THE pebble PARTNERSHIP

Groundwater Quality



November 28, 2007

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WMC

THE pebble PARTNERSHIP

Outline

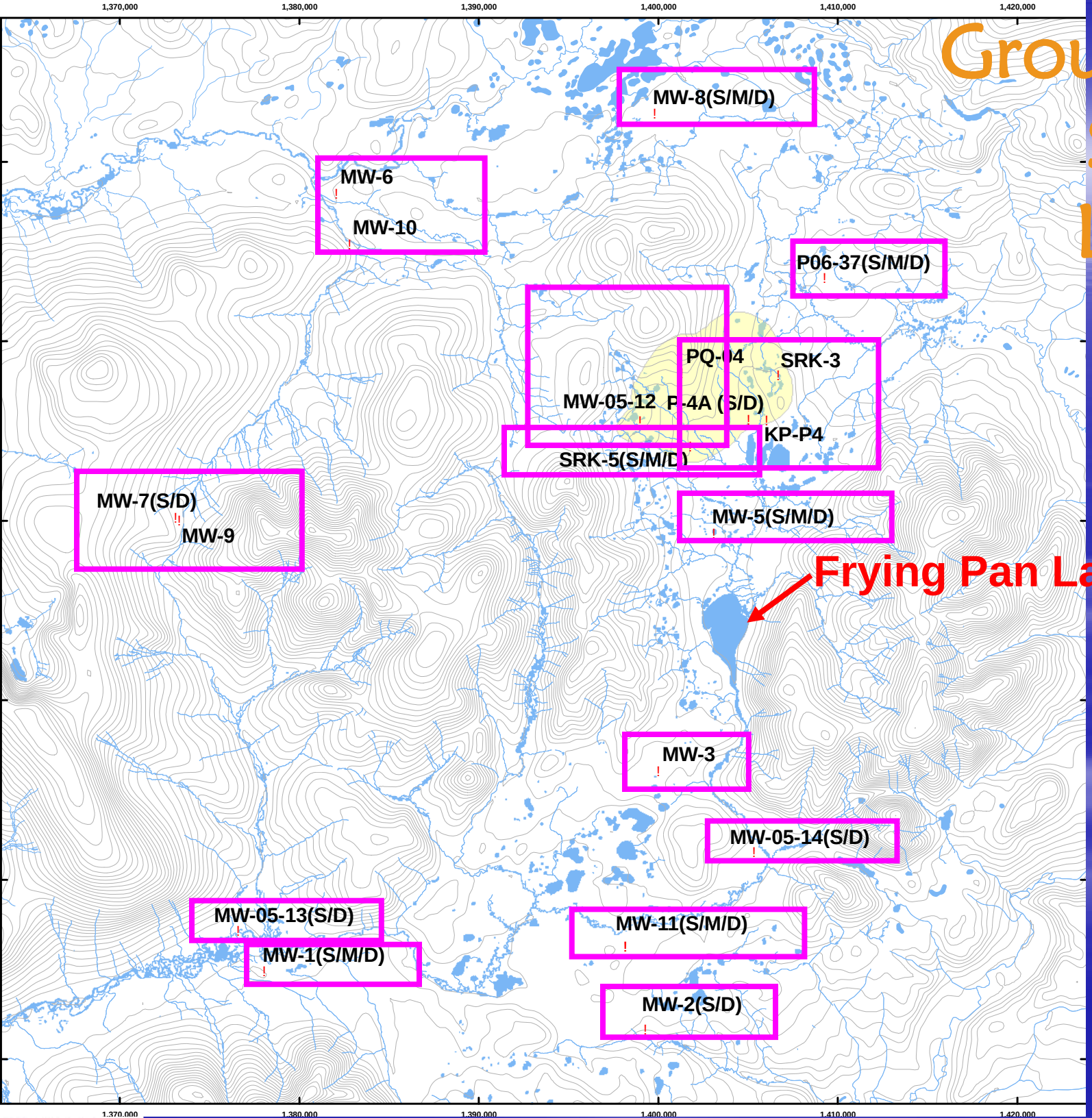
1. Objectives and Overview
2. Field Parameters
3. Major Ions
4. Trace Elements
5. Nutrients
6. Tritium
7. Where we go from here

WATER MANAGEMENT CONSULTANTS
A Schlumberger Company

Groundwater Sampling Objectives

- Characterize the baseline groundwater quality
  - overburden
  - bedrock
  - between catchments
  - seasonally
- Help with interpretation of groundwater flow rates
  - Recharge rates
  - Discharge rates to streams

Groundwater Sampling Locations



Bedrock vs. Overburden

- Bedrock:
  - 2006: 10
  - 2007: 13
- Overburden:
  - 2006: 24
  - 2007: 25

Timing of Groundwater Samples

- 2004 (9 locations, 21 wells)
  - September
  - October
- 2005 (18 locations, 34 wells)
  - Mar
  - May
  - Aug
  - Nov
- 2006 (18 locations, 34 wells)
  - Mar
  - May
  - Aug
  - Nov
- 2007 (20 locations, 38 wells)
  - Mar
  - May
  - Aug
  - Nov

Sampling Methodology: Key Points

- Dedicated submersible pumps
- Low-flow micro-purging
- Field parameters measured in flow-through cell
- Dissolved metals samples filtered in-line in the field with disposable filters
- 10% of samples collected in triplicate
- Detailed QA/QC

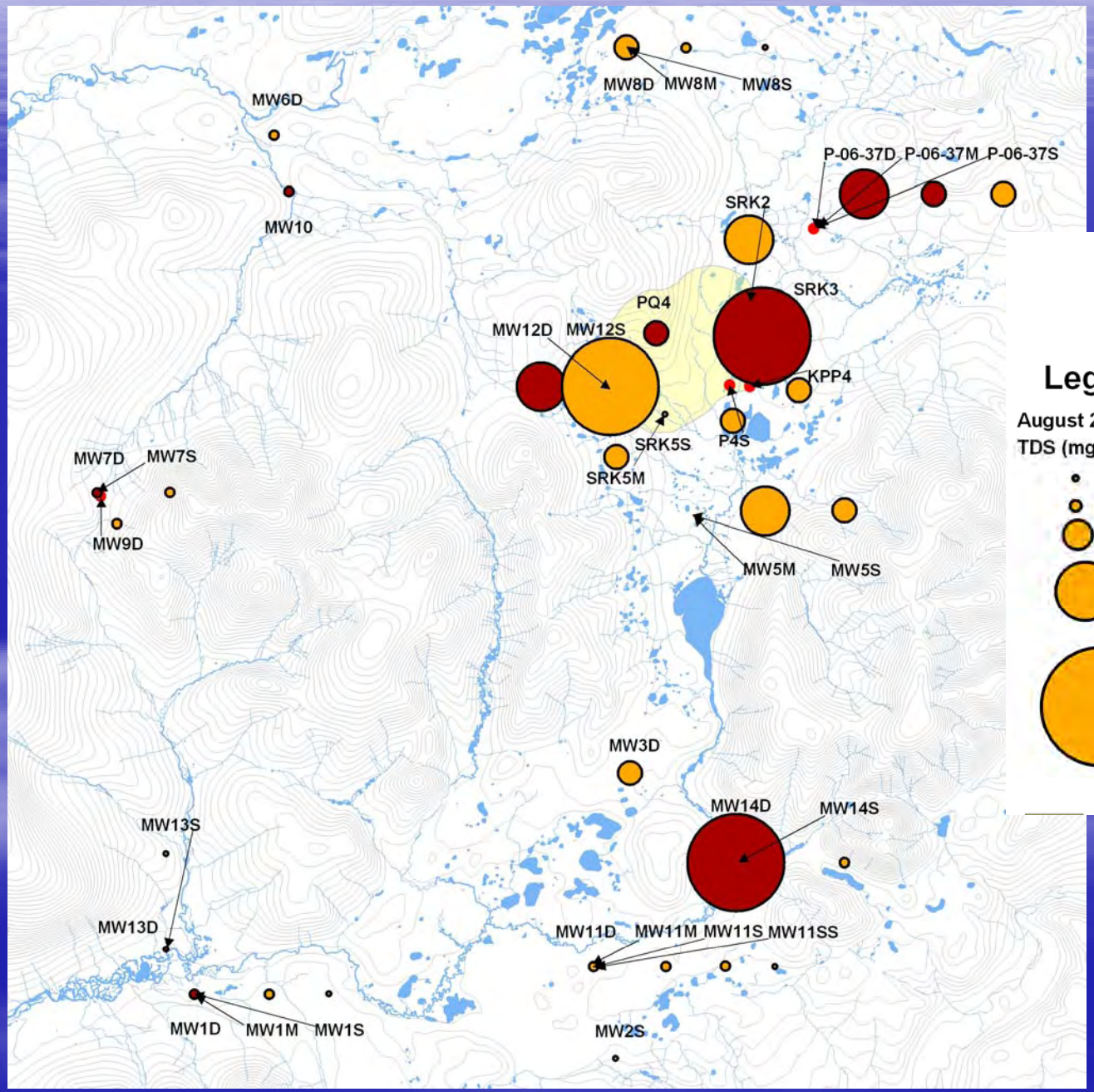
Analyses

- Field parameters
  - Specific Conductance (Total Dissolved Solids)
  - Dissolved Oxygen
  - pH
- Major ions
  - Ca, Mg, Na, K
  - Alkalinity, SO_4, Cl
- Total and dissolved trace elements
- Nutrients
  - NH_3, NO_3, PO_4

Outline

1. Objectives
2. **Field Parameters**
3. Major Ions
4. Trace Elements
5. Nutrients
6. Tritium
7. Where we go from here

TDS Aug 07 Bubble Plot



Total Dissolved Solids
Spatial Distribution:
August 2007

Legend

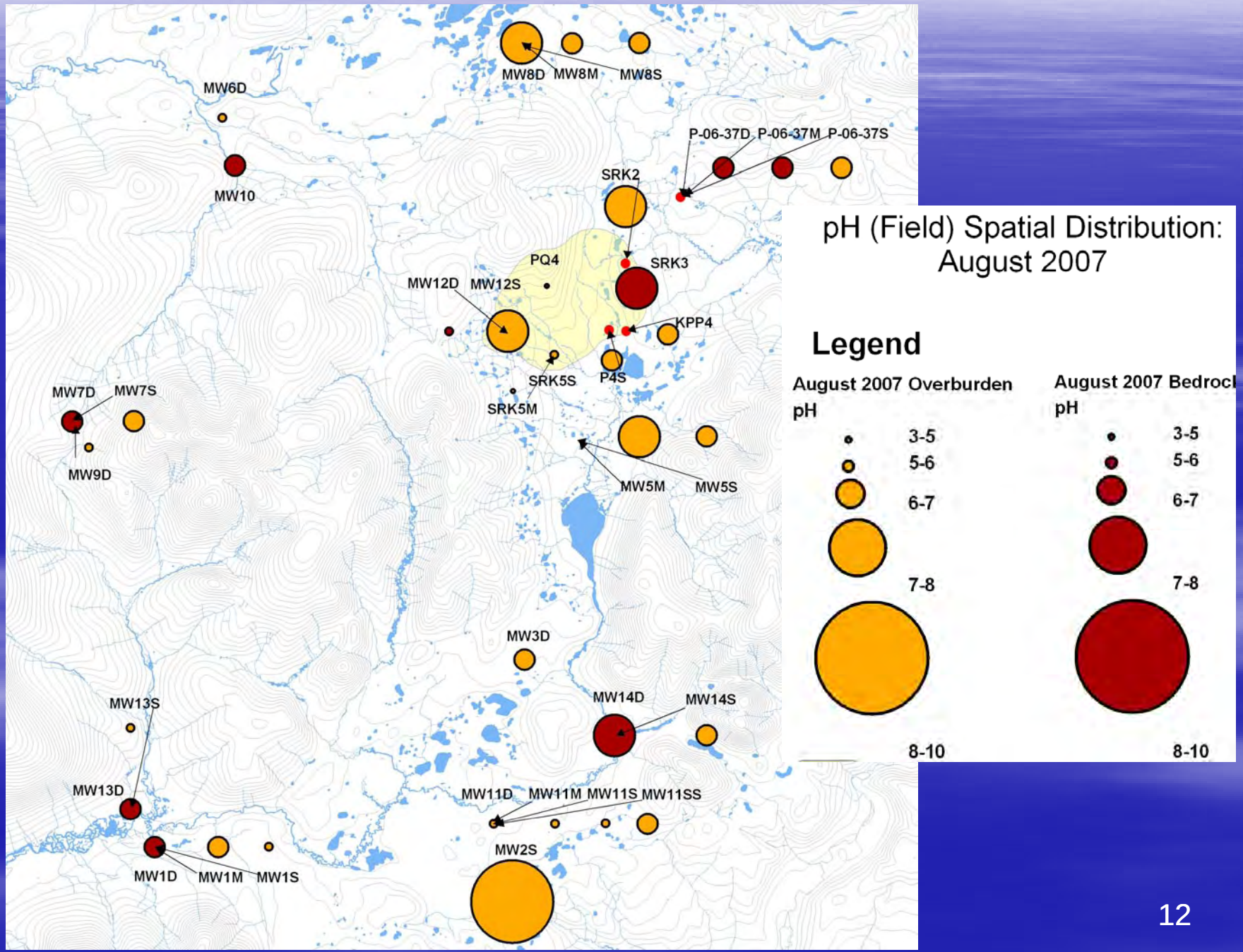
August 2007 Overburden
TDS (mg/L)

- 0-25
- 25-50
- 50-100
- 100-200
- 200-500

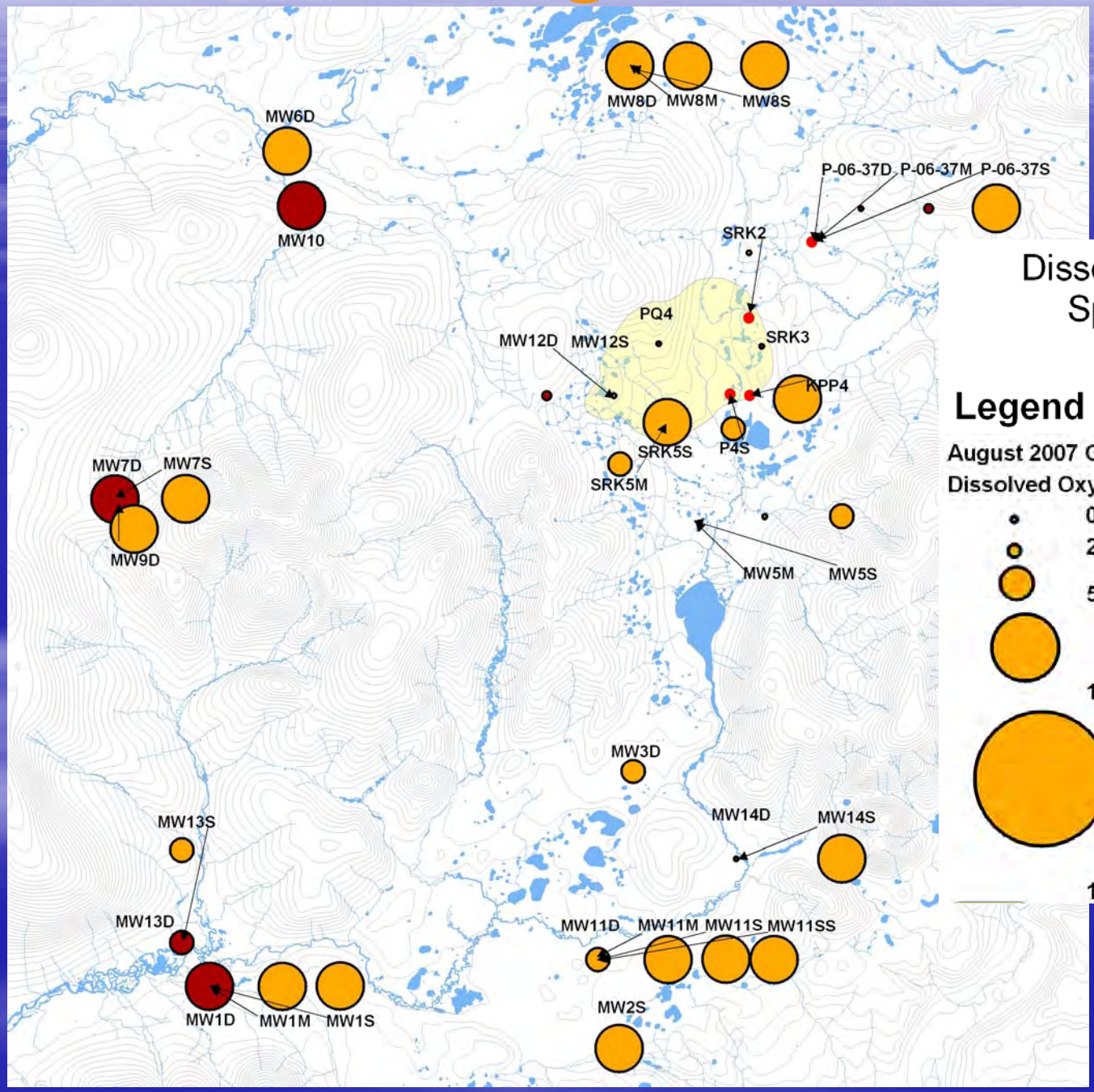
August 2007 Bedrock
TDS (mg/L)

- 0-25
- 25-50
- 50-100
- 100-200
- 200-500

pH Aug 07 Bubble Plot



D.O. Aug 07 Bubble Plot



Dissolved Oxygen (Field)
Spatial Distribution:
August 2007

Legend

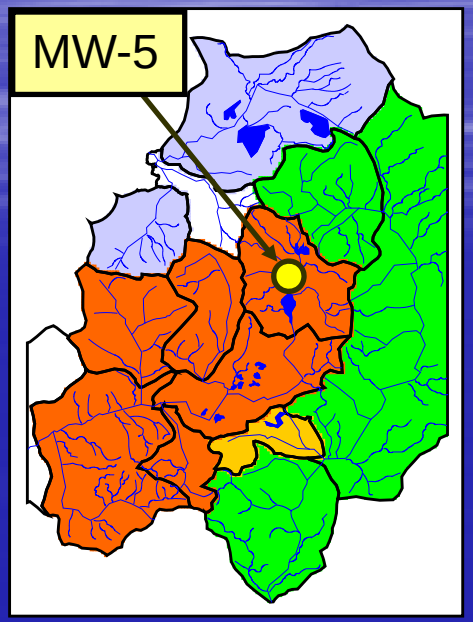
August 2007 Overburden
Dissolved Oxygen (mg/L)

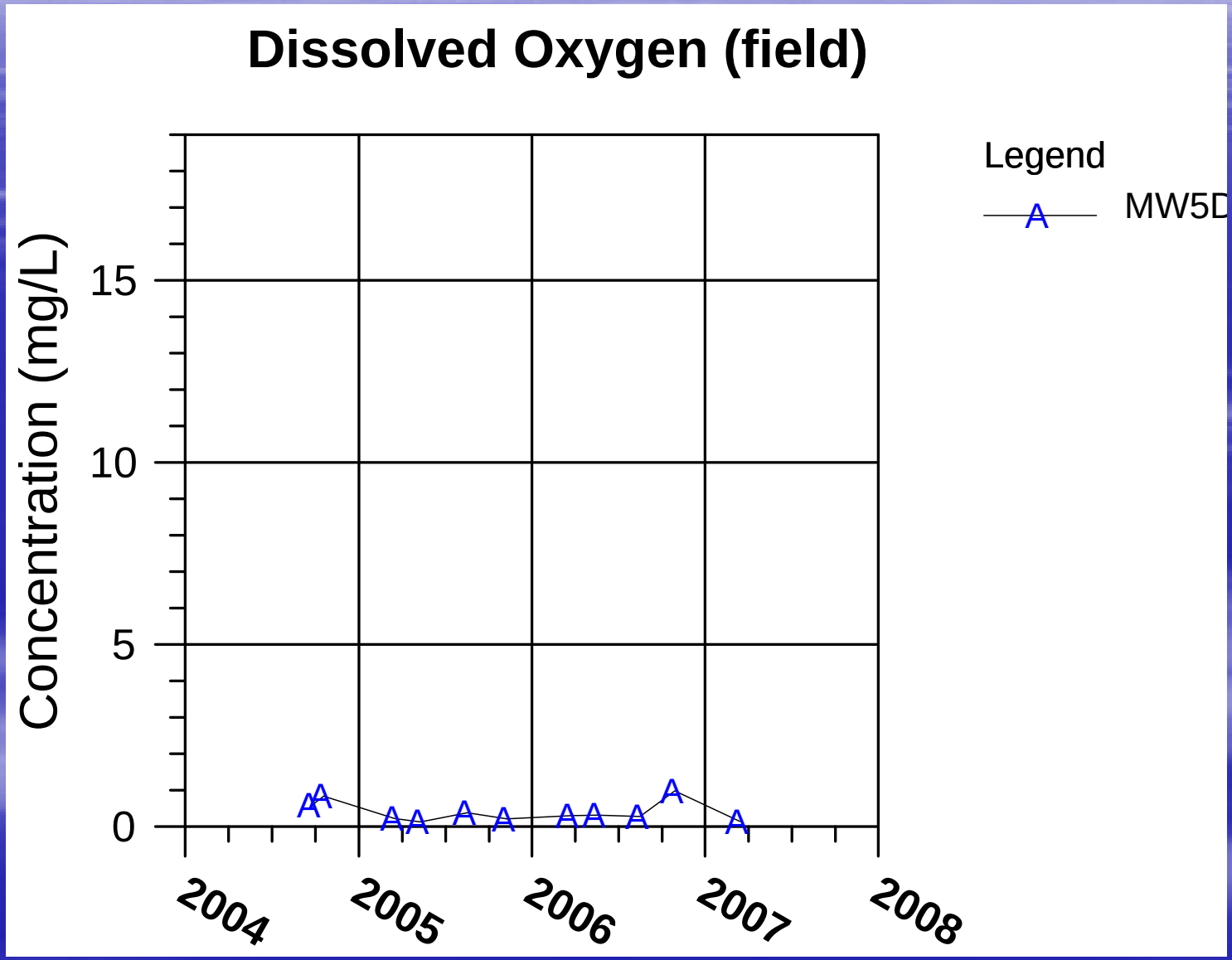
- 0-2.5
- 2.5-5.0
- 5-10
- 10-15
- 15-20

August 2007 Bedro
Dissolved Oxygen (

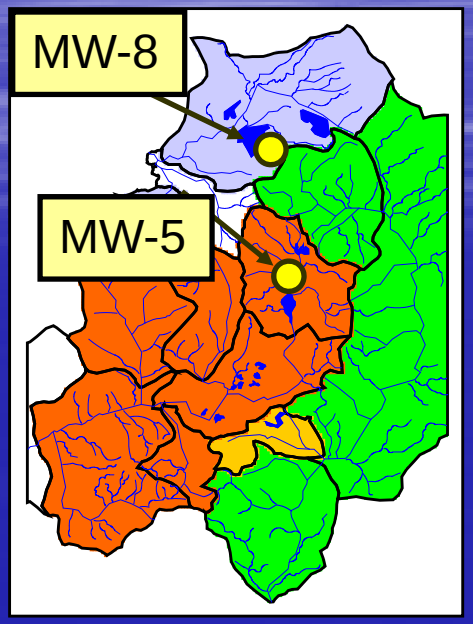
- 0-2.5
- 2.5-5.
- 5-10
- 10-15
- 15-20

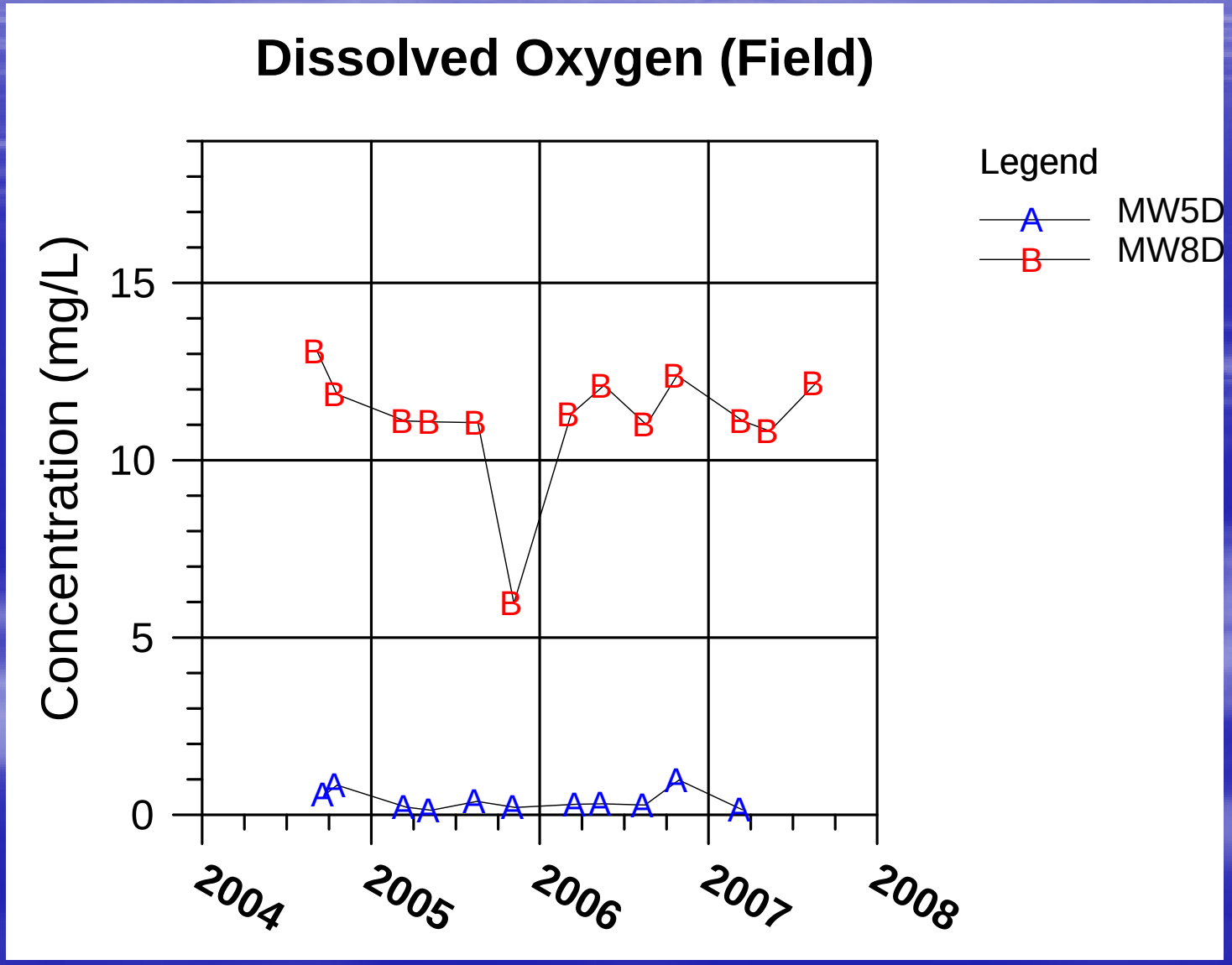
Dissolved Oxygen MW-5D



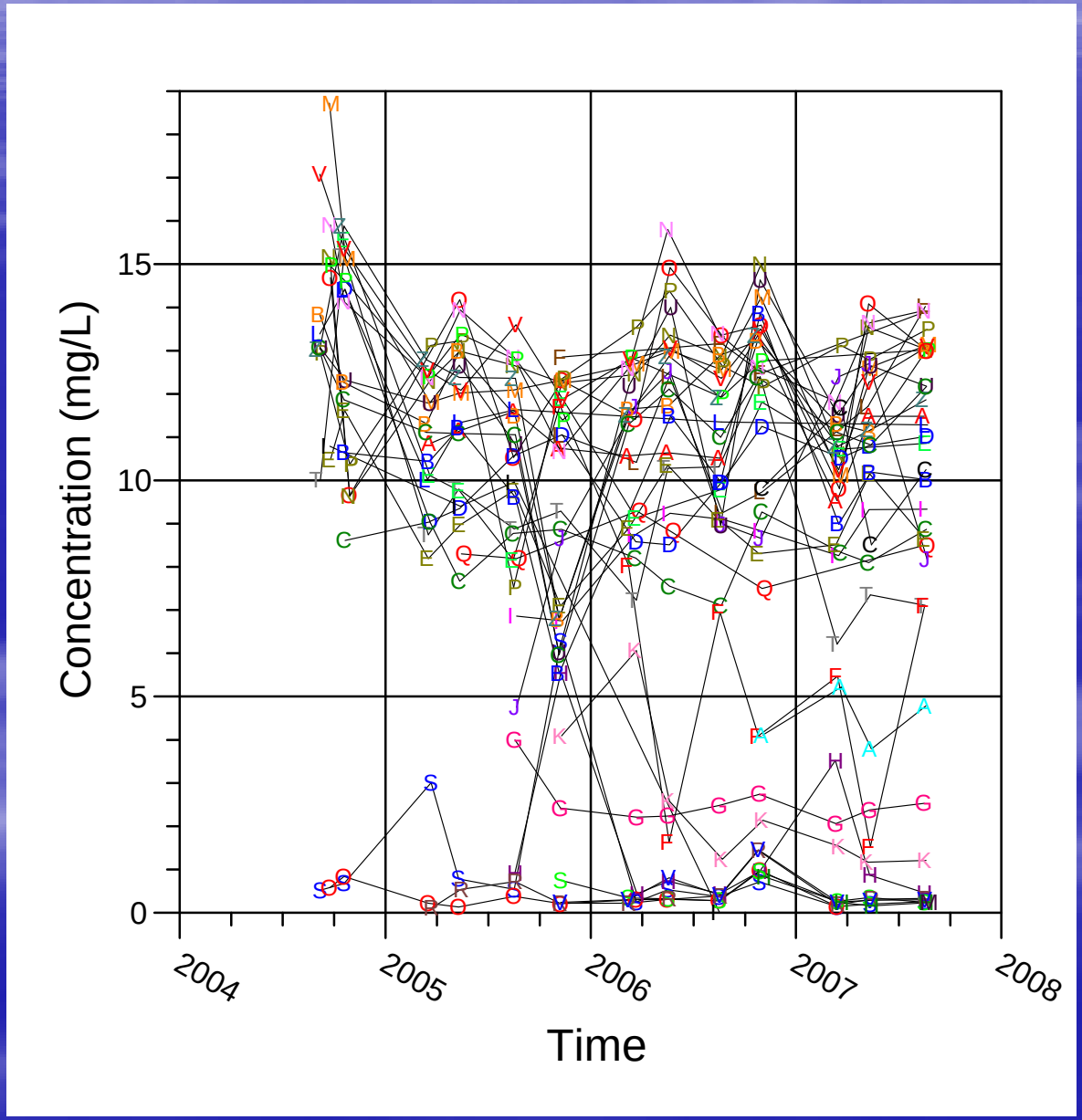


Dissolved Oxygen MW-5D and 8D





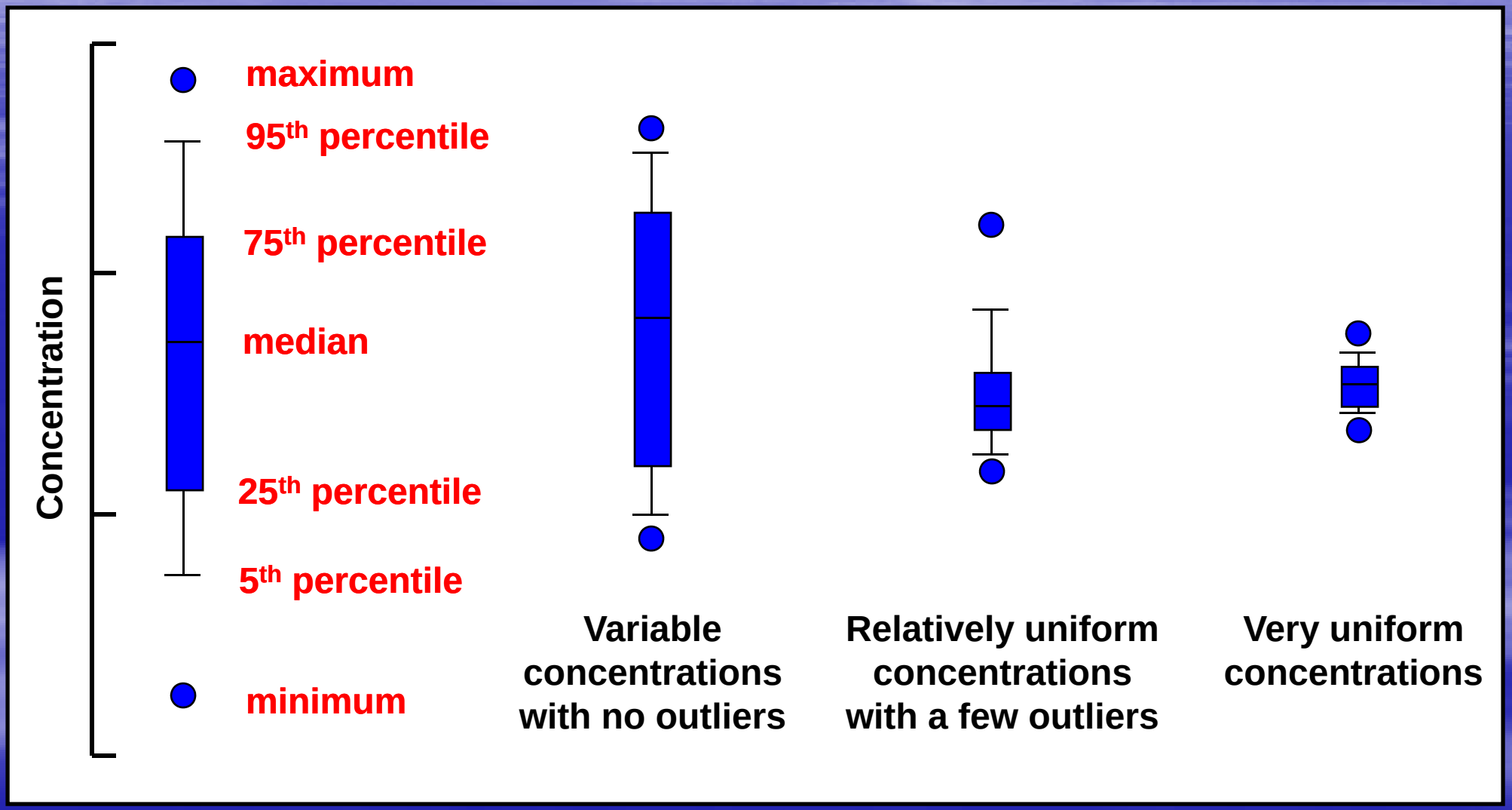
Dissolved Oxygen All



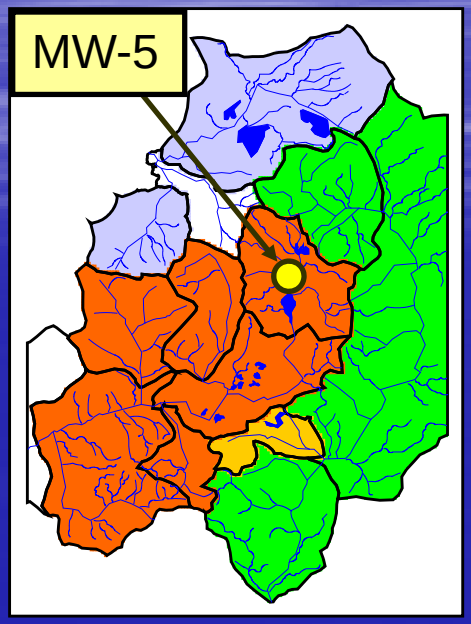
Legend

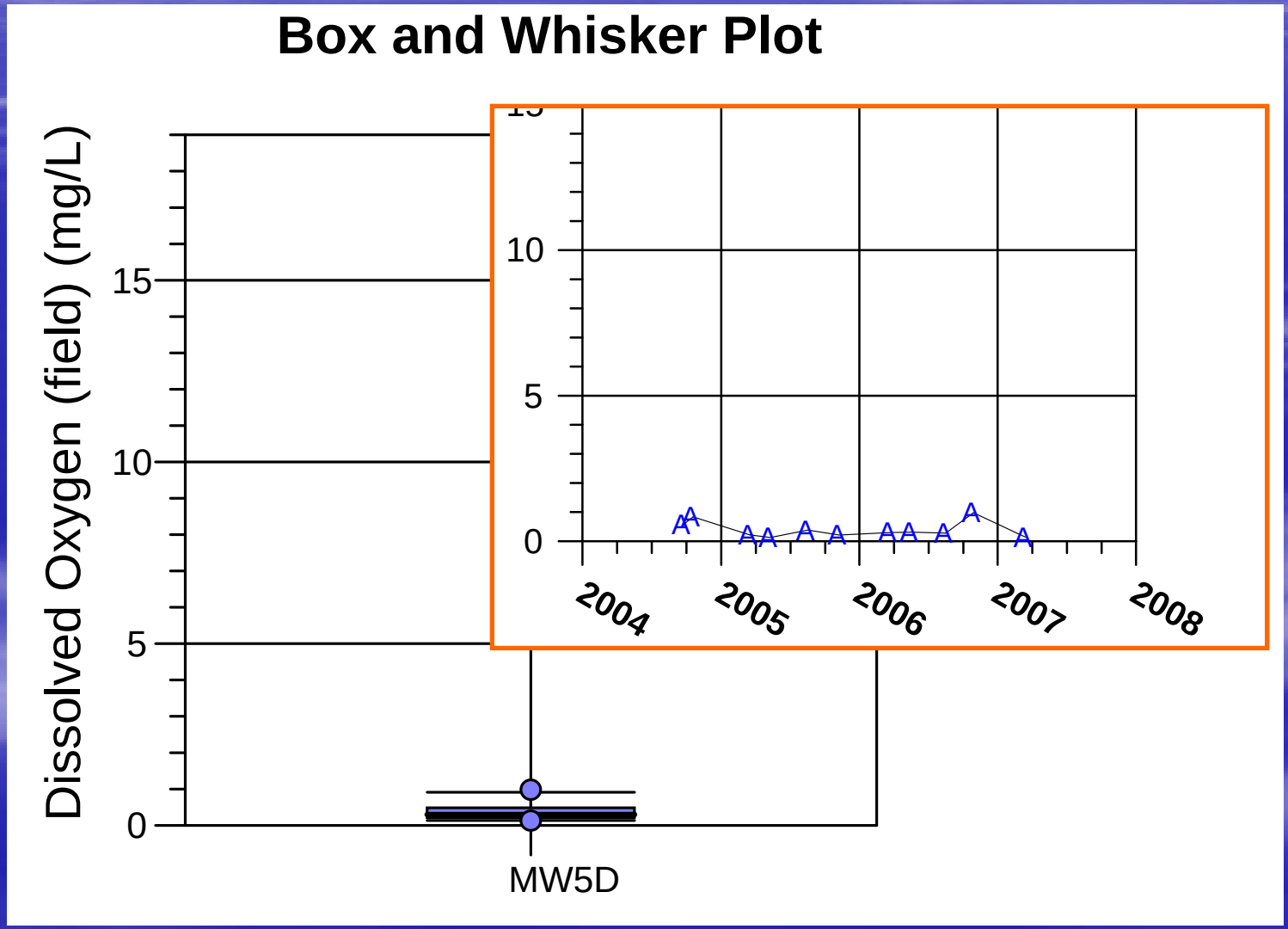
- MW1S
- MW1M
- MW1D
- MW2D
- MW3D
- MW5S
- MW5M
- MW5D
- MW11SS
- MW11S
- MW11M
- MW11D
- MW12S
- MW12D
- MW13S
- MW13D
- MW14S
- MW14D
- KPP4
- P4S
- PQ4
- SRK2
- SRK3
- SRK5S
- SRK5M
- SRK5D
- MW6D
- MW7S
- MW7D
- MW8S
- MW8M
- MW8D
- MW9D
- MW10
- P0637S
- P0637M
- P0637D
- P0638D

Box and Whisker Plot

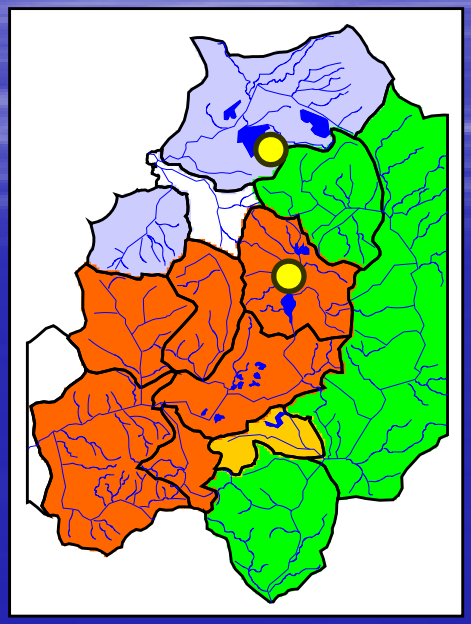


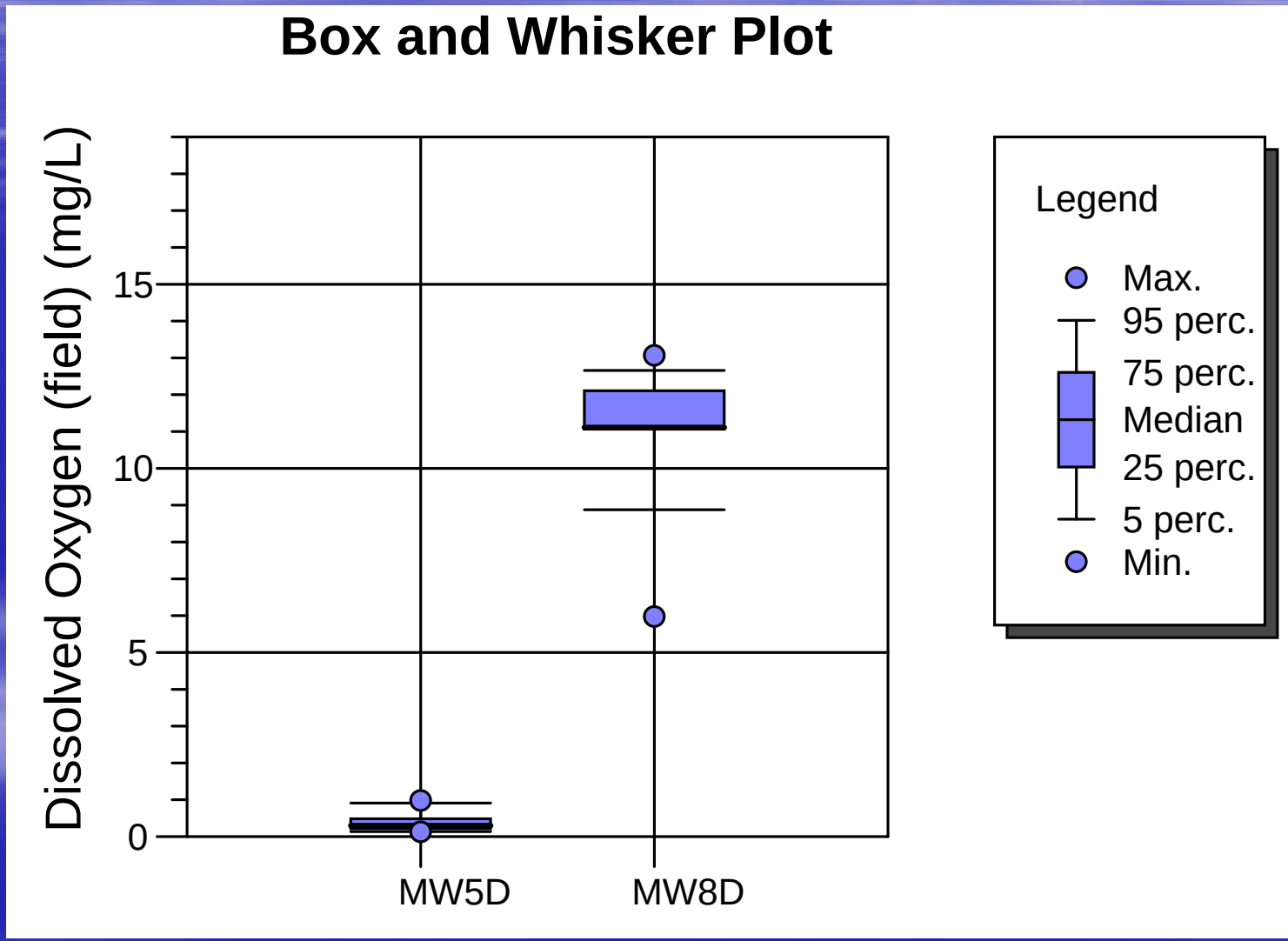
Dissolved Oxygen MW-5D Box and Whisker





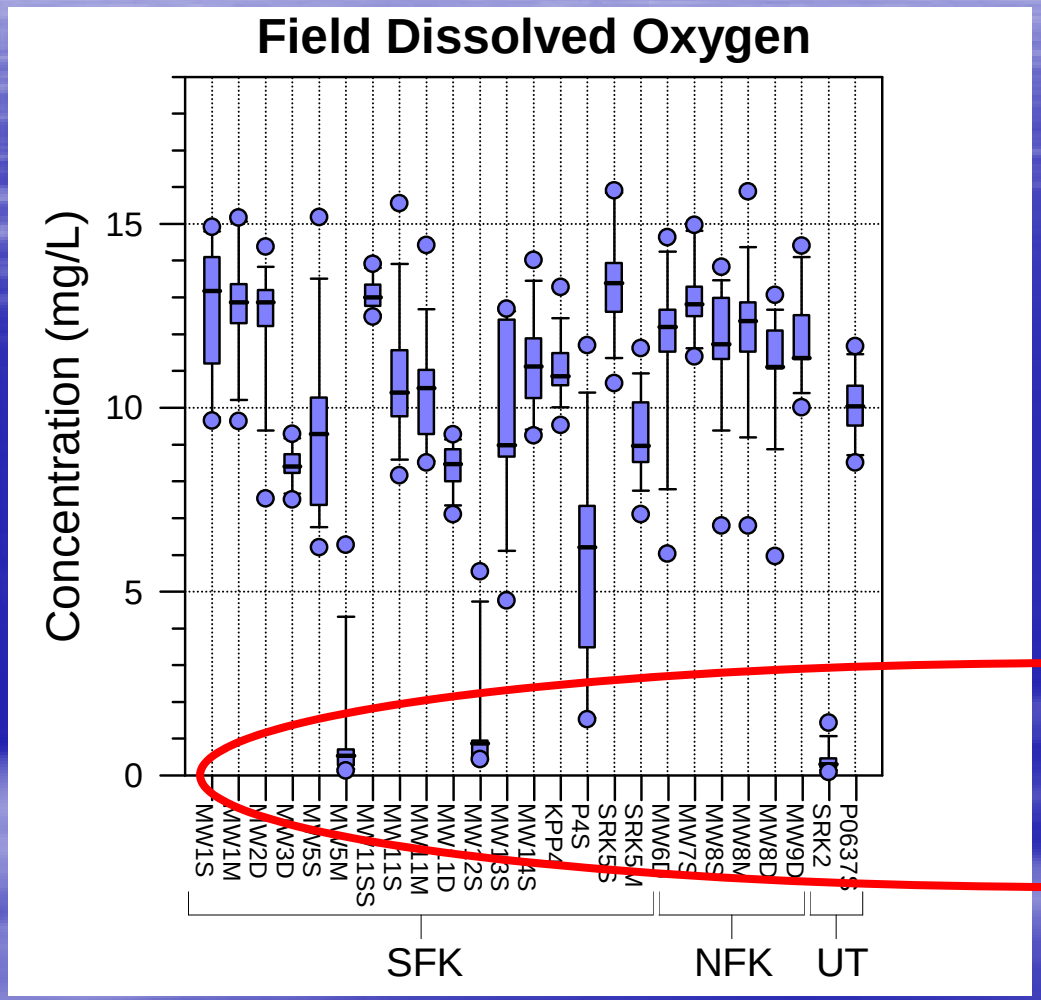
Dissolved Oxygen MW-5D and 8D Box and Whisker



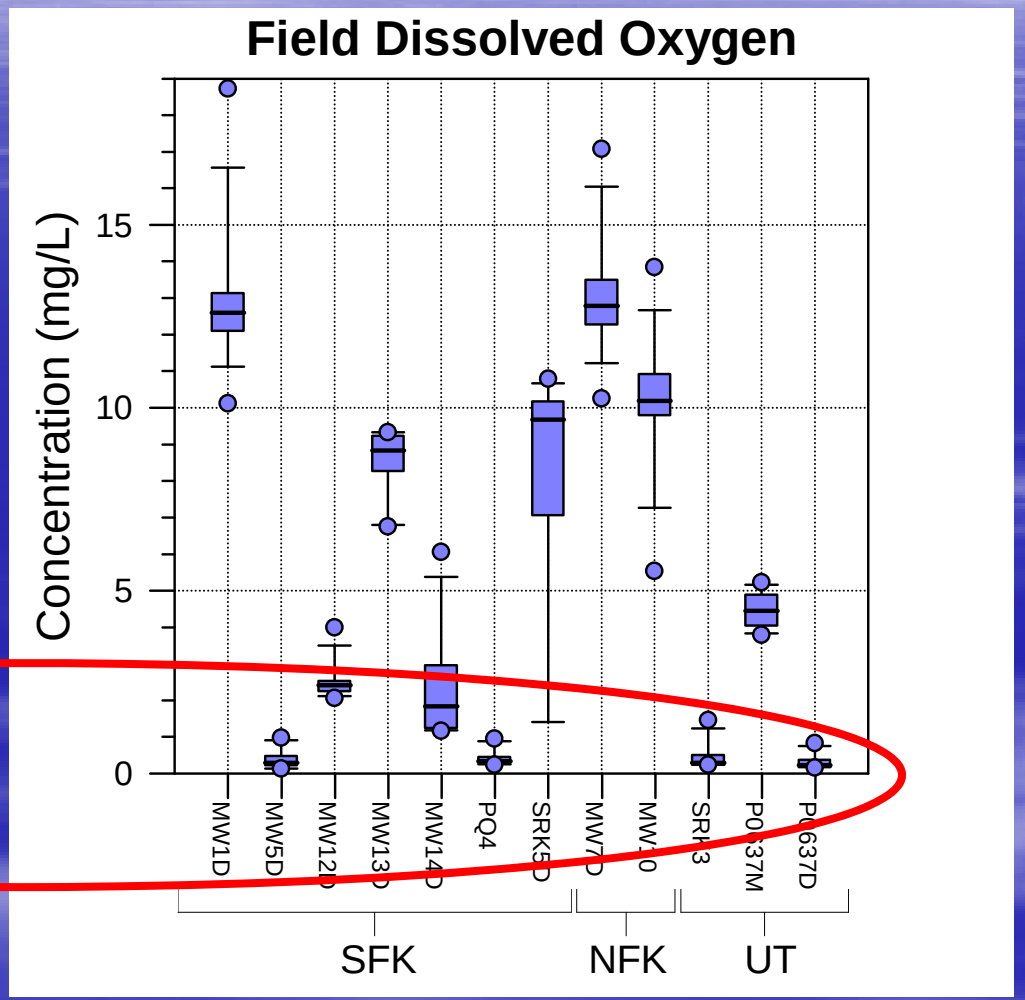


Dissolved Oxygen (field)

Overburden



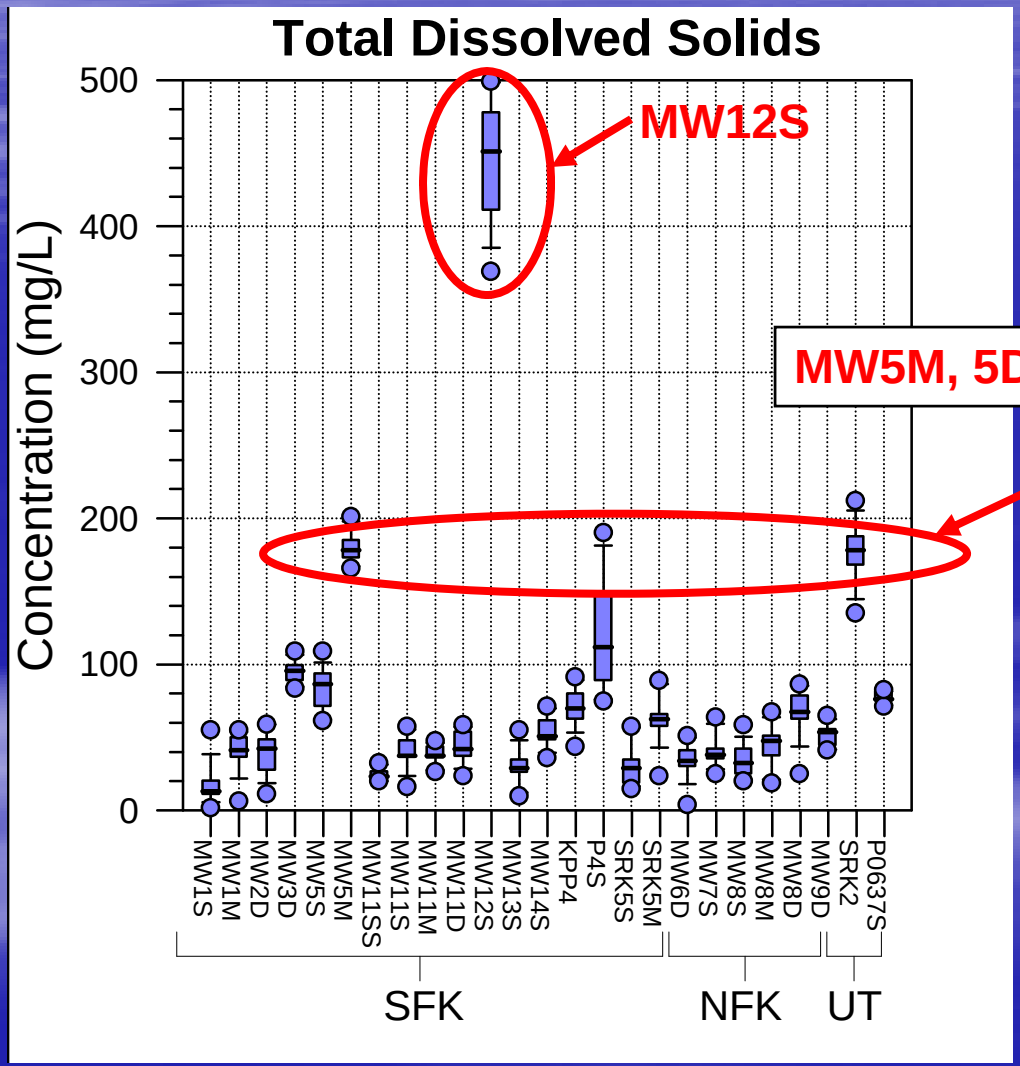
Bedrock



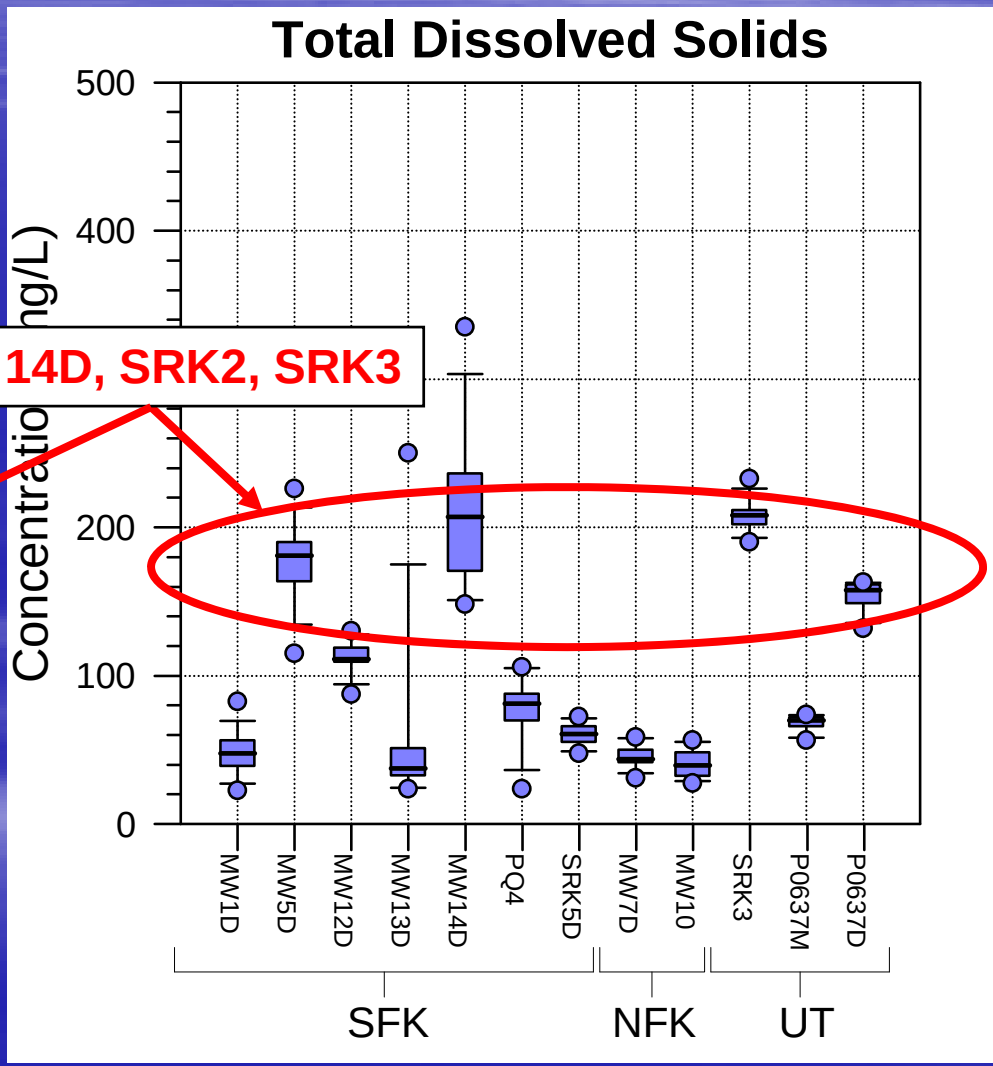
MW-5D & M; 12D & S; 14D; PQ4; SRK2 & 3; P-06-37D: Relatively low D.O.

Total Dissolved Solids

Overburden

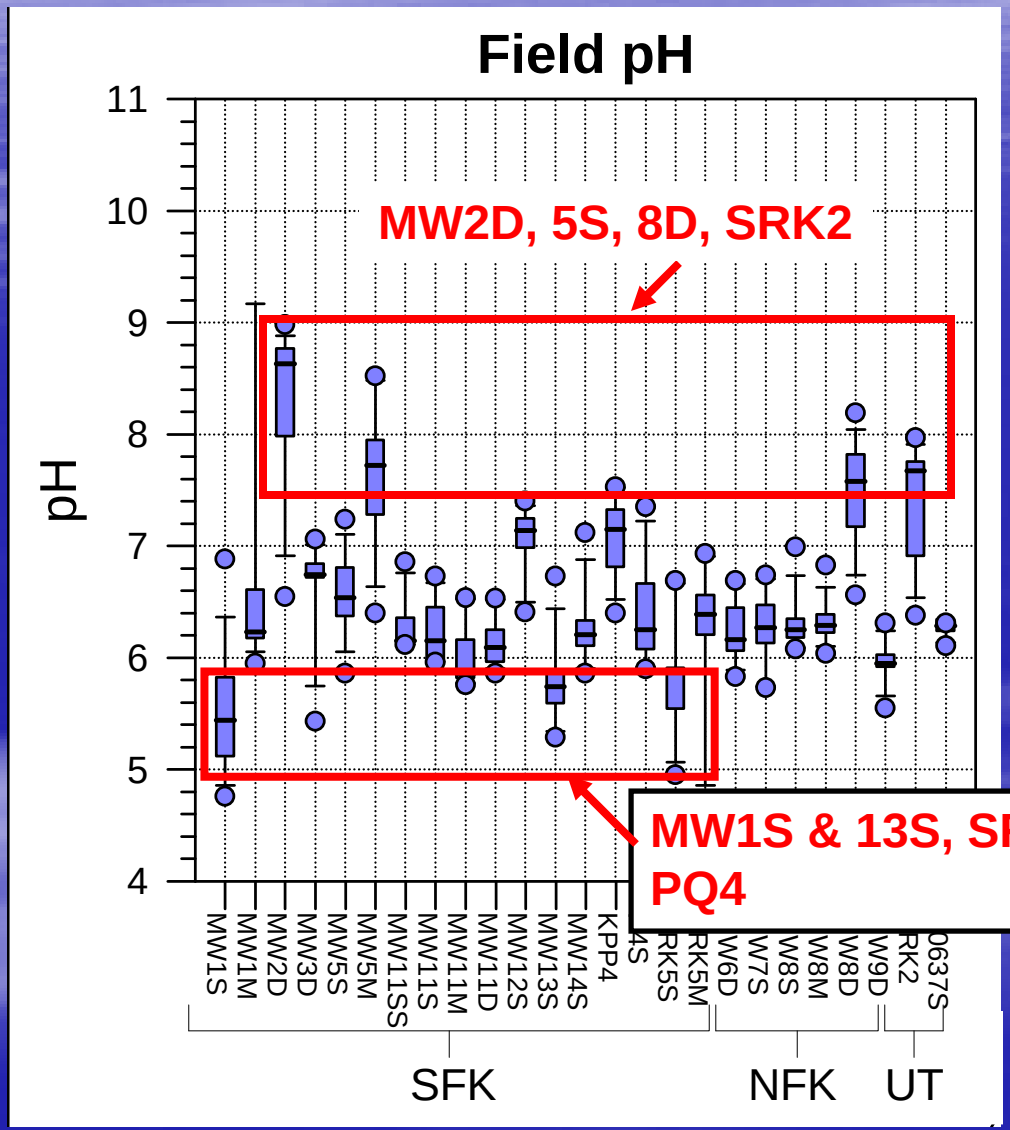


Bedrock

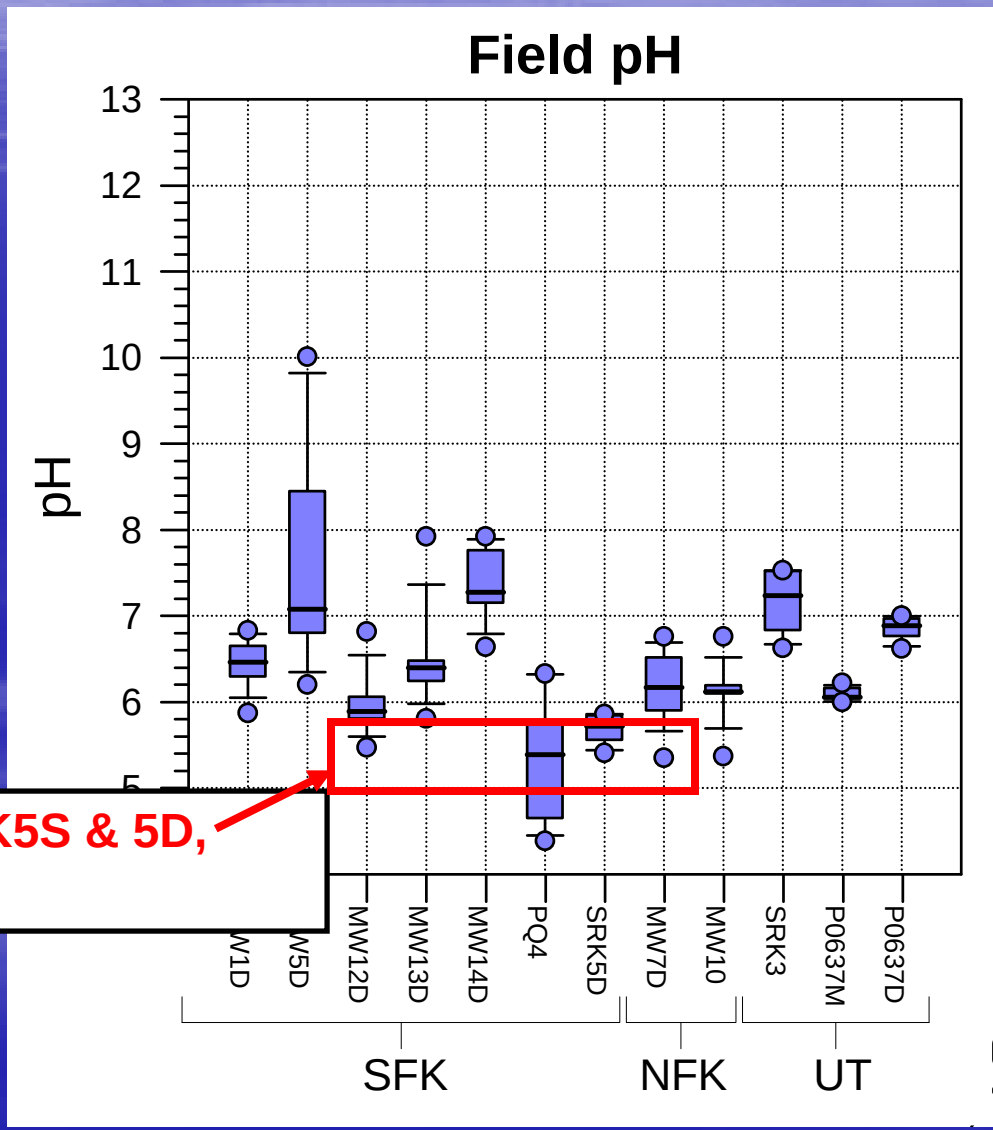


pH (field)

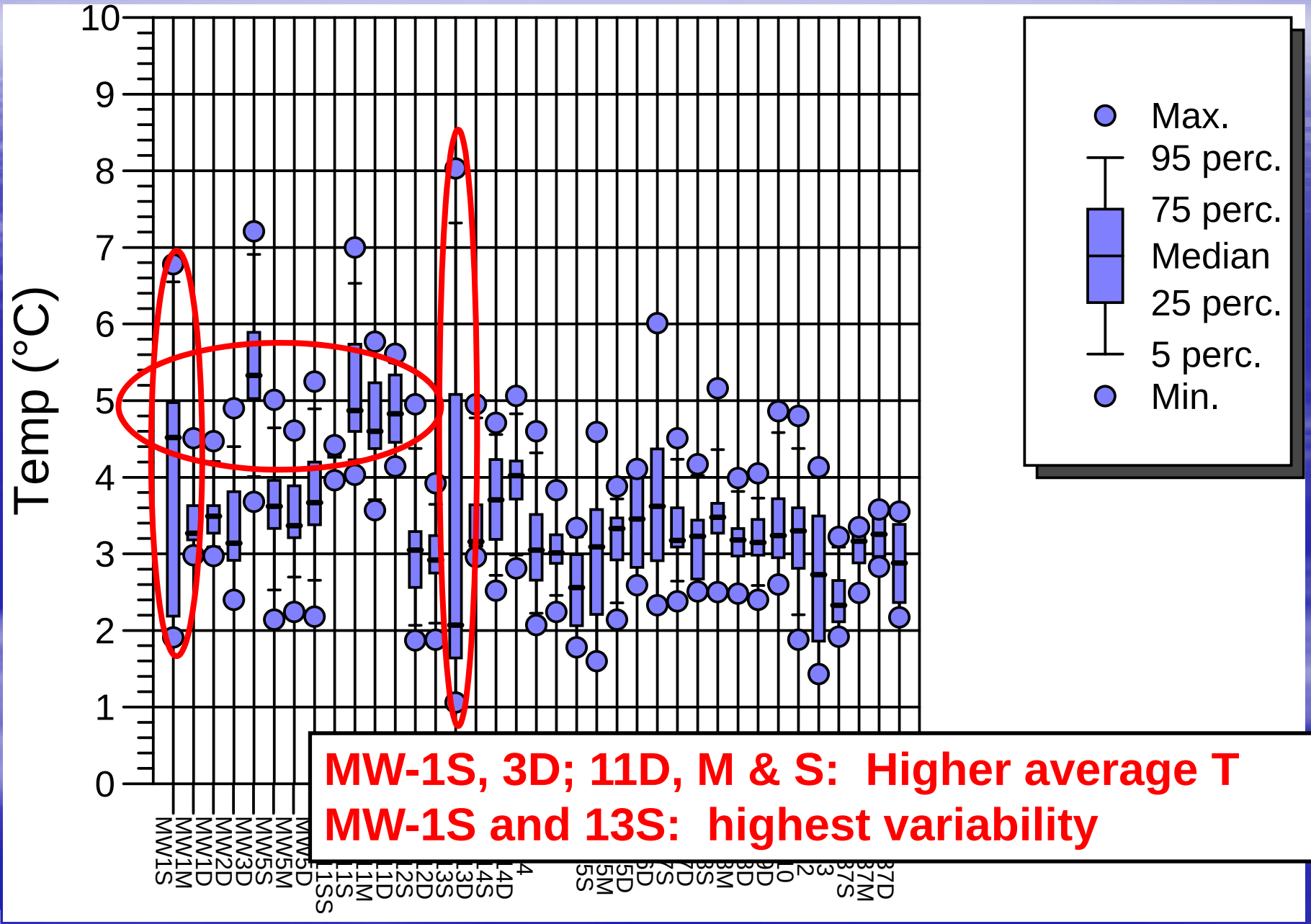
Overburden



Bedrock



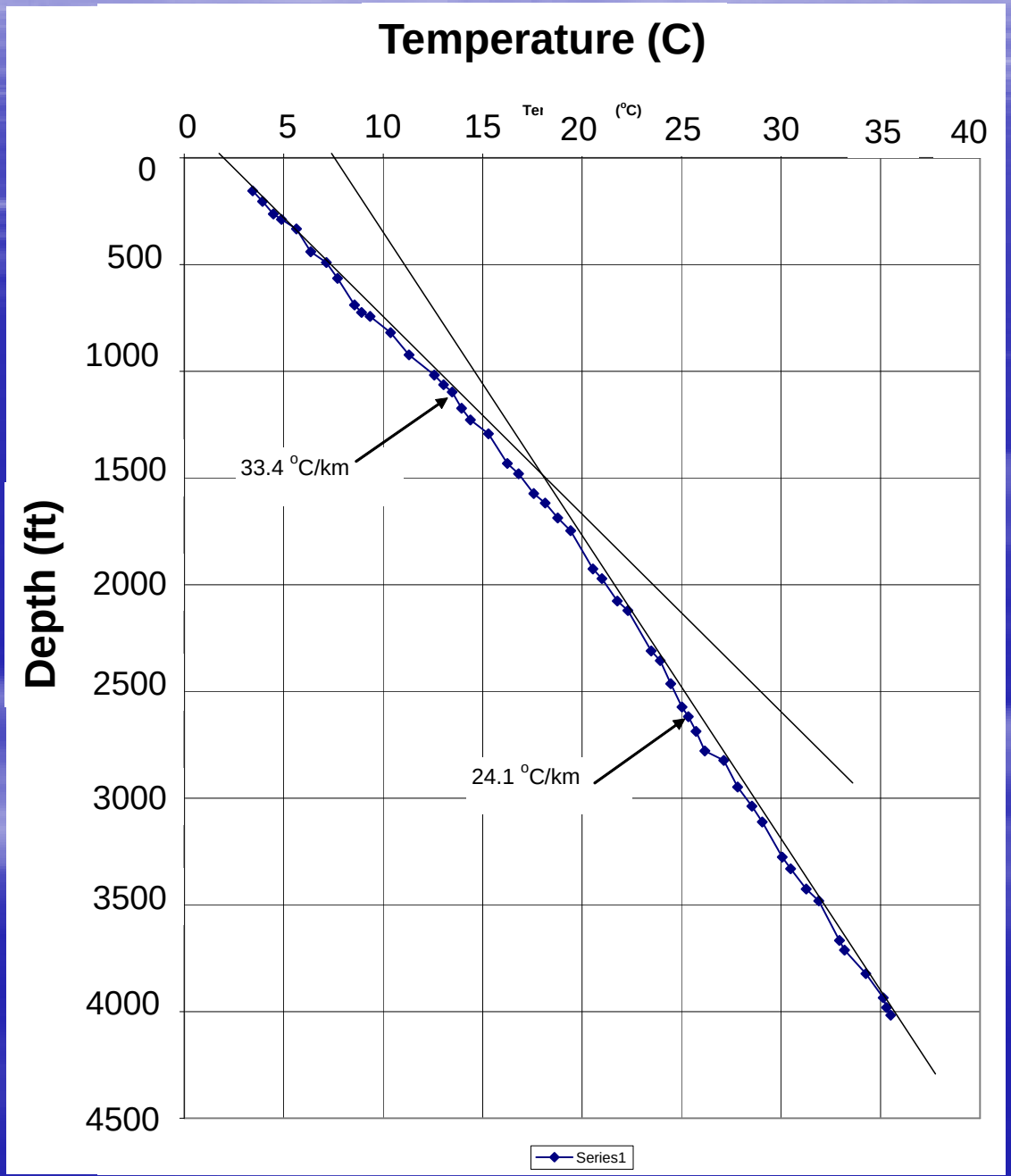
Temperature (field)



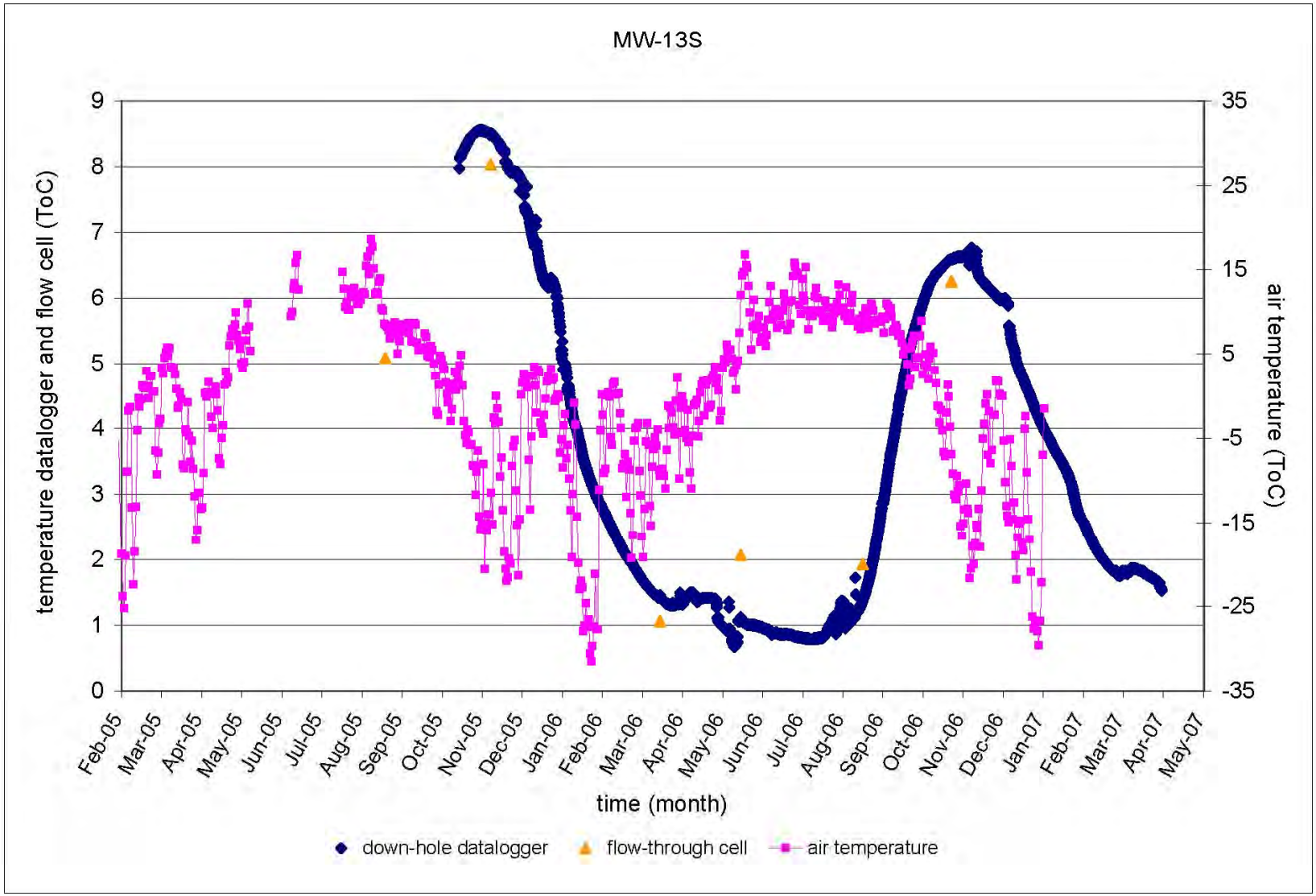
MW-1S, 3D; 11D, M & S: Higher average T
MW-1S and 13S: highest variability

Deep Groundwater Temperature Deposit Area

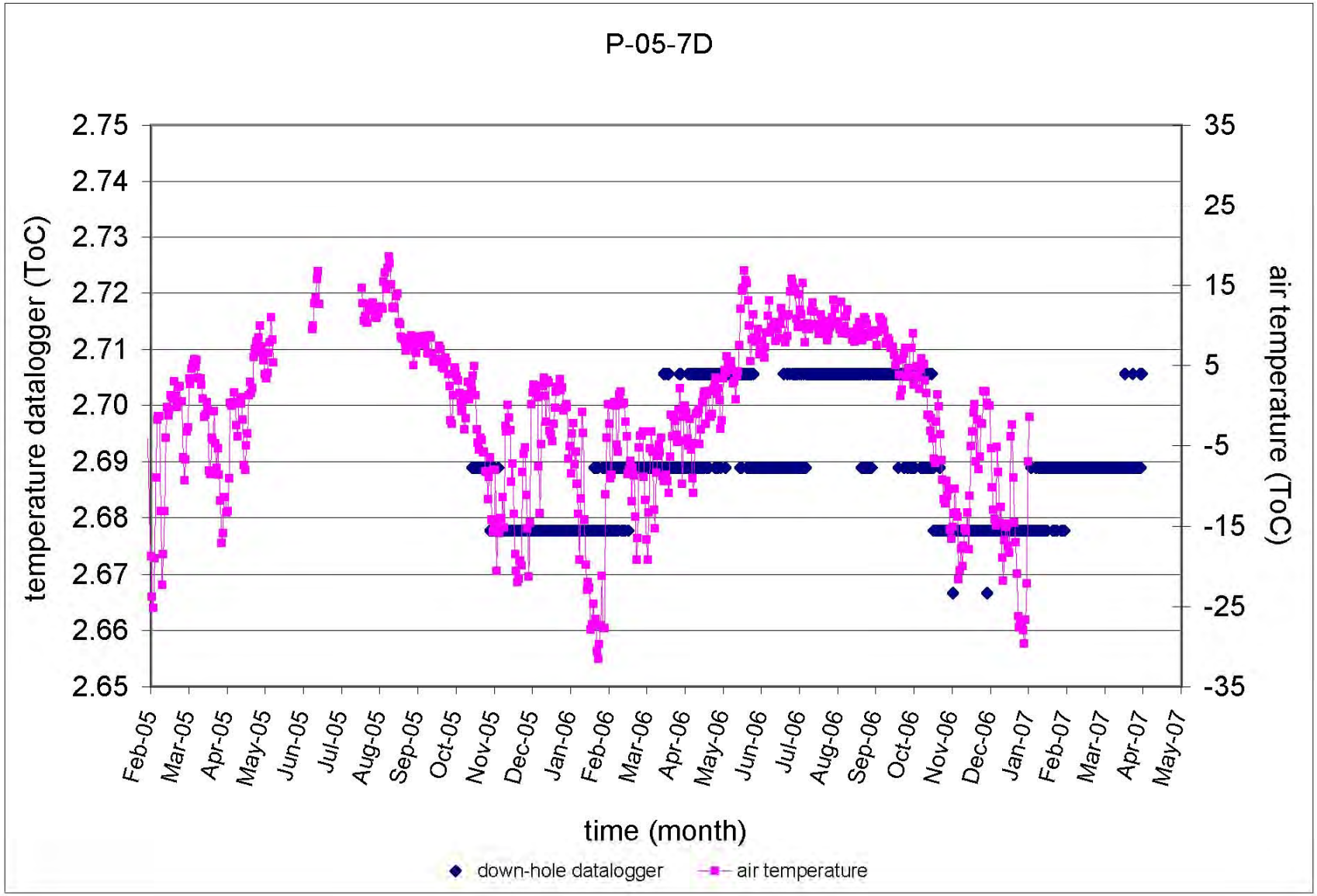
Westbay Data



Shallow Groundwater Temperature Time Series MW-13S



Shallow Groundwater Temperature Time Series P-05-7D

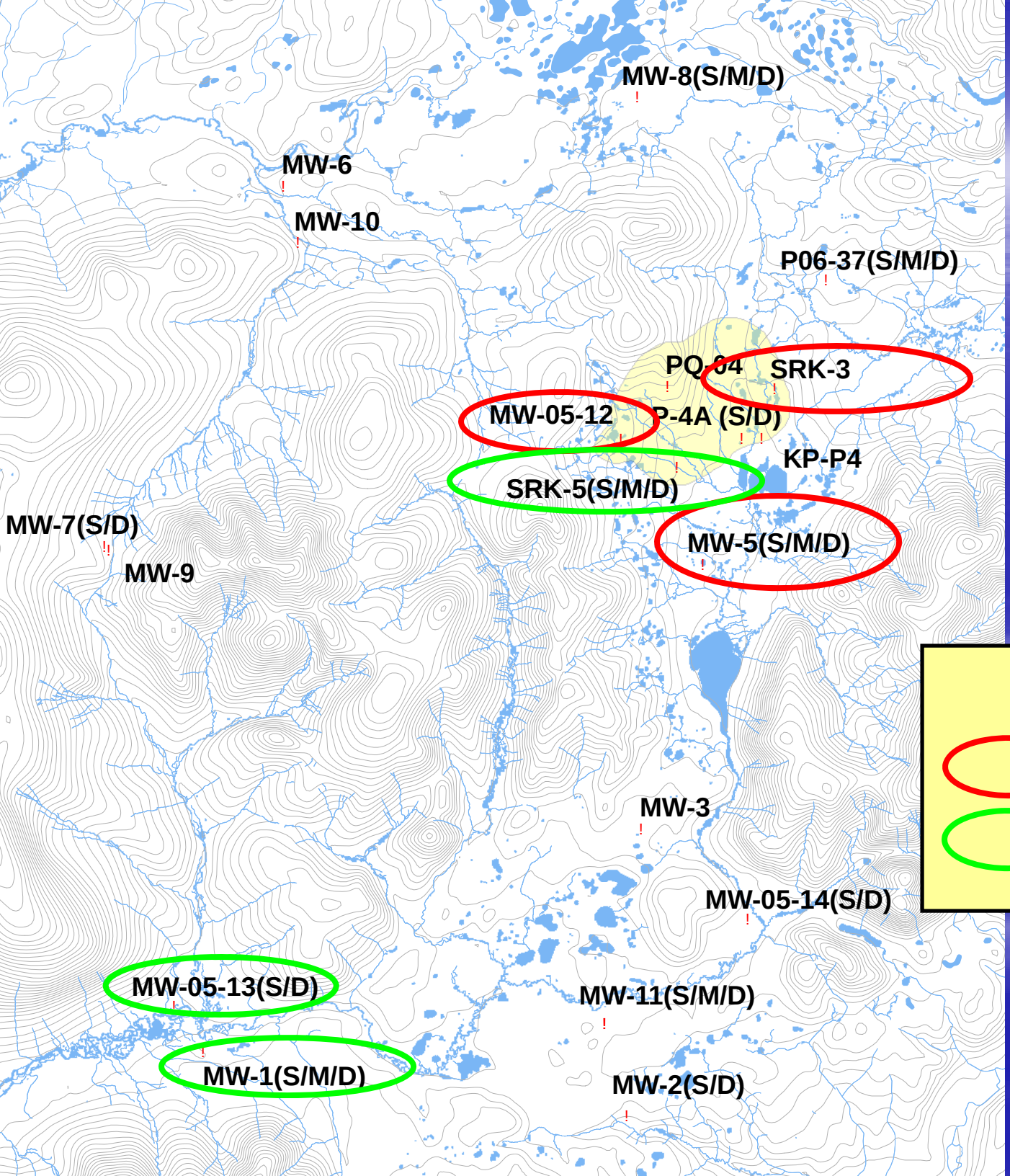


Field Parameters

- Total Dissolved Solids (Specific Conductance):
  - typically very low
- pH:
  - Typically neutral
  - Generally higher with depth
- Temperature:
  - Average 4ºC
- Dissolved Oxygen:
  - Often at or near solubility even in deep wells

Field Parameters: some specifics

- MW-12S:
  - Highest TDS (median about 450 mg/L)
  - Lower D.O.
- MW-5D, 5M, SRK-2:
  - Intermediate TDS (about 180 mg/L)
  - Highest pH (about 8)
  - Lowest DO, along with MW-12S (0.5 mg/L)
- MW-1S, 13S, SRK-5D, SRK-5S:
  - Lowest pH on site (5.5-5.8)



Legend

- High TDS, low D.O.
- Lowest pH

Summary of "Field Parameter" Anomalies

	TDS > 180	pH > 7	pH < 6	D.O. < 2
MW-1S			•	
MW-1M				
MW-1D				
MW-2D		•		
MW-3D				
MW-5S				
MW-5M	•	•		•
MW-5D				•
MW-6D				
MW-7S				
MW-7D				
MW-8S				
MW-8M				
MW-8D		•		
MW-9D				
MW-10				
MW-11SS				
MW-11S				
MW-11M				
MW-11D				

	TDS > 180	pH > 7	pH < 6	D.O. < 2
MW-12S	•	•		•
MW-12D				•
MW-13S			•	
MW13D				
MW-14S				
MW-14D				
KP-P4		•		
SRK2	•	•		•
SRK3				
SRK5S			•	
SRK5M				
SRK5D				
PQ4				
P4S				

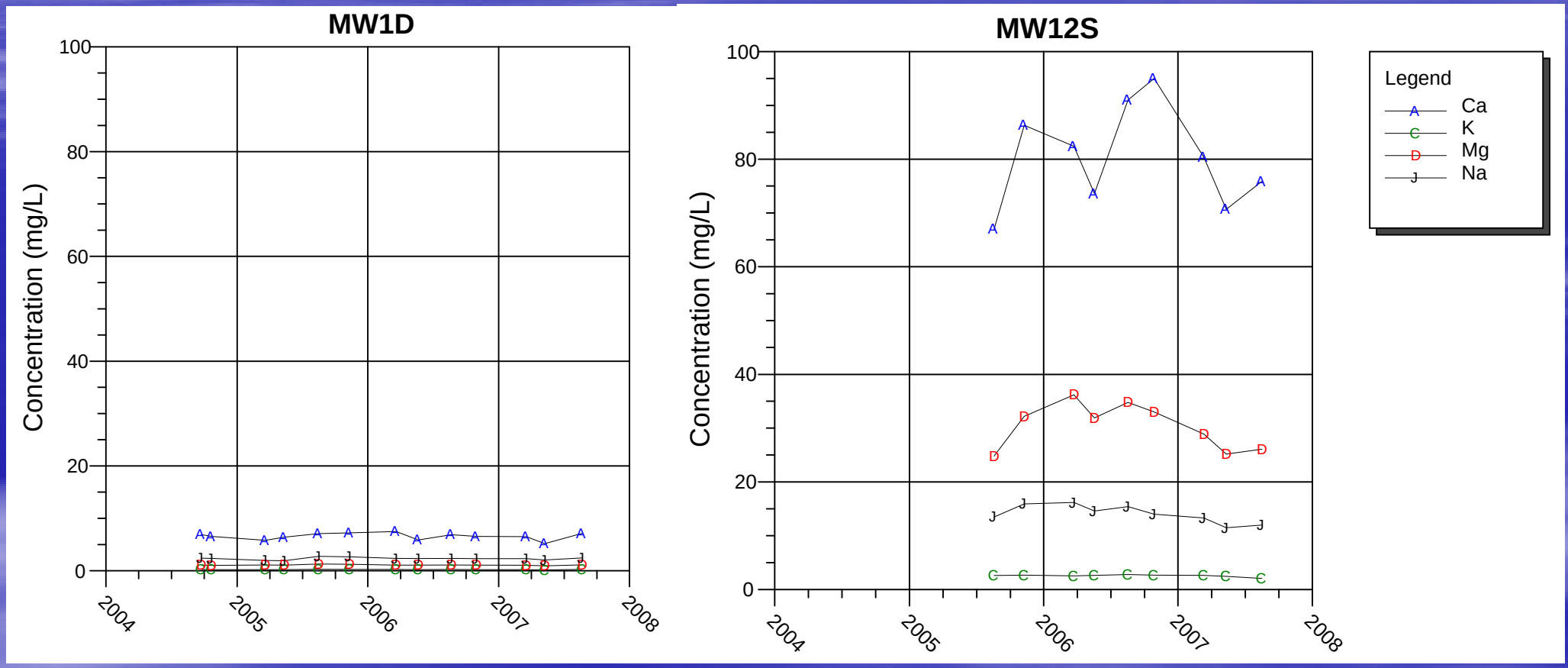
Outline

1. Objectives
2. Field Parameters
3. **Major Ions**
4. Trace Elements
5. Nutrients
6. Tritium
7. Where we go from here

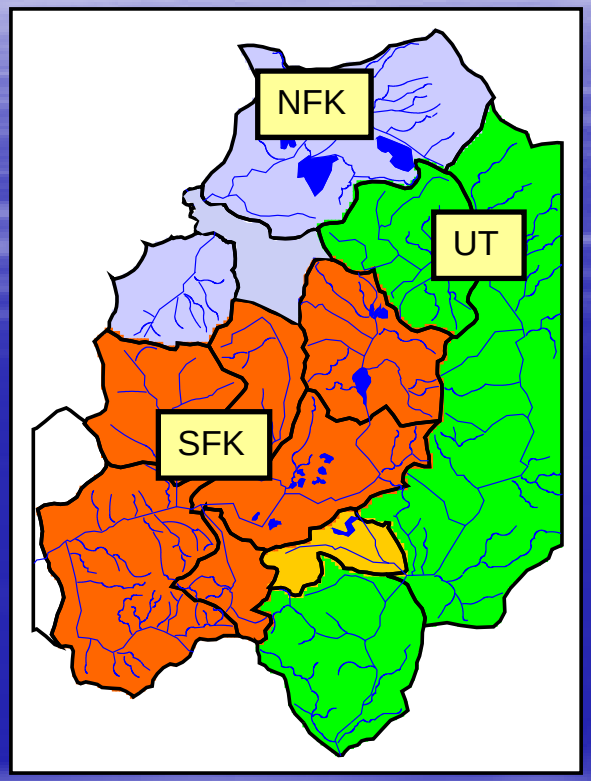
Major Ions

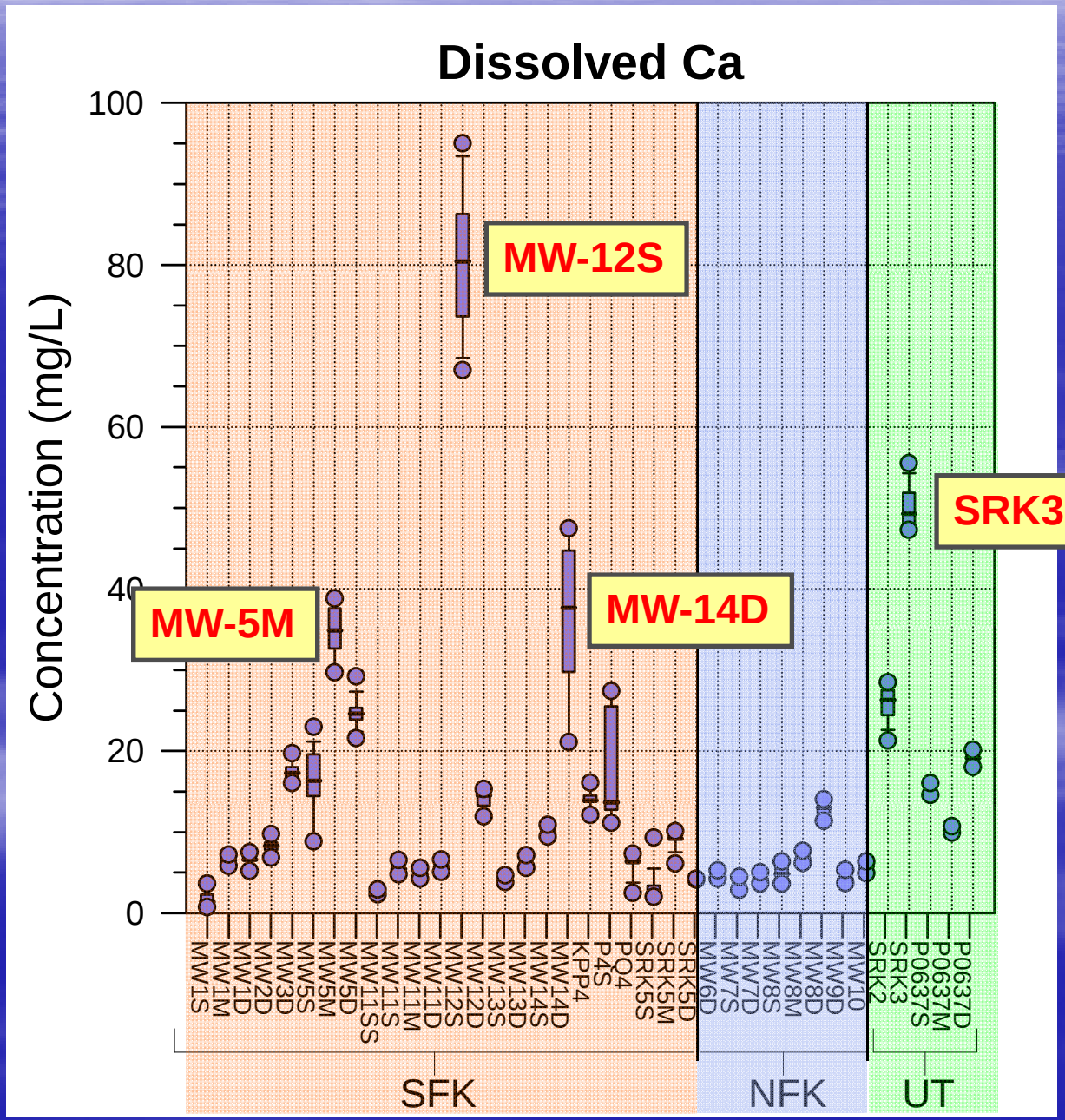
- Cations
  - Ca, Mg, Na, K
- Anions
  - HCO_3, SO_4, Cl
- comprise most of the dissolved solids

Cation Time Series

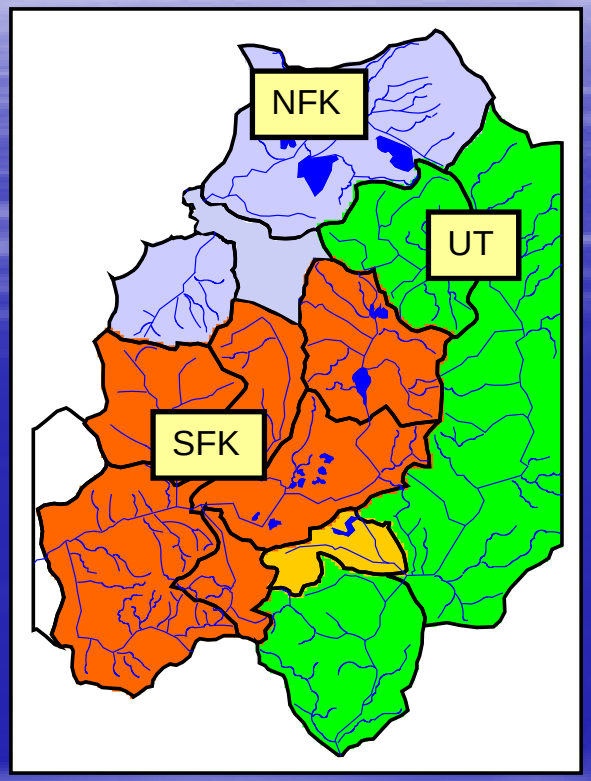


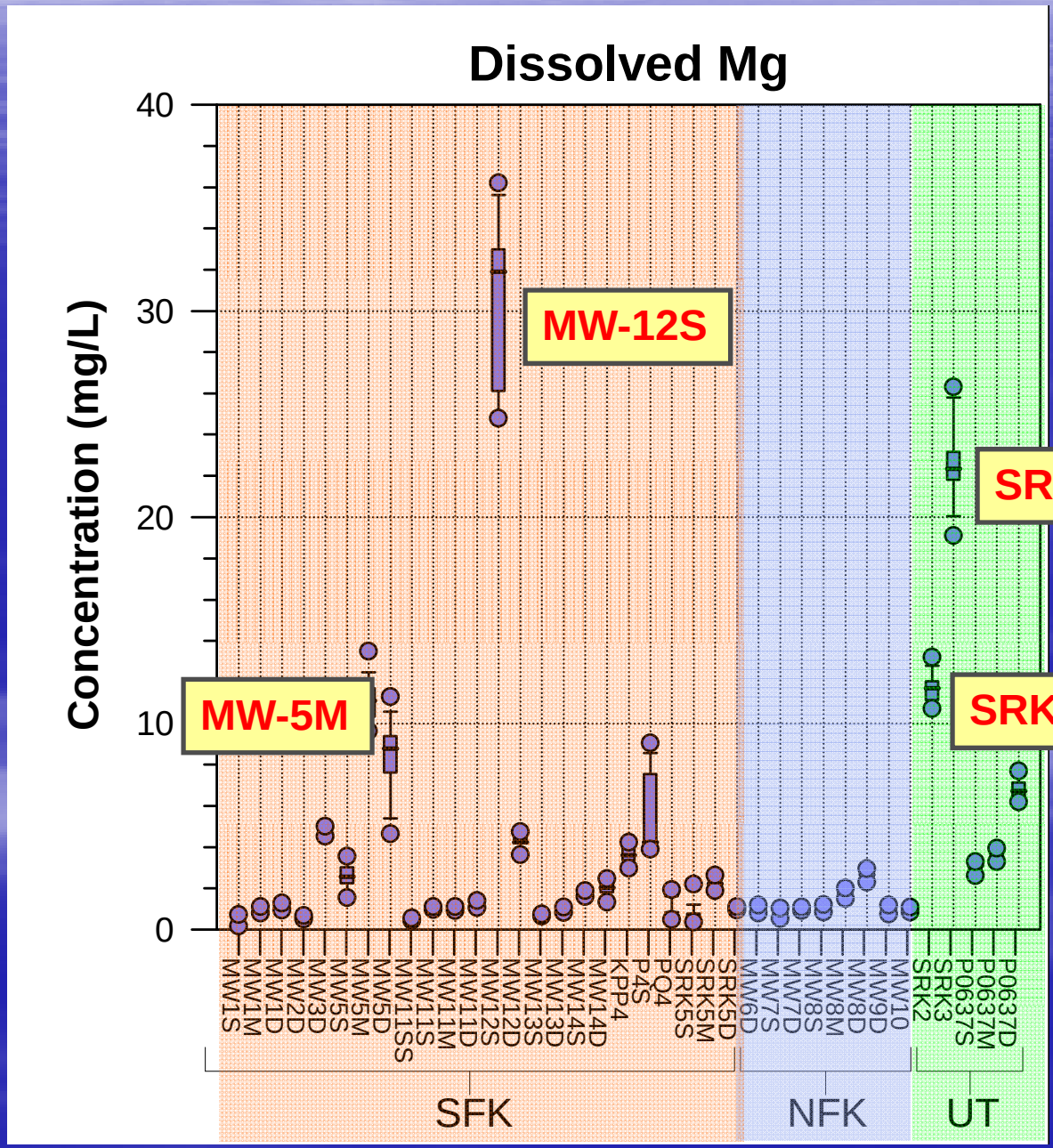
Ca


NFK
UT
SFK

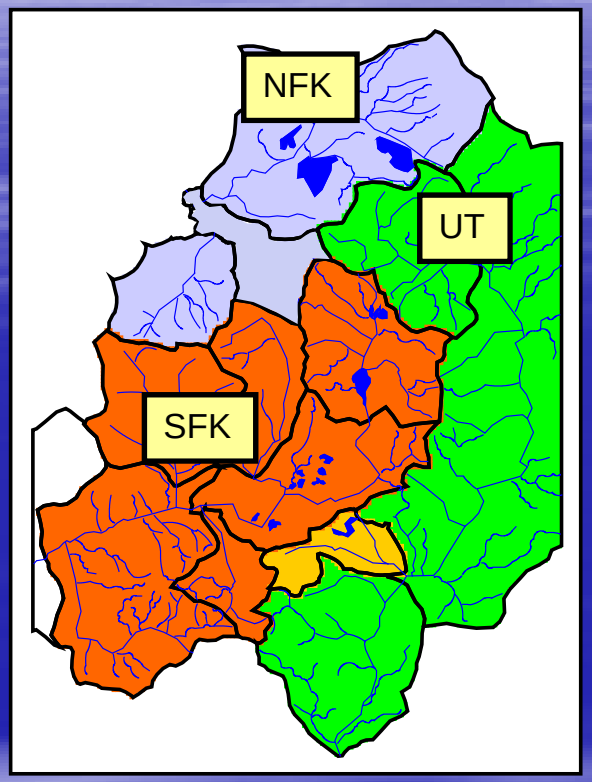

Dissolved Ca
Concentration (mg/L)
100
80
60
40
20
0
MW-12S
MW-5M
MW-14D
SRK3
MW1S
MW1M
MW1D
MW2D
MW3D
MW5S
MW5M
MW5D
MW11SS
MW11S
MW11M
MW11D
MW12S
MW12D
MW13S
MW13D
MW14S
MW14D
KPP4
P4S
PO4
SRK5S
SRK5M
SRK5D
MW6D
MW7S
MW7D
MW8S
MW8M
MW8D
MW9D
MW10
SRK2
SRK3
P0637S
P0637M
P0637D
SFK
NFK
UT

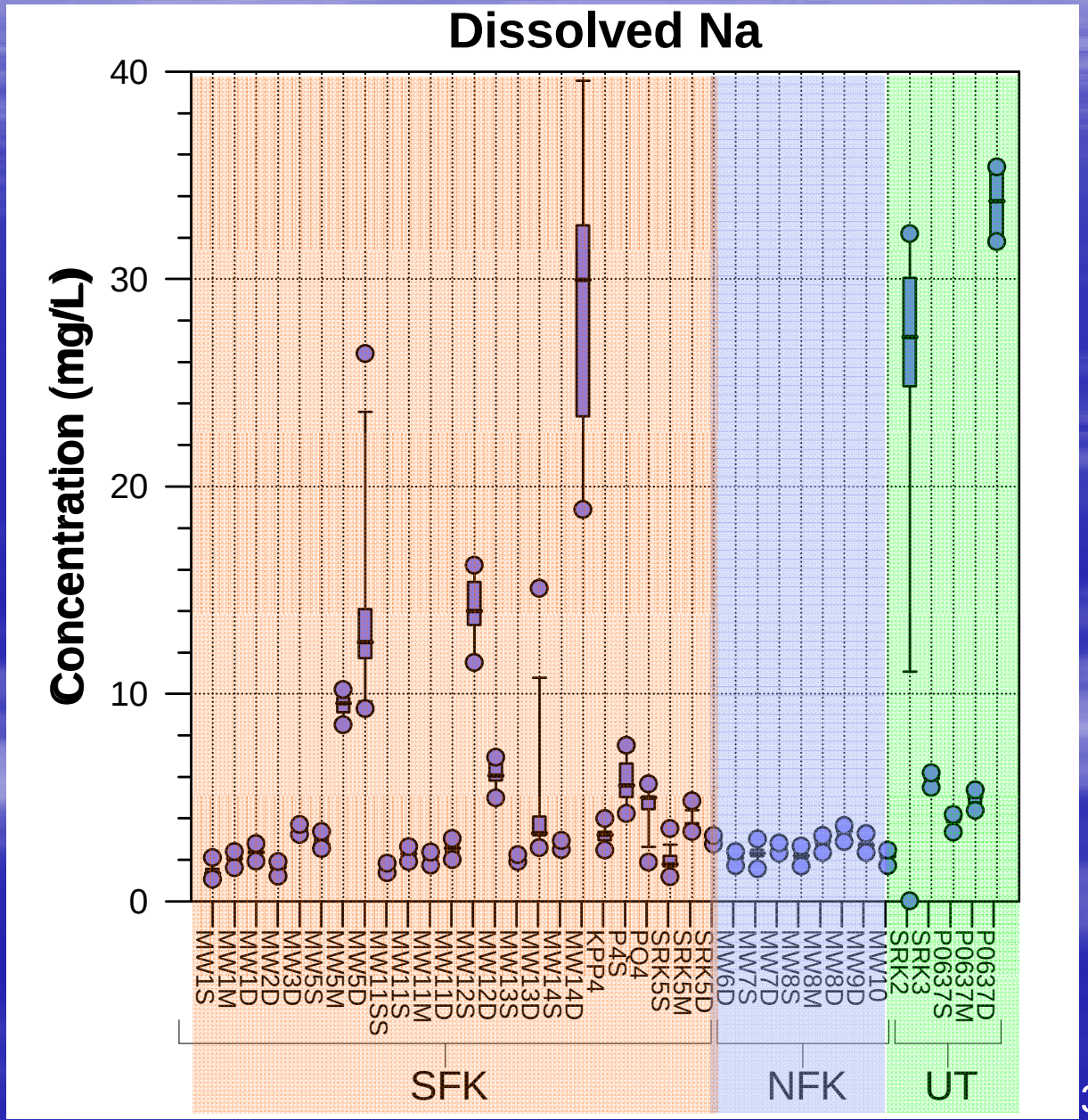
Mg


NFK
UT
SFK

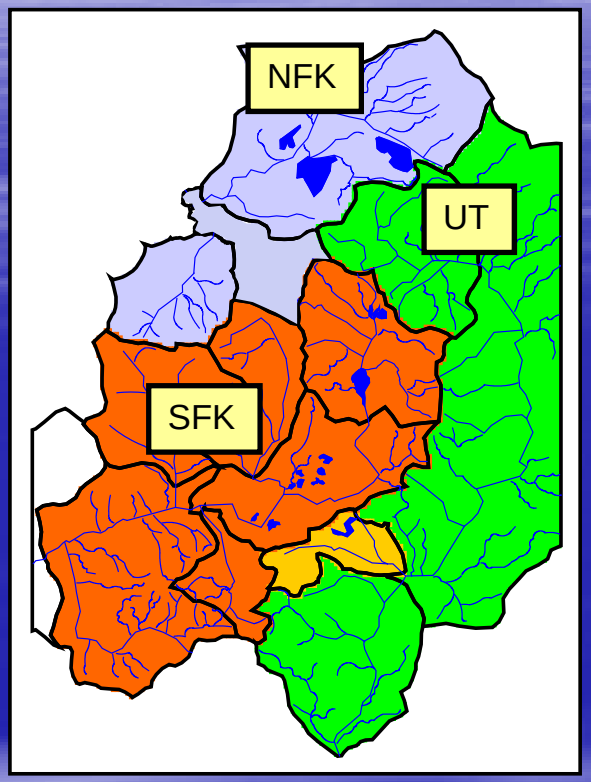

Dissolved Mg
Concentration (mg/L)
40
30
20
10
0
MW-12S
MW-5M
SRK3
SRK2
MW1S
MW1M
MW1D
MW2D
MW3D
MW5S
MW5M
MW5D
MW11SS
MW11S
MW11M
MW11D
MW12S
MW12D
MW13S
MW13D
MW14S
MW14D
KPP4
P4S
PQ4
SRK5S
SRK5M
SRK5D
MW6D
MW7S
MW7D
MW8S
MW8M
MW8D
MW9D
MW10
SRK2
SRK3
P0637S
P0637M
P0637D
SFK
NFK
UT

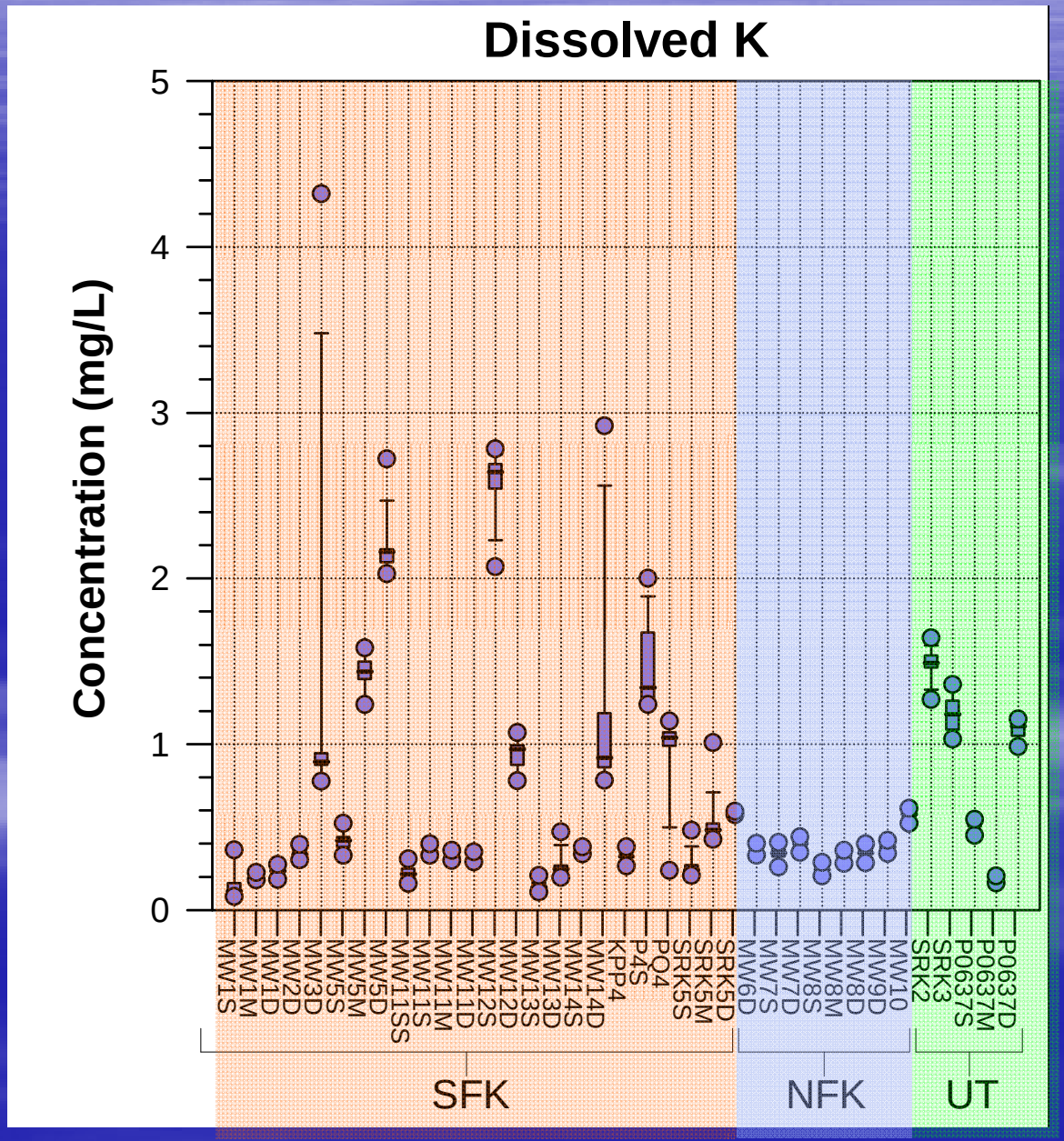
Na


NFK
UT
SFK

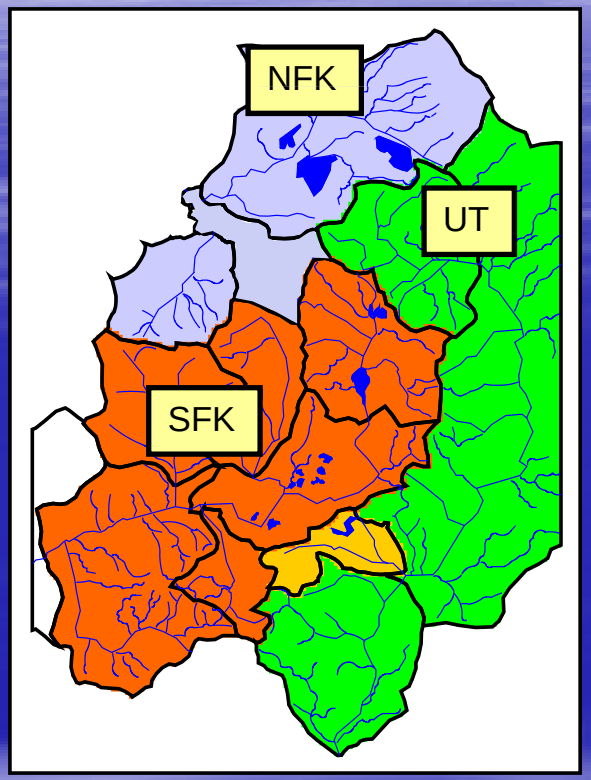

Dissolved Na
Concentration (mg/L)
40
30
20
10
0
MW1S
MW1M
MW1D
MW2D
MW3D
MW5S
MW5M
MW5D
MW11SS
MW11S
MW11M
MW11D
MW12S
MW12D
MW13S
MW13D
MW14S
MW14D
KPP4
P4S
PQ4
SRK5S
SRK5M
SRK5D
MW6D
MW7S
MW7D
MW8S
MW8M
MW8D
MW9D
MW10
SRK2
SRK3
P0637S
P0637M
P0637D
SFK
NFK
UT

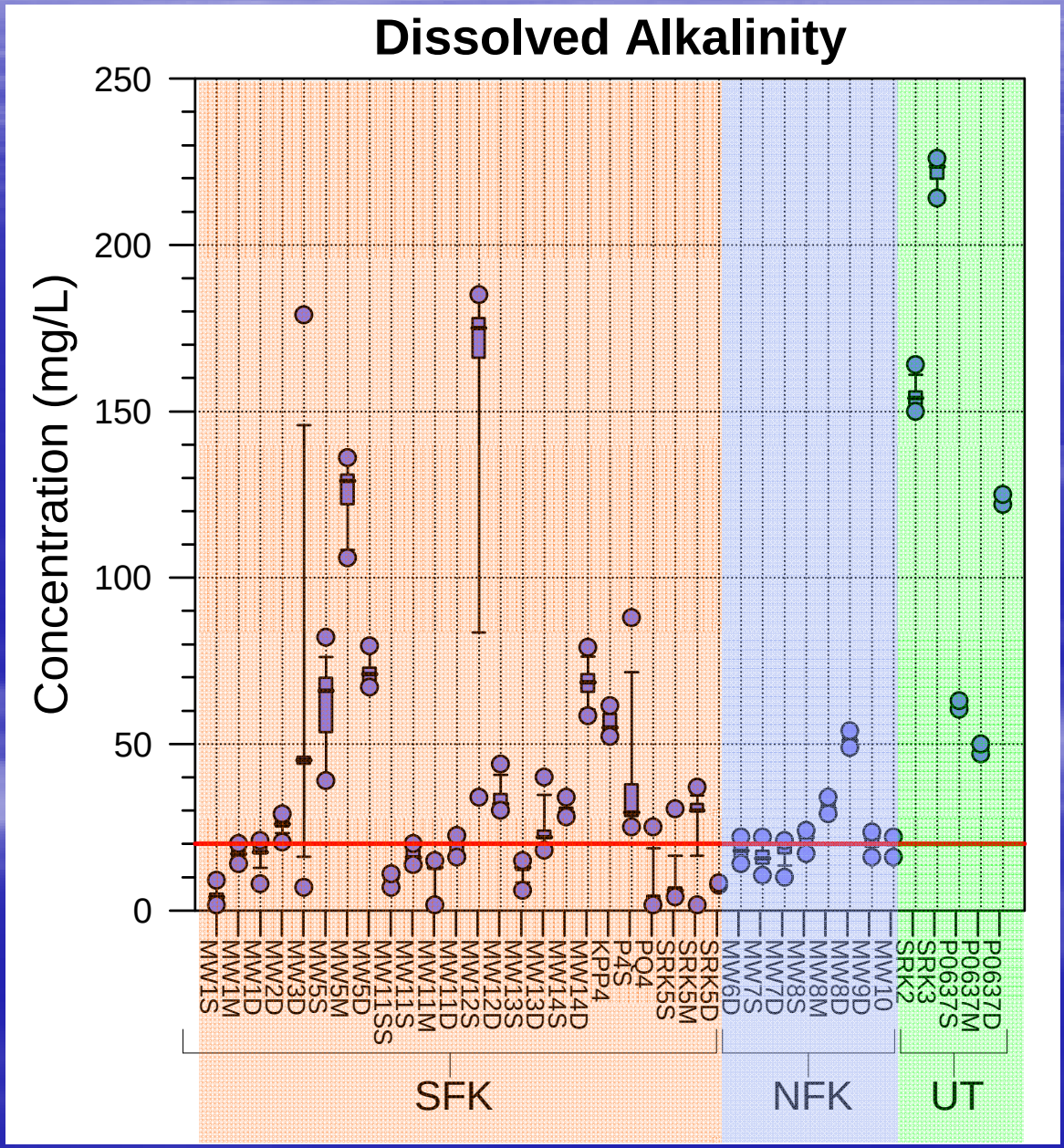
K


NFK
UT
SFK

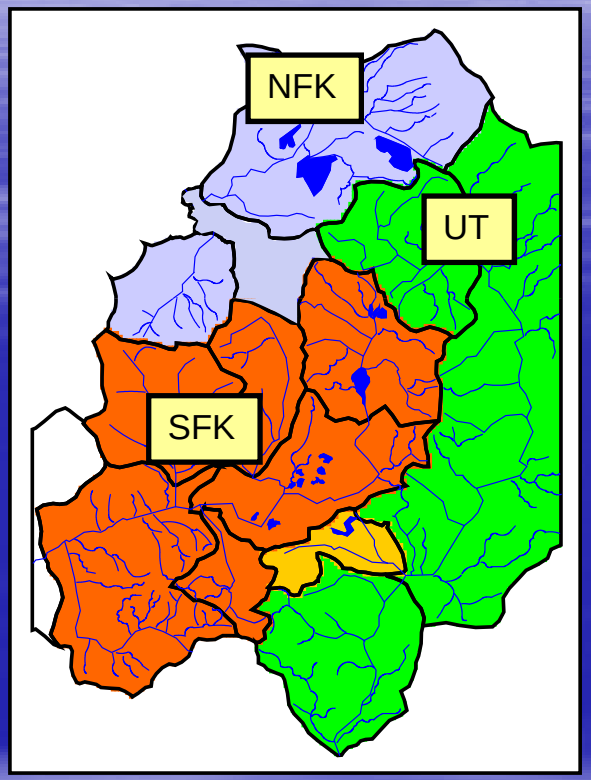

Dissolved K
Concentration (mg/L)
0
1
2
3
4
5
MW1S
MW1M
MW1D
MW2D
MW3D
MW5S
MW5M
MW5D
MW11SS
MW11S
MW11M
MW11D
MW12S
MW12D
MW13S
MW13D
MW14S
MW14D
KPP4
P4S
PQ4
SRK5S
SRK5M
SRK5D
MW6D
MW7S
MW7D
MW8S
MW8M
MW8D
MW9D
MW10
SRK2
SRK3
P0637S
P0637M
P0637D
SFK
NFK
UT

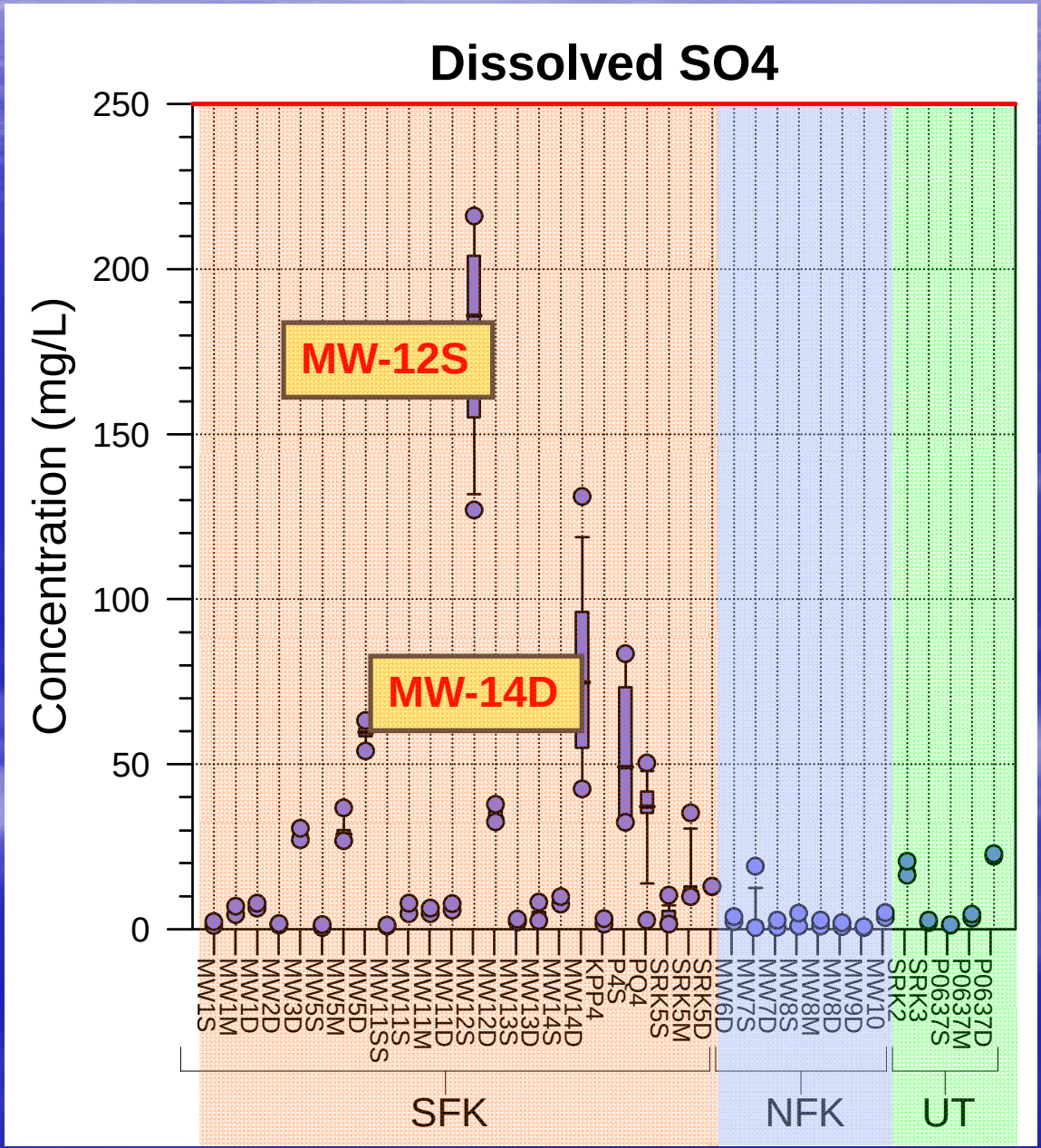
Alkalinity (CO_3 species)



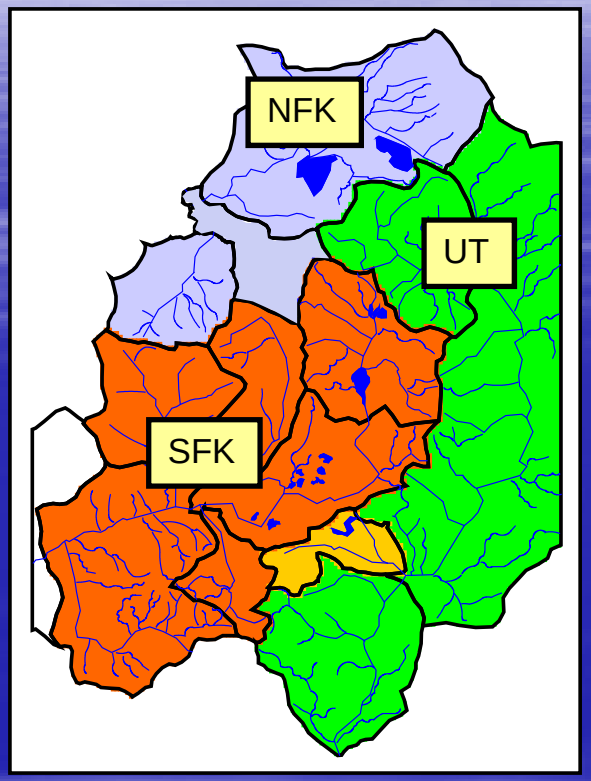


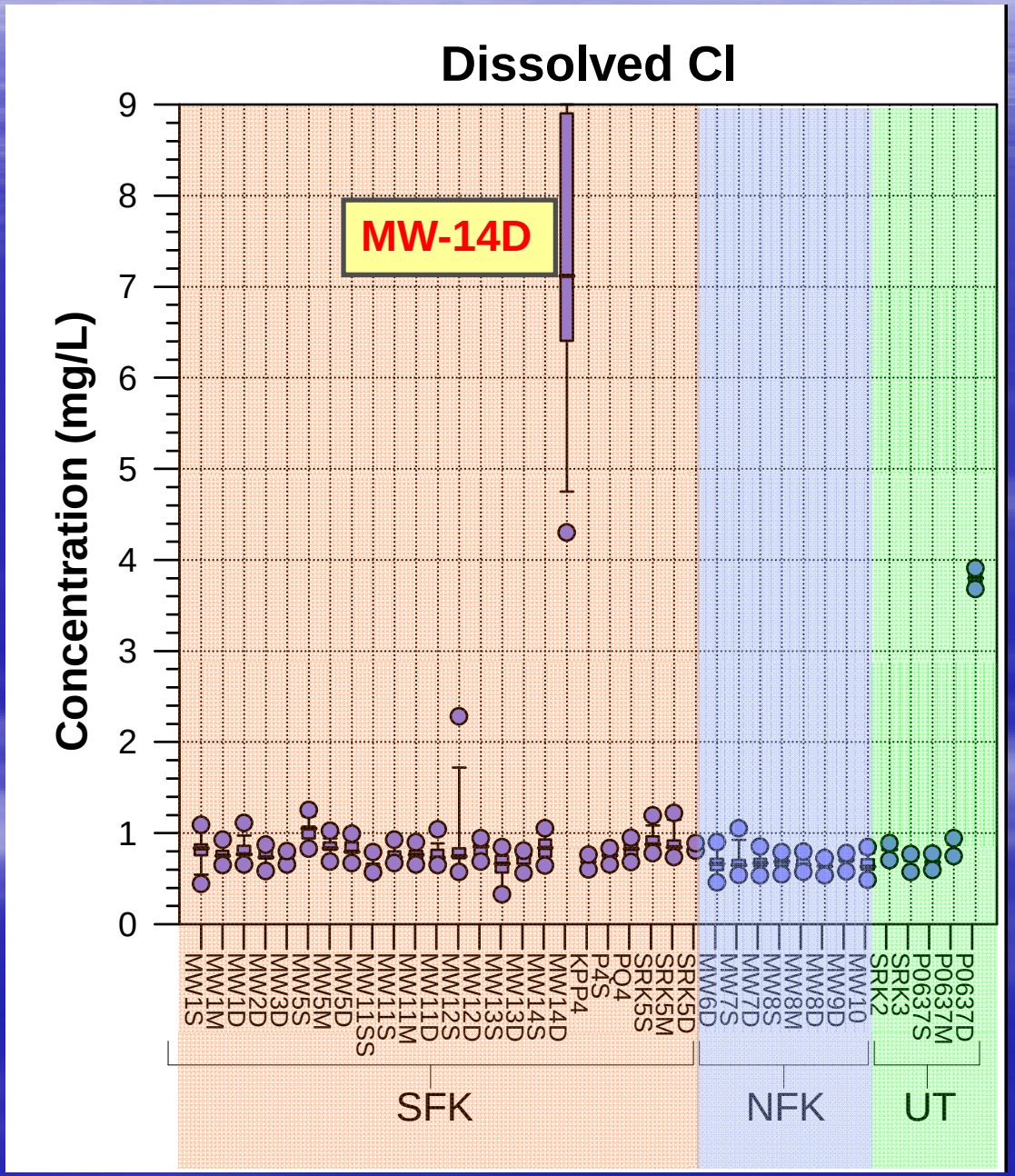
SO_4


NFK
UT
SFK

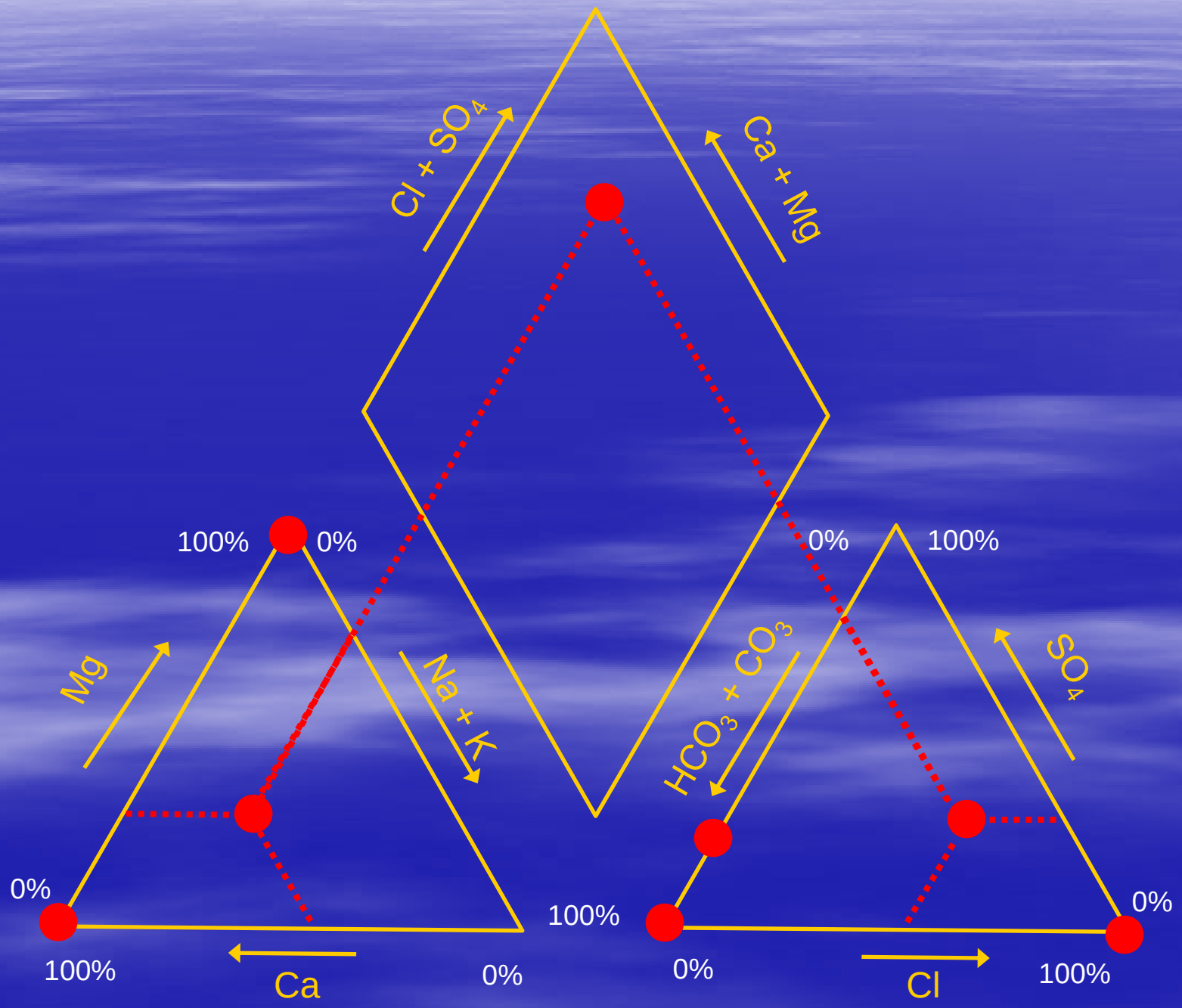

Dissolved SO4
Concentration (mg/L)
250
200
150
100
50
0
MW-12S
MW-14D
MW1S
MW1M
MW1D
MW2D
MW3D
MW5S
MW5M
MW5D
MW11SS
MW11S
MW11M
MW11D
MW12S
MW12D
MW13S
MW13D
MW14S
MW14D
KPP4
P4S
PQ4
SRK5S
SRK5M
SRK5D
MW6D
MW7S
MW7D
MW8S
MW8M
MW8D
MW9D
MW10
SRK2
SRK3
P0637S
P0637M
P0637D
SFK
NFK
UT

Cl

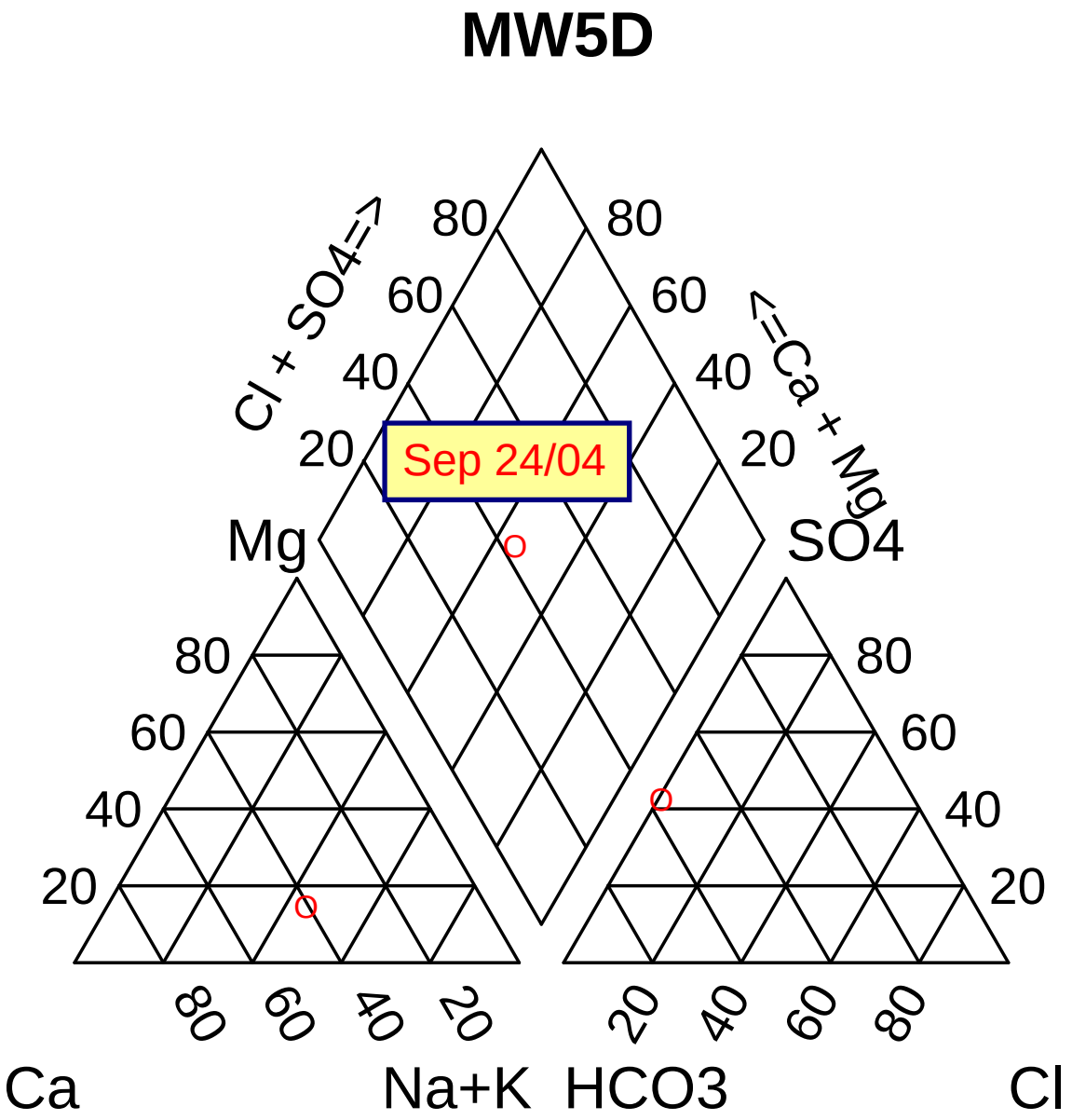

NFK
UT
SFK


Dissolved Cl
Concentration (mg/L)
0
1
2
3
4
5
6
7
8
9
MW-14D
MW1S
MW1M
MW1D
MW2D
MW3D
MW5S
MW5M
MW5D
MW11SS
MW11S
MW11M
MW11D
MW12S
MW12D
MW13S
MW13D
MW14S
MW14D
KPP4
P4S
PO4
SRK5S
SRK5M
SRK5D
MW6D
MW7S
MW7D
MW8S
MW8M
MW8D
MW9D
MW10
SRK2
SRK3
P0637S
P0637M
P0637D
SFK
NFK
UT

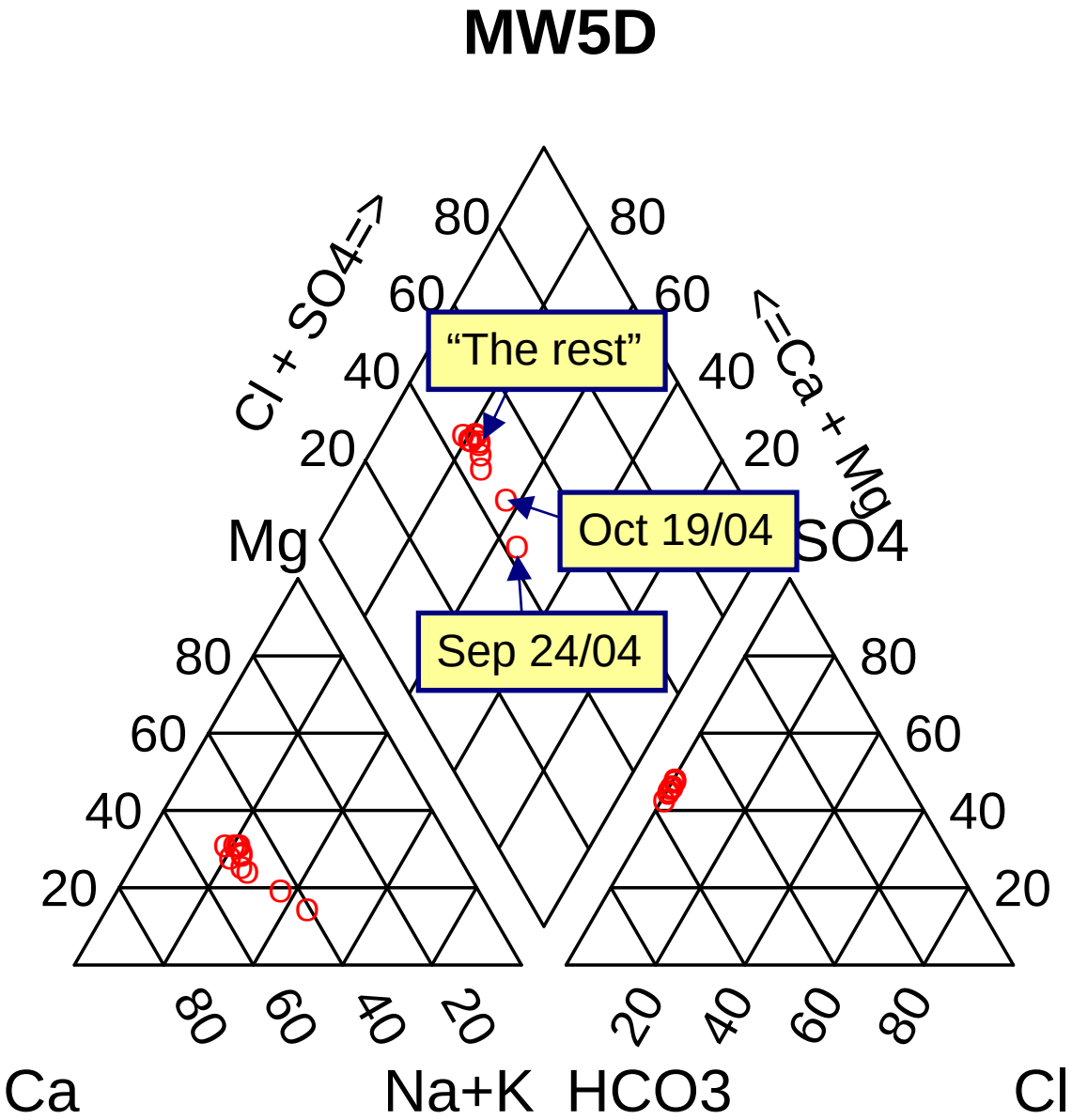
Groundwater Composition: Trilinear Diagram (meq as %)



Piper Plot MW-5D



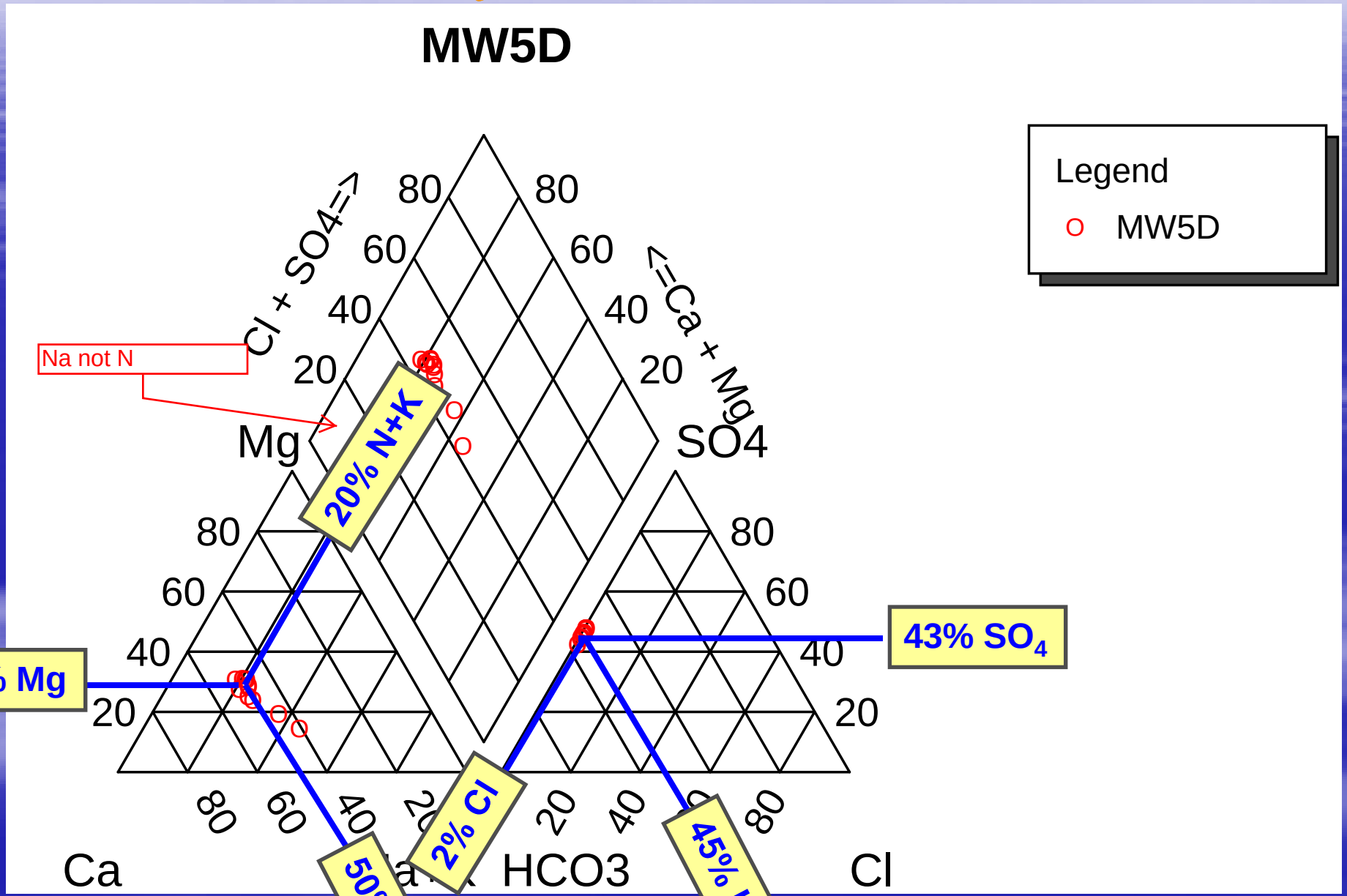
Piper Plot MW-5D all



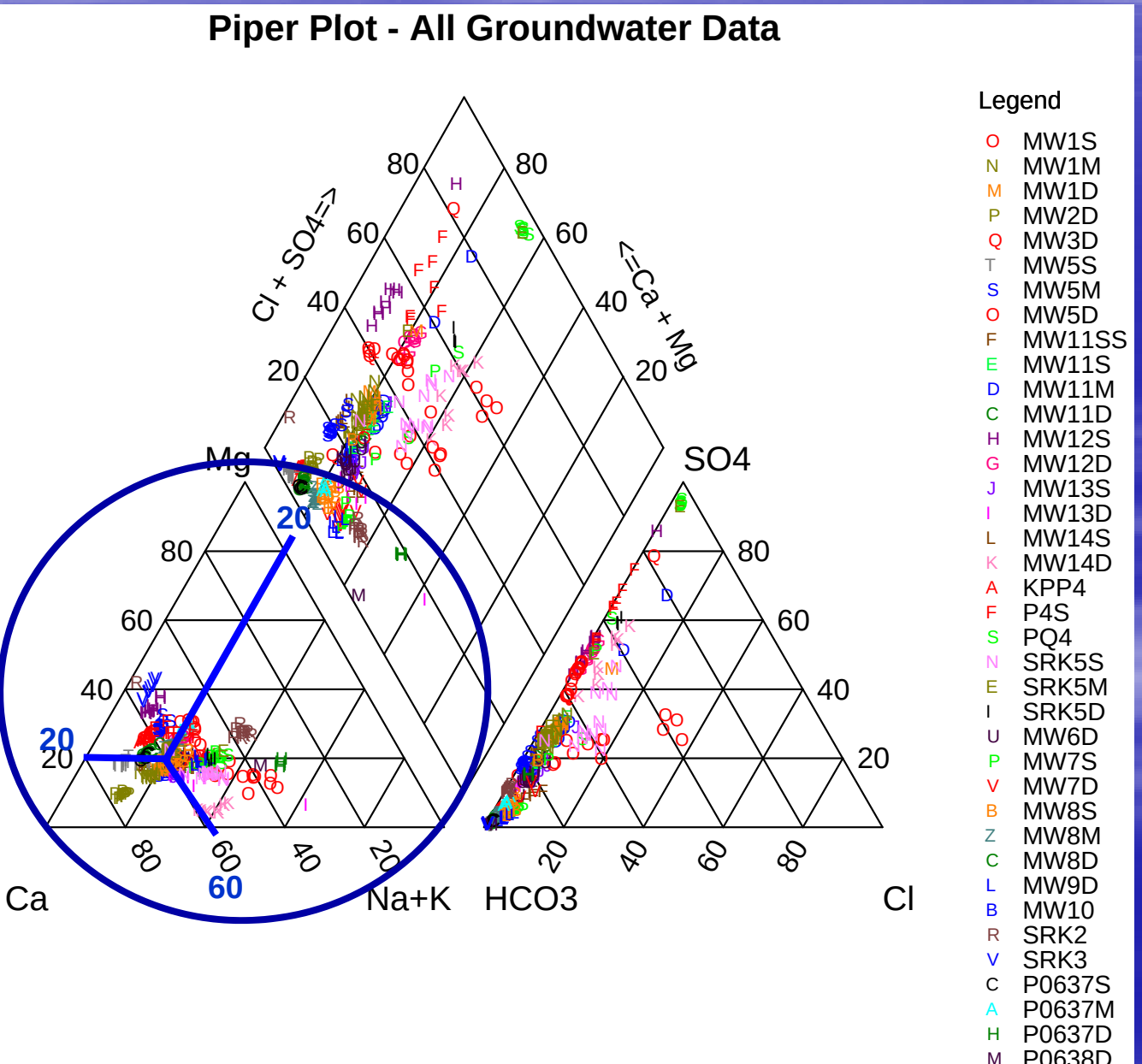
Legend

o MW5D

Piper Plot MW-5D all



Groundwater Composition Cations



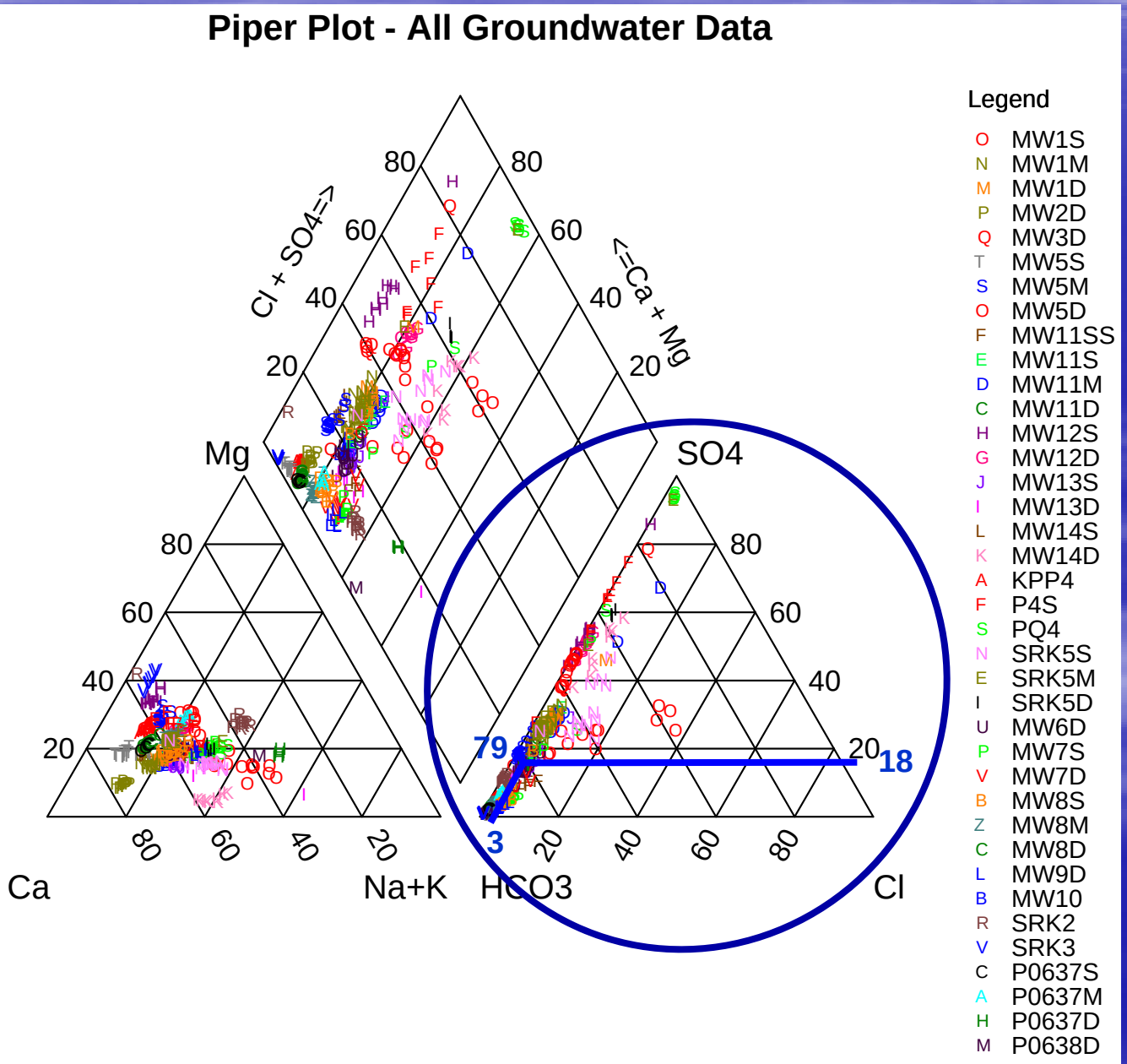
Cations:
- dominated by calcium
- magnesium, sodium, potassium are secondary

Example:
60% Ca
20% Na+K
20% Mg

Major Cation Composition

- Dominated by calcium
- Magnesium is secondary

Groundwater Composition Anions



Anions:

- low chloride
- mostly dominated by carbonate species
- some dominated by sulphate

Example:

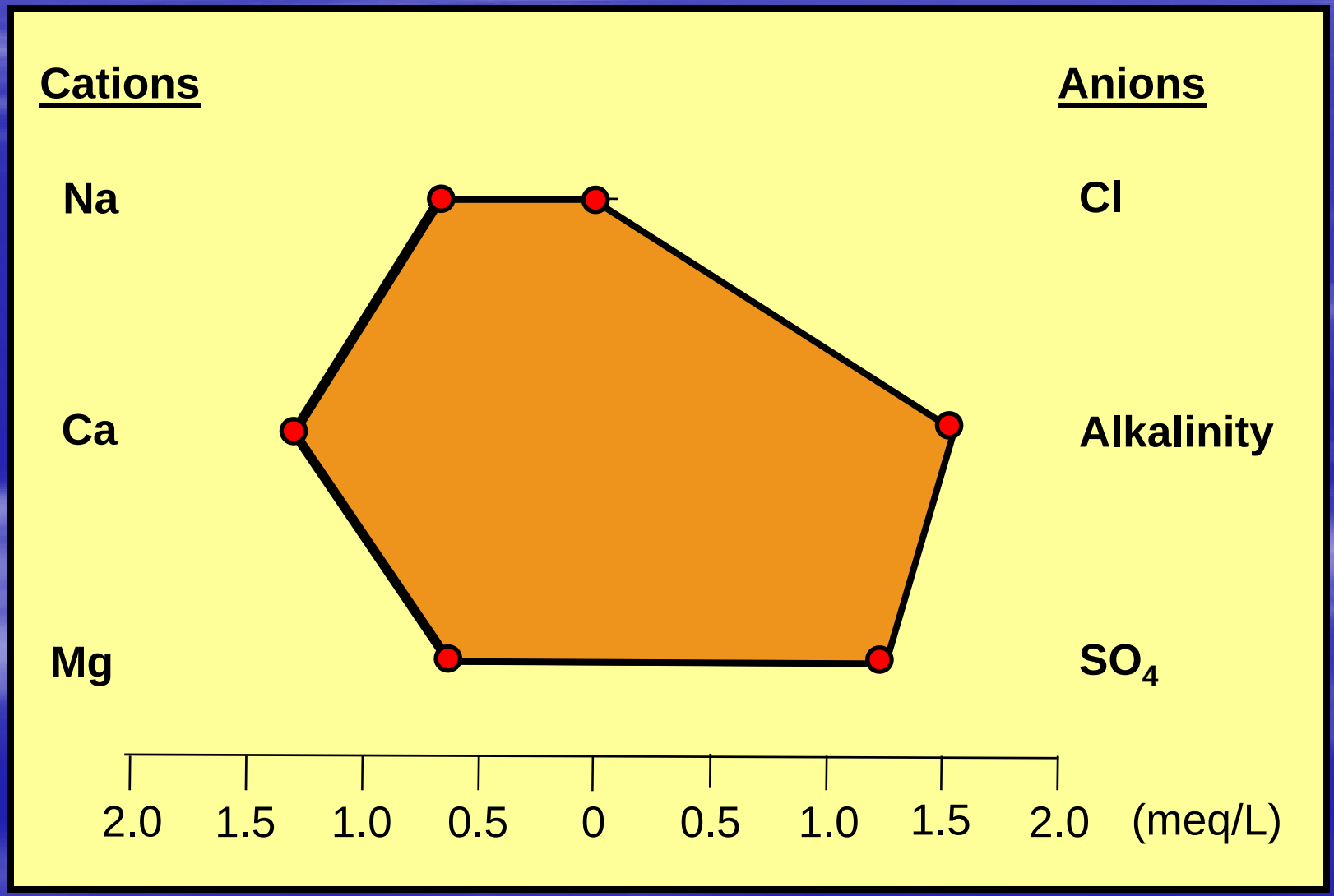
79% carbonate species
18% sulphate
3% chloride

Major Anion Composition

- Most wells dominated by bicarbonate
- Wells dominated by sulphate:
  - MW-5D
  - SRK-5
- MW-5 and SRK-5 clusters are the closest to the mineralized area

Spatial Variation in Water Quality

- Stiff Diagram

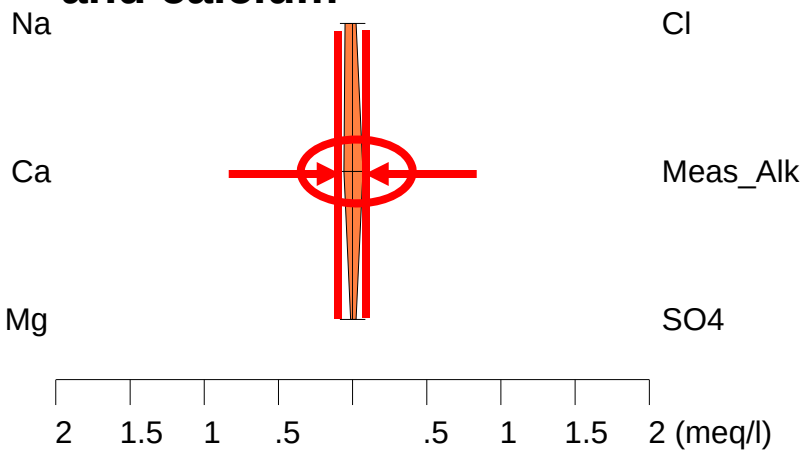


Spatial Variation in Water Quality

- Stiff Diagram
  - MW-1S vs. MW-5D

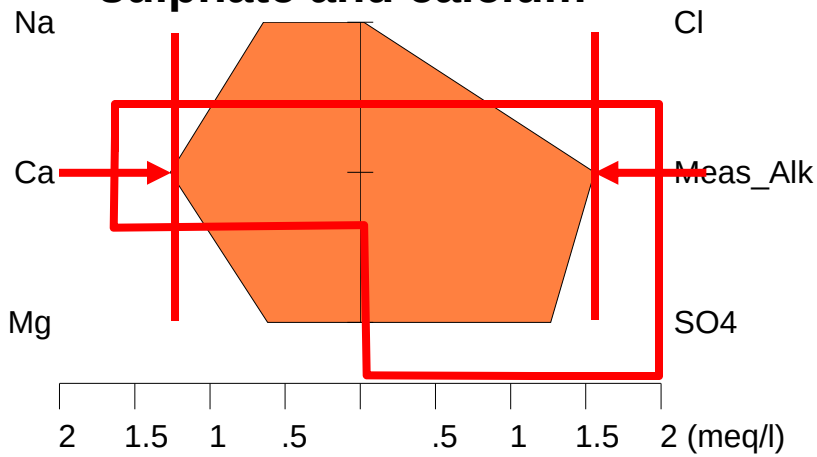
MW1S, 5/13/05

Low TDS
Dominated by carbonate and calcium



MW5D, 5/11/05

High TDS
Dominated by carbonate, sulphate and calcium

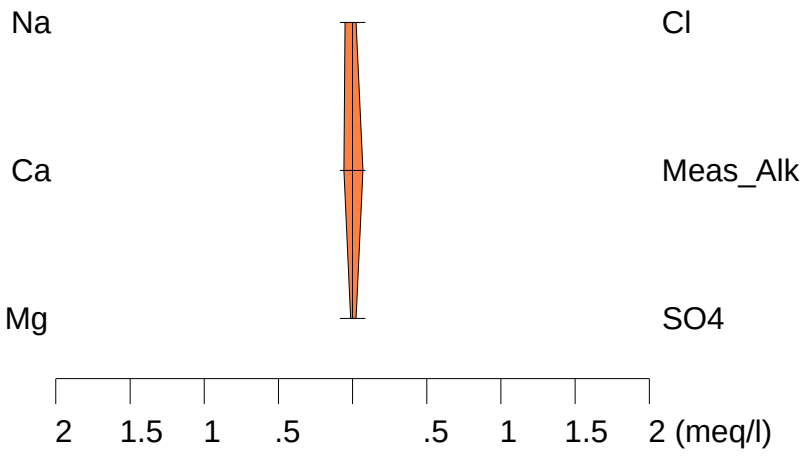


Spatial Variation in Water Quality

- Stiff Diagram
  - MW-1S over time

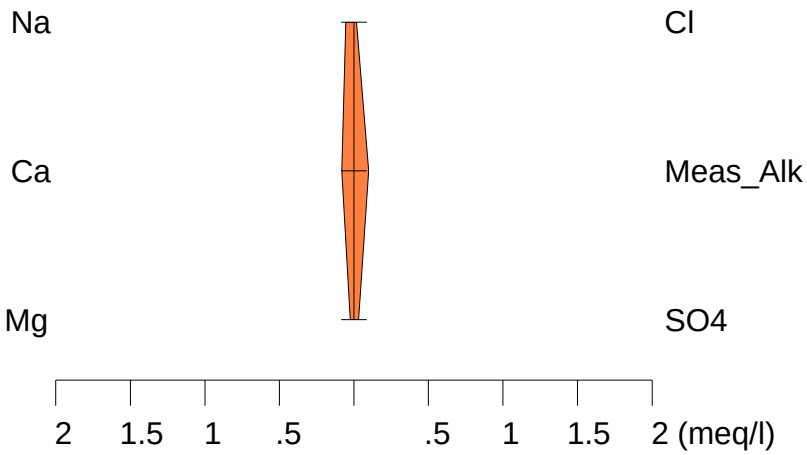
2005

MW1S, 5/13/05



2007

MW1S, 22/08/07

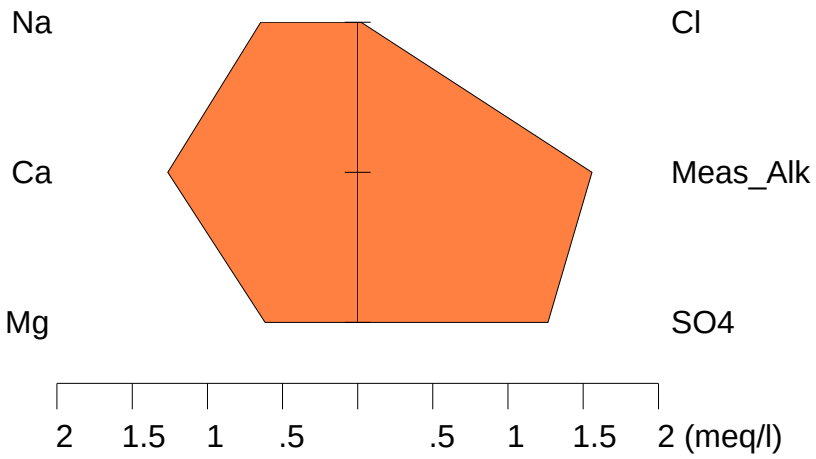


Spatial Variation in Water Quality

- Stiff Diagram
  - MW-5D over time

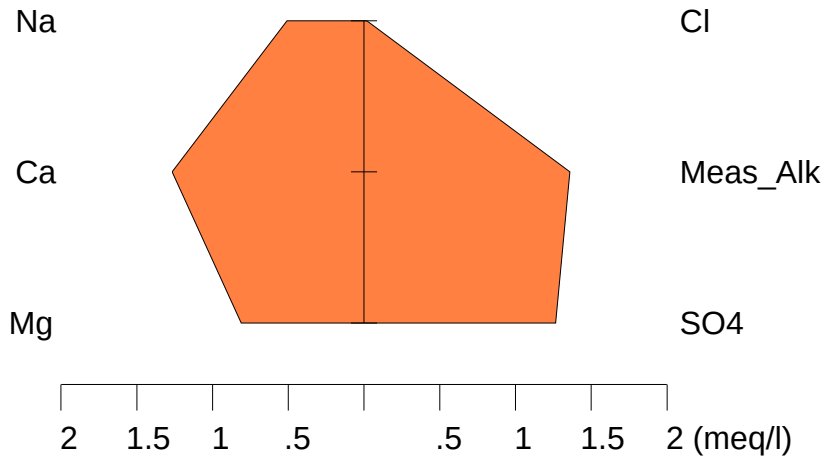
2005

MW5D, 5/11/05



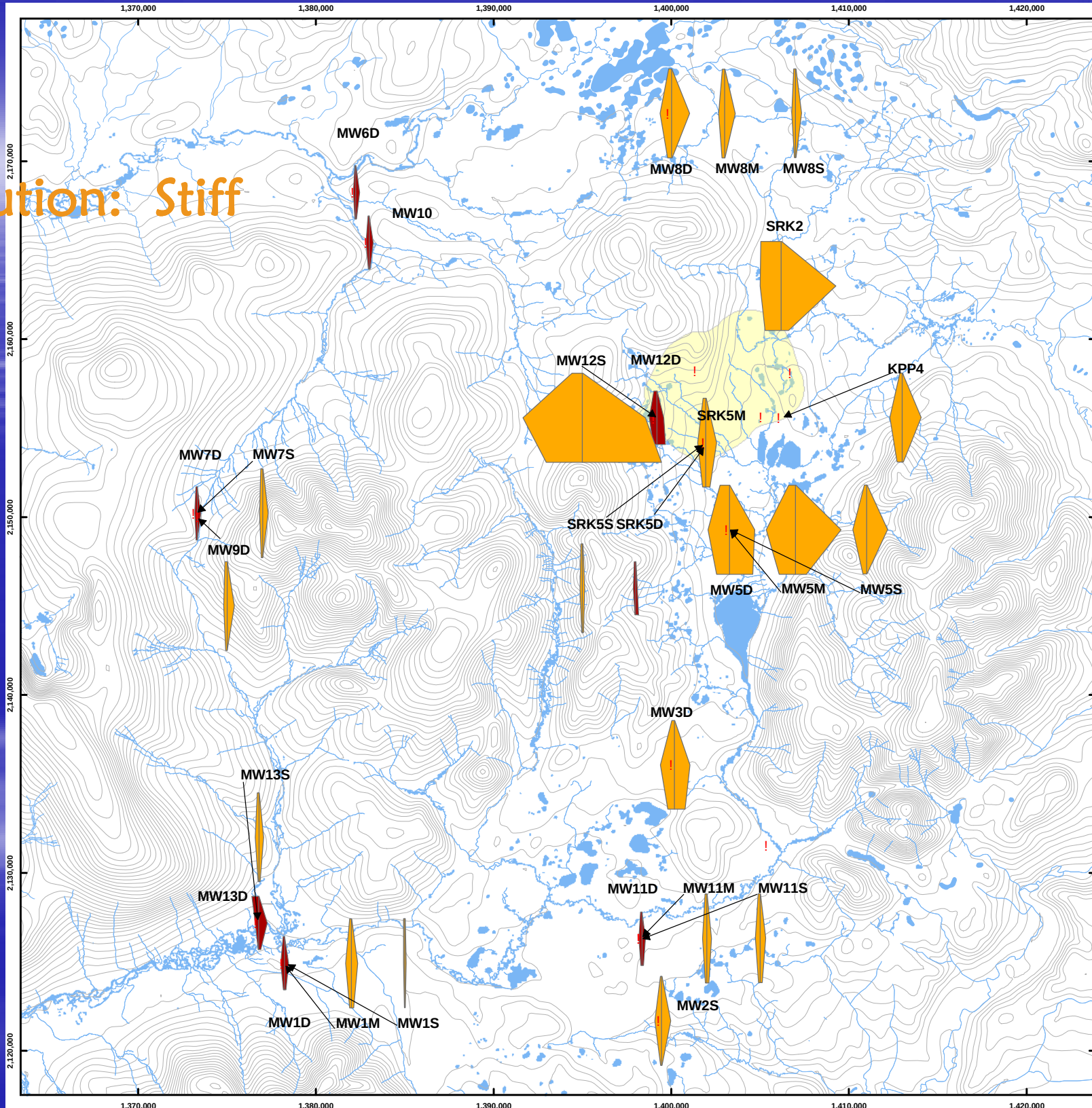
2007

MW5D, 15/03/07



THE pebble PARTNERSHIP

Spatial Distribution: Stiff Diagrams August 05



Legend

- Monitoring wells
- Rivers
- Stiff Diagram - overburden (orange), bedrock (red) wells
- Lakes
- Pit

Stiff Diagram

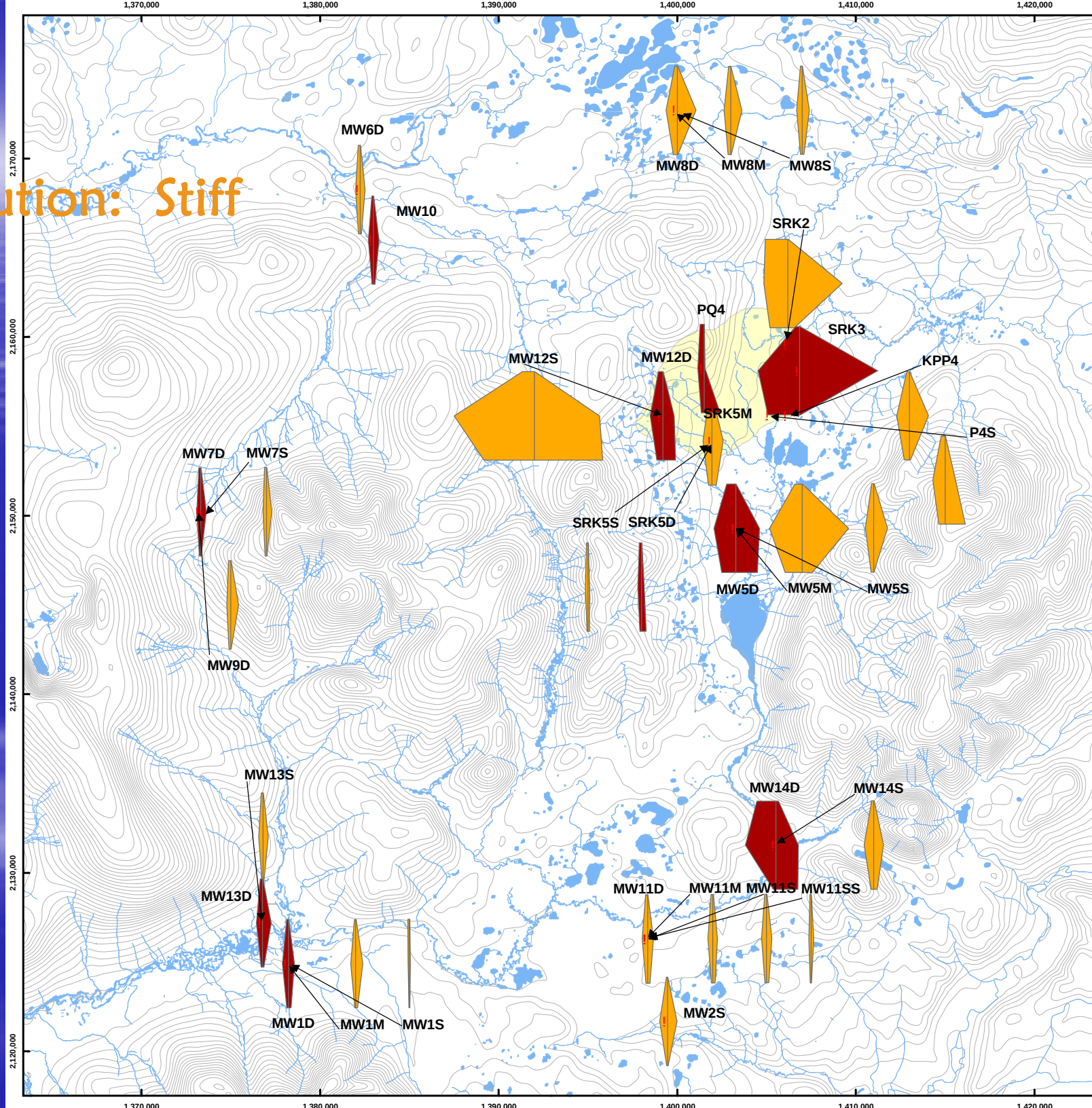
Na, Cl, Ca, HCO3, Mg, SO4

3 0 3 meq

WATER MANAGEMENT CONSULTANTS
A Schlumberger Company

THE pebble PARTNERSHIP

Spatial Distribution: Stiff Diagrams August 06



Legend

- Monitoring wells
- Rivers
- Stiff Diagram - overburden (orange), bedrock (red) wells
- Lakes
- Pit

Stiff Diagram

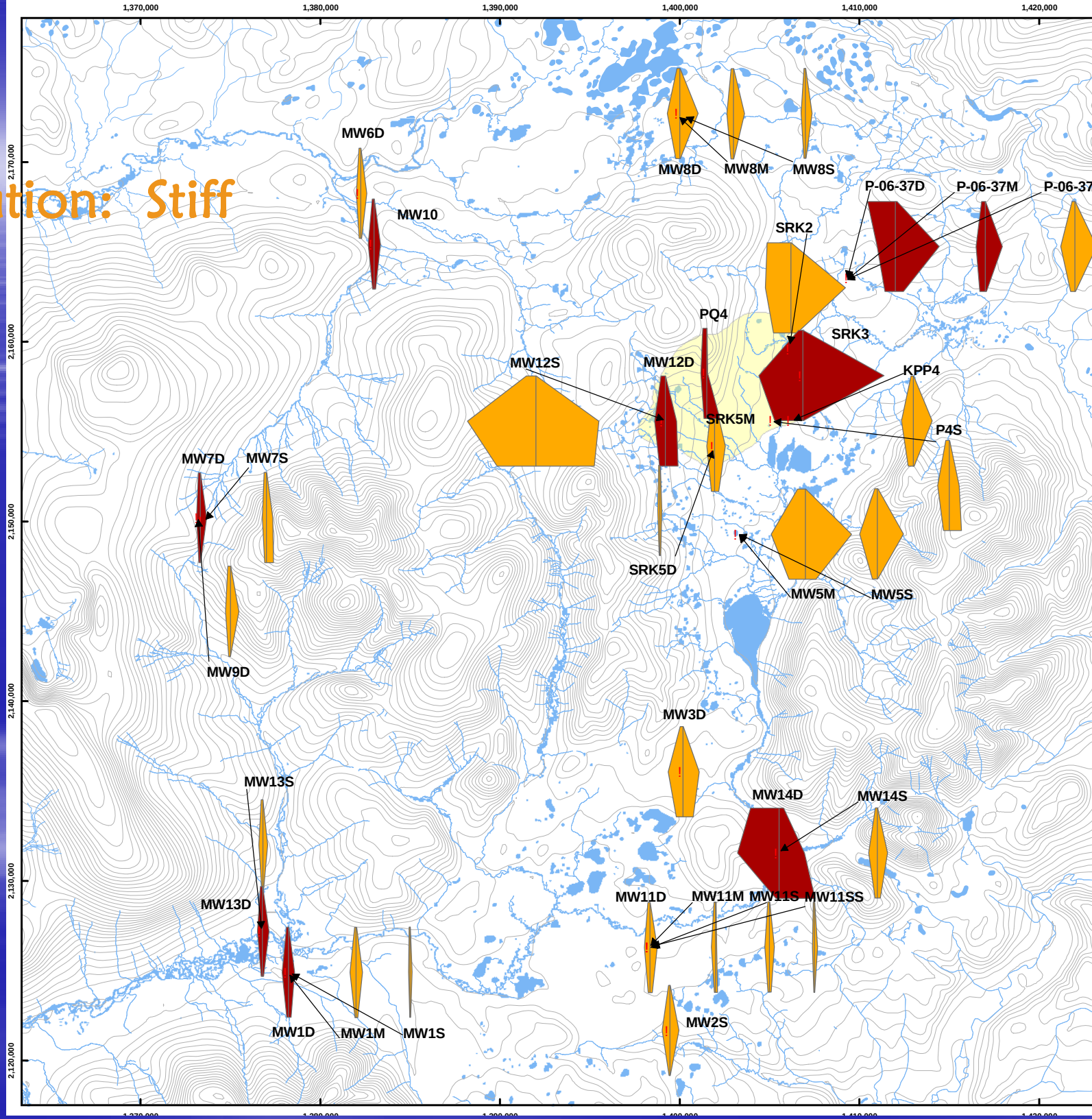
Na, Cl, Ca, HCO3, Mg, SO4

3 0 3 meq

WATER MANAGEMENT CONSULTANTS
A Schlumberger Company

THE pebble PARTNERSHIP

Spatial Distribution: Stiff Diagrams August 07



Legend

- Monitoring wells
- Rivers
- Stiff Diagram - overburden (orange), bedrock (red) wells
- Lakes
- Pit

Stiff Diagram

Na Cl
Ca HCO3
Mg SO4
3 0 3 meq

WATER MANAGEMENT CONSULTANTS
A Schlumberger Company

Summary of Composition Anomalies

	cations	anions	high SO4 %
MW-1S		•	
MW-1M			
MW-1D		•	
MW-2D			
MW-3D		•	
MW-5S			
MW-5M			
MW-5D	•		•
MW-6D			
MW-7S		•	
MW-7D			
MW-8S			
MW-8M			
MW-8D			
MW-9D			
MW-10			
MW-11SS			
MW-11S			
MW-11M		•	
MW-11D			

	cations	anions	high SO4 %
MW-12S		•	•
MW-12D			•
MW-13S			
MW13D			
MW-14S			
MW-14D			•
KP-P4			
SRK2			
SRK3			
SRK5S			
SRK5M			
SRK5D			
PQ4			
P4S			•

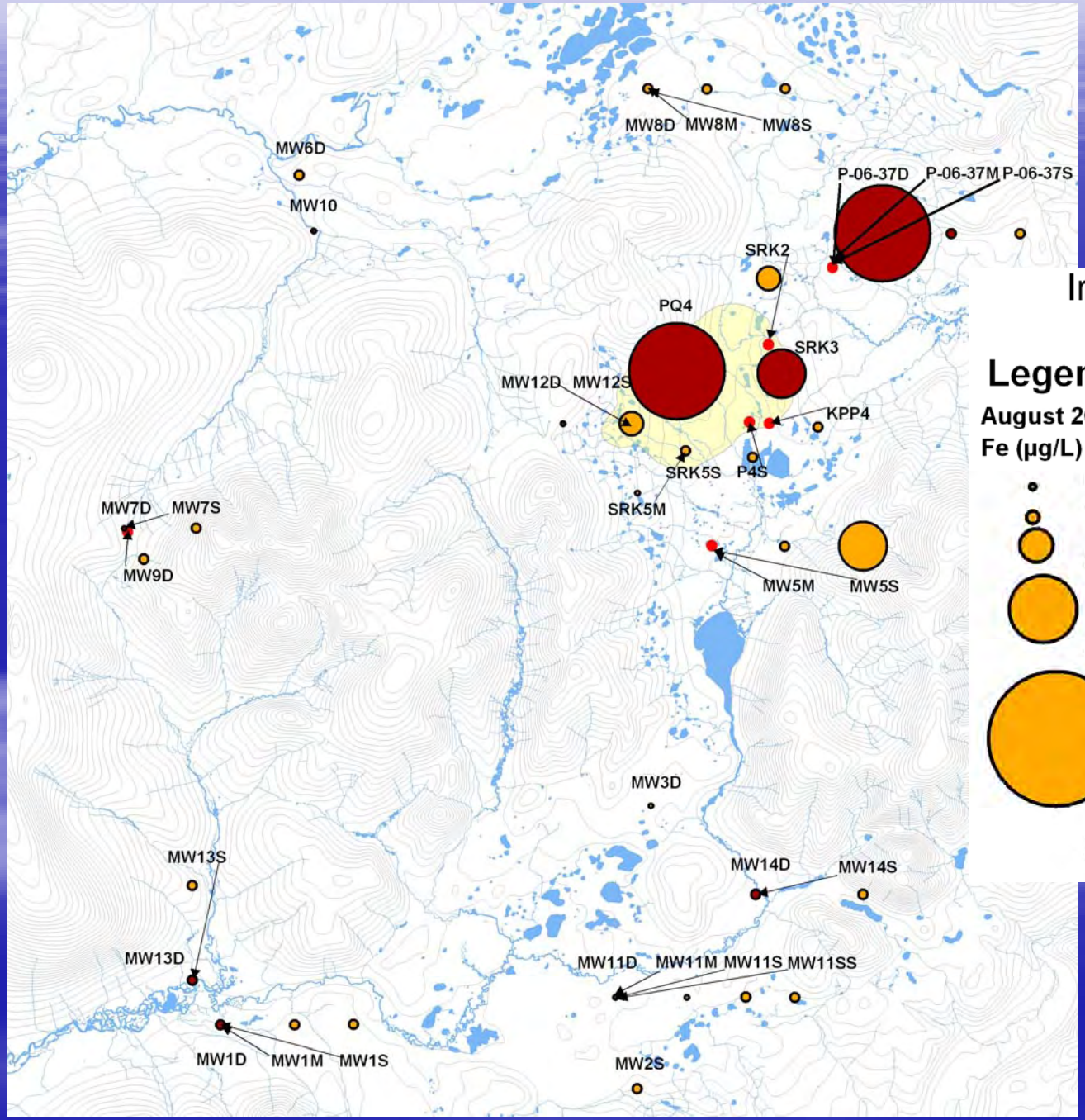
Outline

1. Objectives
2. Field Parameters
3. Major Ions
4. **Trace Elements**
5. Nutrients
6. Tritium
7. Where we go from here

Trace Elements

- metals
- non-metals

Fe Aug 07 Bubble Plot



Iron Spatial Distribution:
August 2007

Legend

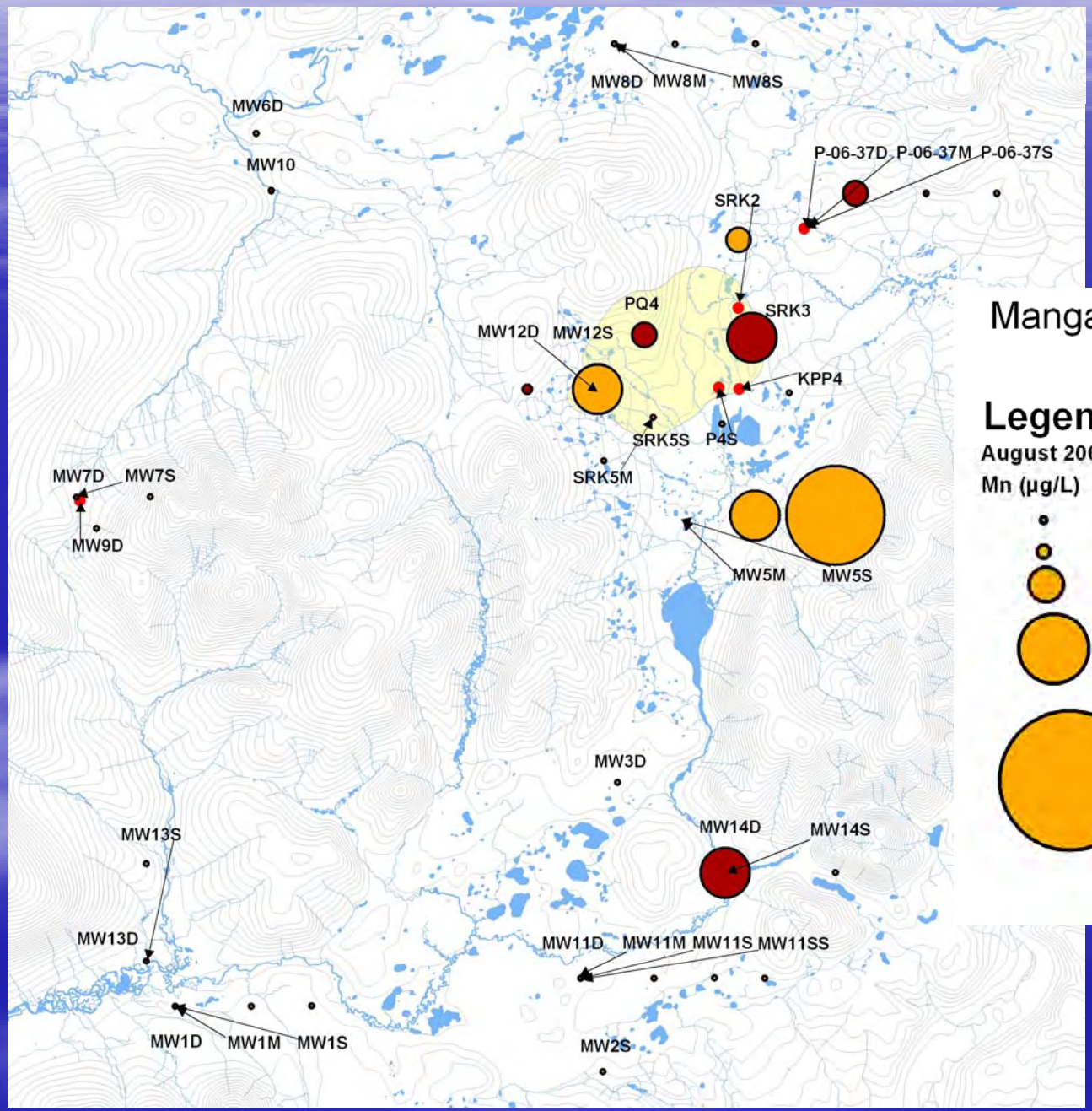
August 2007 Overburden Fe (µg/L)

- 0-10
- 10-50
- 50-100
- 100-500
- 500-1500

August 2007 Bedrock Fe (µg/L)

- 0-10
- 10-50
- 50-100
- 100-500
- 500-1500

Mn Aug 07 Bubble Plot



Manganese Spatial Distribution:
August 2007

Legend

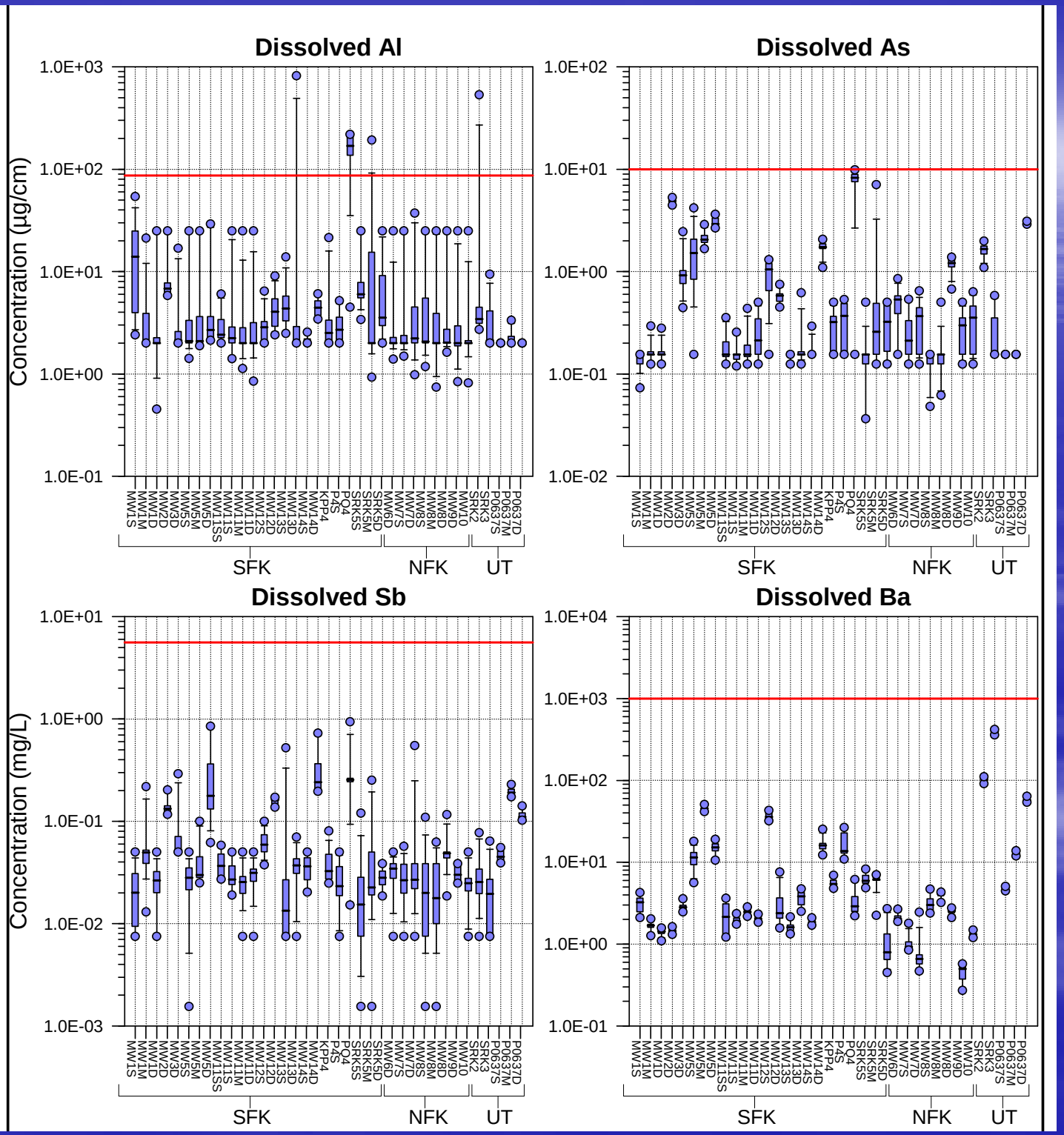
August 2007 Overburden
Mn (µg/L)

- 0-10
- 10-50
- 50-100
- 100-500
- 500-1000

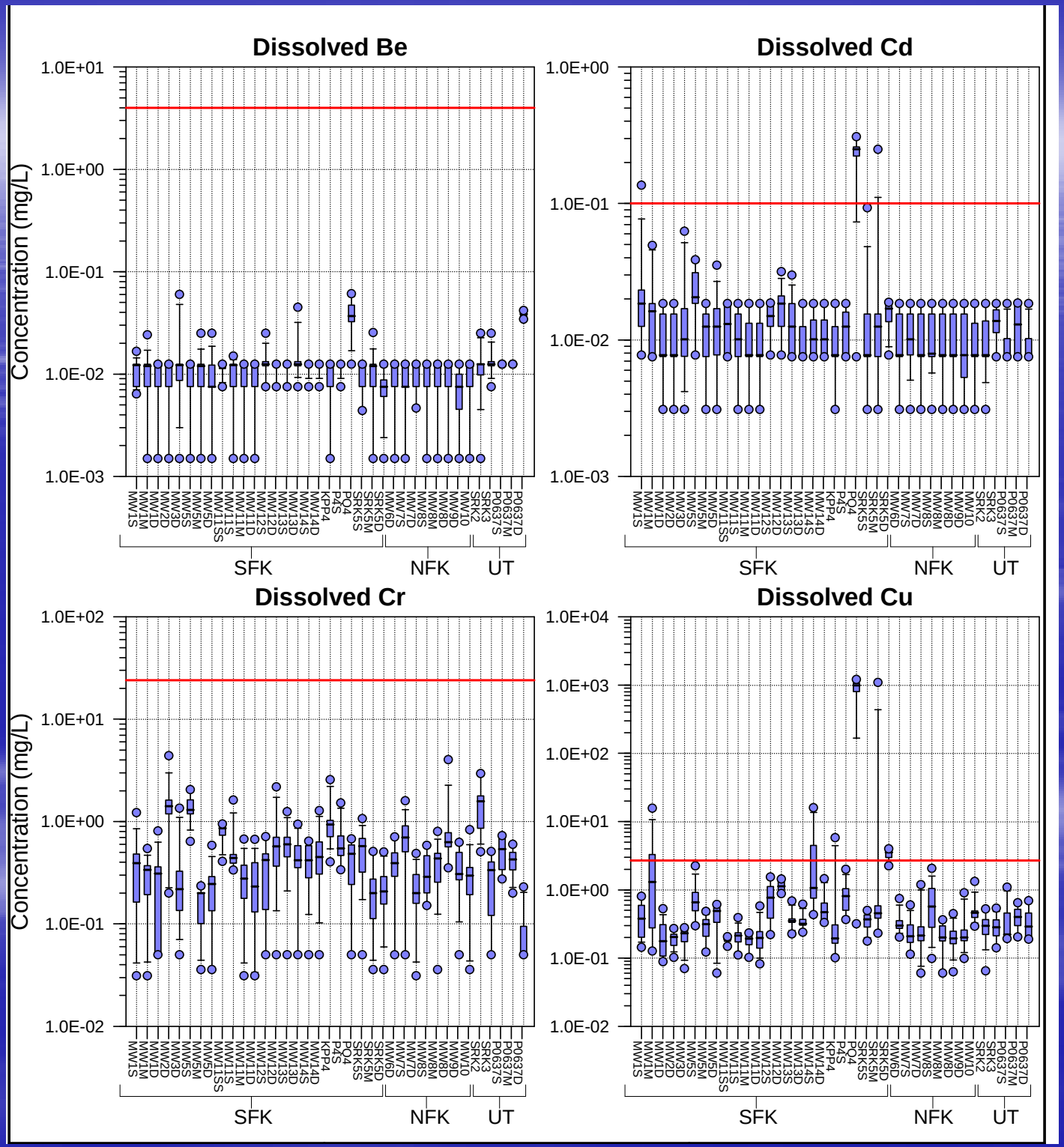
August 2007 Bedrock
Mn (µg/L)

- 0-10
- 10-50
- 50-100
- 100-500
- 500-1000

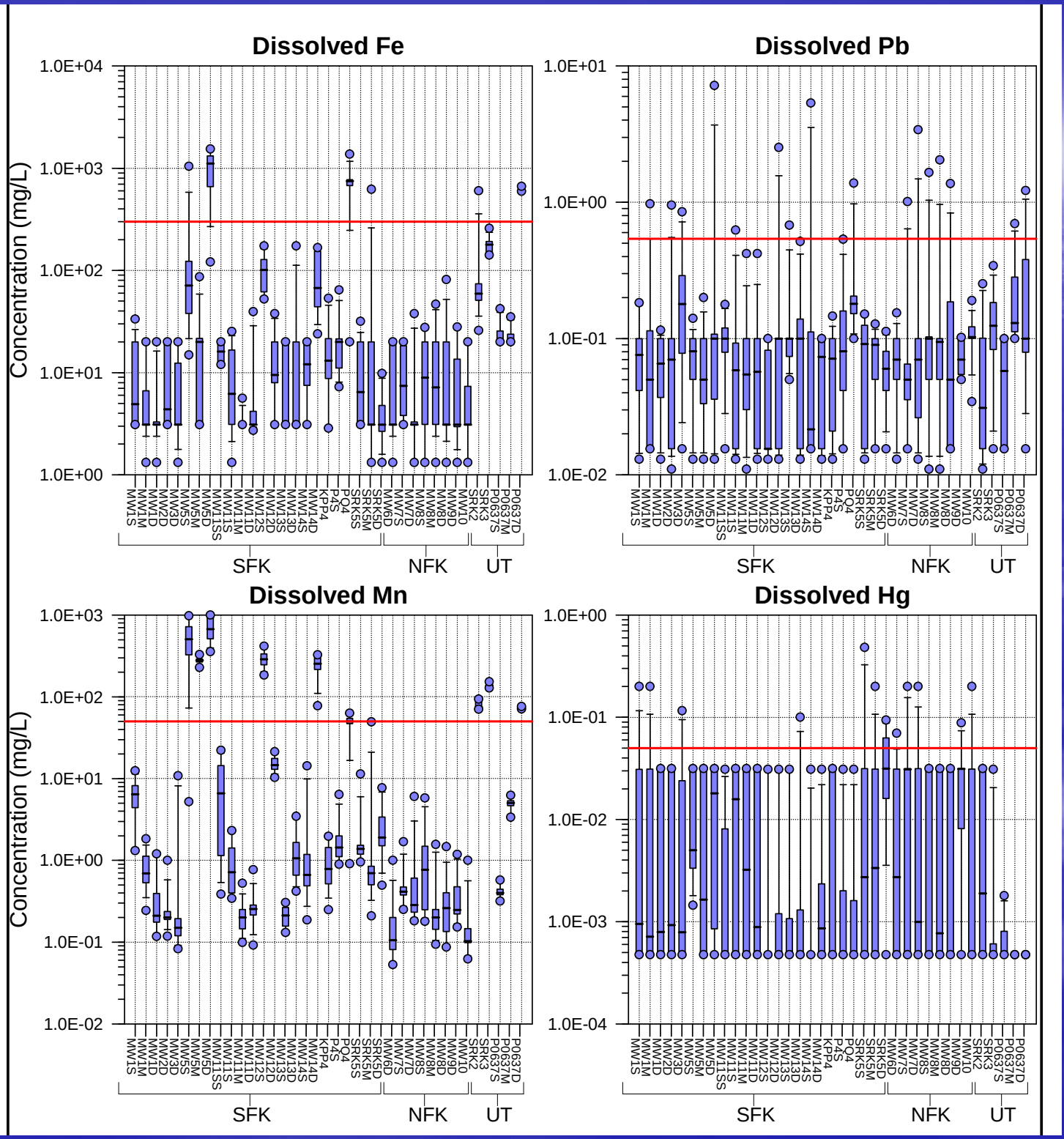
Al, As, Sb, Ba


Dissolved Al
Concentration (µg/cm)
1.0E+03
1.0E+02
1.0E+01
1.0E+00
1.0E-01
Dissolved As
1.0E+02
1.0E+01
1.0E+00
1.0E-01
1.0E-02
Dissolved Sb
Concentration (mg/L)
1.0E+01
1.0E+00
1.0E-01
1.0E-02
1.0E-03
Dissolved Ba
1.0E+04
1.0E+03
1.0E+02
1.0E+01
1.0E+00
1.0E-01
MW1S MW1M MW1D MW2D MW3D MW5S MW5M MW5D MW11SS MW11S MW11M MW11D MW12S MW12D MW13S MW13D MW14S MW14D KPP4 P4S PQ4 SRK5S SRK5M SRK5D MW6D MW7S MW7D MW8S MW8M MW8D MW9D MW10 SRK2 SRK3 P0637S P0637M P0637D
SFK
NFK
UT

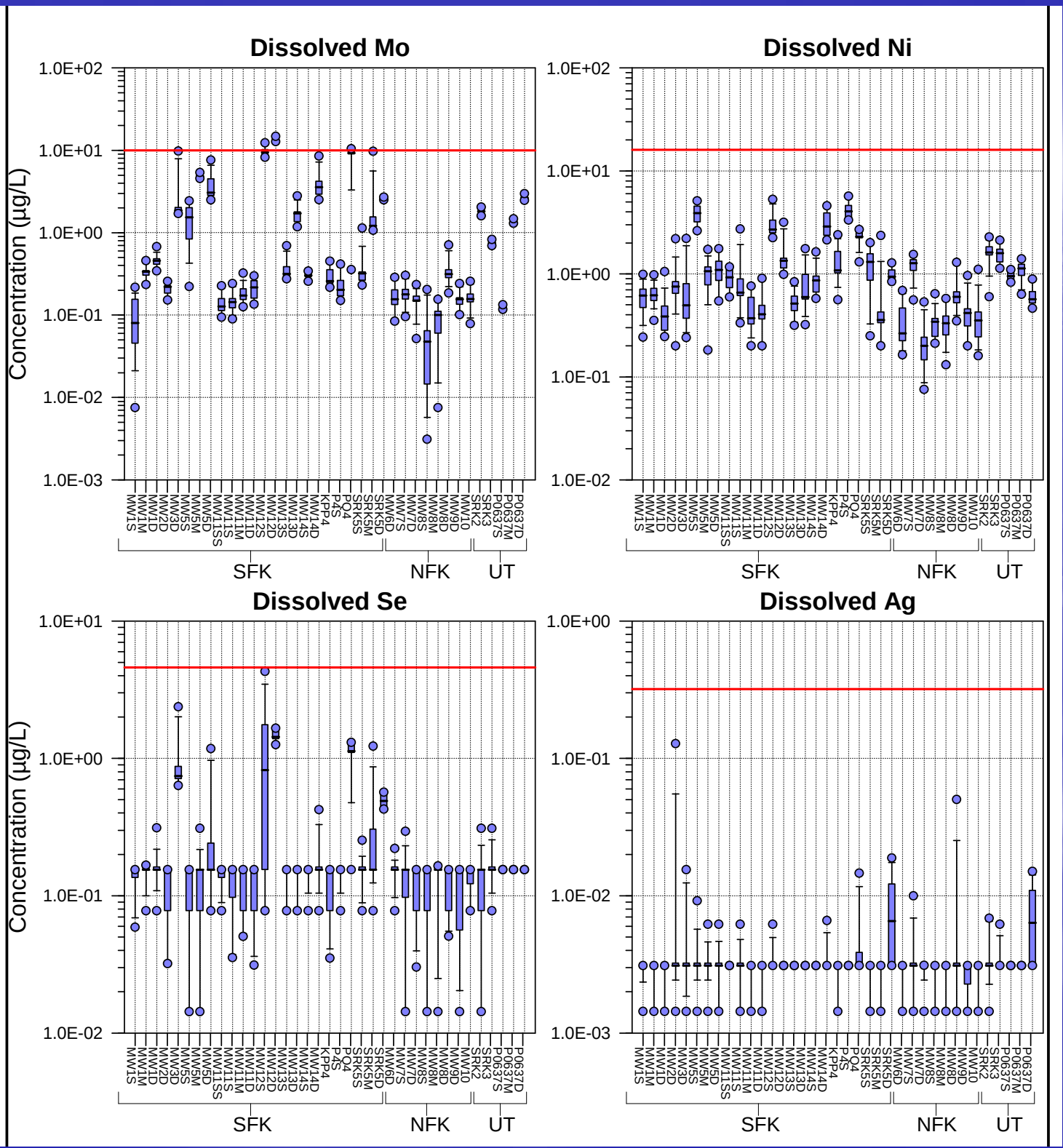
Be, Cd, Cr, Cu


Dissolved Be
Dissolved Cd
Dissolved Cr
Dissolved Cu
Concentration (mg/L)
SFK
NFK
UT

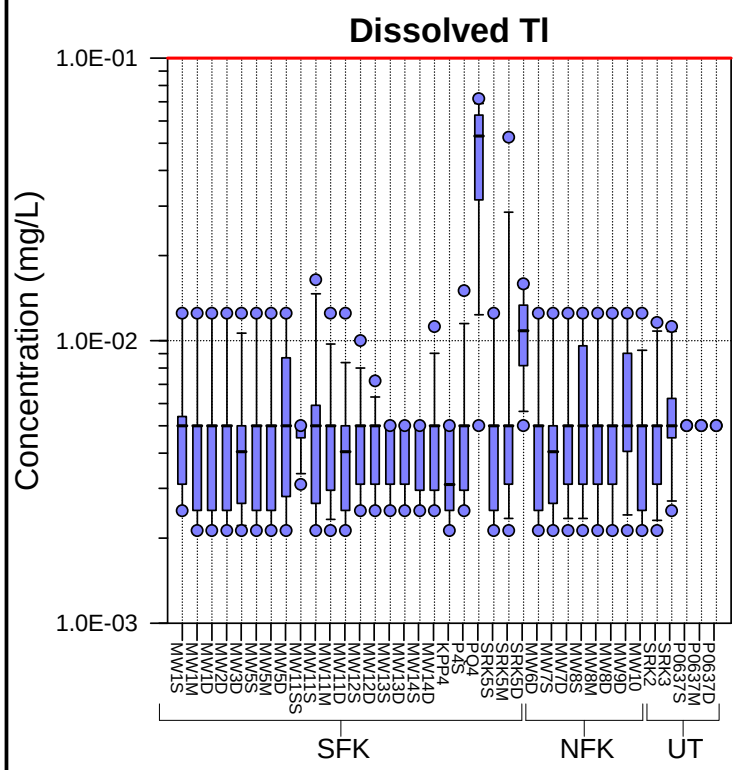
Fe, Pb, Mn, Hg

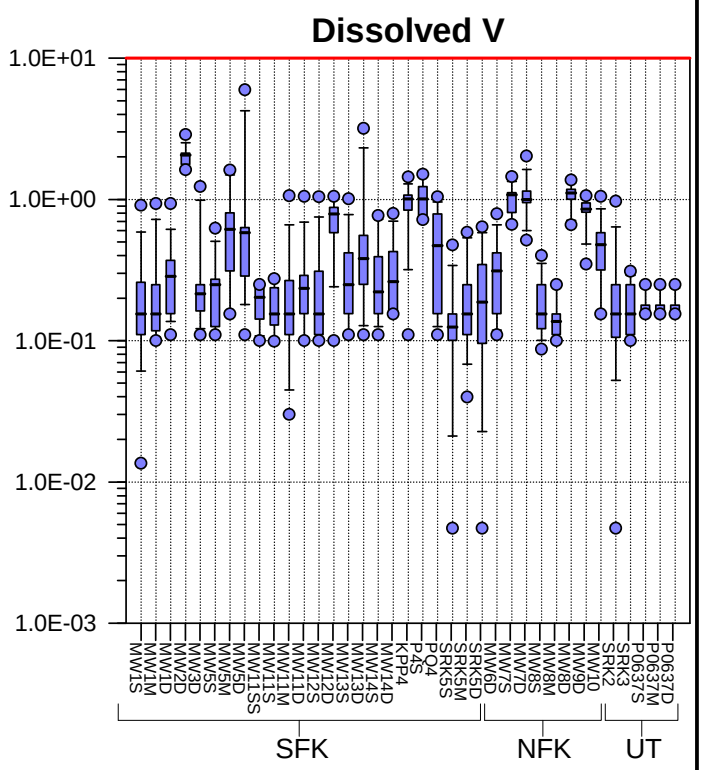

Dissolved Fe
Concentration (mg/L)
1.0E+04
1.0E+03
1.0E+02
1.0E+01
1.0E+00
MW1S MW1M MW1D MW2D MW3D MW5S MW5M MW5D MW11SS MW11S MW11M MW11D MW12D MW13S MW13D MW14S MW14D KPP4 P4S PQ4 SRK5S SRK5M SRK5D MW6D MW7S MW7D MW8S MW8M MW8D MW9D MW10 SRK2 SRK3 P0637S P0637M P0637D
SFK
NFK
UT
Dissolved Pb
1.0E+01
1.0E+00
1.0E-01
1.0E-02
MW1S MW1M MW1D MW2D MW3D MW5S MW5M MW5D MW11SS MW11S MW11M MW11D MW12S MW12D MW13S MW13D MW14S MW14D KPP4 P4S PQ4 SRK5S SRK5M SRK5D MW6D MW7S MW7D MW8S MW8M MW8D MW9D MW10 SRK2 SRK3 P0637S P0637M P0637D
SFK
NFK
UT
Dissolved Mn
Concentration (mg/L)
1.0E+03
1.0E+02
1.0E+01
1.0E+00
1.0E-01
1.0E-02
MW1S MW1M MW1D MW2D MW3D MW5S MW5M MW5D MW11SS MW11S MW11M MW11D MW12D MW13S MW13D MW14S MW14D KPP4 P4S PQ4 SRK5S SRK5M SRK5D MW6D MW7S MW7D MW8S MW8M MW8D MW9D MW10 SRK2 SRK3 P0637S P0637M P0637D
SFK
NFK
UT
Dissolved Hg
1.0E+00
1.0E-01
1.0E-02
1.0E-03
1.0E-04
MW1S MW1M MW1D MW2D MW3D MW5S MW5M MW5D MW11SS MW11S MW11M MW11D MW12S MW12D MW13S MW13D MW14S MW14D KPP4 P4S PQ4 SRK5S SRK5M SRK5D MW6D MW7S MW7D MW8S MW8M MW8D MW9D MW10 SRK2 SRK3 P0637S P0637M P0637D
SFK
NFK
UT

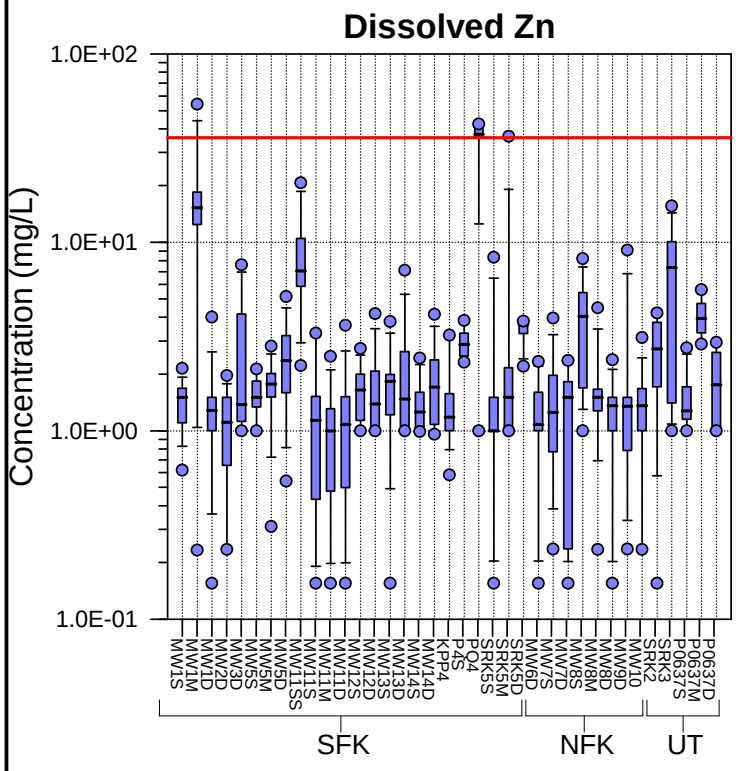
Mo, Ni, Se, Ag


Dissolved Mo
Dissolved Ni
Dissolved Se
Dissolved Ag
Concentration (µg/L)
1.0E+02
1.0E+01
1.0E+00
1.0E-01
1.0E-02
1.0E-03
SFK
NFK
UT

Tl, V, Zn


Dissolved Tl
Concentration (mg/L)
1.0E-01
1.0E-02
1.0E-03
MW1S MW1M MW1D MW2D MW3D MW5S MW5M MW5D MW11SS MW11S MW11M MW11D MW12S MW12D MW13S MW13D MW14S MW14D KPP4 P4S PQ4 SRK5S SRK5M SRK5D MW6D MW7S MW7D MW8S MW8M MW8D MW9D MW10 SRK2 SRK3 P0637S P0637M P0637D
SFK
NFK
UT


Dissolved V
1.0E+01
1.0E+00
1.0E-01
1.0E-02
1.0E-03
MW1S MW1M MW1D MW2D MW3D MW5S MW5M MW5D MW11SS MW11S MW11M MW11D MW12S MW12D MW13S MW13D MW14S MW14D KPP4 P4S PQ4 SRK5S SRK5M SRK5D MW6D MW7S MW7D MW8S MW8M MW8D MW9D MW10 SRK2 SRK3 P0637S P0637M P0637D
SFK
NFK
UT


Dissolved Zn
Concentration (mg/L)
1.0E+02
1.0E+01
1.0E+00
1.0E-01
MW1S MW1M MW1D MW2D MW3D MW5S MW5M MW5D MW11SS MW11S MW11M MW11D MW12S MW12D MW13S MW13D MW14S MW14D KPP4 P4S PQ4 SRK5S SRK5M SRK5D MW6D MW7S MW7D MW8S MW8M MW8D MW9D MW10 SRK2 SRK3 P0637S P0637M P0637D
SFK
NFK
UT

Dissolved Trace Elements

- Concentrations mostly below the lowest water quality criteria

Trace Elements Concentrations Higher Than Other Wells

	Ca	Mg	Na	K	Alk	SO_4	Al	As	Sb	Ba	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Mo	Ni	Se	Ag	Tl	V	Zn
MW-1S																									
MW-1M																									•
MW-1D																									
MW-2D								•																	
MW-3D								•											•		•				
MW-5S								•											•						
MW-5M	•	•	•		•			•		•									•						
MW-5D	•	•	•					•	•						•				•						
MW-6D																									
MW-7S																									
MW-7D																									
MW-8S																									
MW-8M																									
MW-8D																									
MW-9D																									
MW-10																									
MW-11SS																									
MW-11S																									
MW-11M																									
MW-11D																									

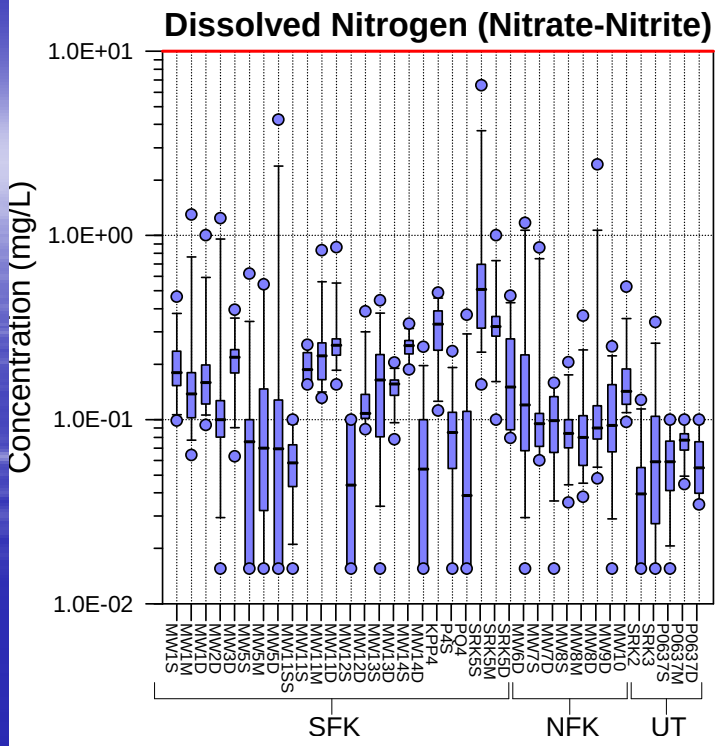
Trace Elements Concentrations Higher Than Other Wells

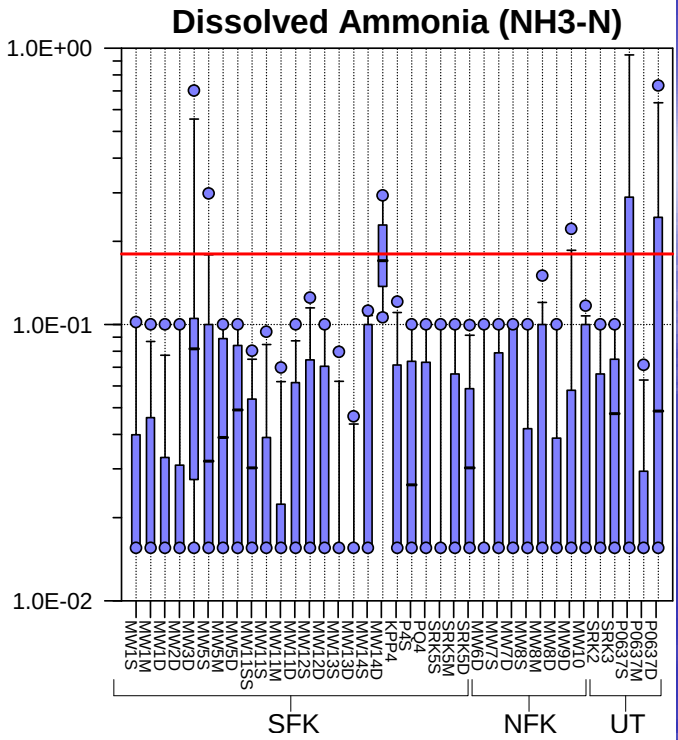
	Ca	Mg	Na	K	Alk	SO_4	Al	As	Sb	Ba	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Mo	Ni	Se	Ag	Tl	V	Zn
MW-12S	•	•	•		•	•				•									•						
MW-12D																			•		•				
MW-13S																									
MW13D																			•						
MW-14S														•											
MW-14D			•					•	•										•						
KP-P4																									
SRK2		•	•		•			•		•									•						
SRK3	•	•			•					•															
SRK5S																									
SRK5M																			•						
SRK5D														•					•						
PQ4							•	•	•			•		•	•				•		•				•
P4S																									

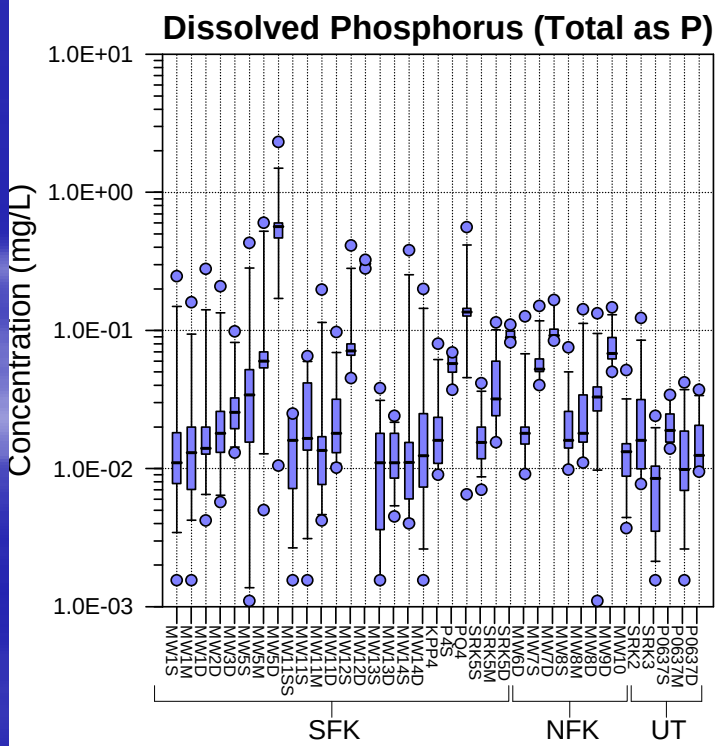
Outline

1. Objectives
2. Field Parameters
3. Major Ions
4. Trace Elements
5. **Nutrients**
6. Tritium
7. Where we go from here

N & P


Dissolved Nitrogen (Nitrate-Nitrite)
Concentration (mg/L)
1.0E+01
1.0E+00
1.0E-01
1.0E-02
MW1S MW1M MW1D MW2D MW3D MW5S MW5M MW5D MW11SS MW11S MW1M MW1D MW12S MW12D MW13S MW13D MW14S MW14D KPP4 P4S PQ4 SRK5S SRK5M SRK5D MW6D MW7S MW7D MW8S MW8M MW8D MW9D MW10 SRK2 SRK3 P0637S P0637M P0637D
SFK
NFK
UT


Dissolved Ammonia (NH3-N)
1.0E+00
1.0E-01
1.0E-02
MW1S MW1M MW1D MW2D MW3D MW5S MW5M MW5D MW11SS MW11S MW1M MW1D MW12S MW12D MW13S MW13D MW14S MW14D KPP4 P4S PQ4 SRK5S SRK5M SRK5D MW6D MW7S MW7D MW8S MW8M MW8D MW9D MW10 SRK2 SRK3 P0637S P0637M P0637D
SFK
NFK
UT


Dissolved Phosphorus (Total as P)
Concentration (mg/L)
1.0E+01
1.0E+00
1.0E-01
1.0E-02
1.0E-03
MW1S MW1M MW1D MW2D MW3D MW5S MW5M MW5D MW11SS MW11S MW1M MW1D MW12S MW12D MW13S MW13D MW14S MW14D KPP4 P4S PQ4 SRK5S SRK5M SRK5D MW6D MW7S MW7D MW8S MW8M MW8D MW9D MW10 SRK2 SRK3 P0637S P0637M P0637D
SFK
NFK
UT

Nitrogen and Phosphorous

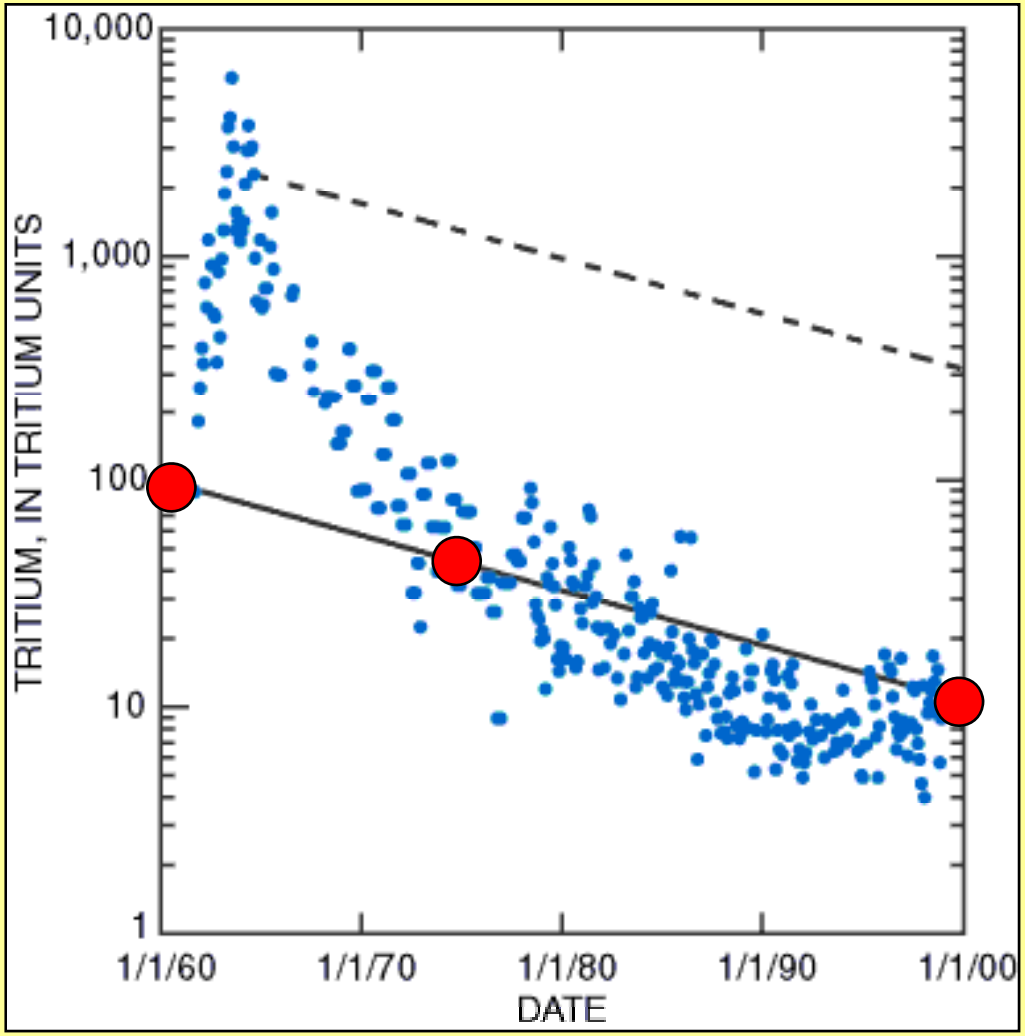
- Nitrogen (ammonia, nitrite and nitrate) occur sporadically at a few locations
- Concentrations mostly below the lowest criteria

Outline

1. Objectives
2. Field Parameters
3. Major Ions
4. Trace Elements
5. Nutrients
6. **Tritium**
7. Where we go from here

Tritium – the concept

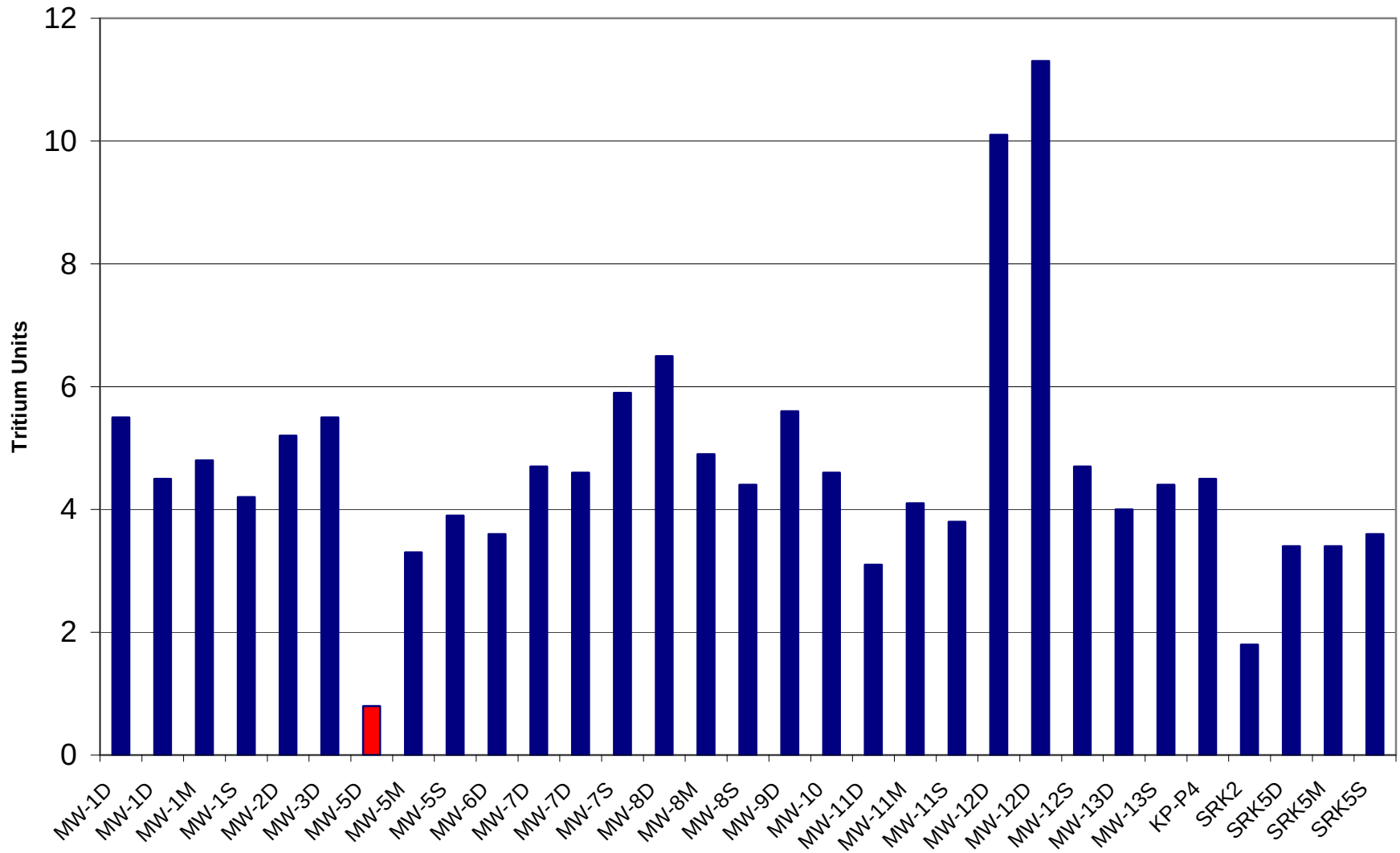
Tritium Concentrations in Anchorage Precipitation



from USGS Fact Sheet FS-022-02

- pre-1953 5-20 TU
- nuclear testing 1953
- peak of 1000's TU
- half life of tritium = 12.4 yr
- pre-1953 currently ~1 TU

Tritium


Tritium Units
0
2
4
6
8
10
12
MW-1D
MW-1D
MW-1M
MW-1S
MW-2D
MW-3D
MW-5D
MW-5M
MW-5S
MW-6D
MW-7D
MW-7D
MW-7S
MW-8D
MW-8M
MW-8S
MW-9D
MW-10
MW-11D
MW-11M
MW-11S
MW-12D
MW-12D
MW-12S
MW-13D
MW-13S
KP-P4
SRK2
SRK5D
SRK5M
SRK5S

Outline

1. Objectives
2. Field Parameters
3. Major Ions
4. Trace Elements
5. Nutrients
6. Tritium
7. Summary and Next Steps

Where we go from here

- expand network of wells
- check low tritium concentration
- continue data interpretation
- integrate interpretation with seeps and surface water

Summary

- Very low dissolved solids
- Surprisingly high dissolved oxygen
- Little to no exceedance of criteria
- Relatively constant over time
- Probably mostly modern recharge

Questions …