Tile Drainage - Manitoba Experiences

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History in Manitoba

- 1980s
  - Drought
  - Wet Sands Research
- 1990s
  - Wet cycle
  - Pilot Project 93-97
  - High Value crops
  - Tile plant
  - Wet sands value !
- 2000s
  - Environment ?
  - Salinity

Tile in Manitoba - Purpose

- Reduce risk of drown out !
  - Loamy sands
  - Sandy loams
  - Fine sandy loams
  - Silt loams
- Reduce salinity ?
  - Fine sandy loams
  - Clay loams
- Improve root zone and field access

Pilot Project – 1994 to 1997

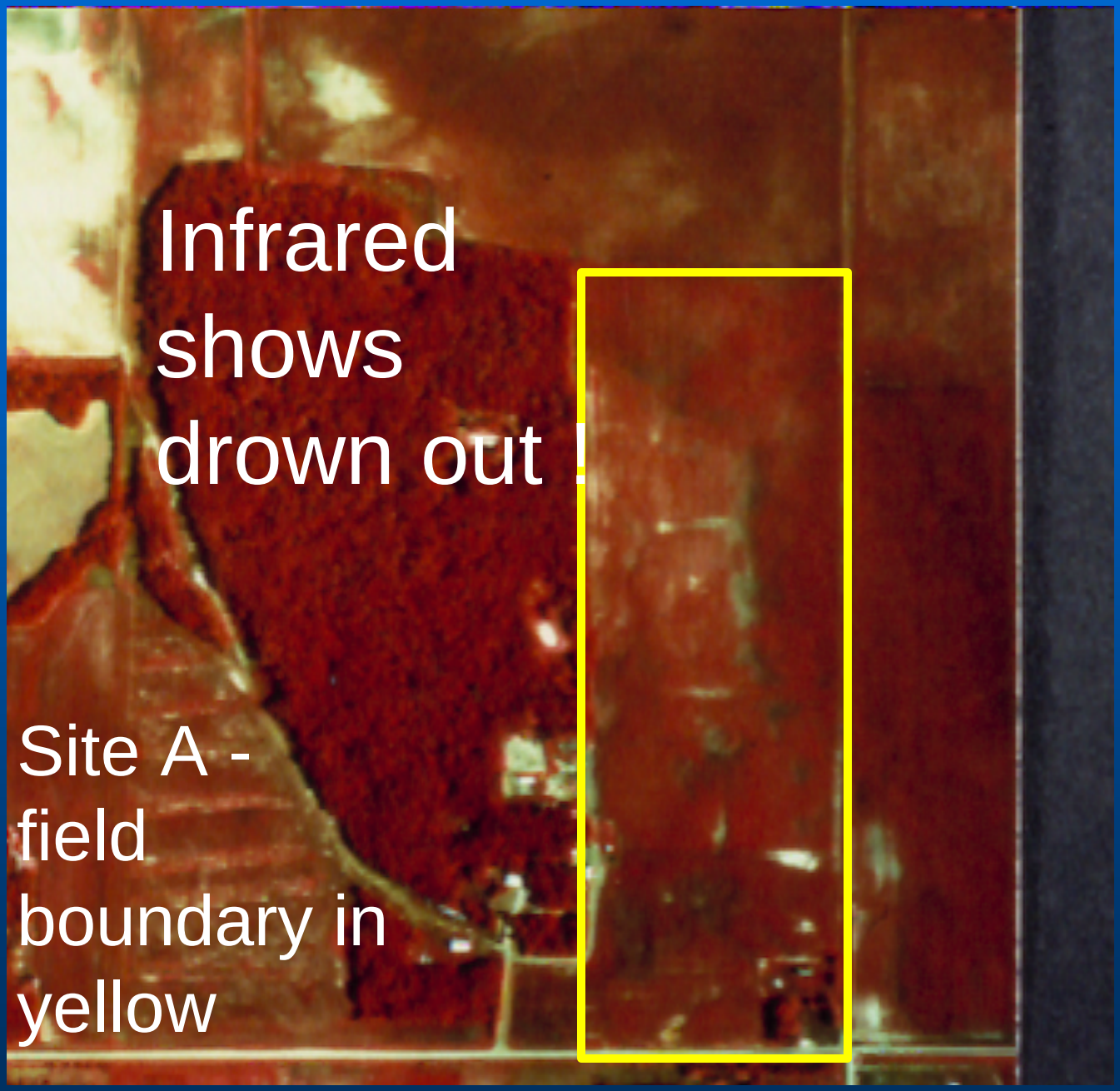
- evaluated
  - drainage effectiveness
  - environmental impact
- 4 sites (soil types = clay loam to sand)
- factsheet available (copies)

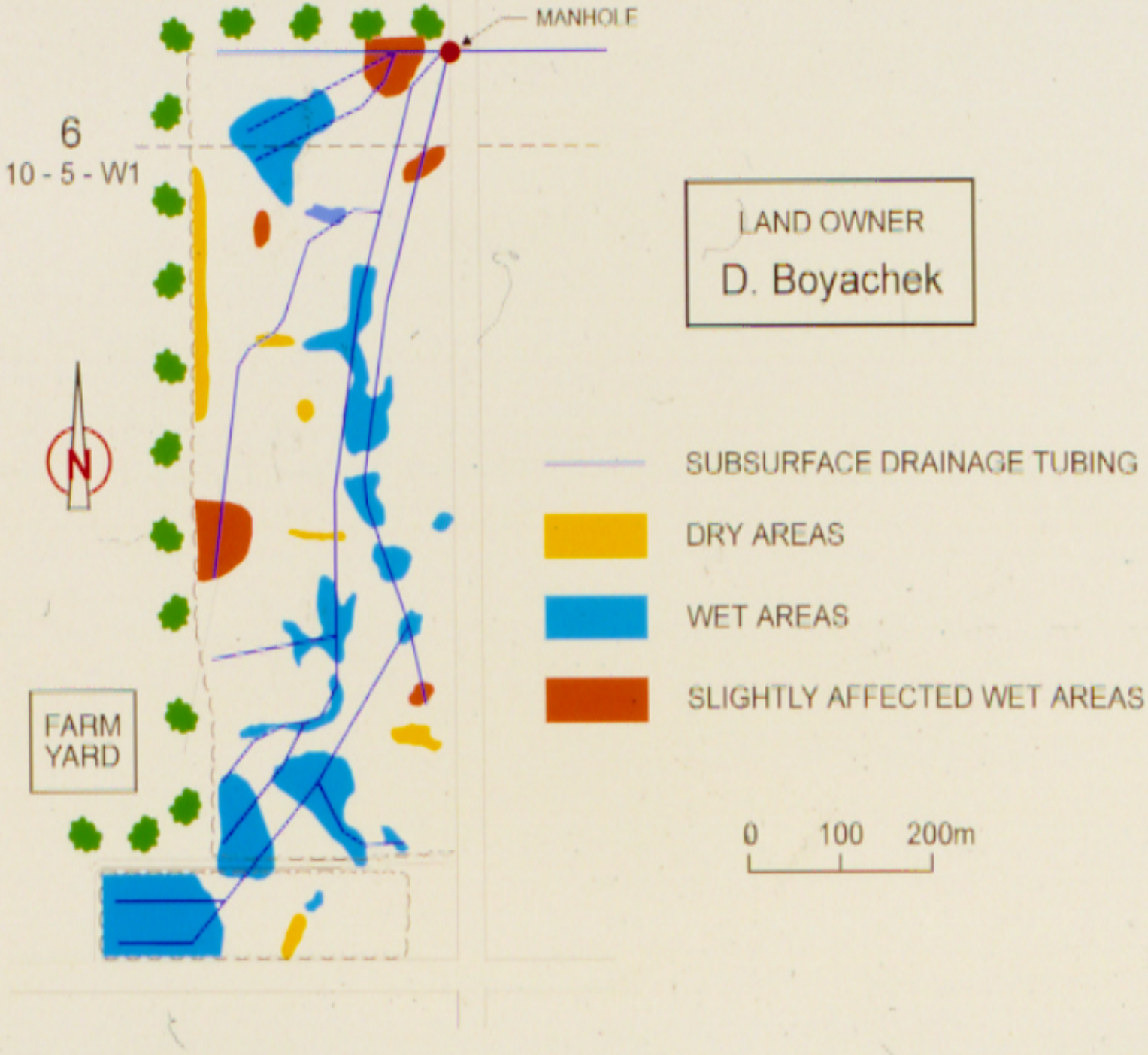
Design Criteria – Pilot Project

- $300-$500 per acre
- account for silt in soils (filter cloth)
- hydraulic conductivity varies
- drainage coefficient ~ 6 mm/day (1/4 “ per day)
- considered crop demand (3 to 6 mm/day)
- considered soil storage potential and water to drain
  - clay; silt; sand
- design rainfall ?
  - 1:50 rain ~ 14 mm/day for 10 days OR 8 mm/day for 20 days
- median growing season rainfall 350 mm (14 inch)

Pilot Project Sites

Site	Acres	Soil Type	Design	Spacing Between Tile (m)	Depth to Drain Invert (m)	Outlet Type	$/ac
A	27	sand over clay	random	30 to 40	0.9 to 1.3	gravity	510
B	21	sand	systematic	40	0.8 to 1.5	pumped	387
C	81	clay loam or sandy loam over clay	systematic	30	0.9 to 1.2	gravity	542
E	45	sandy loam over silty clay	systematic	30	1.2 to 1.4	gravity	461


Infrared shows drown out !
Site A - field boundary in yellow


MANHOLE
6
10 - 5 - W1
N
FARM YARD
LAND OWNER
D. Boyachek
SUBSURFACE DRAINAGE TUBING
DRY AREAS
WET AREAS
SLIGHTLY AFFECTED WET AREAS
0
100
200m


SITE A -
Random

Bruce & Bob Bartley: Tile Drainage Performance Assessment

Site C – Systematic 81 acres drained

1:12,000

0 150 300 600 900

Meters

Data Source:
Designated Drains, Highway - Provincial Roads, and Continuous Section Fabric data from Manitoba Land Initiative, Manitoba Conservation. Map Unit Number from Land Resource Unit 1:20,000

Map Design: Sonia Selinger, PFRA Morden
Created in ArcMap 9.0: February 28, 2006
File Reference: G:\AV_2005\TileDrain\BartleyTile_Bartley.mxd

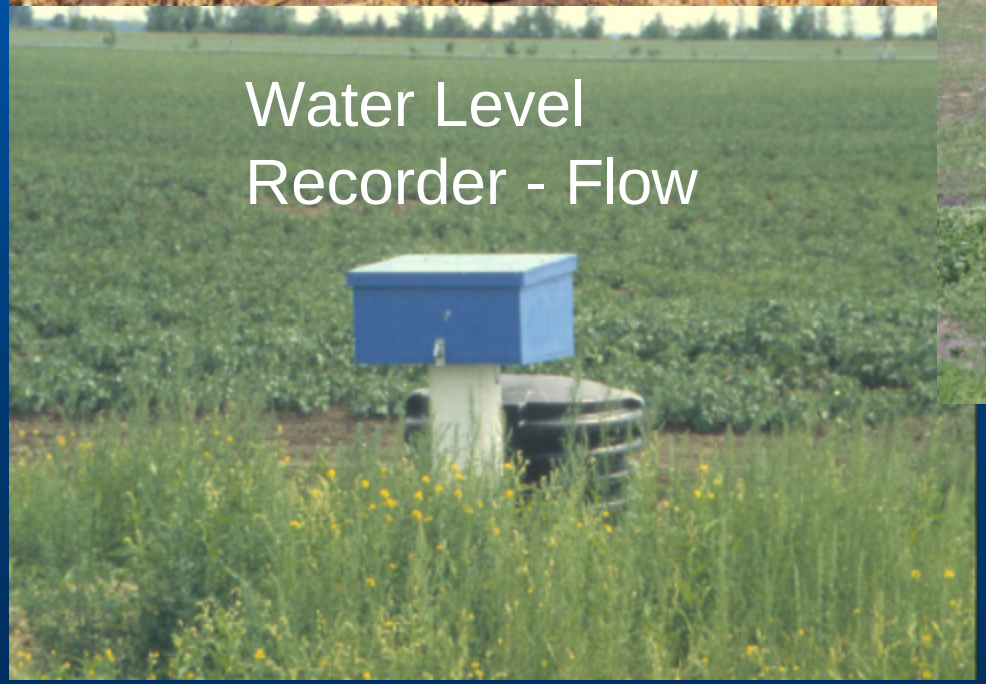
Rural Municipality of Roland


Site E –
Systematic
-45 acres
- recycle water

Monitoring Program

- Precipitation
- Water Table Levels
- Discharge
- Water Quality
- Crop Management Practices

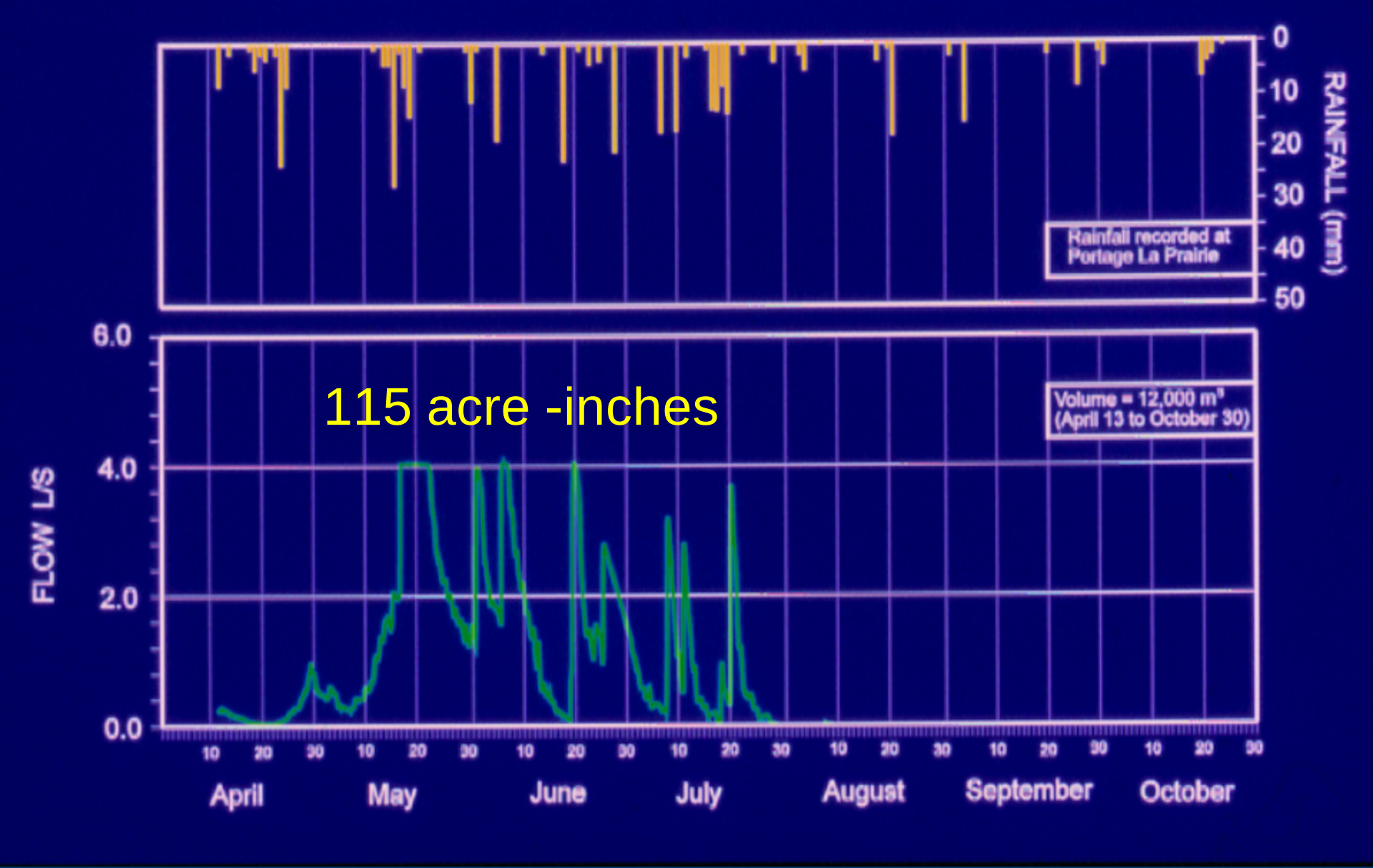
Monitoring Equipment



1996 - Site A - Field Data

- Area Drained — 27 Acres
- Soil — Loamy Sand over Clay
- Total Rainfall — 12 Inches
- Crop Grown — Corn
- Design Flow — 103 igpm
- Observed Max. Flow — 66 igpm
- Discharge — 9.6 ac. ft.

(4.3” on 27 ac.)



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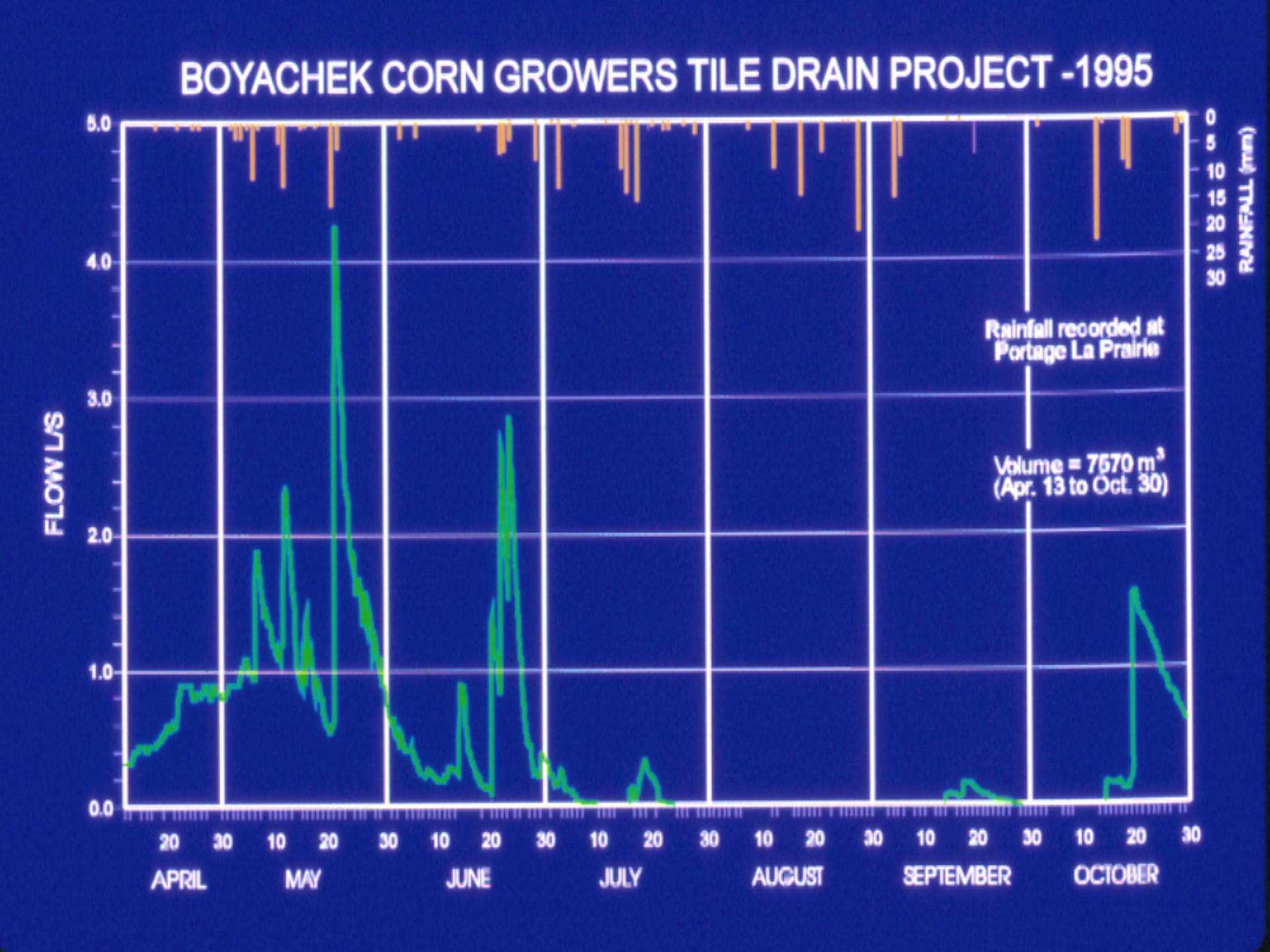
Site A - 1996

Canada


BOYACHEK CORN GROWERS TILE DRAIN PROJECT -1995
FLOW L/S
5.0
4.0
3.0
2.0
1.0
0.0
RAINFALL (mm)
0
5
10
15
20
25
30
Rainfall recorded at Portage La Prairie
Volume = 7670 m³
(Apr. 13 to Oct. 30)
20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER

1996 - Site A - Water Quality

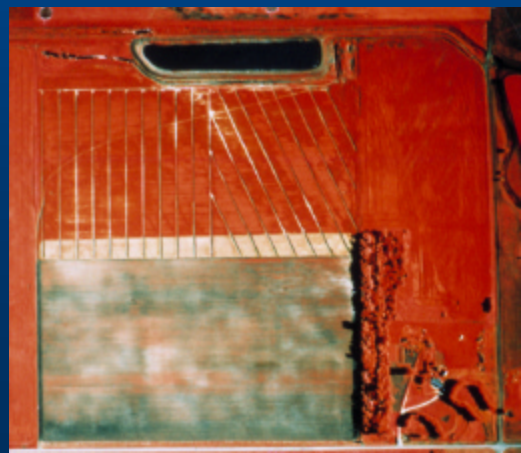
- **Nitrate-N**
  - Max. Conc. — 43.5 ppm (Apr. 24)
  - Min. Conc. — 28.5 ppm (July 25)
- **Conductivity**
  - Max. — 1720 uS/cm (May 23)
  - Min. — 1260 uS/cm (Apr. 21)
- **Pesticide Levels**
  - Atrazine — 0.0002 ppm (July 25)

Comments – Producer Site A

- " the tile allowed me to get on the field in the fall of 1994 and to seed at least a week earlier in 1995"
- " the 1995 crop in the tiled low areas outyielded the crop in the untiled low areas by 70%; overall yield improvement due to tile was about 20%"

1995 - Site E - F ield Data

- Area Drained 45 Acres
- Total Rainfall 15 Inches (plus 2”irrigation)
- Crop Grown Onions
- Design Flow 194 gpm
- Observed Max. Flow 36 gpm



1996 - Site E - Field Data

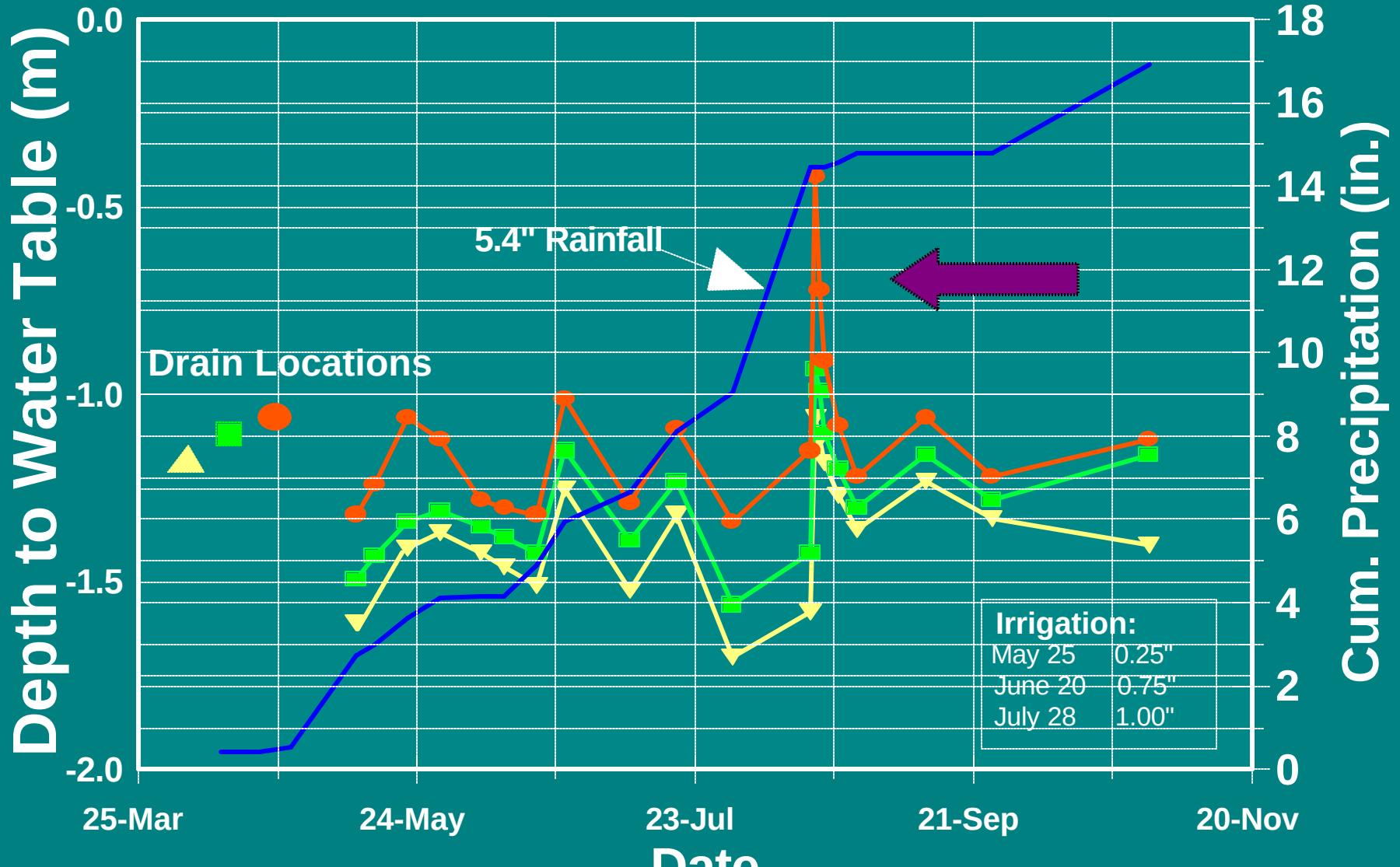
- Area Drained — 45 Acres
- Total Rainfall — 11 Inches (plus 1” irrigation)
- Crop Grown — Potatoes
- Design Flow — 194 gpm
- Observed Max. Flow — 53 gpm

1996 - Site E - Water Quality

- **Nitrate-N**
  - Max. Conc. 59 ppm (July 25)
  - Min. Conc. 3 ppm (Aug. 8)
- **Conductivity**
  - Max. 5070 uS/cm (May 23)
  - Min. 1140 uS/cm (Aug. 8)
- **Pesticide Levels**
  - Furadan not detected (ppt)
  - Polyram not detected (ppt)

Site E

1995 Water Table Level & Precipitation



Comments: Producer Site E

- “took awhile for impact of the drainage to become evident after installing in 1994”
- “pretty much would have lost the 45 acres onion crop in 1995 without the tile”
- (ps. Installed more tile on main farm BUT installing at 15 m spacing (50’) and shallower!)

Tile Water Quality - Pilot

- Conductivity 303 to 5070 uS/cm
- Nitrate-N 1.8 to 73.6 ppm
- Pesticides 1 detect
  - Atrazine 0.0002 ppm (CWQG 0.005 ppm)
  - all other below D.L.'s

Pilot Project Conclusions - 1997

- Tile Performance:
  - water volume significant (3”to 5”/ac)
  - water quality issues (nitrates and EC)
  - 30 m (100 foot) spacing and 0.9 to 1.2 m (3 to 4 feet) depth adequate especially for loamy sands
  - Ps. producers NOW going 50-60 foot spacing !
  - gravity outlet preferred, but pumps work

- Producer benefits !
  - Earlier start
  - Reduced drown out
  - Access for spraying and cultivation
  - Compaction reduced
  - HOPE for salinity reduction
  - PROBABLY better fertilizer utilization and timing
  - Decreased surface runoff
  - Frost control

Economics of Tile Drainage

- PFRA Study

- "to cover the cost of the drainage, corn producers would have to realize and increase of 21to 30% in corn yields" over a ten year planning horizon
- for the most costly project this is equal to 18/bu/ac

Future (Predicted 1994)

- increase tile drainage
  - increased acreage of potatoes
  - other high value crops
  - more cost efficient designs
  - increase in land values
- minimize environmental impacts
  - adopt BMPs
  - reuse/recycling of effluent water
- licensing issues ?
  - environmental concerns (Fisheries, Endangered Species)

Post Pilot Project 1997 - today

- Tile plant in late 1990s
- Manitoba based contractors and self installers

- Farmer satisfied with drainage
  - Cost/benefit good
  - Design (50’ spacing)
  - Tile water recycling
  - Salinity reduction
- Farmer concerns with drainage
  - Water quality
  - Downstream impacts (feel these are minor)

Questions ?