

Sustainable Irrigation Development

Monitoring Soil and Water Quality



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Wednesday March 22, 2006

Outline

1. **Agriculture in Saskatchewan**
2. **Three pillars of Sustainability**
3. **History of Irrigation in Saskatchewan**
4. **Regulation & Irrigation Certification**
5. **Soil Quality Monitoring**
6. **Water Quality Monitoring**
7. **Sustainability – Are we there yet?**

Agriculture in Saskatchewan

- 49.2 million acres cultivated land/tame pasture
- 12 million acres natural pasture
- 388,000 acres irrigated
- \$3.6 billion Ag & Food Exports
\$245 million Ag & Food Imports (2004)
- Ag Exports to U.S. = \$950 million
Ag Imports from U.S. = \$245 million (2000 to 2004 Average)
- Ag Exports = 3.6 out of 12.2 billion total Saskatchewan exports

Agriculture in Saskatchewan

- 41% of world lentil exports
- 38% of world dry pea exports
- 56% of North American pulse seedings are in Saskatchewan

In 2005 Saskatchewan produced:

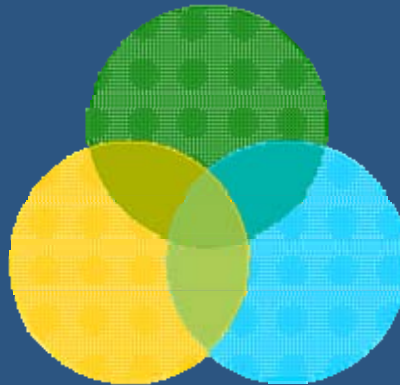
- 51% Canada's Wheat
- 43% Canada's Barley
- 48 % Canada's Canola

What is Sustainability?

3 Pillars For Any Sustainable System:

Environmental

Social

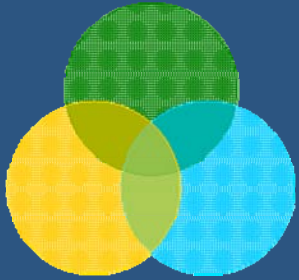


Economic

Sustainable Irrigation: Productivity in the long term

- In “Is Irrigated Agriculture Sustainable?”, J. Letey (1994), states that long-term productivity in irrigation is limited by three groups of limitations: natural/biological factors, social factors, and economic factors.
- He defines natural/biological factors as water quantity, and soil and water quality.
- SAF’s Agro Environmental Unit is responsible for water and soil quality issues in irrigation.

Three Pillars for a Sustainable Irrigation Industry:



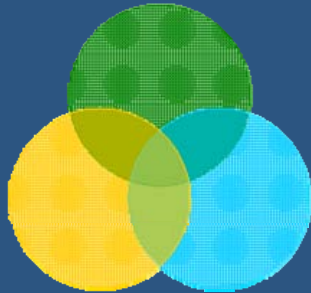
Environmental: Quantity of Water
Soil Quality
Water Quality

Economic: Viable Businesses
Market Demand
Infrastructure

Social: Societal Benefit
Community Relationships
Public Opinion/Perception

SAF Agro Environmental Unit

Focuses on Environmental Sustainability



Soil Quality

Water Quality

Standards

Certification

Environmental Monitoring

Saskatchewan's Irrigation History



*Richardson – McKinnon Irrigation Project Feb 27th, 1903
approved by the Government of the Northwest Territories.*

1880's: Cypress Hills & Maple Creek
6000 Acres by 1905

Irrigation is nothing new!

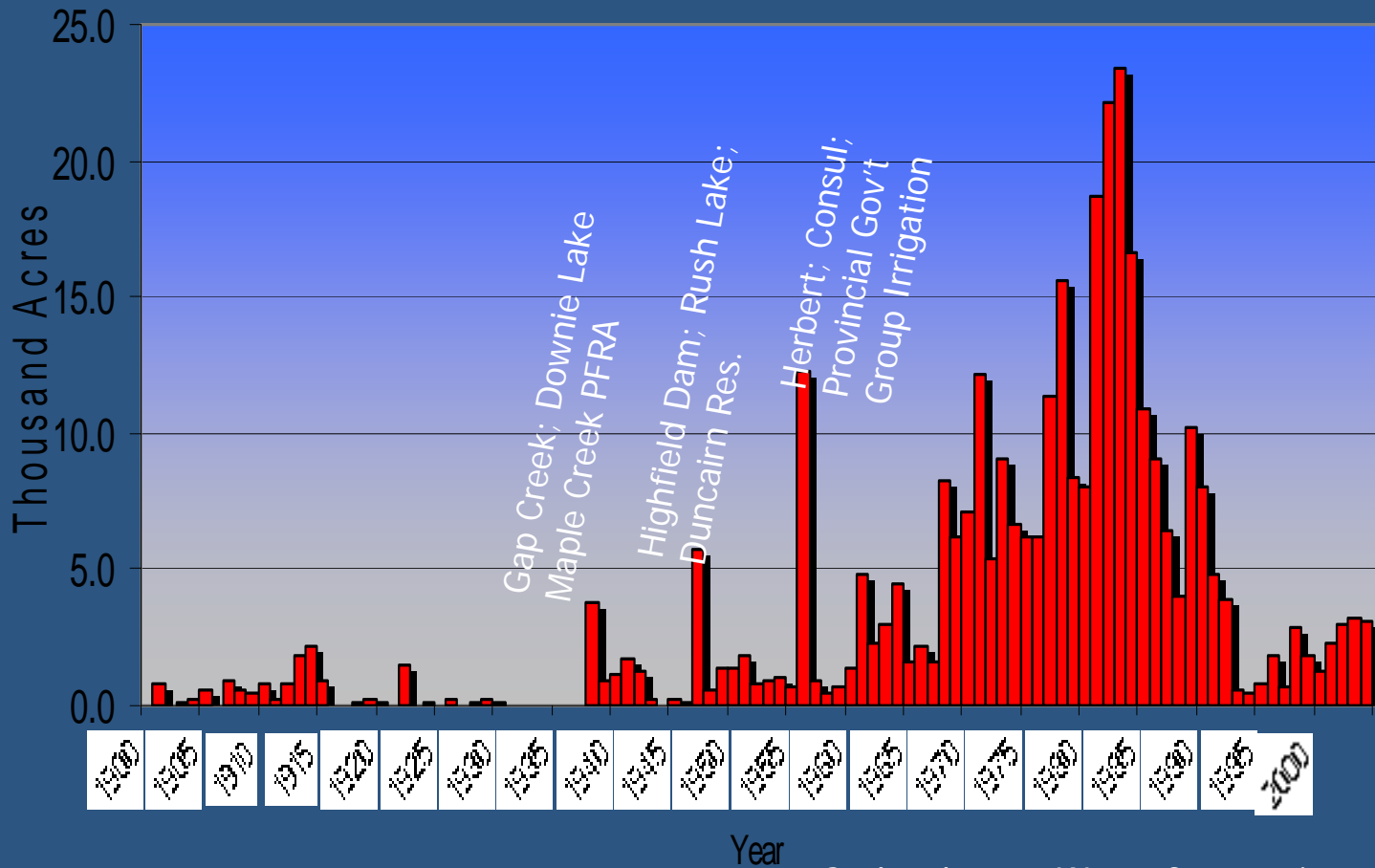


Prairie Farm Rehabilitation Administration
Established in 1935

- Built 26 Storage Reservoirs for Irrigation and Other Uses.
- Developed 23,000 acres between 1935 and 1966.



Year by Year Irrigation Development From 1901 to 2004



Late 1970's thru the 80's: Development Boom

- Gardiner Dam finished in 1967
- Hopes for high grain prices
- \$100 million for infrastructure
(50-50 with feds) PAWBED
- Up to \$100/acre grant to producer
- Development continued despite high interest rates.

Irrigation Districts Incorporated:

- SSRID #1 (1966)
- Luck Lake (1984)
- Riverhurst (1987)
- Macrorie (1989)



Irrigation Certification

- Introduced by the Irrigation Act, 1996.
- Issued if land meets certification criteria as determined by SAF.
- Protects soil and water resources
- Protects applicant's investment by ensuring development occurs on a suitable and productive area.
- SAF can impose special terms.

Certification Requirements

- Recent and historical water samples
- Soil salinity investigation
- Soil samples as required
- Land use history, previous irrigation suitability ratings, air photos, and current production plans are considered.
- Records are kept and sites may be revisited to observe changes after development

Soil Investigations

EM-38

- Measures soil's response to induced electro-magnetic field
- Can determine soil salinity when EM readings are correlated with laboratory soil results.
- Takes many readings in one second.

Dual EM-38
Reads Surface and Depth
Simultaneously



Distance Between Boundaries = 881.5 (m)

Acreage

GPS Time 497048

EM DATA

NAV
X-Track

Speed
0.0
Heading

N/A

GPS

PDOP

1.4

Svs

9

Pos

RT20

(4864)

DIFF

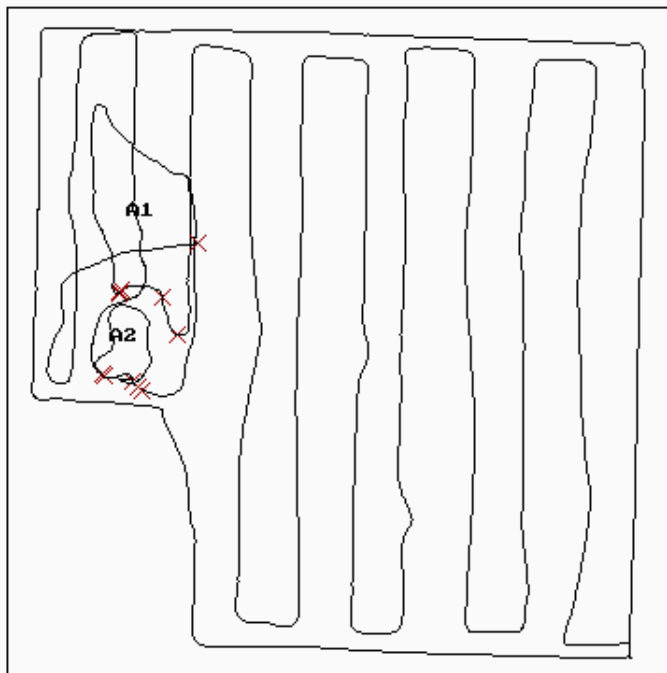
(434)

PTPOS

(1)

INVALID

(4)



Perin.

143.42

Area A1

5.84

Area A2

1.23

Start Area

End Area

Start Slough

End Slough

Start Visible Salt

End Visible Salt

Soil Sample # 1

Soil Sample ?

Hazard ?

add more here

keep it short

Stopping point # 1

E 356102.7, N 5692232.2, H 565.6, (DL 2.0)

!! END OF PLAYBACK FILE !!

Start Perimeter

End Perimeter

T-sect Width ?

T-sect Dir ?

Begin Navigation

Stop Navigation

Navigation Screen

GPS Status Screen

End Project

F1 ZOOM ALL

F2 ZOOM IN

F3 ZOOM OUT

F4 MAP VIEW

F5 SOIL GRID

F6 RESERVED

F7 NEXT

F8 PREV

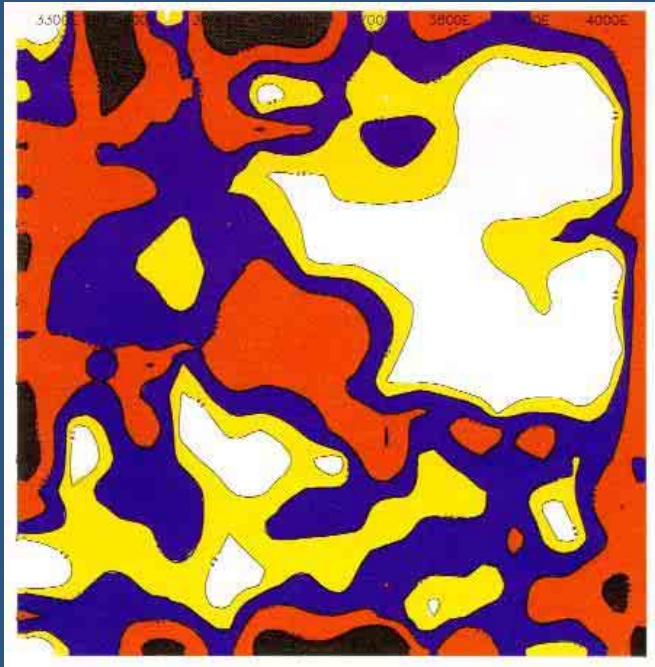
F9 NAV TO

F10 NAV DONE

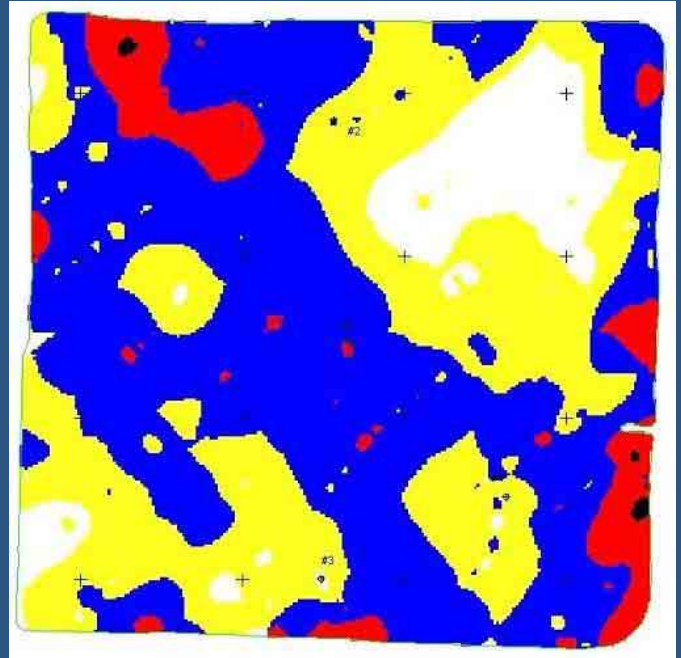
F11 RESET CP

F12 INPUT SC

Examples of EM38 Mapping



Gravity irrigated since the 1960's.
Horizontal Salinity mapped in 1994.
Converted to pivot in 1995.



Re-mapped in the fall of 2001.
Movement of salts out of surface
noticeable.

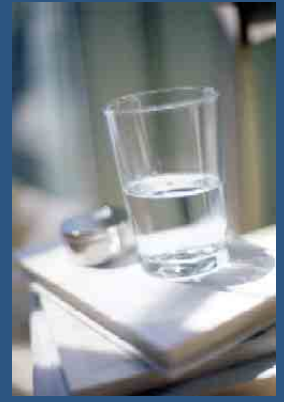
Water Quality & Monitoring

In addition to sampling required for certification:

- 560 piezometers in irrigation districts and potential development areas annually.
- Reservoir water sampling annual or every few years
- Groundwater levels need more investigation



Water Quantity



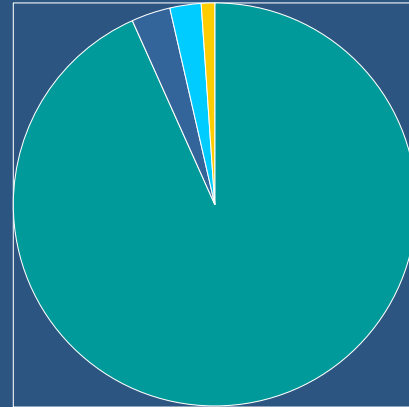
What are our opportunities?

Diefenbaker – Surface Water Use

(Sask. groundwater is not generally being used for irrigation)

Lake Diefenbaker Use

- 93.2% Downstream
- 3.3% Evaporation
- 2.2% Use
- 1.2% Qu'Appelle



■ Downstream ■ Evaporation ■ Use ■ Qu'Appelle

Improved Water Use Efficiency

- New sprinklers utilizing latest technology
- Pipes and lined canals reduce water loss in transport
- Irrigation not excessive, expensive

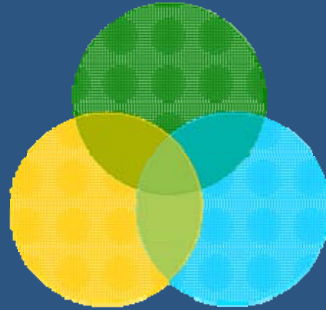
Example: H & M Gold Project in Southwest SK

4t hay/ 1 acre-foot of water, compared with 2t hay/ 3 acre-feet of water.
Water Use Efficiency increased by 6X

- Closer to water source
- Better soil suitability
- Sprinkler vs. gravity
- Pipeline vs. surface canal
- Modern irrigation scheduling



Environmental Sustainability



Are we there?

Recall the Components for a Sustainable Irrigation Industry:



Environmental Components:

Quantity of Water

Soil Quality

Water Quality

Conclusion

- The Saskatchewan irrigation industry is protecting its natural resources. We have technology and opportunities that other parts of the world do not have.
- Through land evaluation and testing, water and soil quality is protected.
- We are also blessed with an abundant supply of high-quality surface water. If we plan accordingly, part of this water supply can be used for economic development with the least possible impact on our environment and future productivity.

Environmental Stewardship is Ethical

But also vital to reduce lost production, increase the value of crop production, and improve food safety.

References

- Letey, J. 1994. *Is Irrigated Agriculture Sustainable?* p. 23-37. In: Soil and Water Science: Key to Understanding Our Global Environment. Soil Science Society of America Special Publication Number 41. SSSA Madison, USA.
- Pederson, Roger. 2003. *The Direction of Irrigation in Saskatchewan*. Power Point Presentation.
- Pulse Crop News. Fall 2004.
- Sask Ag & Food. 2006. *Agricultural Statistics Fact Sheet 2006*. Web Site: http://www.agr.gov.sk.ca/docs/statistics/crops/prices_marketing/AgStatsFactsheet2006.pdf Last Accessed on March 7, 2006.
- Sask Ag & Food. 2003. *Pulse Opportunities in Saskatchewan*. PDF Document: <http://www.agr.gov.sk.ca/docs/crops/pulses/PulseOpportunities2003.pdf>. Last accessed on March 7, 2006.
- Saskatchewan Environment. 2000. *Water Management Initiatives in Saskatchewan: A Brief History*. Government of Saskatchewan Web Site: <http://www.se.gov.sk.ca/ecosystem/water/HISTORY.htm> Last Accessed on March 7, 2006.