

Agricultural Water Management: A Critical Link in Climate Resilience and Food Security

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Farm Girl
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Overview

- Importance of Ag Water Management in SK (Drainage & Irrigation)
- Managed vs Unmanaged Landscapes – Locally , Provincially, Nationally
- Why This Matters?
- Collaboration & Extension – SK DEN
- Gaps
- OPPORTUNITIES – Program Considerations & Enhancements

...

“



Whiskey is for drinking; water is for ~~fighting~~ over.

MANAGEMENT

- Mark Twain
- SASKFSA”

SCAN ME 

... 





Partner with government and regulators to advance practical, **win-win land and water policy** that benefits farmers and the environment.

Deliver field-validated economic and agronomic analysis that demonstrates the **importance of proper land and water management**

Engage, develop, and maintain **positive relationships with all stakeholders** interested in land and water management.

Be recognized **as the leading source of information** on land and water management practices and challenges in the province.



Saskatchewan Farm Stewardship Association

Driving practical policy change where it matters ~~the~~ in the field.

6–7% of Canada's land base can produce food.

A large portion of that land sits right here in SK!

SASKATCHEWAN

~40% of CDN farmland

~24% annual cropland

~11% forage/pasture

~20% water systems & protected areas

~43% forest & other natural land

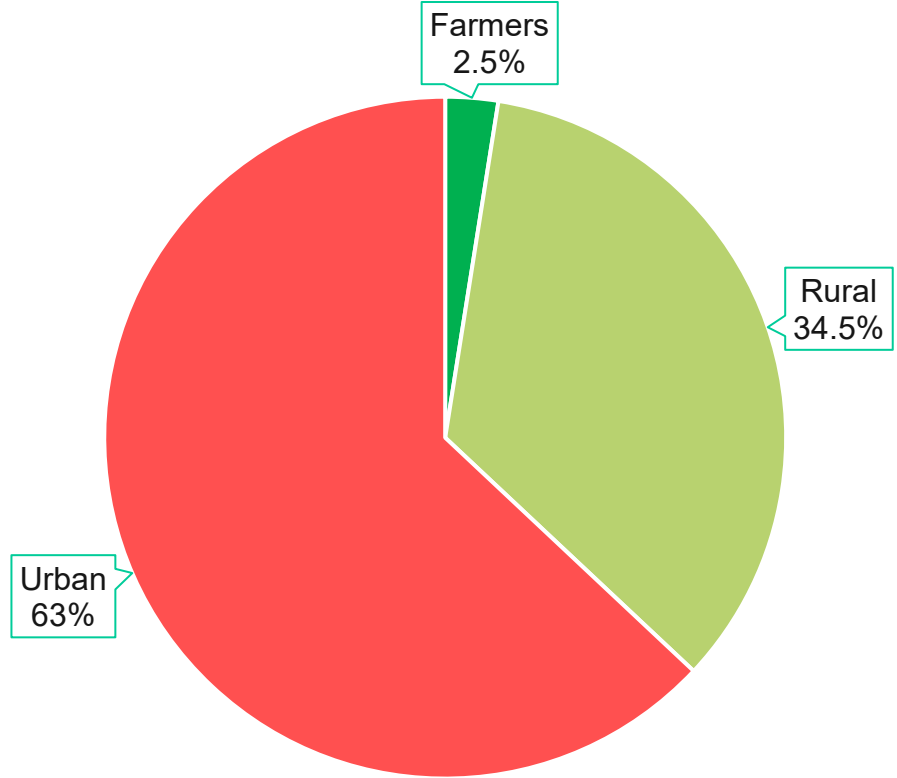
~2% urban & infrastructure

Province	Farmland Acres	Share of CDN Farmland
Saskatchewan	~ 38 M	≈ 40%
Alberta	~ 20.7 M	≈ 22%
Manitoba	~ 11.6 - 12 M	≈ 12%

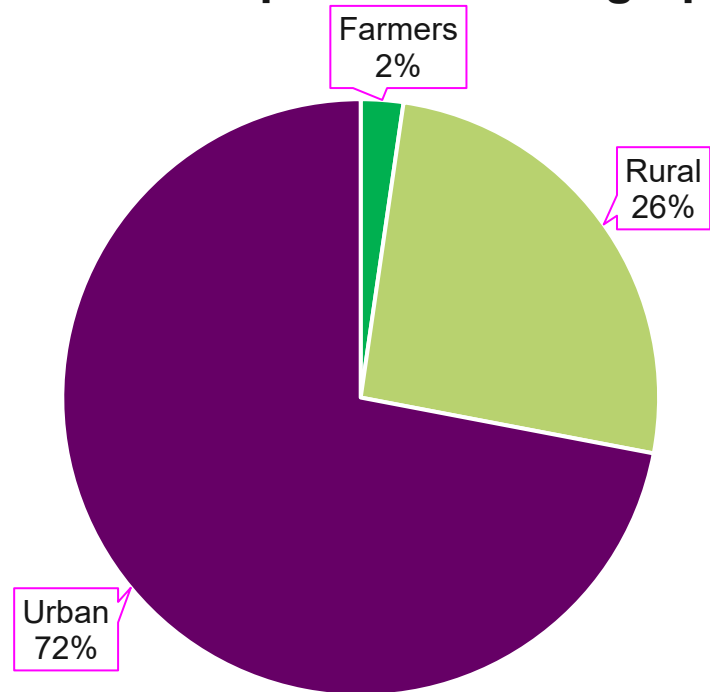
~74% of food acres in the Prairies!



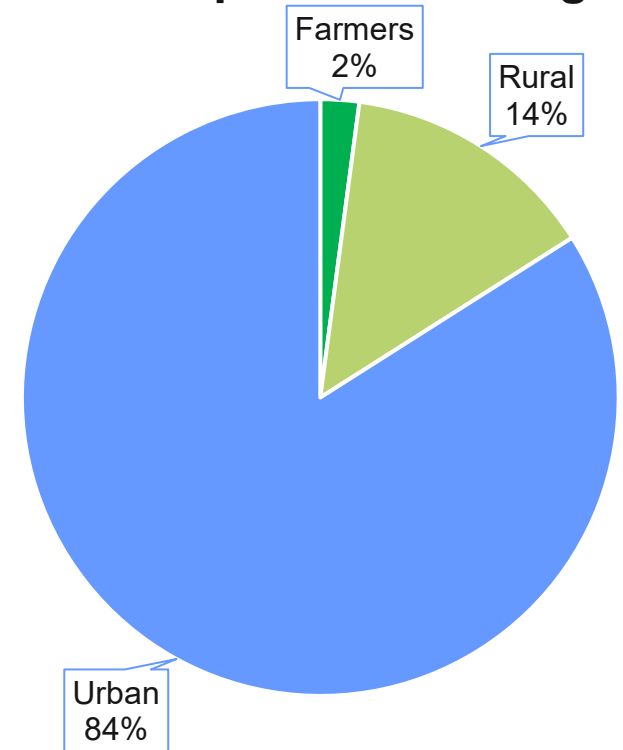
SK Population Demographics



MB Population Demographics

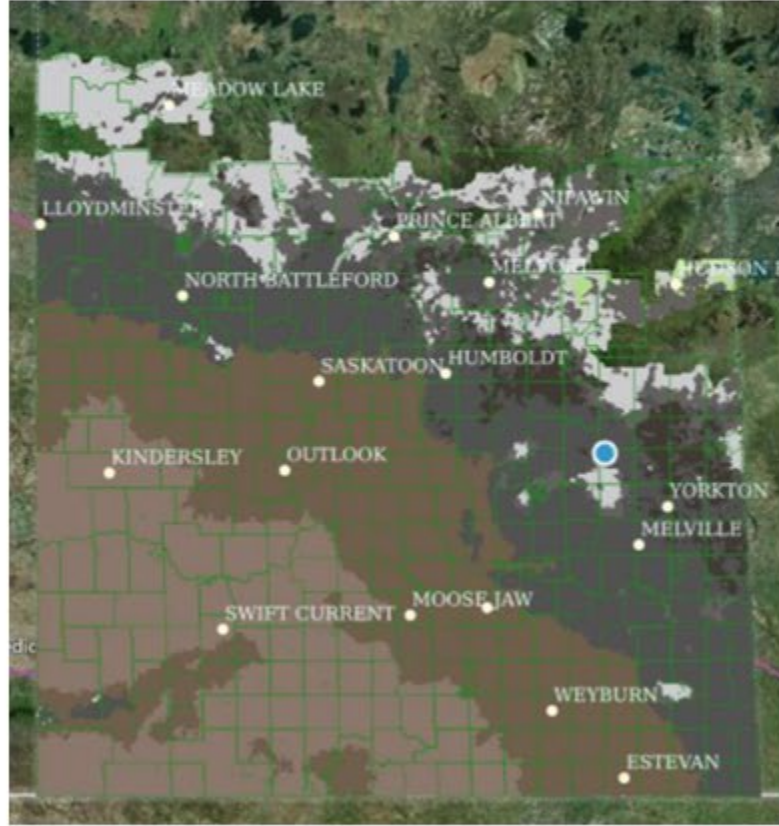


AB Population Demographics

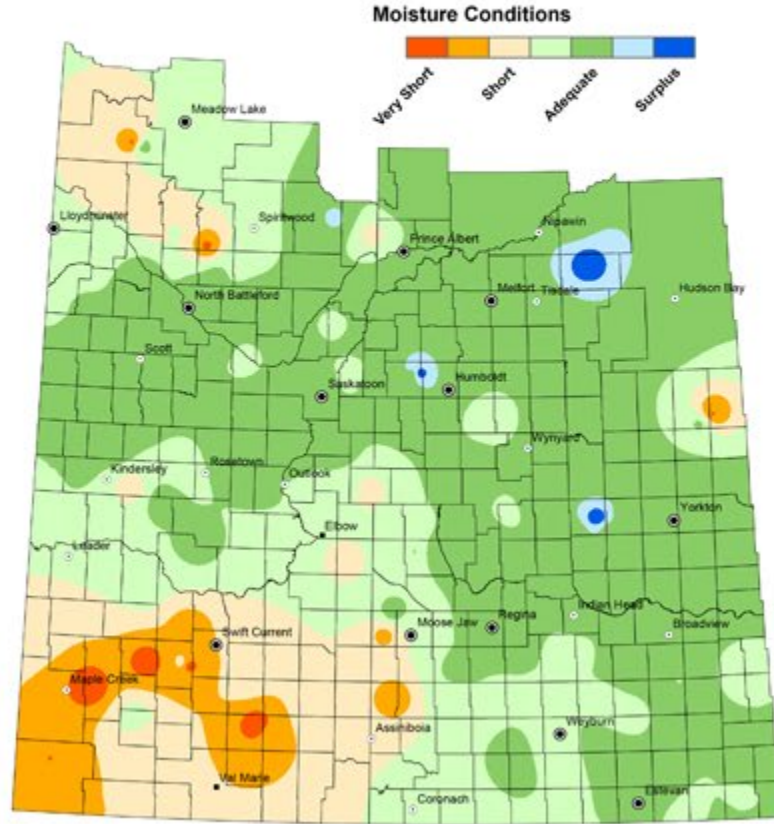




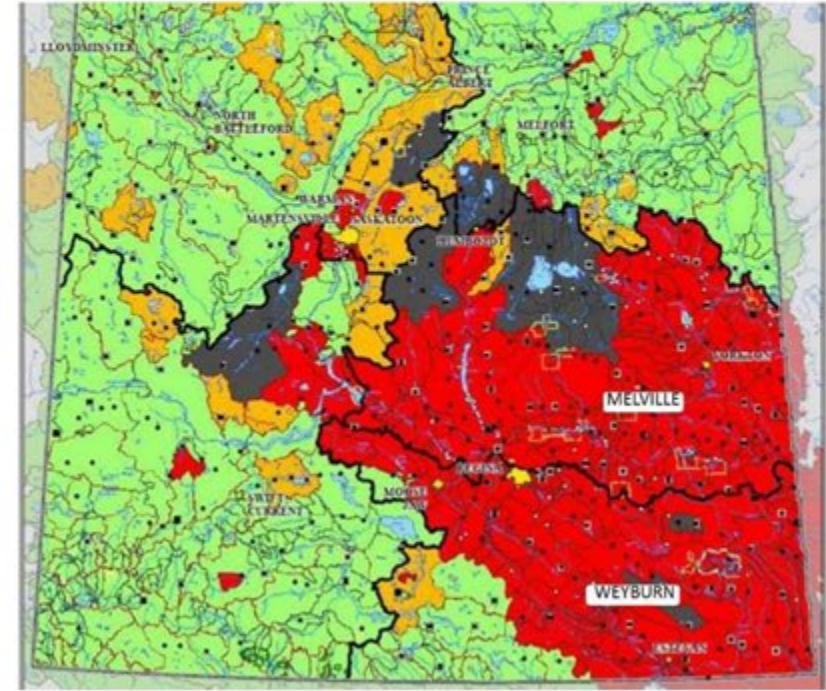
SK Soil Zones



Cropland Topsoil Moisture Conditions from June 24 to June 30, 2025



WSA Watershed Vulnerability Map



AG ZONE

SOIL ZONE & TOPOGRAPHY → dictate areas well suited for food production
CLIMATIC CONDITIONS → influence capacity /potential of the soil zones
WATERSHED VULNERABILITY → overlap exactly over the productive soil zones
WE KNOW THIS → Responsible water management will improve production and soil health while reducing vulnerability in watersheds and communities



#BESTWHENMANAGED

HOW DO YOU DEFINE AG WATER MANAGEMENT?

- ✓ DRAINAGE
- ✓ IRRIGATION
- ✓ WATER USE EFFICIENCY
- ✓ ORGANIC MATTER

Where Does 2 Million Litres Go?

Canola Water Use in One Growing Season
(Per Acre – Saskatchewan Context)

Seasonal Crop Water Use (ET): 400–500 mm
≈ **1.6–2.0 million litres per acre**

(Based on Saskatchewan evapotranspiration and crop water use data.)

Managed Soil Water Conditions	Saturated / Poorly Managed Conditions
-------------------------------	---------------------------------------

Higher Proportion of Water Supports Yield

- Strong taproot development
- Oxygenated root zone
- Efficient nutrient uptake
- Lower disease pressure



- Strong taproot development
- Oxygenated root zone

Reduced Water Productivity

- Restricted, stunted root system
- Oxygen deficiency
- Elevated disease pressure



- Reduced risk of rot diseases
- Stronger stem + tiller growth

Typical Water Use Efficiency:
~5–10 kg seed per hectare per mm

(Equivalent to strong Prairie Wheat Production Systems)

A greater share of seasonal water contributes directly to transpiration and grain filling.

Data Context:

- Co-Benefits of Properly Managed Water
 - Supports nutrient retention
 - Reduces GHG emissions
 - Stabilizes yield, increasing per-acre efficiency.

(Based on Saskatchewan evapotranspiration and Prairie crop WUE research)

Where Does 1.6 Million Litres Go?

Wheat Water Use in One Growing Season
(Per Acre – Saskatchewan Context)

Seasonal Crop Water Use (ET): 350–450 mm
≈ **1.4–1.8 million litres per acre**

(Based on Saskatchewan evapotranspiration and crop water use data.)

Managed Soil Water Conditions	Saturated / Poorly Managed Conditions
-------------------------------	---------------------------------------

Higher Proportion of Water Supports Yield

- Deep: well-oxygenated root system
- Oxygen deficiency
- Increased risk of fusarium
- Stronger stem + tiller growth



- Typical Water Use Efficiency:
~10–10 kg grain per hectare per mm

Reduced Water Productivity

- Restricted, shallow root system
- Nitrogen lost via denitrification
- Increased risk of fusarium
- Fluctuating tillers, uneven heads



- Observed Outcome: Reduced water use efficiency and lower yield stability

Observed Outcome: Reduced water use efficiency and lower yield stability

A smaller proportion of seasonal water contributes to **productive transpiration**.

Data Context:

- Co-Benefits of Properly Managed Water
 - Supports nutrient retention
 - Reduces GHG emissions
 - Stabilizes yield, increasing per-acre efficiency.

(Based on Saskatchewan evapotranspiration and Prairie crop WUE research)

THE VALUE OF 1% ORGANIC MATTER

Each 1 % of Organic Material contains:

10,000 lbs. of C @ \$4 / ton = \$20

1,000 lbs. of N @ \$.50 / LB = \$500

100 lbs. of P @ \$.70 / LB = \$70

100 lbs. of K @ \$.40 / LB = \$40

100 lbs. of S @ \$.50 / LB = \$50

.3" - 1" of H2O

Using average fertilizer prices that's about \$680!

Every 1% increase in OM raises soil's water-holding capacity by as much as 27,000 gallons per acre

(Ohio State University- 2014)



4R'S OF WATER MANAGEMENT

The RIGHT AMOUNT of moisture...

at the RIGHT TIME...

in the RIGHT FORM...

and at the RIGHT PLACE!

(IF ONLY WE COULD MANAGE THIS!)

The difference?

- Crop vigor, stress, uniformity, disease, yield
- Soil / microbe health
- Water use efficiency
- Nutrient use efficiency
- Weed pressure, control, resistance
- Overlap / lost crop inputs
- Time, equipment efficiency, repairs
- GHG / carbon footprint

Excess Water

Candace Mitschke PAg
Every year? in the PPR

DIFFERENT?

Drought

Kevin Hursh, PAg,
2023 article in Western Producer



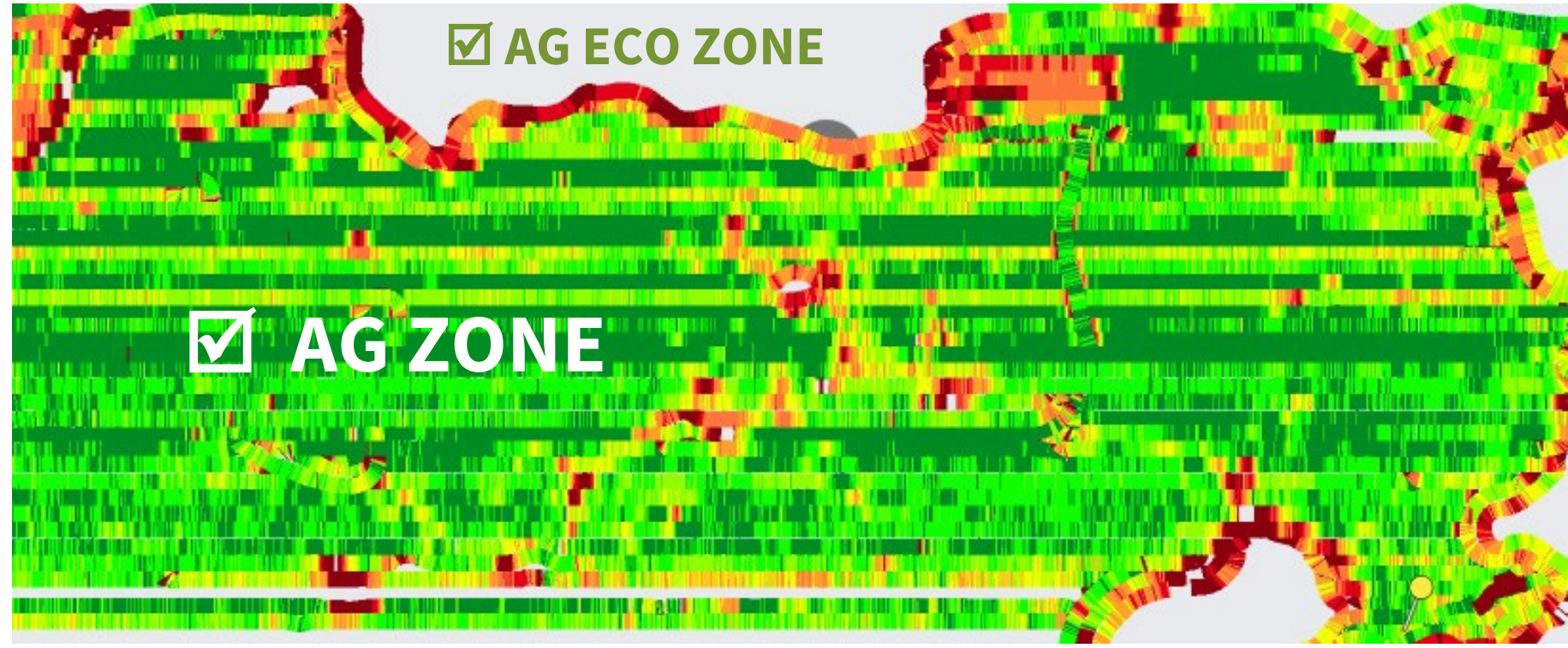
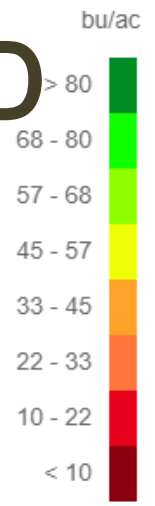
Prairie Pothole Region

HOW MANY DAYS TO GET DRY?
HOW MANY HOURS TO GET WET?



YIELD MAP MANAGED FIELD

“Best
When
Managed”



FIELD EFFICIENCY DRAINAGE MANAGEMENT (TILE AND SURFACE)



☑ AG ECO ZONE

☑ AG ZONE

☑ AG ECO ZONE



MANAGED-SPRING 2024

✓ **AG ZONE**

✓ **AG ECO ZONE**

FIELD EFFICIENCY

This is the same field, APRIL 2024. This field is a typical, fully managed field in the PPR. It is managed with drainage to support sustainable crop production. It is **IMPORTANT TO NOTE** that drainage management provides flood control, spring ground water recharge and seasonal migratory habitat.



#BESTWHENMANAGED



MANAGED—JULY 2024

✓ **AG ZONE**

✓ **AG ECO ZONE**

FIELD EFFICIENCY

This is the same field, JULY 2024. A crop can survive under water for 48 hours. Beyond that, excess rain in season will result in crop stress, disease and death. Drainage management is critical to prevent this. The AG Zone and the AG Eco Zone are both best when managed.



#BESTWHENMANAGED



SEPTEMBER 2024

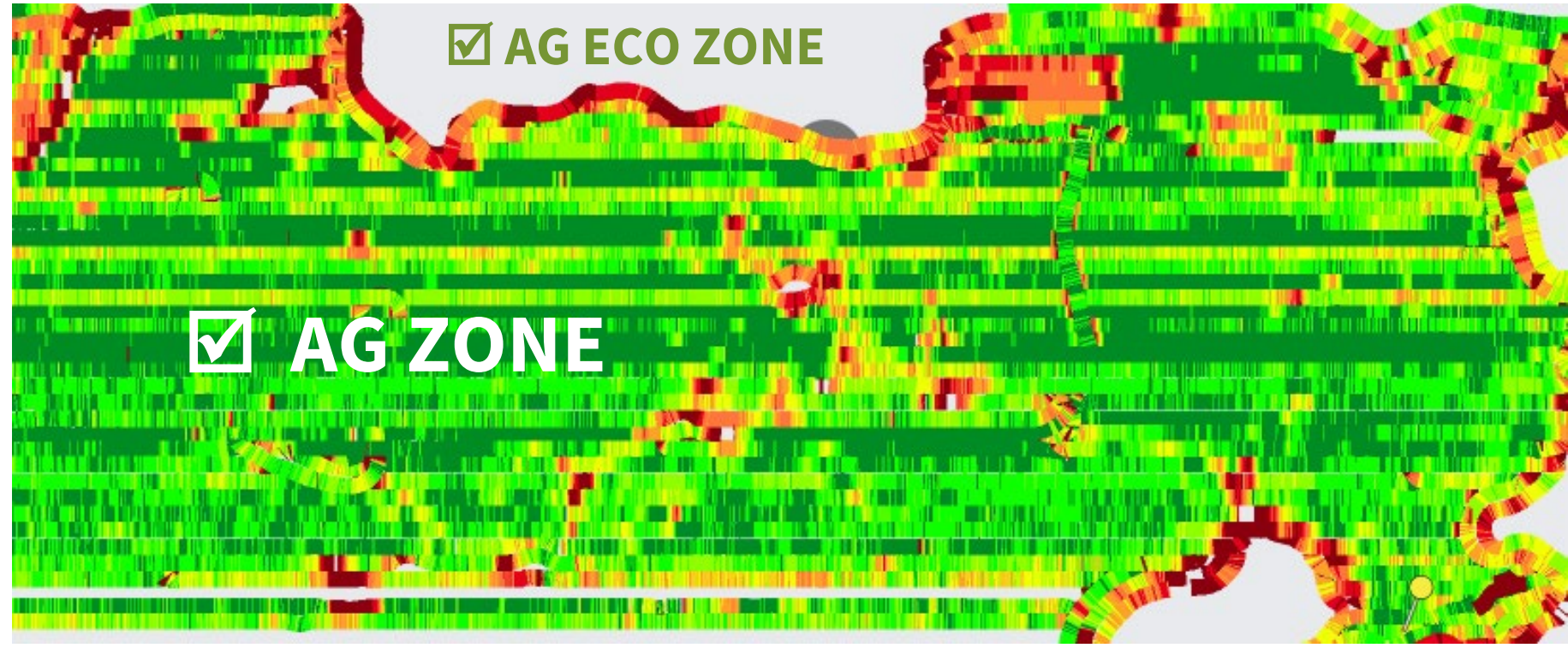
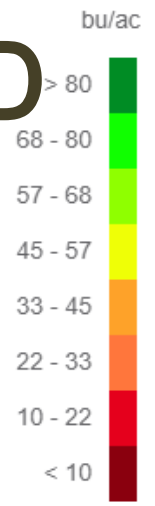
- ✓ **This is drainage management**
- ✓ **This is field efficiency**
- ✓ **This is a balanced AG zone**

BEST WHEN MANAGED.



YIELD MAP MANAGED FIELD

“Best
When
Managed”



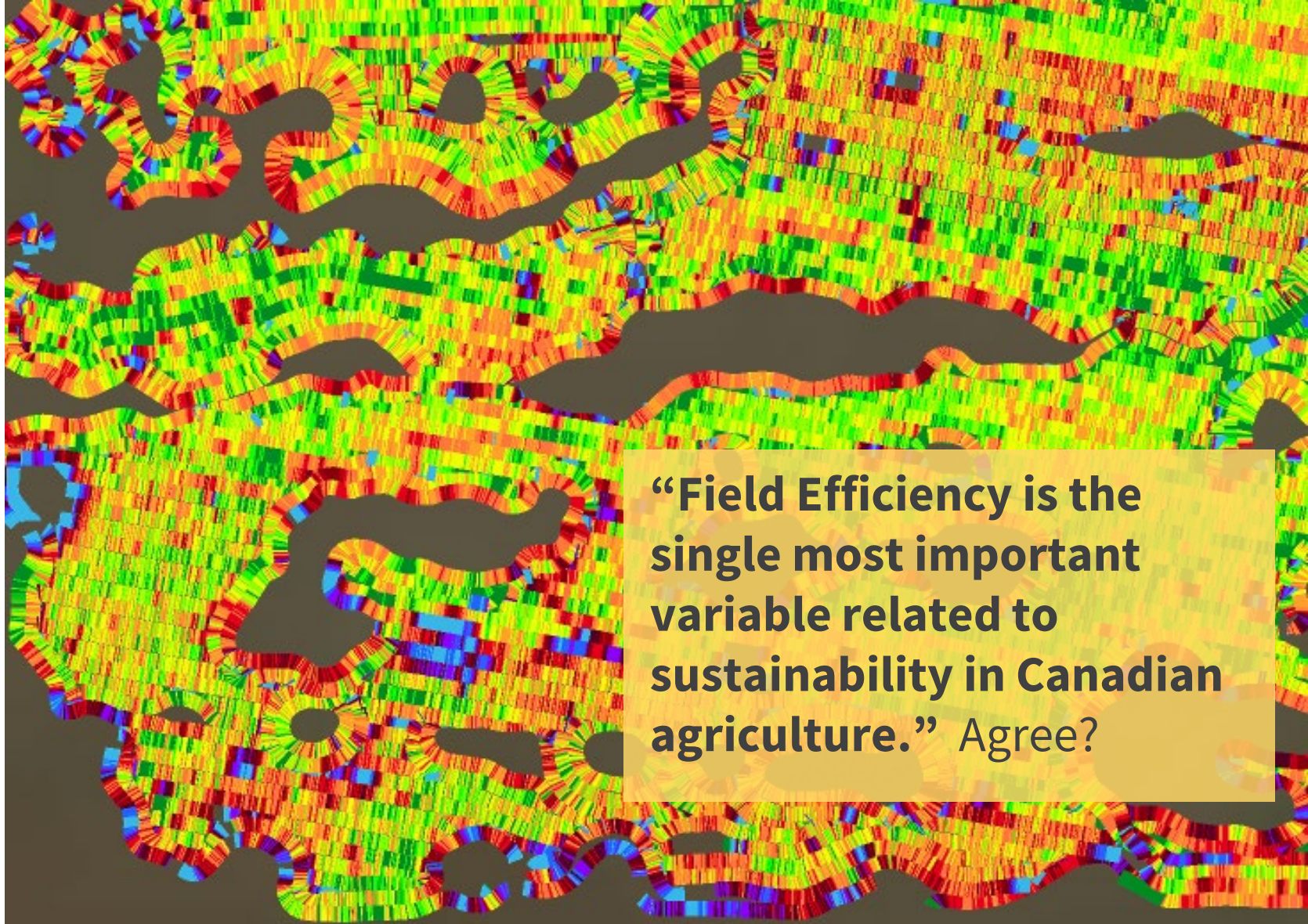
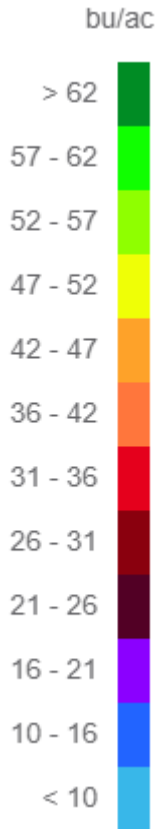
FIELD EFFICIENCY DRAINAGE MANAGEMENT (TILE AND SURFACE)



YIELD MAP

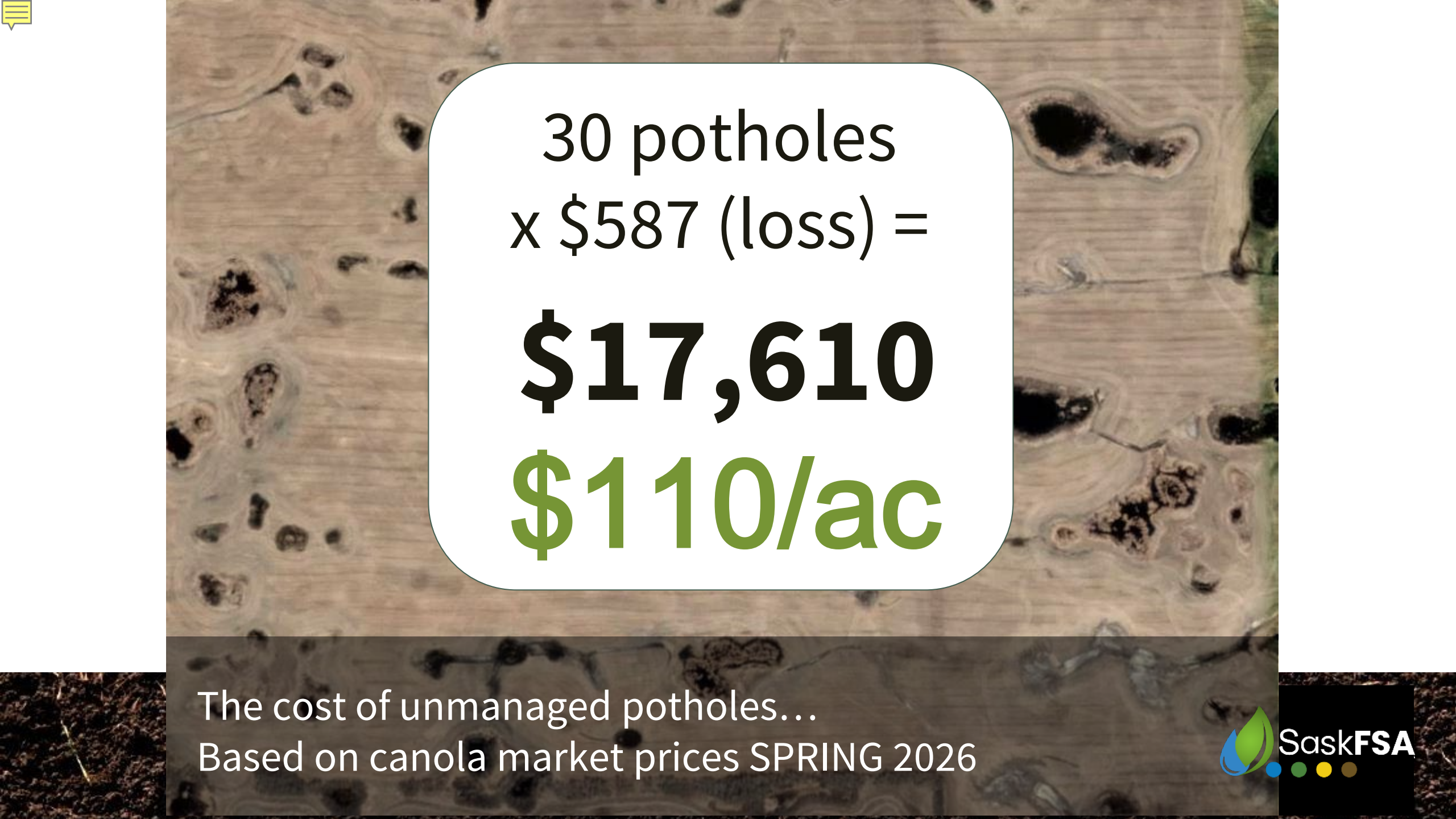
CANOLA 2024 - acres,
inputs, overlap, time,
fuel, equipment, corners,
compaction, weeds,
bushels . . .

**It all adds up.
It all matters.**



“Field Efficiency is the single most important variable related to sustainability in Canadian agriculture.” Agree?

FIELD EFFICIENCY NOT MANAGED



30 potholes
x \$587 (loss) =

\$17,610

\$110/ac

The cost of unmanaged potholes...
Based on canola market prices SPRING 2026



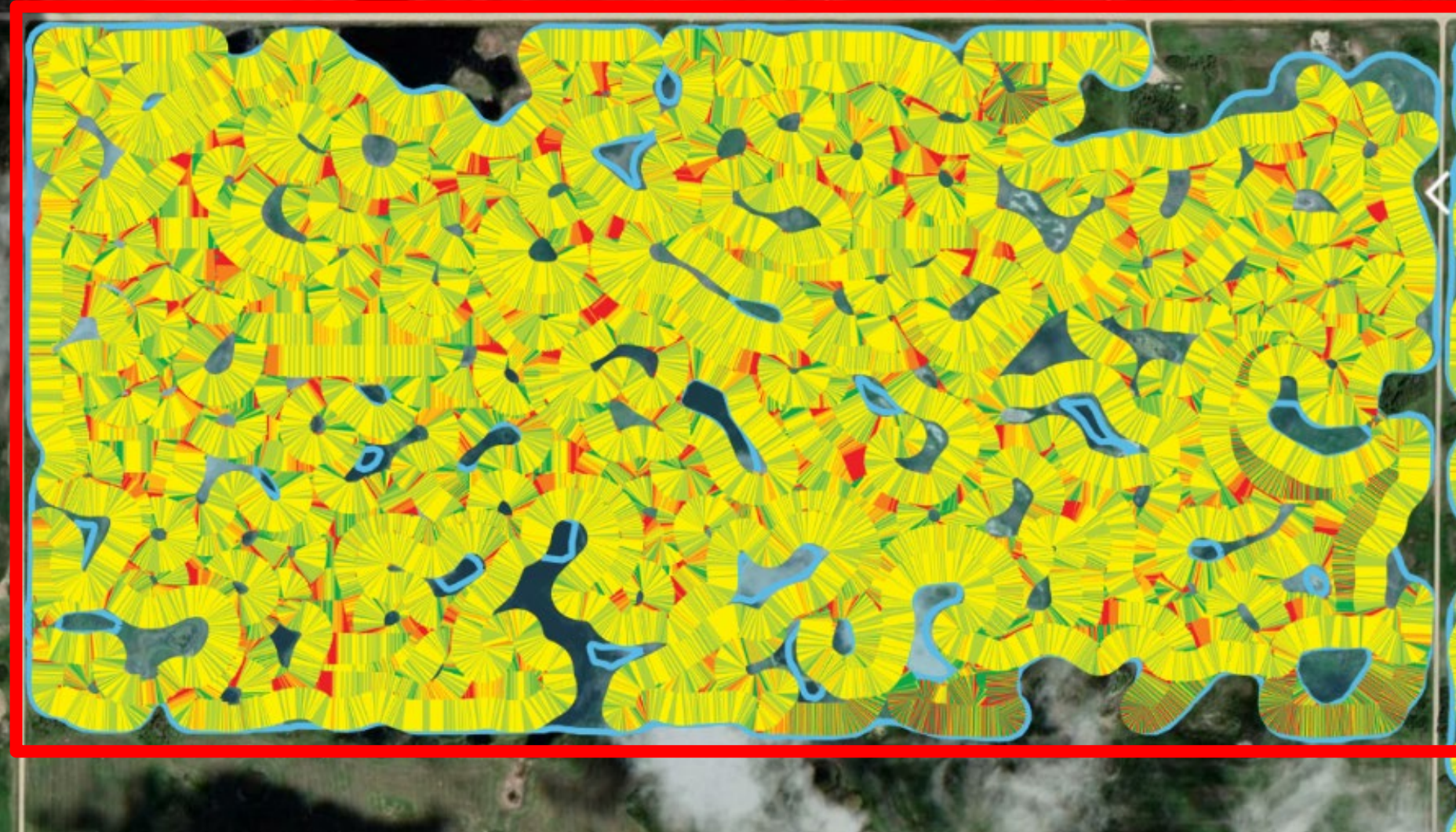
Application Map

Sprayer Operator:

“I would be stretching the truth if I said the complete boom was fully on for 30% of the field”

**Average
Speed: 10.7 mph**

**Productivity
Rate: 103 ac/hr**



Technology can only do so much...

CRUNCHING THE NUMBERS

Turning - 307 mins
Travel - 235 mins
= 9 HOURS MORE!!!

Cost of Ownership/ Depreciation

Seeding \$830
Spraying x 4 - \$1026
Harvest - \$614
Tractor/harrow - \$196
= \$2,666 OR \$13.33/ac!

Extra Fuel

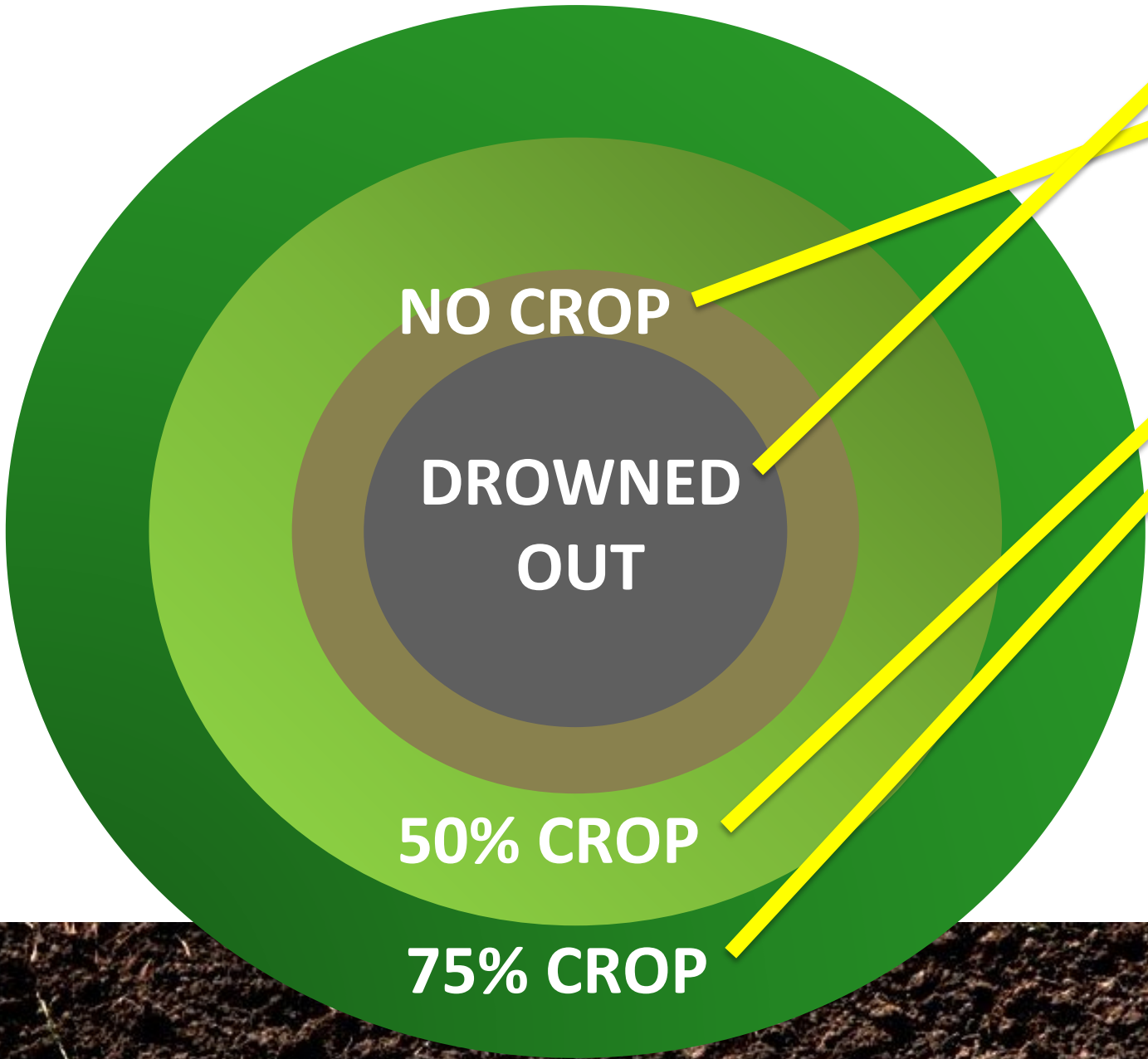
\$1332 more used
= \$6.65 / ac

Overlap

From 7% on managed to 14% on unmanaged
 $7\% \times \$250 / \text{ac} = \mathbf{\$17.50 / ac}$

IT ALL ADDS UP...





0.50 ac underwater (dead)
0.17 ac saturated (dead)
= 0.67 ac 100% CROP LOSS

+ unused 80N, 20P, 20S (~\$120)

2.04 ac 50-75% YIELD LOSS

+ unused 86N, 22P, 22S (~\$130)

In addition to previous
\$/ACRE LOSS ...

Fertilizer Use Efficiency
~\$250 unused?!?



MANAGED

UNMANAGED



WHY THIS MATTERS

***Agricultural Water Management:
A Critical Link in Climate Resilience & Food Security***

Agricultural Water Management in Saskatchewan

An Integrated, Working Landscape-Scale System - Agricultural water management in Saskatchewan is the coordinated management of surface water, subsurface water, soil systems, infrastructure, and governance to improve farm viability, steward environmental outcomes, and manage climate risk in a highly variable prairie landscape.



1. Surface Water Management

- Controlled conveyance
- Managed drainage corridors
- Temporary & permanent retention
- Point of adequate outlet
- Flood mitigation
- Infrastructure (culverts, berms, channel stabilization)

* This includes both **moving water** and **slowing water**.

2. Subsurface Water & Salinity Control

- Tile drainage – grid or targeted
- Water table management
- Root zone monitoring
- Salinity mitigation

* In SK, **drainage is critical** for:
- Yield stability
- Preventing saline expansion
- Long-term soil productivity

3. Irrigation & Water Use Efficiency

- Precision irrigation / variable rate irrigation
- Soil moisture monitoring
- Crop water productivity
- Yield per mm of water
- Crop selection based on water profile
- Return flow management

4. Soil Health (Foundational System Driver)

- Soil organic carbon
 - Aggregate stability
 - Infiltration capacity
 - Biological activity
 - Root system development
 - Water holding capacity
 - Residue management
 - Reduced tillage / no-till
 - Cover cropping
- * Healthy soils:
- Increase infiltration
- Reduce runoff
- Improve drought resilience
- Increase water use efficiency

5. Nutrient & Water Interaction

- Nitrogen movement
- Phosphorus runoff
- Denitrification
- 4R nutrient management
- Nutrient efficiency

6. Wetland & Landscape Hydrology

- Functional wetland strategy in the AG zone
- Permanent vs. temporary wetland management
- Outcome-based stewardship
- Retention vs. managed flow
- Watershed-scale hydrology
- Watershed connectivity
- Hydrologic balance

7. Climate Risk & Variability Management

- Flood resilience
- Drought buffering
- Snowmelt management
- Extreme event response
- On-farm resilience planning

*This is economic risk management.

8. Governance, Infrastructure & Economic Viability

- Regulatory framework
- Drainage approvals
- Watershed & C&D coordination
- Federal stewardship overlays
- Public trust
- Economic viability
- Infrastructure implementation, improvement & maintenance – roads, culverts, drains
- ROI of water improvements

* Farms & communities must be viable to implement stewardship.



Water is not a fringe issue in agriculture.

It is:

- A production issue – agronomically, economically
- A stewardship issue
- A risk management issue
- A food security issue

AN OPPORTUNITY → practical, scalable, producer-led



Pieces

Existing programs support pieces of water management:

- FRWIP infrastructure programs
- WSA Ag Water Management Fund
- BRM programs responding to weather impacts

These programs are **valuable** — but **operate independently.**



Agriculture water belongs in the NPF

- ✓ Every acre, food production system and community relies on water management
- ✓ To be effective water needs to move
- ✓ Water management is **climate resilience**
- ✓ Deliver **agronomic, environmental & economic** outcomes
- ✓ Saskatchewan is uniquely positioned **TO LEAD**

The timing is right.



and Agriculture vs? Conservation

Current funding often focuses primarily on conservation outcomes.

While important, the agricultural zone also requires support for:

- ✓ Productive drainage management
- ✓ Drainage stewardship practices (BMPs)
- ✓ Irrigation access and efficiency
- ✓ Regional coordination

The goal is not to limit responsible water management tools...

The goal - **IMPROVE** how those tools are implemented & **CREATE MORE IMPACT ACROSS MORE ACRES.**



CONNECT

THE

SILOS

It is clear we have
**a lot of valuable
resources
in this province.**

People and water
are 2 of them.

We can do better
when it comes to
developing **strategic
partnerships.**



The formation of the SK Drainage Extension Network.

The SK DEN is a private sector leadership initiative. A collaboration of landowners, industry leaders and strategic advisors.





“Water is **FUNDAMENTAL** to **AG**”

“**CURIOSITY** to know more”

“Water management is **STABILITY**”

“When people are connected to water – **THEY ARE CONNECTED** – and **passionate about it**”

“Drive the conversation **FORWARD** around water management”

“**COLLABORATION**”

“Water quality – for agriculture and the people of SK.”

“**EFFICIENCY**”

“**WE CAN DO BETTER** – always improving responsible drainage”

“We have more **WATER POTENTIAL** than our industry can grasp”

“If you do not manage it, you do not win”

“**GENERATIONAL IMPROVEMENT** with water management”

“**EDUCATION** is a **BRIDGE**”

“Precision. **Practicality**. Passion.”



Our SK DEN Team & Advisors



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SK DEN Project Lead
Exec Director - SaskFSA



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SK DEN Team Member
Farmer & President - SaskFSA



Phillip Harder
SK DEN Team Member
Research Hydrologist - SwatMaps



Kyle Henderson
SK DEN Team Member
Manager - Crop Intelligence



Ryan Scragg
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Louis Hebert
SK DEN Team Member
Farmer - Hebert Grain Ventures



Myron Kopec
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Farmer, Division 1 Director - SASK



Will Vanderbyl
SK DEN Team Member
Farmer & Board Chair - SCCA



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Join the team!





Rooted In Collaboration

- **A network to connect** SK landowners, agricultural organizations, industry, researchers and government
- **To share and build knowledge** on innovative, responsible water management practices for healthier soil, resilient crops, and sustainable landscapes.
- **A research and education platform** to foster trust relationships, communication and solutions.



Priority Areas & COMMITTEES

- Drainage Research
- Drainage BMPs
(Beneficial Management Practices)
- **Connection & Education**
(Building partnerships and public trust)





↑ FIELD EFFICIENCY

- REDUCE SALINITY
 - IMPROVE SOIL HEALTH
 - REDUCE OVERLAP
 - REDUCE CROP INPUTS
 - REDUCE CROP LOSS
 - IMPROVE OVERALL PLANT HEALTH
 - IMPROVE NUTRIENT USE EFFICIENCY
 - IMPROVE WATER USE, RETENTION VIA CROP
 - IMPROVE EQUIP & LABOUR EFFICIENCY
 - REDUCE CARBON FOOTPRINT (FUEL)
 - REDUCE DENITRIFICATION
 - REDUCE COMPACTION
 - RESTORE MARGINAL ACRES
 - IMPROVE WEED CONTROL (REDUCE WEED RESISTANCE)
- = INCREASE PRODUCTIVE ACRES**

WHAT IF....

WE COULD DO IT ALL??

GROUND ZERO

2024 BASELINE YEAR



FIELD EFFICIENCY 1.0 DRAINAGE RESEARCH

Quantify agronomic and environmental benefits of improving field efficiency through managing temporary and seasonal water with surface and sub-surface targeted drainage on a field scale.



Current Initiatives - Res

Cereals	
Generating Pre-Harvest Sprouting Ratings for Barley Varieties	Development of Field Ready Cultivars of Canada Western Soft White Spring Wheat
Saskatchewan Variety Performance Group Regional Barley Trials	Saskatchewan Variety Performance Group Regional Wheat Trials - Hex 1 & 2 Wheat
Translocans causing BLS of cereals Assessing seed to seedling transmission of <i>Xanthomonas translucens</i> causing BLS of cereals to establish inoculum thresholds	Saskatchewan Variety Performance Group Regional Durum Trial
Saskatchewan Variety Performance Group Fall Rye Evaluation for Irrigation vs Dry Land Production	Saskatchewan Variety Performance Group Regional Oat Trial
Components of Potash Fertilizer Affecting Yield Response of Malt Barley and Spring Wheat	Saskatchewan Variety Performance Group Regional Wheat Trials - Winter Wheat
Winter Cereal Demonstration Showcasing Winter Wheat, Winter Triticale, and Fall Rye	

Does Seeding Date and Rate of C Effect Spring Flea Beetle Pressure and Quality?
Saskatchewan Variety Performance Group Regional Flax Trials
Performance of Saline tolerant C saline soils
Comparing Irrigation Scheduling Saskatchewan



Figure 1-1. Framework for Sustainable and Regenerative Agriculture.

Principles of Sustainable Agriculture

SOIL ORGANIC MATTER CONSERVATION

Soil organic matter (SOM) is the principal basis for soil health and long-term sustained productivity. Agricultural systems should seek to at least maintain and generally increase SOM where possible. SOM consists of decomposed fungi, bacteria, plant material, feces, and any other once-living matter that is at various stages of decomposition and gives soil its color (Ontl and Schulte, 2012). Soil organic carbon (SOC) is specifically a measure of the carbon contained within SOM. The two terms are frequently used

interchangeably though between the two (the mass of SOM).

SOC levels are a biomass production in rates driven mostly management. Warm, organic matter decom climates. Plant matter with a C:N ratio between 20:1 and 30:1 will decompose faster than residues with higher C:N ratios. Tillage increases decomposition rates as it increases microbial activity through

Wetlands (2025) 43:18
<https://doi.org/10.1007/s13157-025-01898-9>

REVIEW PAPER

Drivers of Soil Carbon Variability in North America's Prairie Pothole Wetlands: A Review

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Abstract

There is an ongoing demand for region-specific soil organic carbon estimates to support sustainable land management and inform carbon credit programs. The Prairie Pothole Region is prominent agricultural area that extends through Canada and the United States, and features a significant number of wetlands commonly referred to as prairie potholes. The contribution of these wetlands to landscape-level soil organic carbon storage is complex and may not be consistent across the region as influenced by several environmental and management factors. This study reviews existing literature to identify the main factors that contribute to variability in soil organic carbon stocks in prairie pothole wetlands. Soil organic carbon stock data from 10 studies in the Prairie Pothole Region were summarized through a meta-analysis. Variable importance and regression analyses were used to assess which factors explain variability in soil organic carbon. Wetland class explained up to 26.6% of the variability in soil organic carbon. Other important factors included ecoregion as well as land management. There were significant differences in average wetland soil organic carbon stocks across the ecoregions. Data limitations restricted our ability to accurately estimate the stocks for wetland class and land management. The findings from this study highlighted the need for targeted studies in the Northern short grassland ecoregion as well as studies that consider wetland classes under various land uses. To advance wetland carbon research in the Prairie Pothole Region, recommendations were provided on landscape-level carbon modelling, soil carbon measurement and monitoring, and improved wetland classification systems.



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 and Bioresources
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The Roadmap is in place

SK DEN Core Pillars

- Applied research and demonstration (elevating)
- Drainage BMP development (initiated)
- Information HUB and knowledge sharing (mobilized)
- Extension network collaboration (gaining momentum (exciting))
- Sustainable funding (lacking)

The roadmap identifies the structure needed to turn research, stewardship, and policy into **measurable outcomes for farms, the environment, our local communities, Saskatchewan and across Canada.**



The Gap

Without coordination between:

- Policy
- Research
- Extension
- Farm Implementation

We see:

- Research not reaching producers
- Successful practices not scaling
- Short-term research losing expertise
- Investments occurring in isolation

**VALUABLE work occurs across the system,
but the FULL POTENTIAL of those efforts is not realized.**

The gap in agricultural water management today is not effort.

The gap is coordination (and funding to support it)

Without a system connecting these pieces, the full potential of our investments is not realized.





Program Enhancements for the NPF

1. Support **NEW & EXISTING** Agricultural Water Management funding streams

- ✓ Drainage stewardship
- ✓ Irrigation efficiency
- ✓ Applied research and monitoring
- ✓ SK DEN and other partner / watershed coordination efforts

2. Invest in **PERMANENT** Agriculture Water research capacity

- ✓ Permanent Agriculture Water research positions
- ✓ Potential **Ag Water Research Chair at the University of Saskatchewan**
- ✓ Long-term knowledge continuity





Program Enhancements for the NPF

3. Fund demonstration and BMP validation

- ✓ Demonstration sites across soil zones
- ✓ Testing / validation of AG Water BMPs (stewardship)
- ✓ Consistent performance measurements

4. Invest in research translation

- ✓ SK DEN research connector / coordinator
- ✓ Extension activities and field learning
- ✓ Knowledge sharing across partners

This is not about starting from scratch — it is about connecting and scaling what already exists.



“NEW”! + EXISTING!

Validate innovation & showcase proven practices.

Showcase EXISTING work

- ✓ Highlight successful BMPs
- ✓ Build producer confidence
- ✓ Accelerate adoption

Support NEW coordinated research

- ✓ Test emerging practices
- ✓ Evaluate economic, agronomic & environmental outcomes
- ✓ Develop Saskatchewan-specific evidence

Demonstration research bridges the gap between research and real-world farm adoption.



THE OPPORTUNITY

The Next Policy Framework presents an opportunity to move beyond individual programs and build a **coordinated agricultural water management system** that:

- ✓ Builds long-term research capacity → critical knowledge retention
- ✓ Connects research to people → impact through extension
- ✓ Accelerates adoption & scale of BMPs
- ✓ Strengthens climate resilience → AG landscapes & communities
- ✓ Aligns water management with climate & food security outcomes
- ✓ Advances innovative, collaborative leadership → SK DEN

What Success Looks Like... Managed AG Water Landscape

- Improved crop productivity
- Healthier soils and reduced salinity risk
- Protection of infrastructure
- Stronger climate resilience
- Measurable environmental outcomes
- Increased public trust in agriculture
- Strengthened domestic food production capacity & supply reliability
- Greater resilience to global trade disruption & geopolitical uncertainty

Responsible water management delivers economic, environmental, and social returns — and strengthens our (Canada's) ability to produce its own food in an increasingly uncertain world.



WATER

**is one of the most powerful forces
shaping our agricultural landscape.**

**When managed well, it becomes one
of our greatest opportunities.**

Candace Mitschke 
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