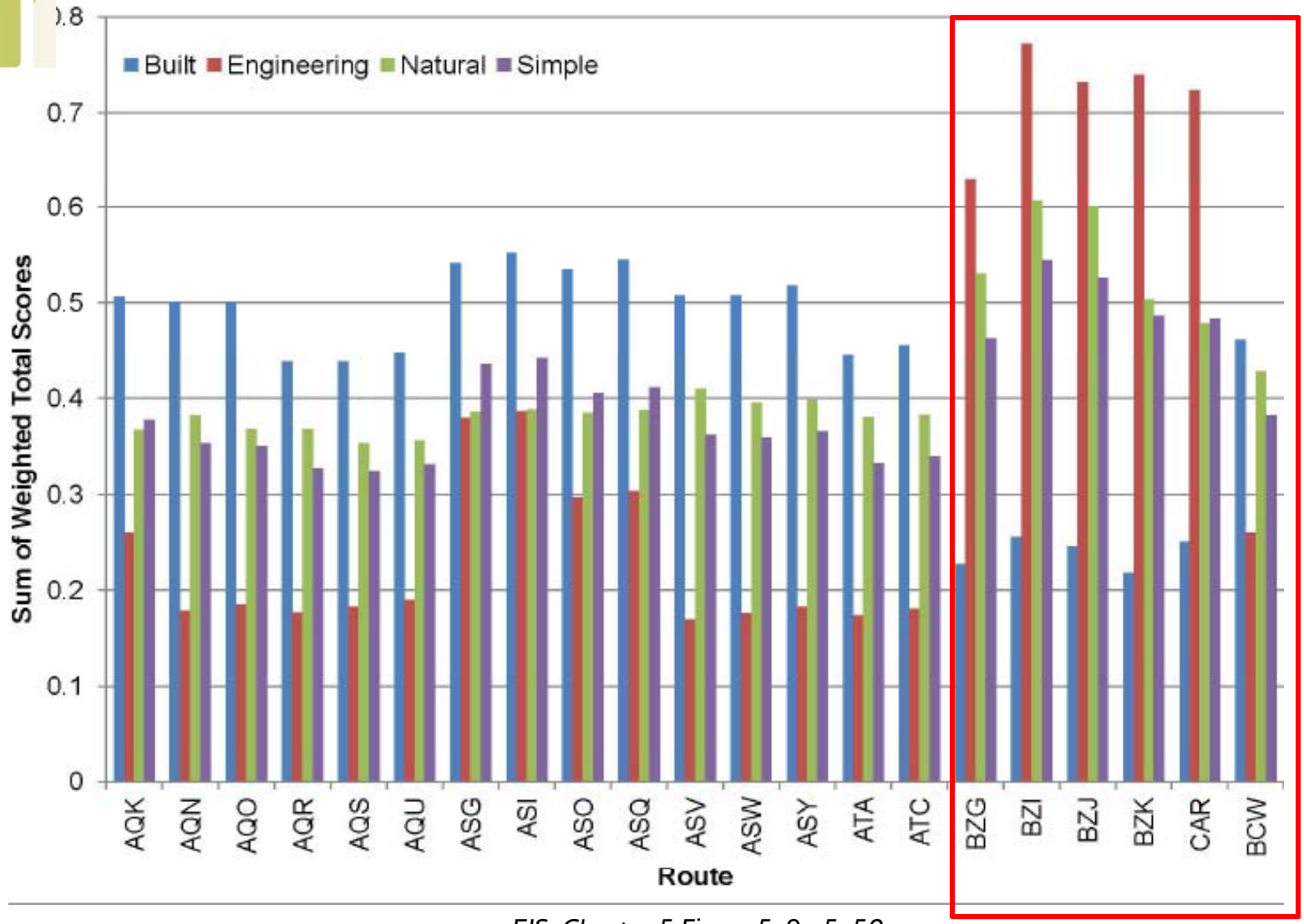
EIS: Table 5-6; p 5-30

Manitoba Hydro

Comparative Evaluation

- Criteria-based comparison;
- Engineering, natural and built considerations.

AREM Outputs



EIS: Chapter 5,Figure 5-9 p5-50

Preference Determination Model

Criteria	Percent	Description
Cost	40%	Cost was based on high-level construction cost estimates used for relative comparison, defined in the alternative route evaluation criteria (values do not represent actual cost estimates for the Project).
Community	30%	Input received from the public and First Nation and Metis engagement processes.
Schedule Risks	5%	Includes consideration of the need for additional approvals, seasonality of construction, overall level of complication expected that could result in delays.
Environment (Natural)	7.5%	Consideration of the natural based statistics from the alternative route evaluation criteria, further interpretation by the Project team and additional information not captured by the criteria that can inform the relative potential effect on the natural environment of different route alternatives.
Environment (Built)	7.5%	Consideration of the built statistics from the alternative route Evaluation criteria, further interpretation by the Project team and additional information not captured by the criteria that can inform the relative potential effect on the built environment of different route alternatives.
System Reliability	10%	Proximity of the route to existing 500 kV lines. Informed by considering the statistic calculated during route evaluation (index of proximity), as well as the number of crossing points with other high voltage transmission lines

EIS: Table 5-9; p 5-39

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Route Evaluation Workshop

- Project team including staff to represent each major perspective
  - Biophysical specialists (Stantec, MH)
  - Socioeconomic specialists (Consultants, MH)
  - Engineering staff (Project management, construction, operations/maintenance)
  - Engagement staff (public and FNMEP)

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Route Evaluation Workshop

Environment (natural)	TC	3	Route TC crosses wetlands, ecological reserves and more natural areas.
	UM	1	Route UM crosses the least natural area.
	SU	1.5	Route SU crosses more natural area than UM (but less than SY and TC).
	UC	1.5	Route UC crosses more natural area than UM (but less than SY and TC).
	SY	2	Route SY crosses more forested land, requiring more clearing and has more river crossings.

EIS: Chapter 5 Table 5-10; p 5-40

Manitoba Hydro

Comparative Evaluation

- Criteria-based comparison;
- Engineering, natural and built considerations.

Route Evaluation Workshop

Table 5-11 Preference Determination, SLTC to Gardenton

(showing relative scores, weighted scores and total sum; lower values are preferred for routing)

Criteria	Weight	Routes				
		SU	SY	TC	UC	UM
Cost[1]	40%	1.25	1.02	1	1.6	1.53
Weighted		0.5	0.41	0.40	0.64	0.61
System Reliability	10%	1	1	1	1	2
Weighted		0.1	0.1	0.1	0.1	0.2
Risk to Schedule	5%	1	1	2	2	3
Weighted		0.05	0.05	0.1	0.1	0.15
Environment (Natural)	7.5%	1.5	2	3	1.5	1
Weighted		0.11	0.15	0.075	0.15	0.23
Environment (Built)	7.5%	2.5	2	1	2	3
Weighted		0.19	0.15	0.075	0.15	0.23
Community	30%	1.5	1.75	1	2	3
Weighted		0.45	0.53	0.3	0.6	0.9
TOTAL		**1.4**	**1.39**	**1.05**	**1.74**	**2.32**
RANK		**3**	**2**	**1**	**4**	**5**

NOTE:
[1] A scaling factor was used to determine the relative score for each route.

EIS: Chapter 5, Table 5-11 p5-42

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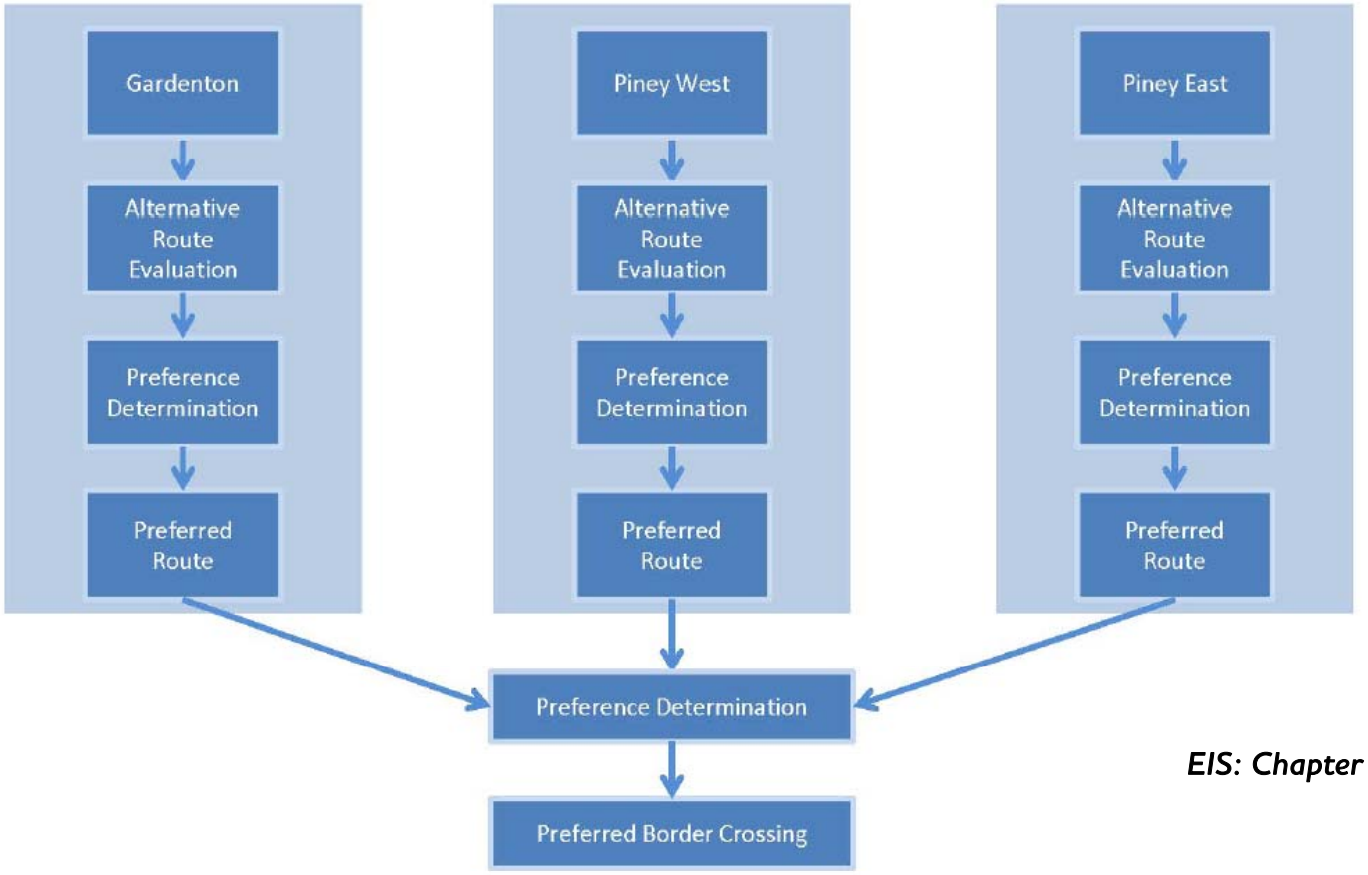
Border Crossing Determination



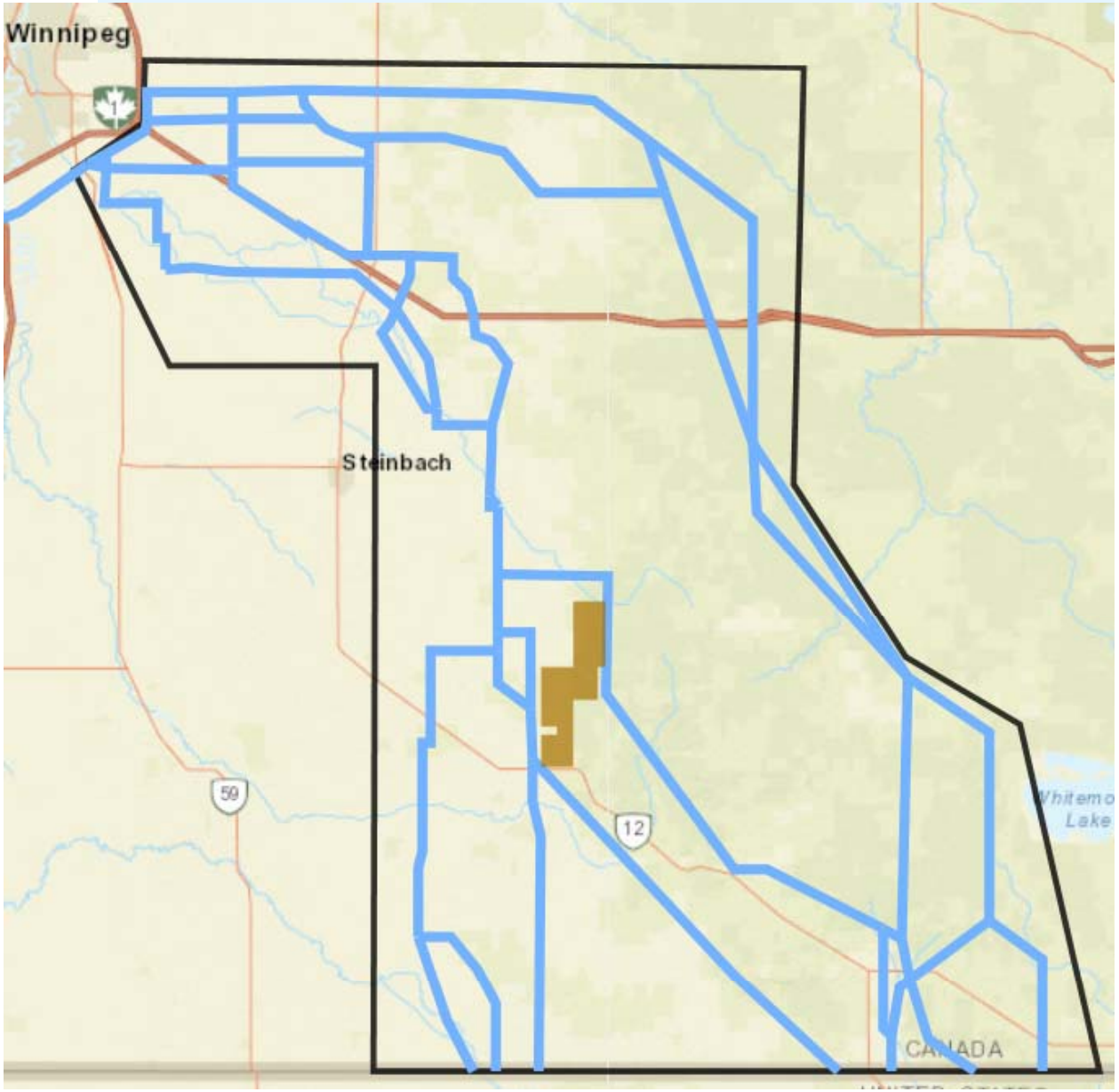
EIS: Chapter 5, Page 5-32

Figure 5-6 Round 1 Alternative Route Evaluation Flow Chart

Round 1

Determine a border crossing

Alternatives presented

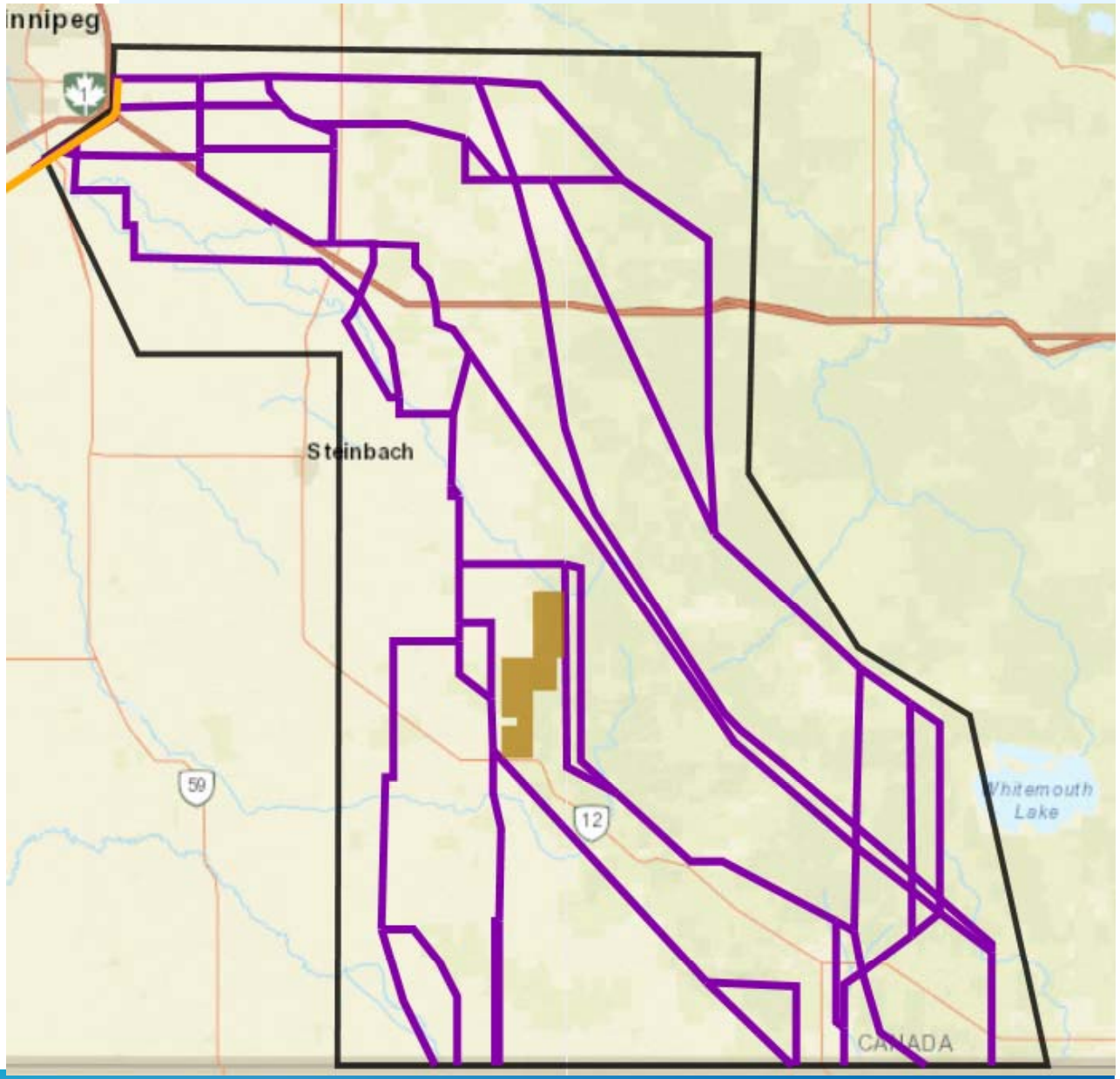


EIS: Chapter 5, Map 5-11

Round 1

Determine a border crossing

Alternatives evaluated



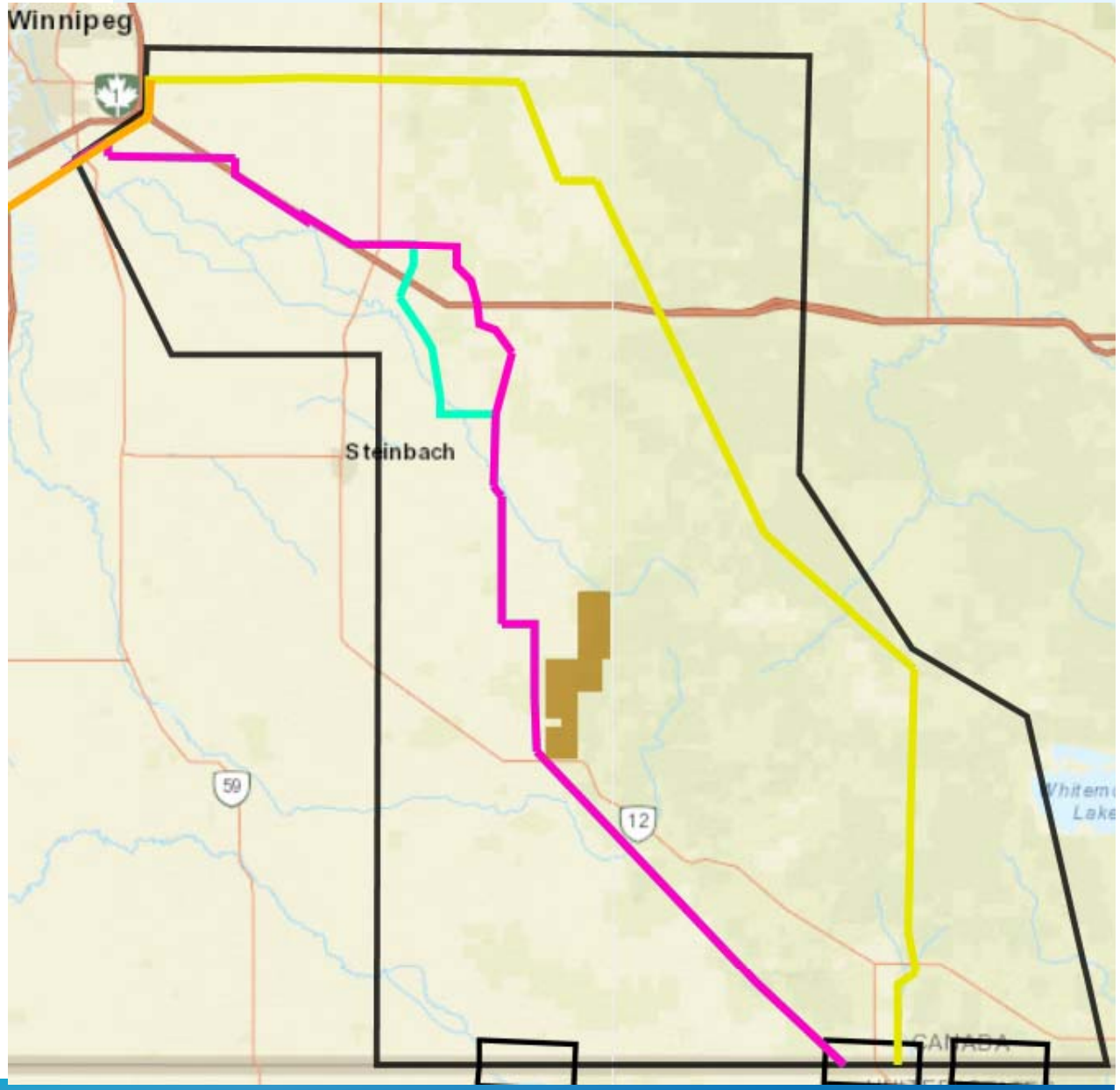
EIS: Chapter 5, Map 5-11

Round 1

Determine a border crossing

Finalists evaluated

Border Crossing Selected

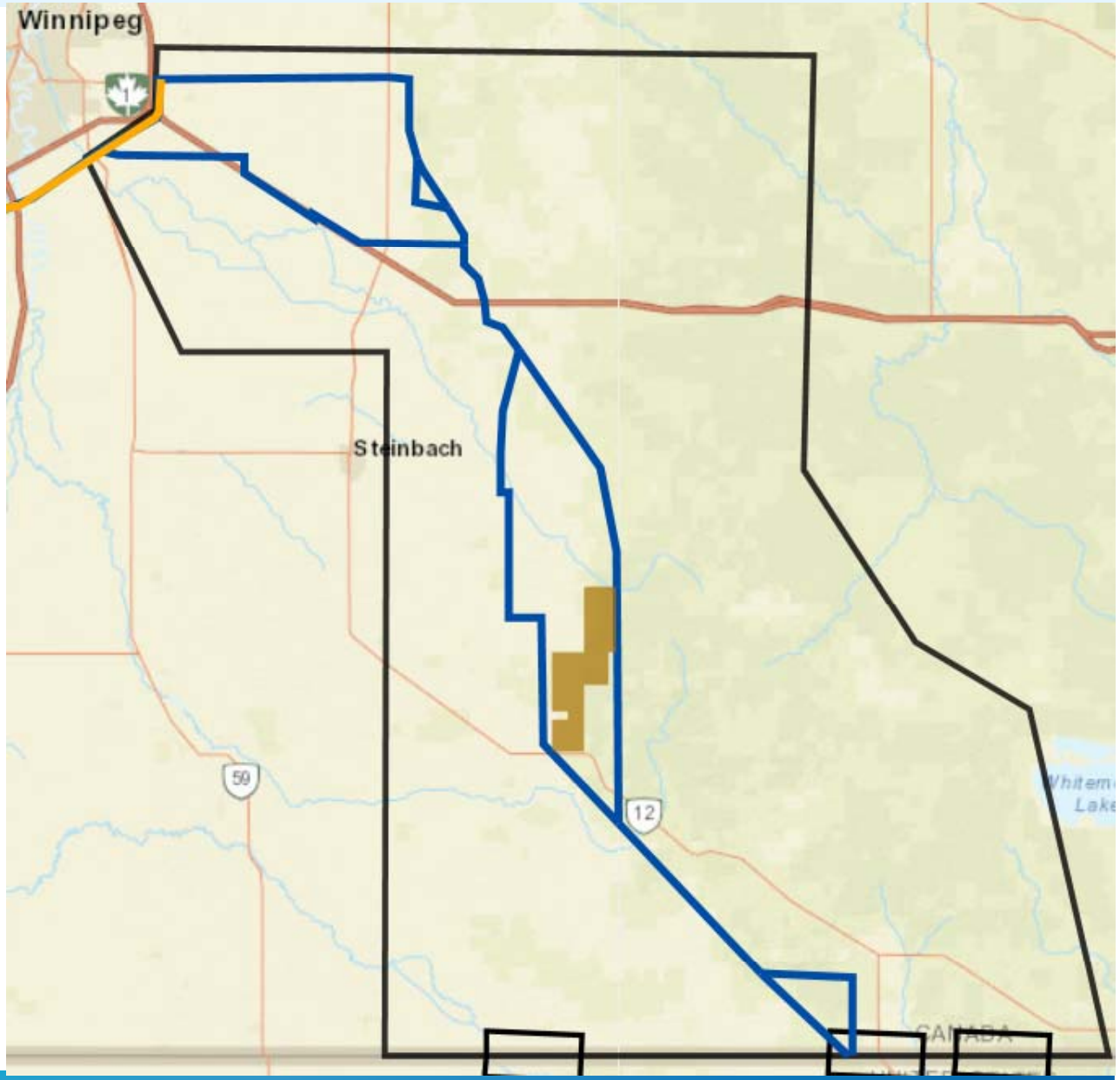


EIS: Chapter 5, Map 5-14

Round 2

Determine preferred route to border crossing

Alternatives presented

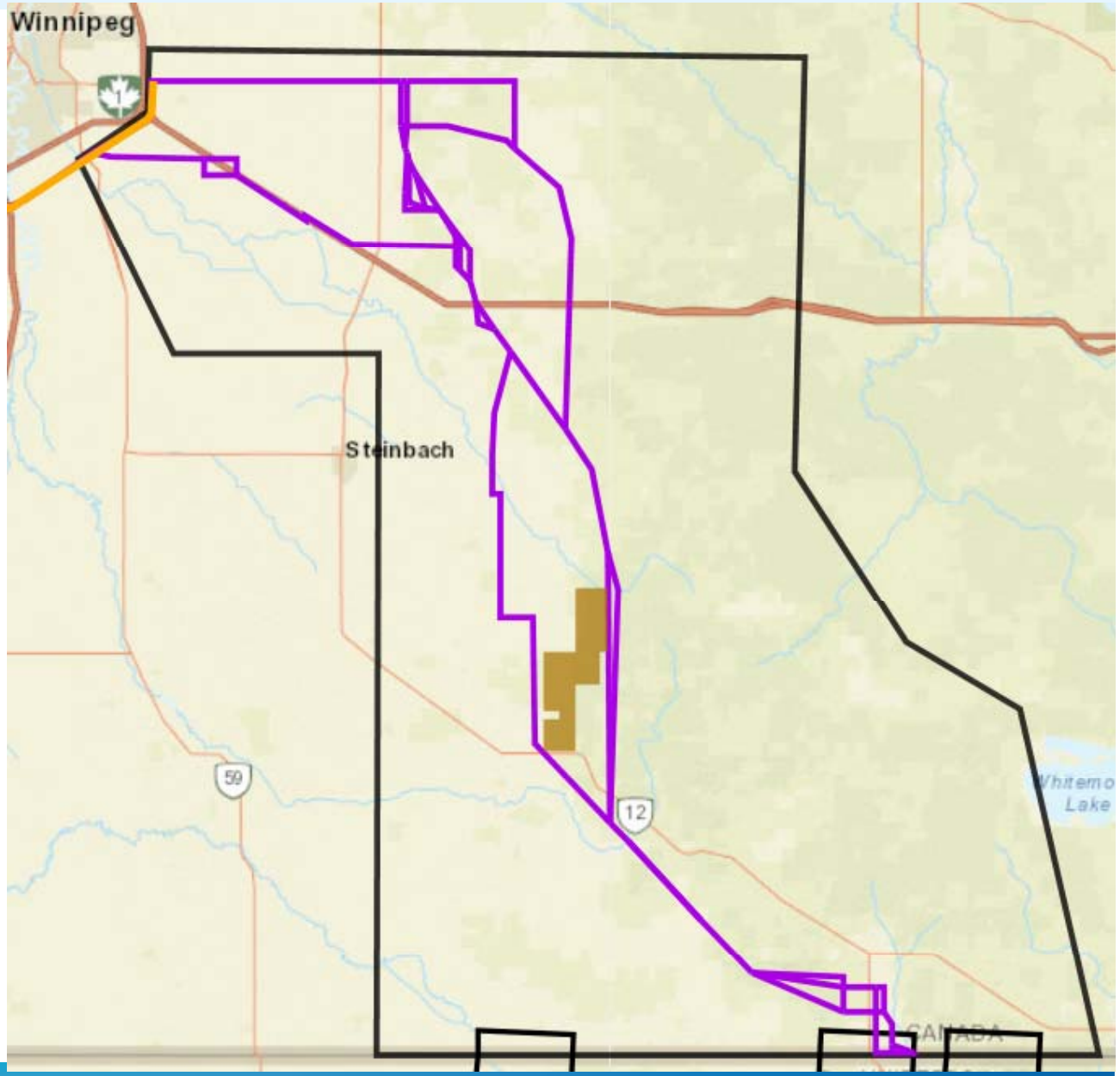


EIS: Chapter 5, Map 5-16

Round 2

Determine preferred route to border crossing

Alternatives evaluated

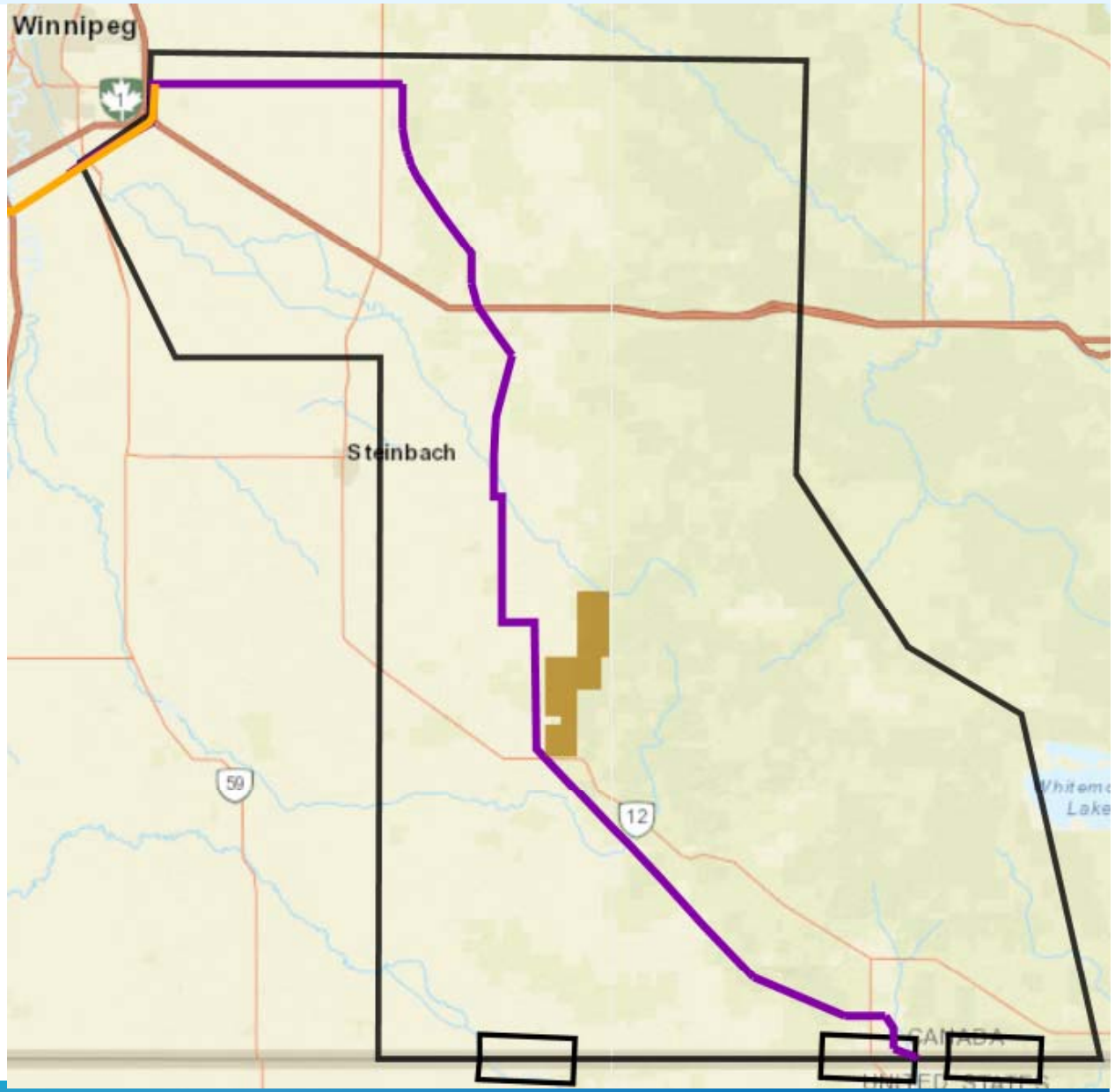


EIS: Chapter 5, Map 5-17

Round 2

Determine preferred route to border crossing

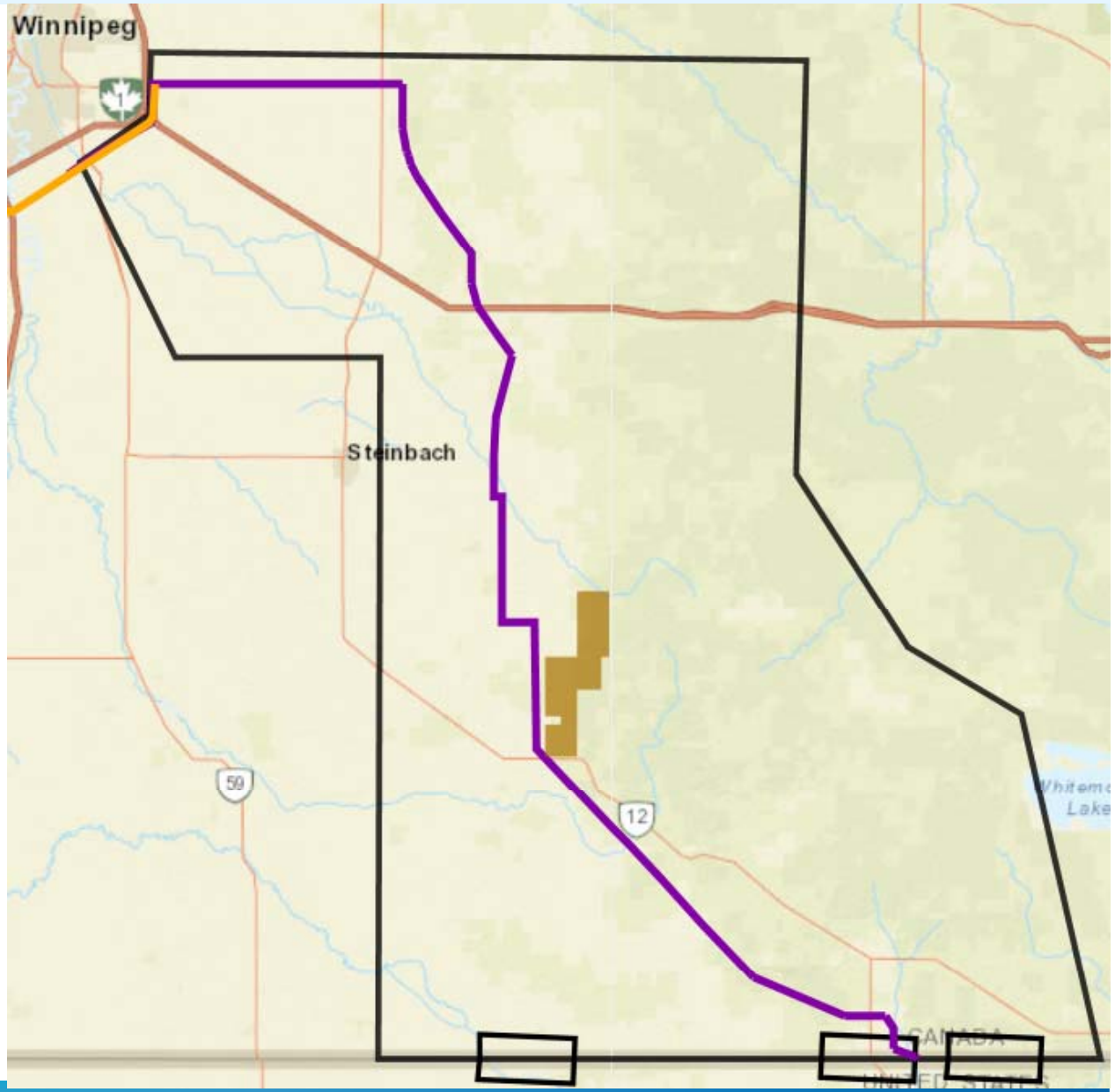
Selected



EIS: Chapter 5, Map 5-19

Round 3 Finalize placement of preferred route

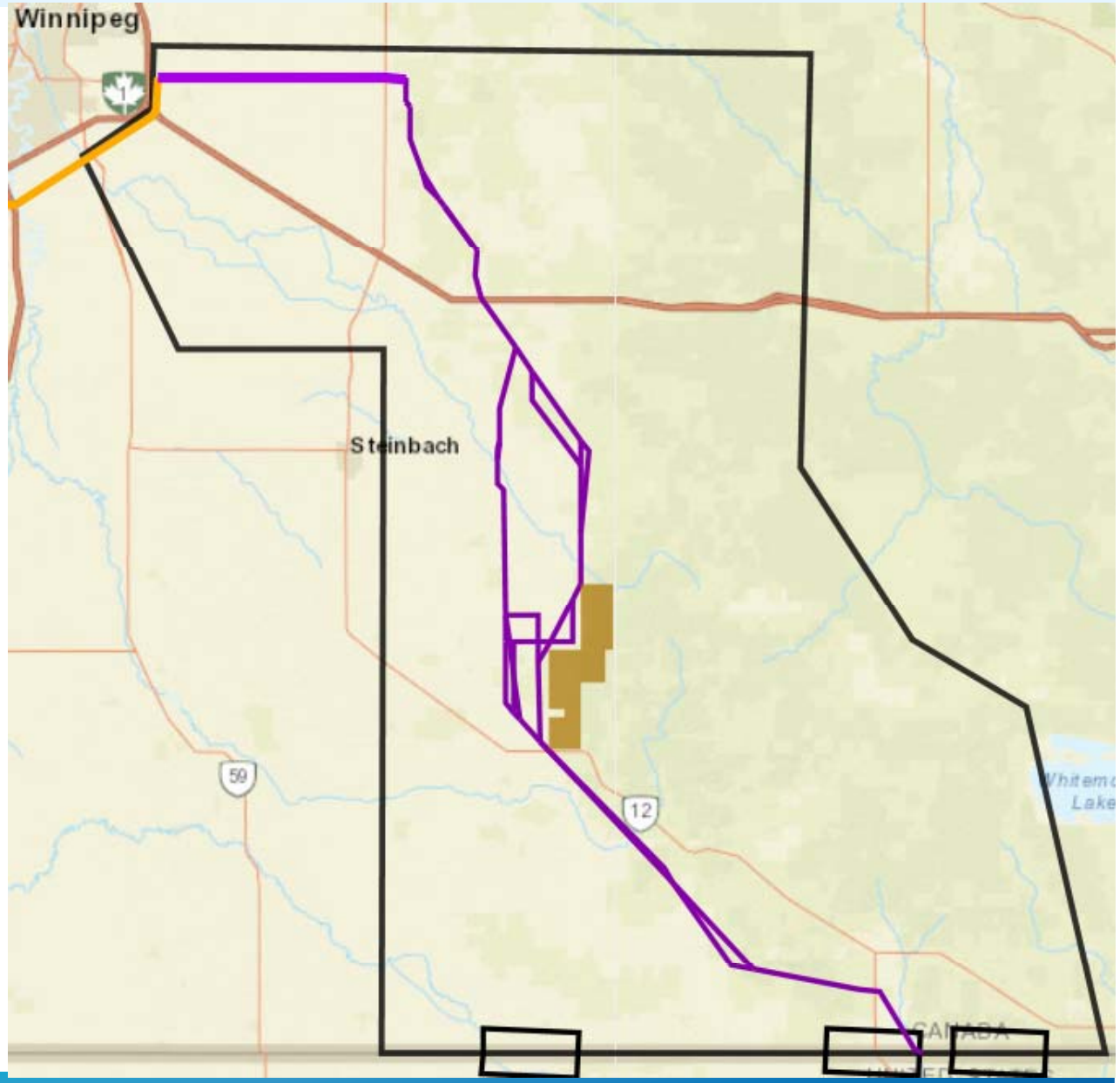
Presented



EIS: Chapter 5, Map 5-20

Round 3 Finalize placement of preferred route

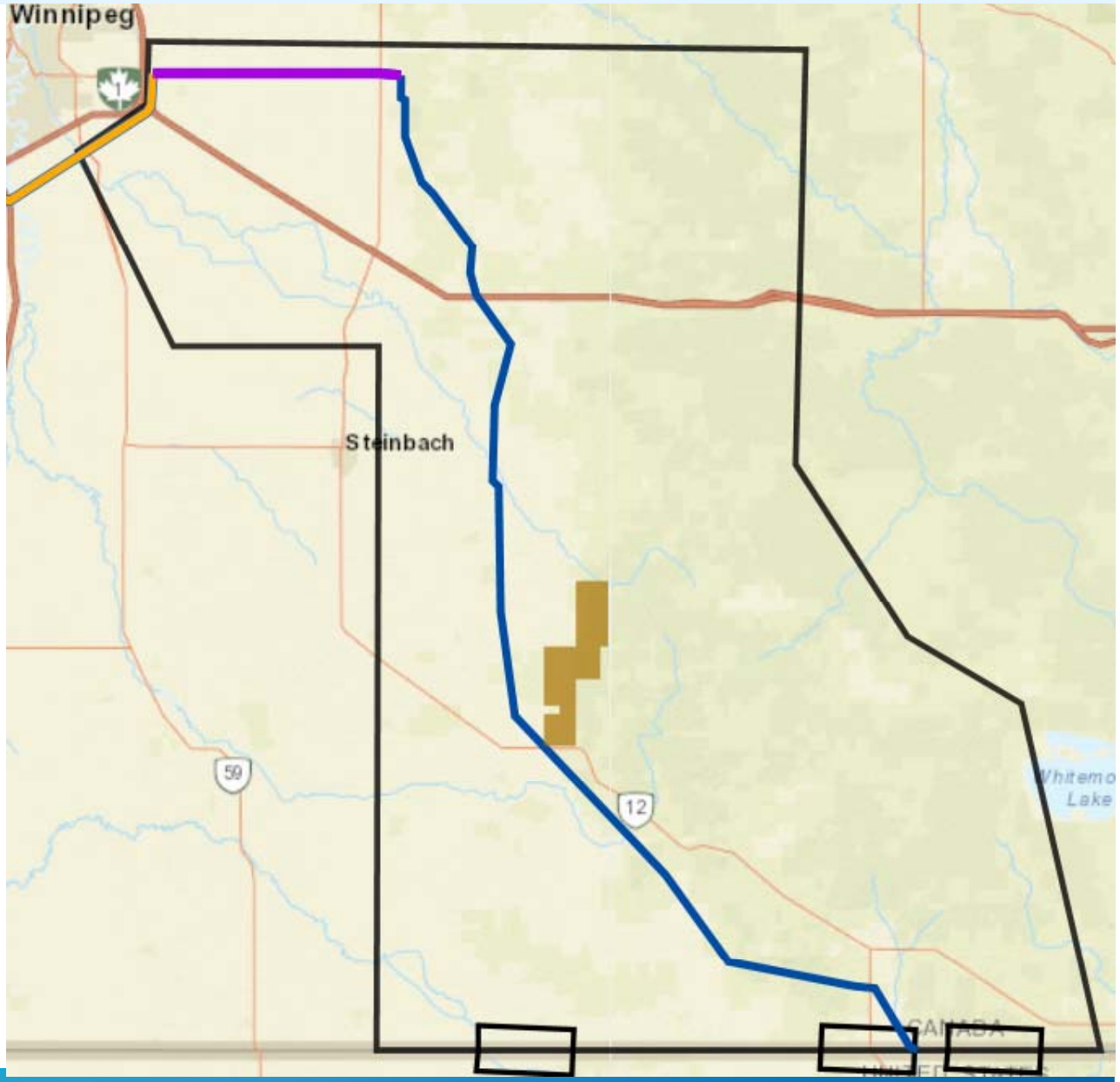
Evaluated



EIS: Chapter 5, Map 5-20

Round 3 Finalize placement of preferred route

Selected



EIS: Chapter 5, Map 5-22

Questions?