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Buffer Design for the Canadian Prairies

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Acknowledgements

- Alan Stewart
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- Kim Fomradas
- Shannon Hall

Outline

- Background & Tool Development
- Buffer Design Tool
 - Preliminary office assessment
 - Field assessment key
 - Outcomes & buffer sizing guidelines
- Opportunities/Gaps

Background to the Project

- Buffers a BMP in the National Farm Stewardship Program
- Problems:
 - Available regional guidelines very general
 - Guidelines formulated for sediments & nutrients
 - No guidance for making adjustments for:
 - stream conditions,
 - complex landscapes,
 - land management
 - Little regional research

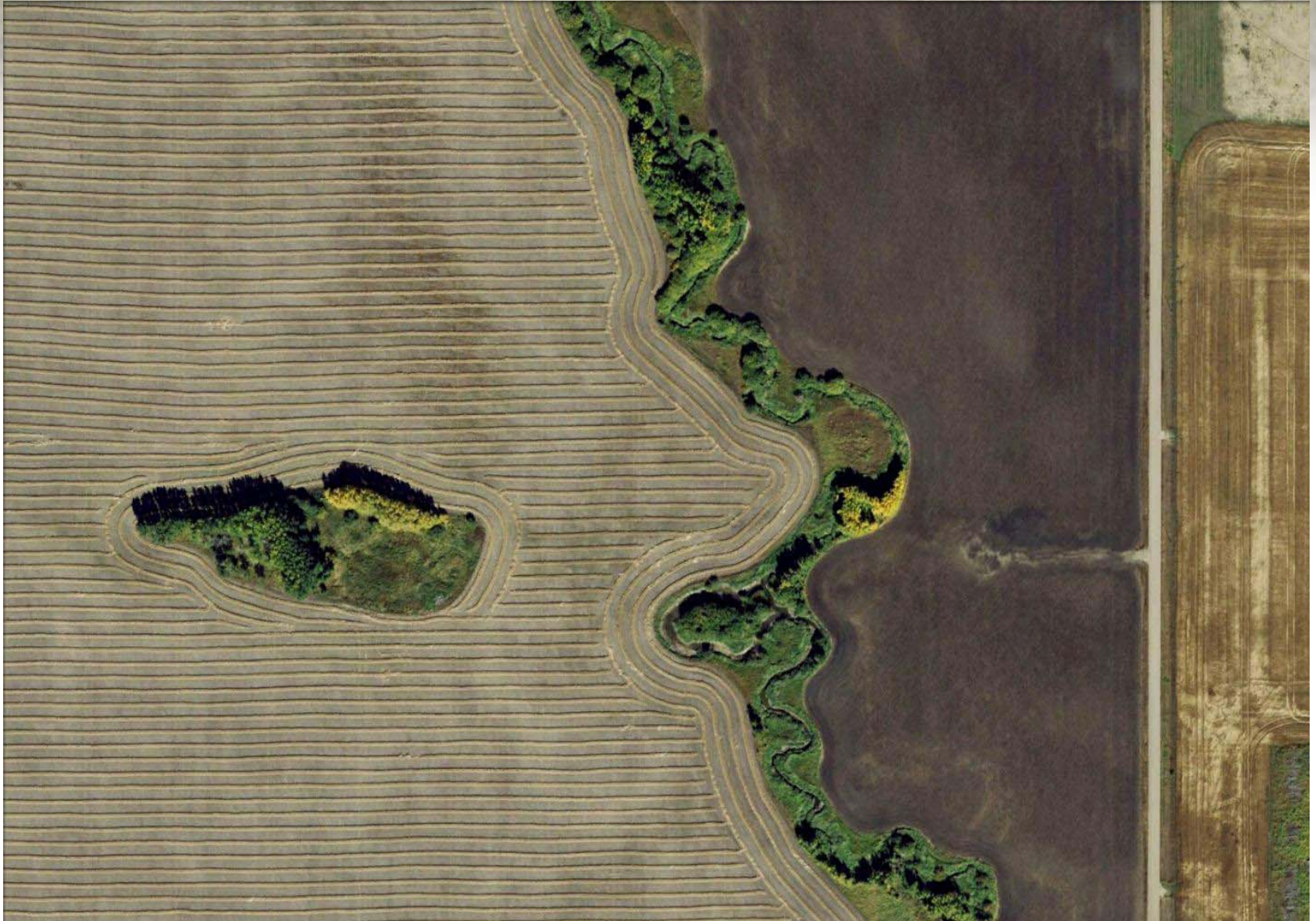
Background to the Project



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Tool Development

- Empirical / analytical & field based approach adopted
 - Dearth of regional research
 - Complex landscape and streamscapes
 - Consideration of land management practices
 - Fit with NFS program delivery (site specific, one-on-one)
- Toured and assessed buffers in the field
 - Subjectively made buffer recommendations
 - Reviewed and systemized our reasoning
 - Developed a logic framework for decision steps
 - Identified interventions and indicators for making recommendations

Tool Components: Preliminary Assessment

- Landowner concerns and objectives
- General setting of site and watershed using, maps, air photos, stream hydrology and other published information

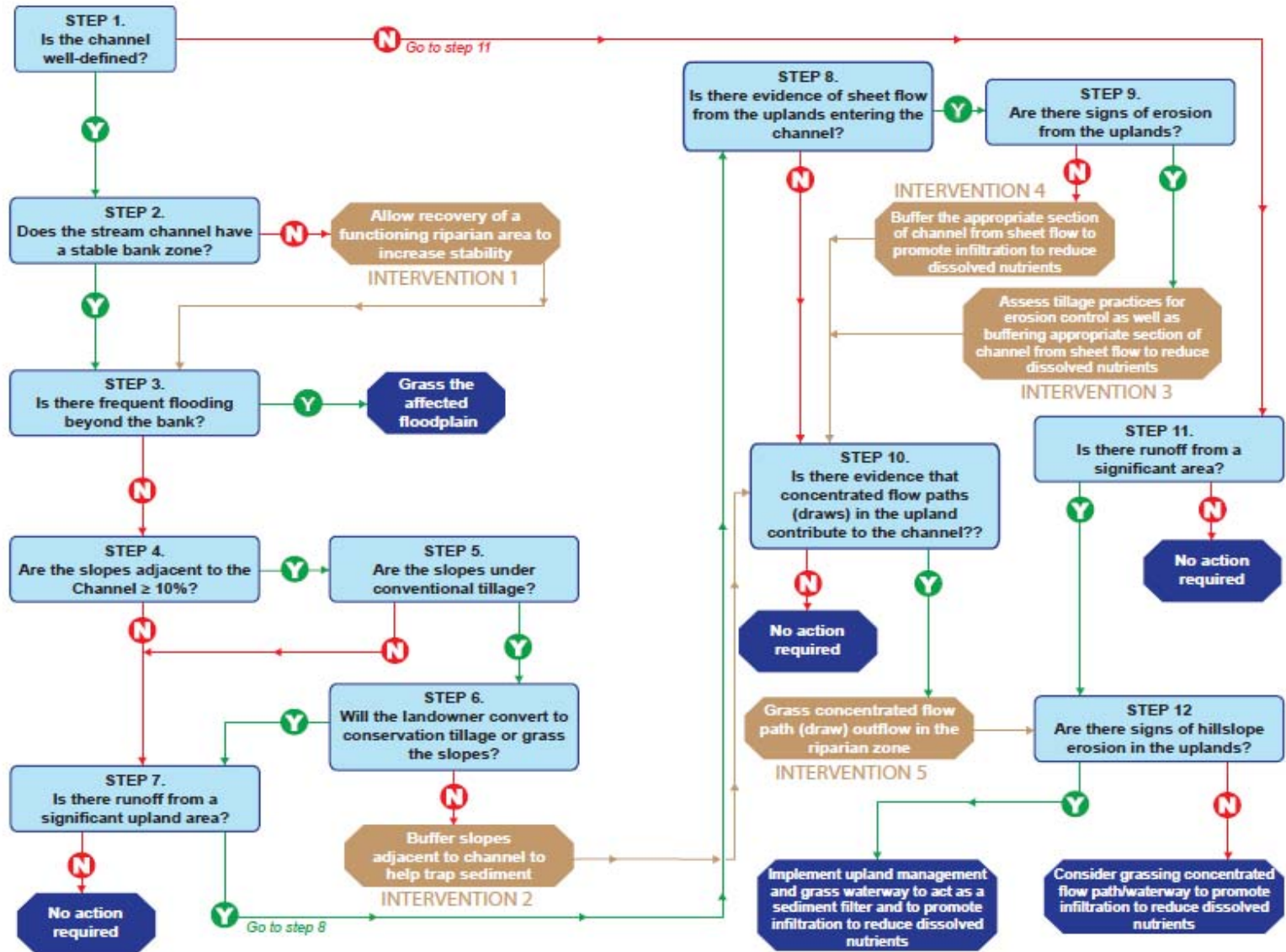


Tool Components: Field Assessment

With landowner; use landowner information to supplement observations

- Walk the full length and both sides of the stream within the property
- Use the buffer design key to assess
 - Stream and stream conditions
 - Stream bank conditions
 - Near-bank conditions
 - Subcatchments and overland flow into the stream

Logic Framework



Elements of the Key – stream & bank conditions

Nature of the channel



Well-defined



Not well-defined

Condition of the banks



Stable bank zone



Unstable bank zone

Elements of the Key – near-stream conditions

Flooding



Slopes and land management adjacent to the stream



Steep slopes and intensive tillage



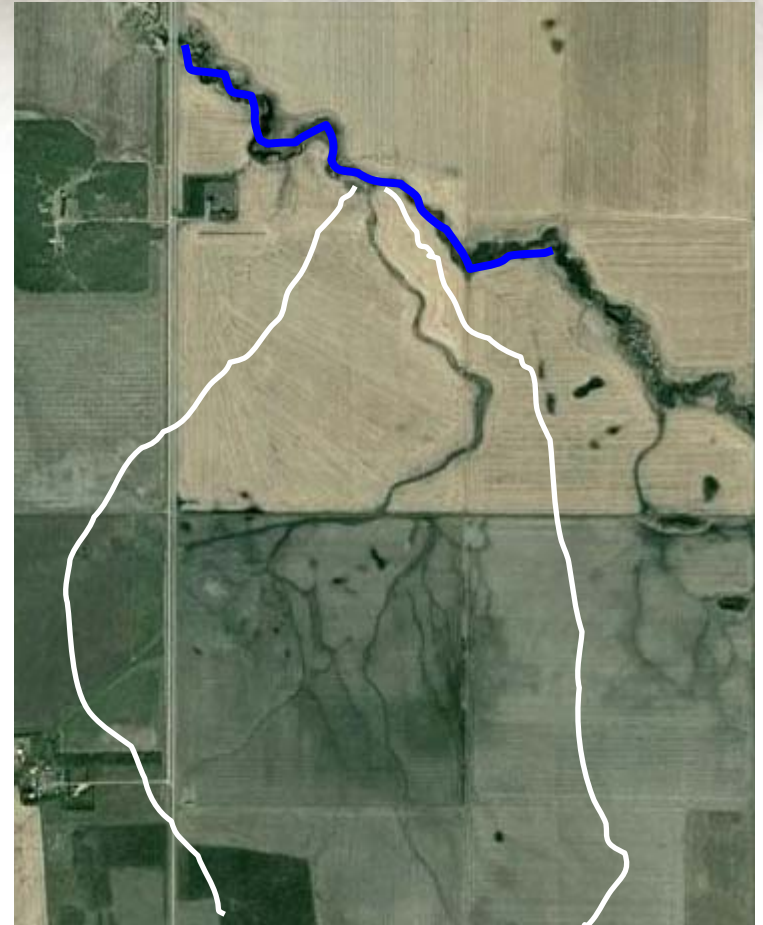
Steep slopes and reduced tillage

Elements of the Key – sub-watershed hydrology



Sheet flow

Concentrated flow



Tool Components: Key Outcomes

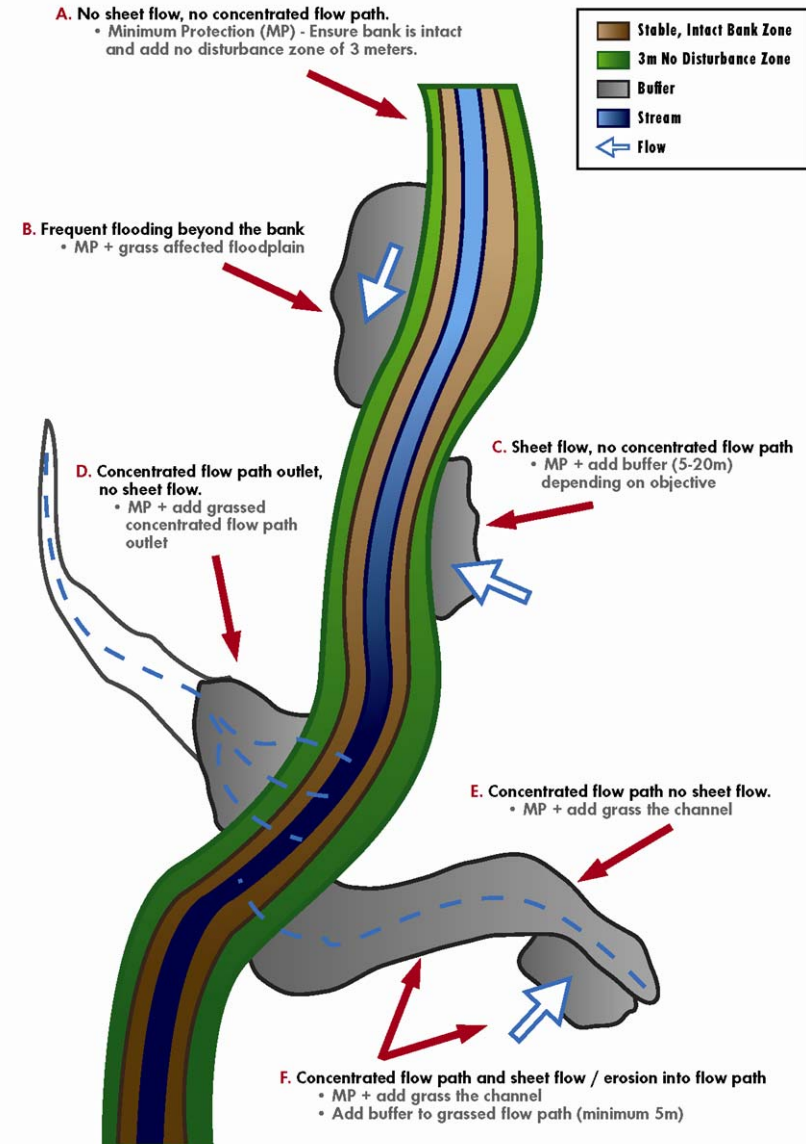
Little overland flow

Frequent flooding

Near-stream high-risk

Sheet flow

Concentrated flow



Tool Components: Buffer Sizing (1)

- Minimum protection
 - Stable bank plus 3m no-disturbance zone; preferably native vegetation
- Frequent flooding
 - Seed affected floodplain to perennial forage
- Near-stream high-risk
 - Change land management / use to minimize field losses
 - Fit buffer between field and stream to the landscape;
 - Determine design width based on needs / buffer objective

Tool Components: Buffer Sizing (2)

- Sheet flow
 - Adjust land management / use
 - Fit buffer between field and stream to the landscape
 - Determine design width based on needs / buffer objective
- Concentrated flow
 - Fit to concentrated flow outlet;
 - Extend as far as there are signs of erosion / sedimentation in the flow path
 - Add (widen) buffer to intercept sheet flow if there is erosion in the field
 - Change land management / use to minimize field losses

Opportunities/Gaps

- Atlantic manual
- Validation, Testing
- Research
 - recommendations & land management
 - long term effectiveness of buffers
 - ...



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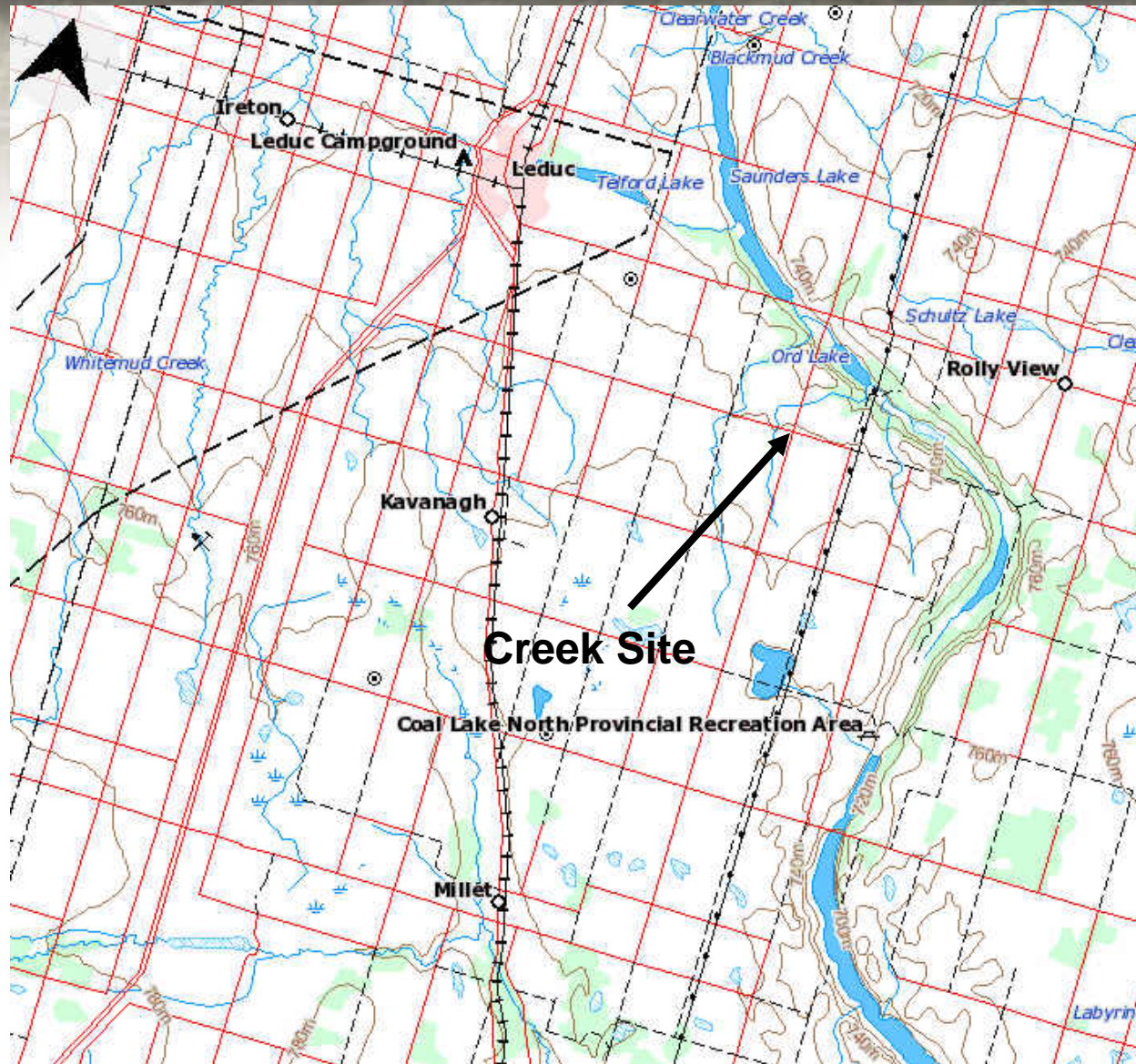
QUESTIONS?

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Example: Sheet Flow

Site: Unnamed ephemeral creek SE of Leduc, Alberta





Step 1 – *Is the channel well-defined?*



YES

Go to Step 2

Step 2 – *Does the stream have a stable bank zone?*



YES

Go to Step 3

Step 3 – *Is there frequent flooding beyond the bank ?*



NO

Go to Step 4

Step 4 – *Are the slopes adjacent to the stream $\geq 10\%$?*



NO

Go to Step 7

Step 7 – *Is there potential for a significant amount of runoff?*



YES

Go to Step 8

Step 8 – *Is there evidence of sheet flow from the uplands entering the channel?*



YES

Go to Step 9

Step 9 – *Are there signs of erosion from the uplands?*

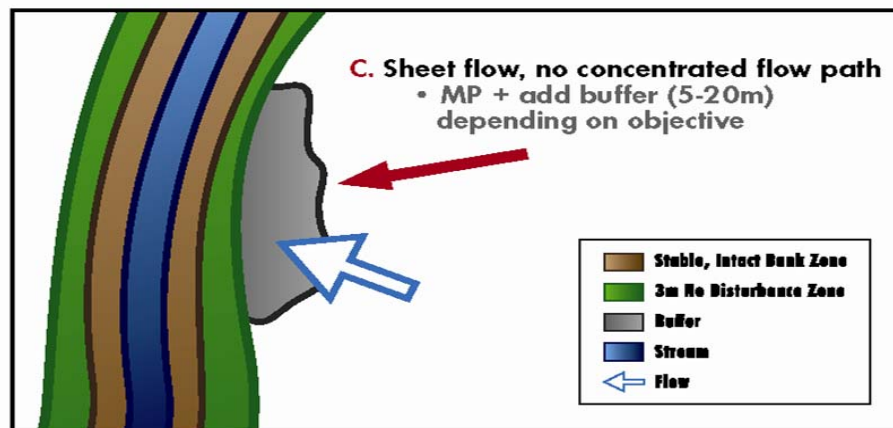
Although there is sheet flow, there are no signs of erosion from the uplands.

NO

Go to Intervention 4

Intervention 4

Because there is a significant amount of runoff, a buffer along the section of channel receiving sheet flow is recommended to reduce dissolved nutrients (through infiltration).



Buffer stream channel from sheet flow.

Go to Step 10

Step 10 – *Is there evidence that concentrated flow paths (draws) in the upland contribute to the stream channel?*

There is no evidence that concentrated flow paths (draws) in the uplands contribute to the stream channel.

NO

No further action required



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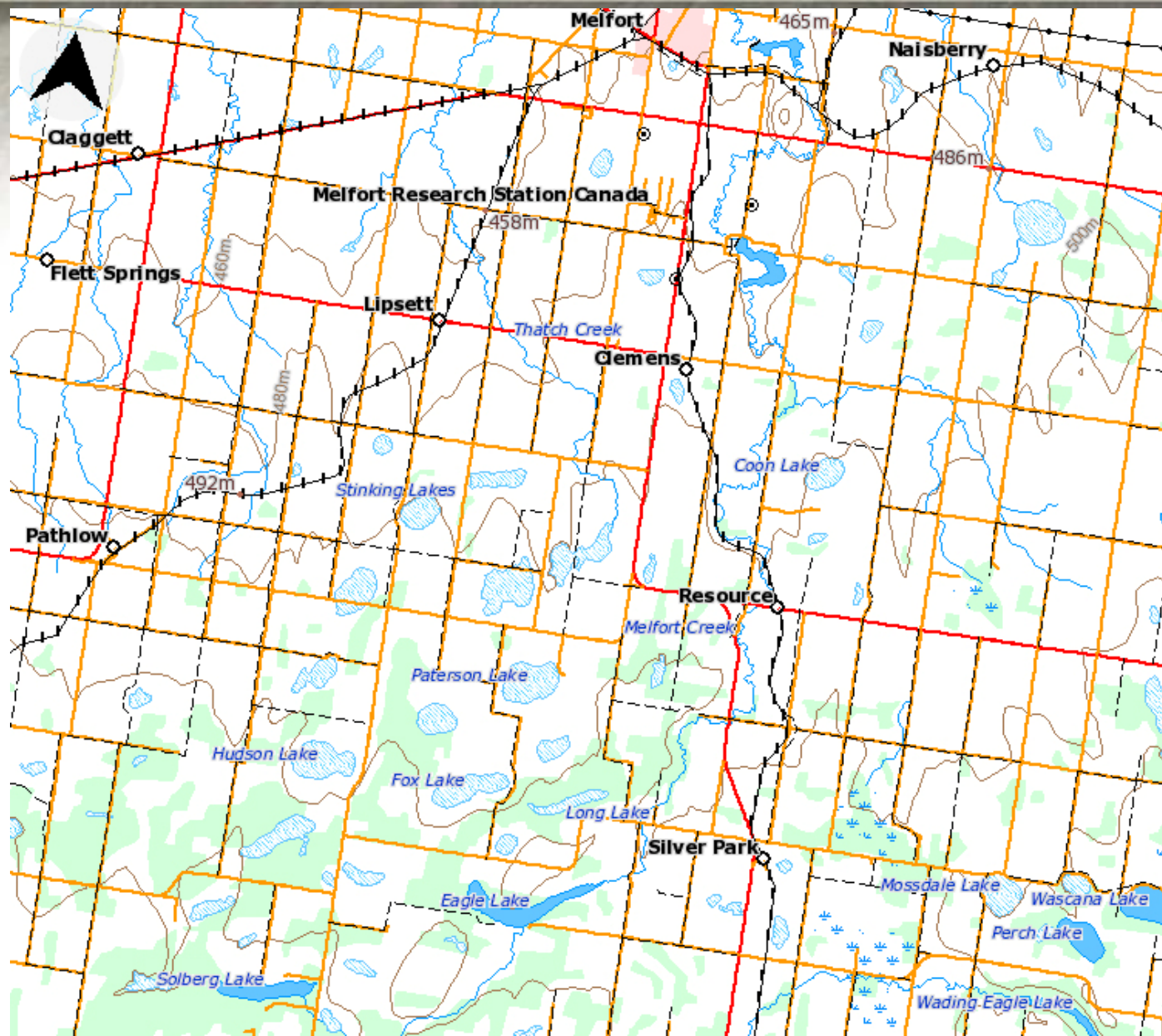
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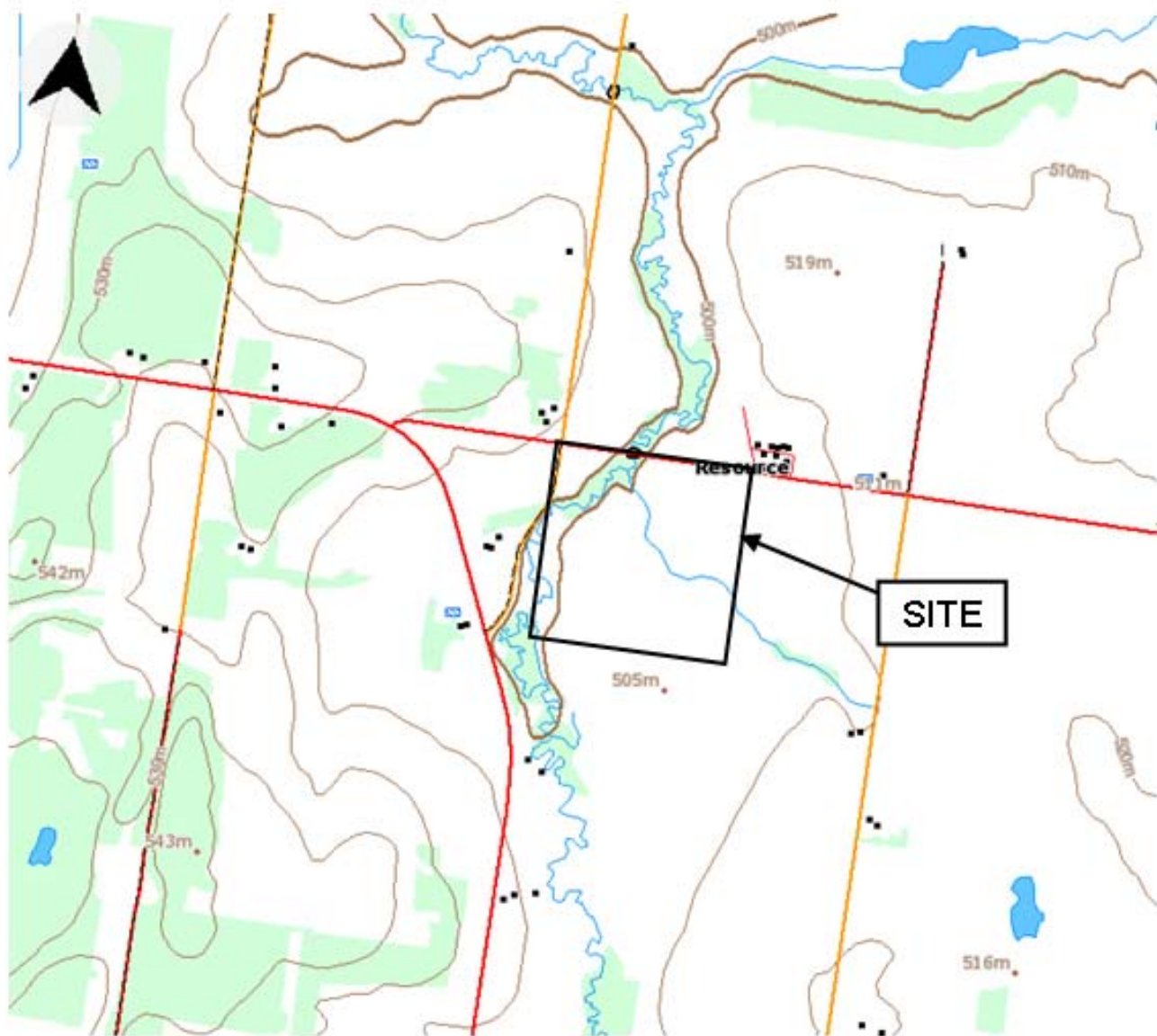
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Example: Concentrated Flow Path

Site: Melfort Creek near Resource, Saskatchewan





Step 1 – *Is the channel well-defined?*



YES

Go to Step 2

Step 2 – *Does the stream have a stable bank zone?*



NO

Go to Intervention 1

Intervention 1

- Unstable bank is caused by natural bank erosion
- Elsewhere the bank is stable and well vegetated with grasses, shrubs and trees
- If there is concern than bank stabilization alternatives could be considered (biotechnnnology, gabions etc)

Go to Step 3

Step 3 – *Is there frequent flooding beyond the bank?*

Eagle Lake acts to store much of the melt water in the watershed

Flooding beyond the banks at the site is infrequent

NO

Go to Step 4

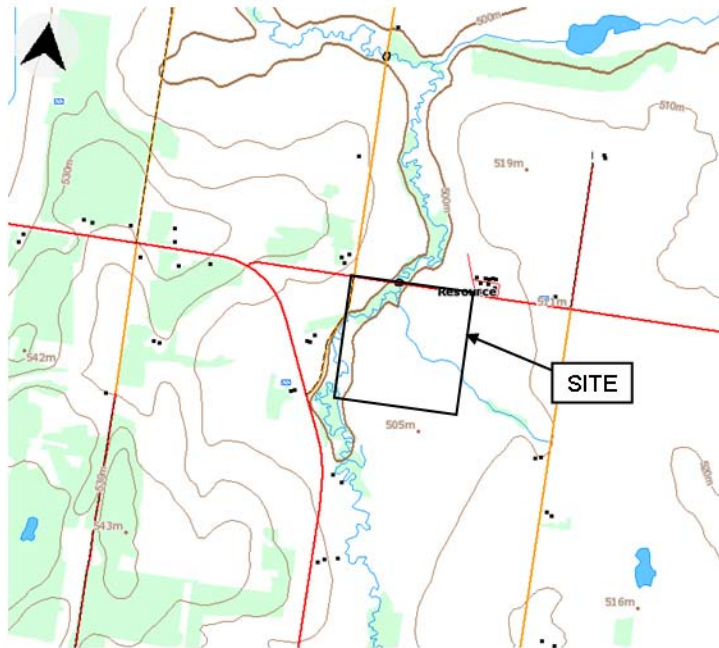
Step 4 – *Are the slopes adjacent to the stream $\geq 10\%$?*



NO

Go to Step 7

Step 7 – *Is there potential for a significant amount of runoff?*



YES

Go to Step 8

Step 8 – *Is there evidence of sheet flow from the uplands entering the channel?*



NO

Go to Step 10

Step 10 – *Is there evidence that concentrated flow paths (draws) in the upland contribute to the stream channel?*

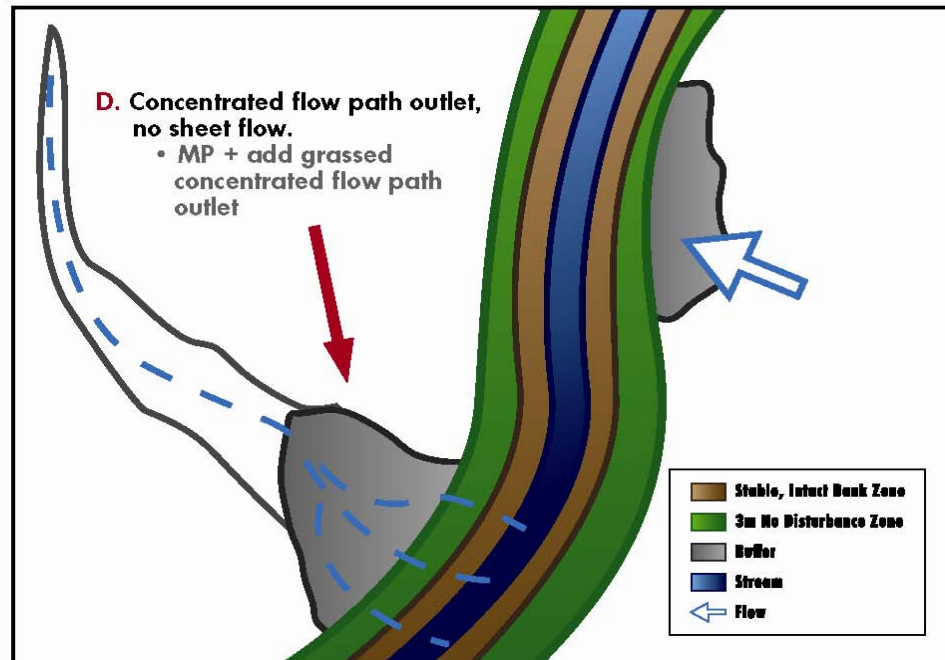


YES

Go to Intervention 5

Intervention 5

Concentrated flow entering the channel needs to have the buffer placed at the confluence, shaping the buffer to fit the concentrated flow path and sizing the buffer to exceed the normal lateral extent of the runoff.



Grass channel outflow

Go to Step 12

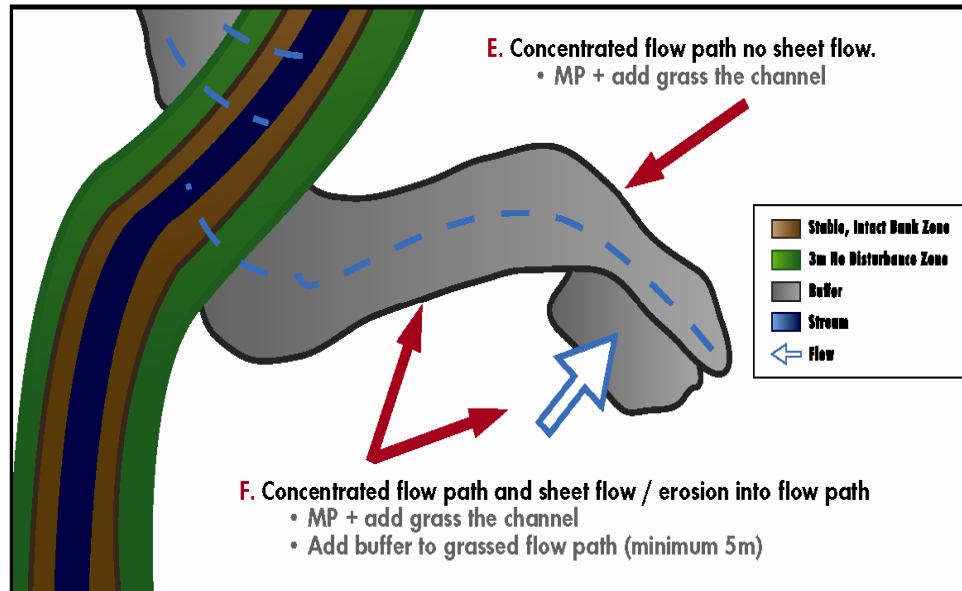
Step 12 – Are there signs of hillslope erosion in the uplands?



YES

If erosion is controlled: Grass waterway to promote nutrient infiltration.
(Outcome **E**)

If erosion is not controlled: Extend buffer 5m beyond the flow path up the slopes to intercept sediments, and grass waterway to promote nutrient infiltration. (Outcome **F**)



If erosion is controlled: Grass waterway to promote nutrient infiltration.
(Outcome **E**)

If erosion is not controlled: Extend buffer 5m beyond the flow path up the slopes to intercept sediments, and grass waterway to promote nutrient infiltration. (Outcome **F**)



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