SWAT MODELING AT MARRECAS WATERSHED IN RIO GRANDE DO SUL, BRAZIL

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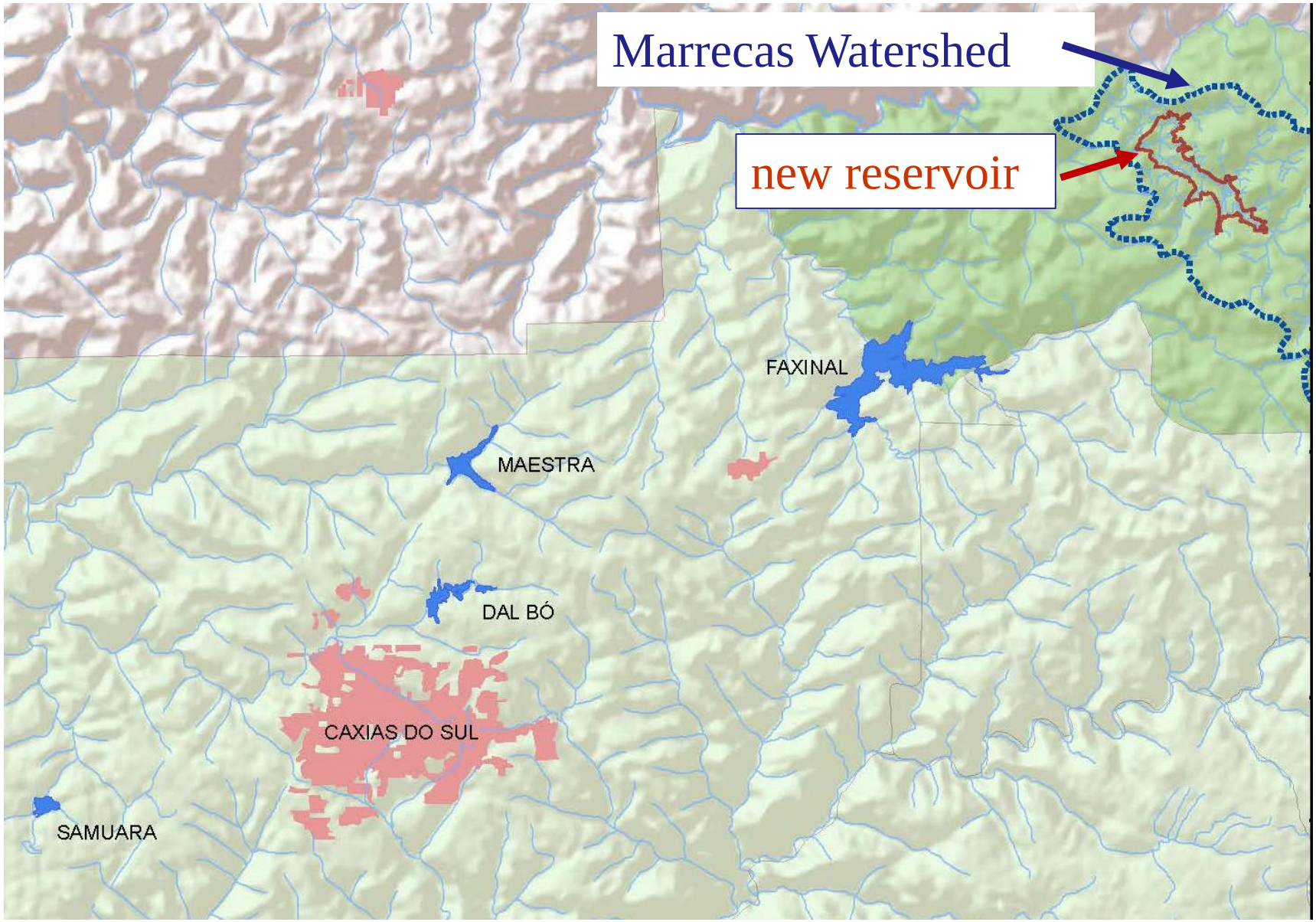
DO RIO GRANDE DO SUL

Enviromental Context

- Caxias do Sul, 2nd largest city in Rio Grande do Sul state , was facing municipal water supply shortage, as currrent supply from exisiting reservoirs (was nearing available capacity;

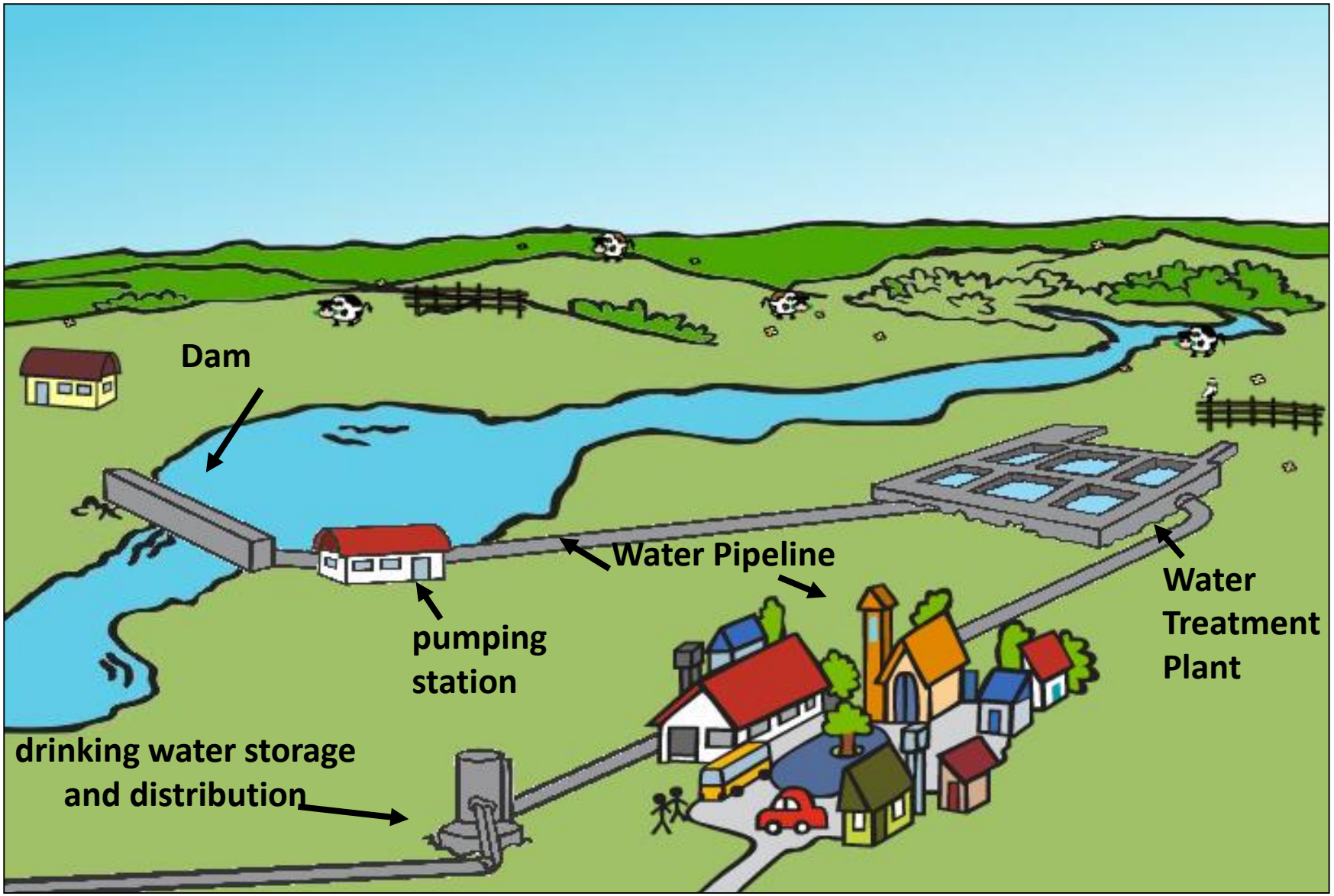
- water quality quality concerns (previous issues with Feitoria Reservoir);


Marrecas Watershed
new reservoir
FAXINAL
MAESTRA
DAL BÓ
CAXIAS DO SUL
SAMUARA

Arroio das Marrecas (Ducks´Creek) watershed

- 5,370 ha
- subtropical (MAT 16°C)
- natural vegetation is subtropical forests and grasslands
- geology is basalt-rhyolite and soils usually shallow (Inceptisols and Ultisols, with high organic matter content)

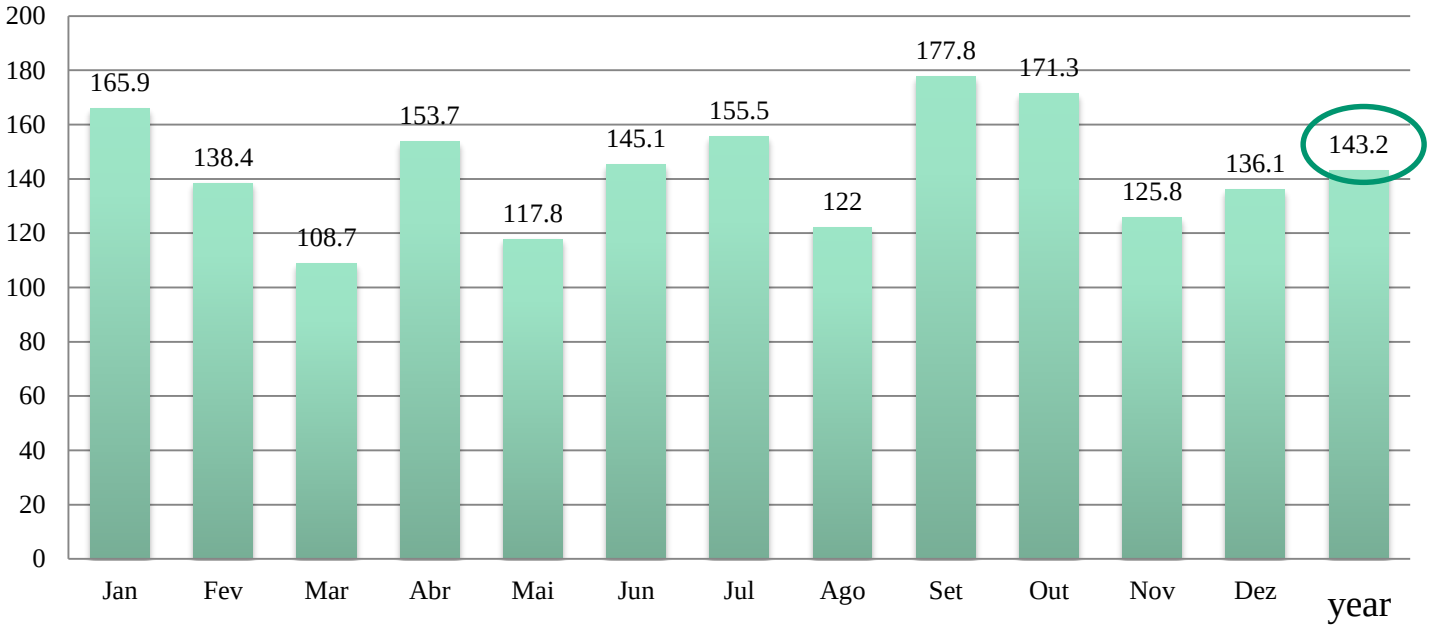
- Concrete dam built in 2012-2013, flooded 216 ha of the watershed (33 million m³), owned by SAMAE – municipal water utility


Dam
Water Pipeline
pumping
station
Water
Treatment
Plant
drinking water storage
and distribution

Data Availability

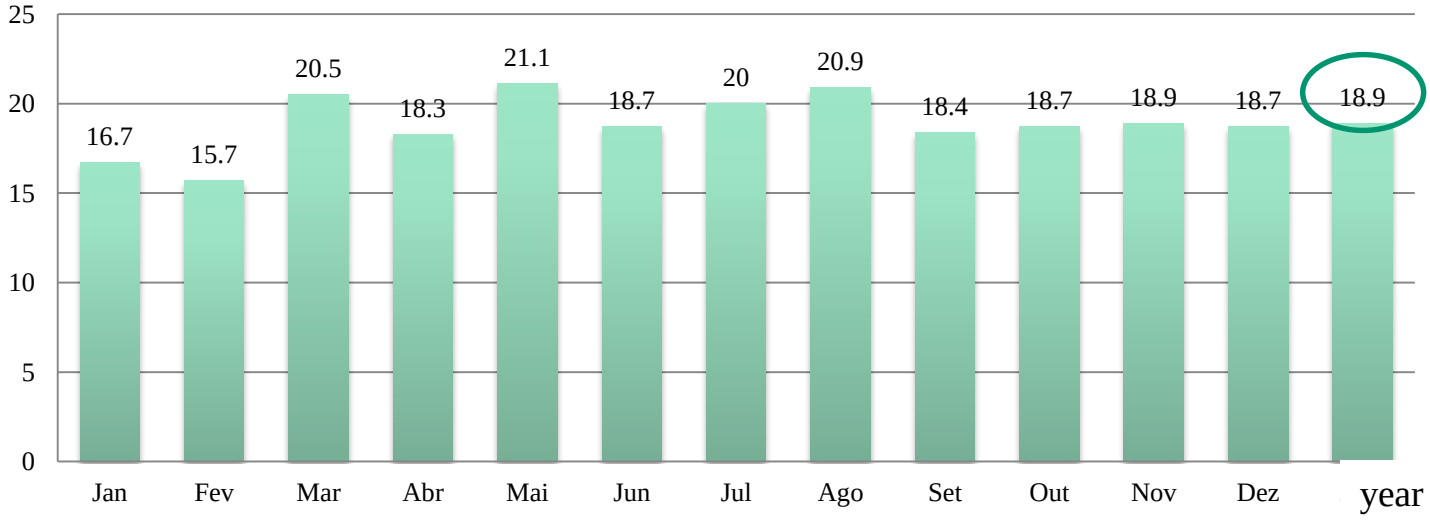
- survey of land use and ag practices including farm chemicals;
- weather station < 20km;
- Environmental Impact Assesment, Environmental Management Plan
- geospatial database – soils, DEM, land use-land cover;
- Water quality data (before, during and after dam filling)

Monthly Rainfall (mm) – 30 year average

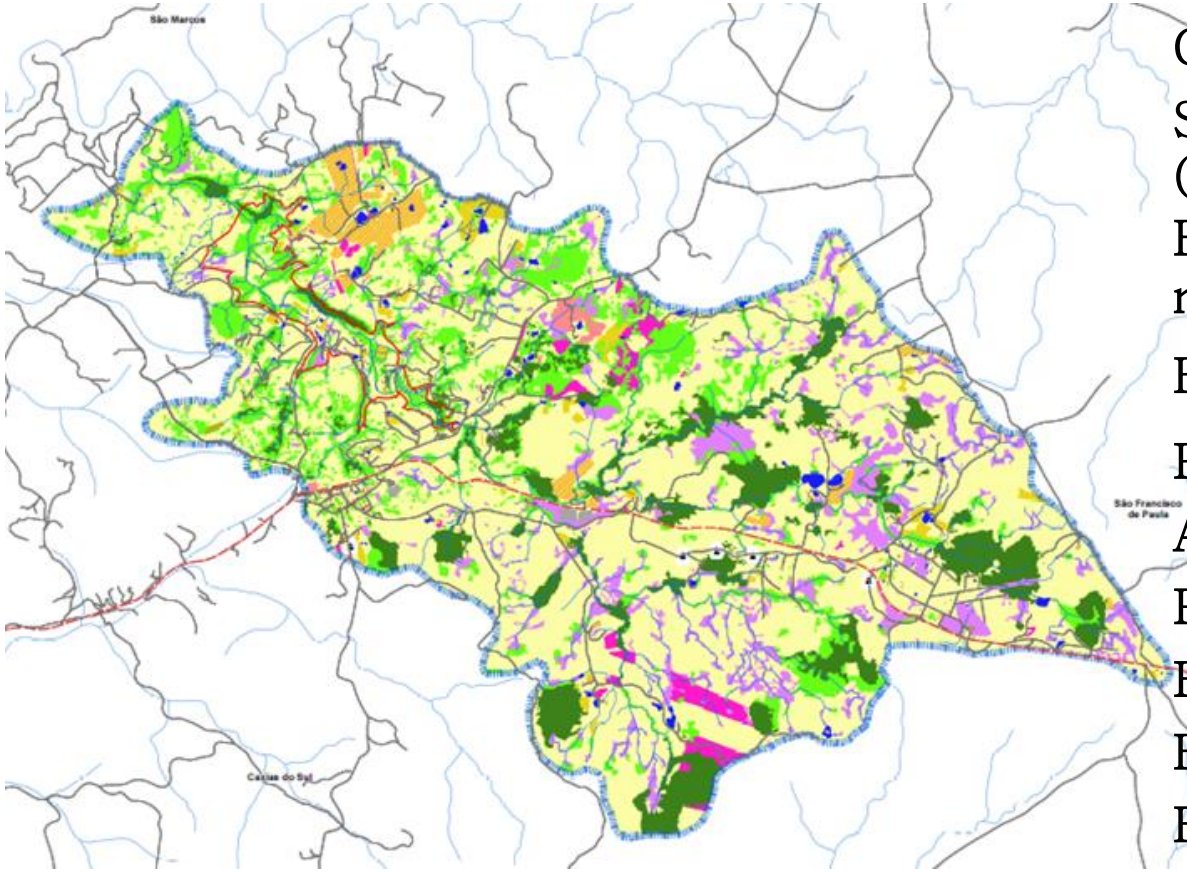


~ 1730 mm/year

Days with Rainfall – 30 year average



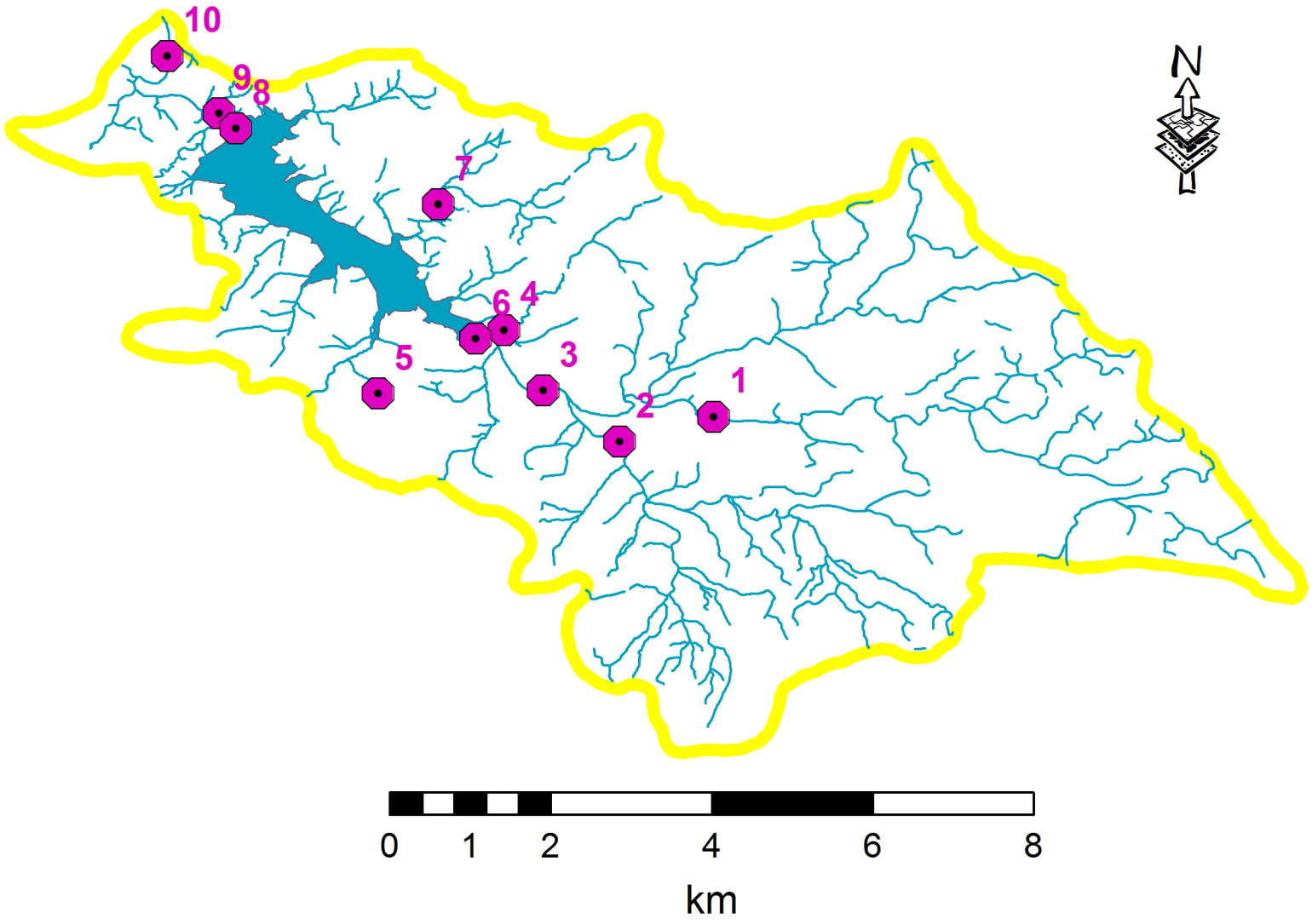
Land Use in 2013



Grasslands	3,490
Subtropical Forests (w/*Araucaria* groves)	1,391
Flooded Land (after reservoir filling)	216
Fruit Orchards	114
Pine (plantations	90
Annual grain crops	84
Ponds	49
Residential Buildings	11
Farm Buildings	3.7
Fish ponds	1.9
Rock outcroppings	9.4
Degraded Land	20.6

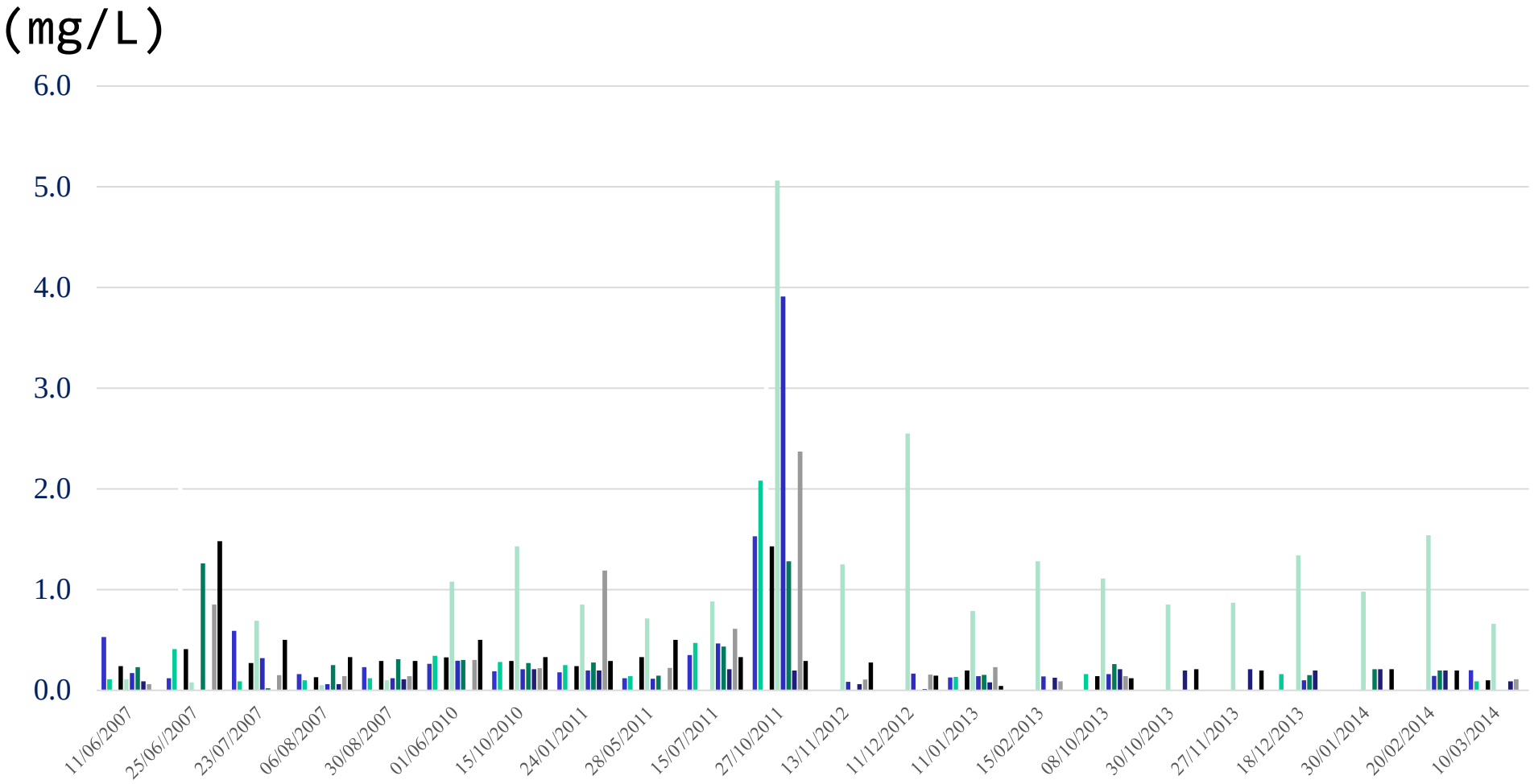
SAMAE/Polar/2013

Surface Water Sampling Points



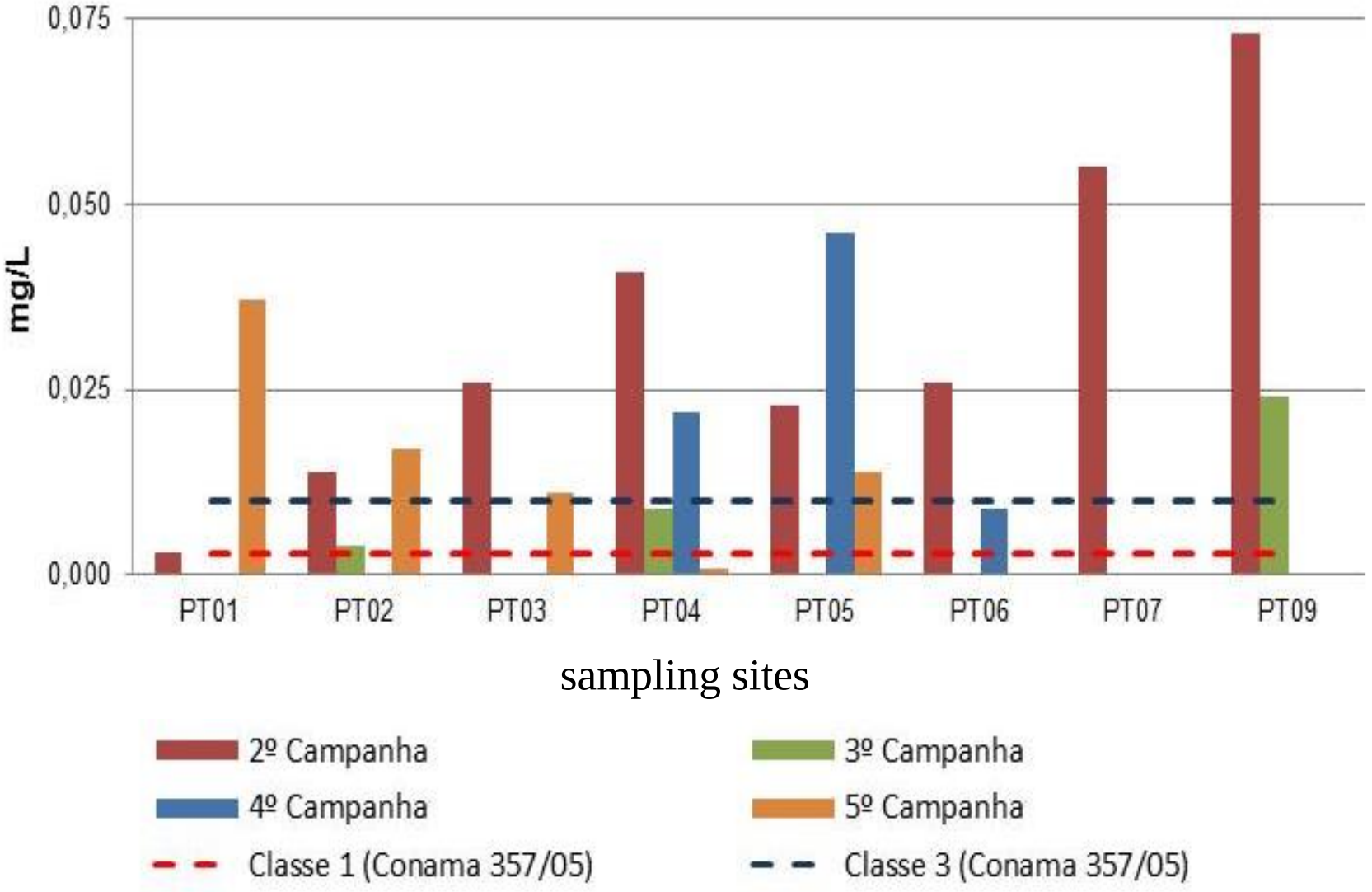
Water Quality Trends @ Marrecas

Nitrate



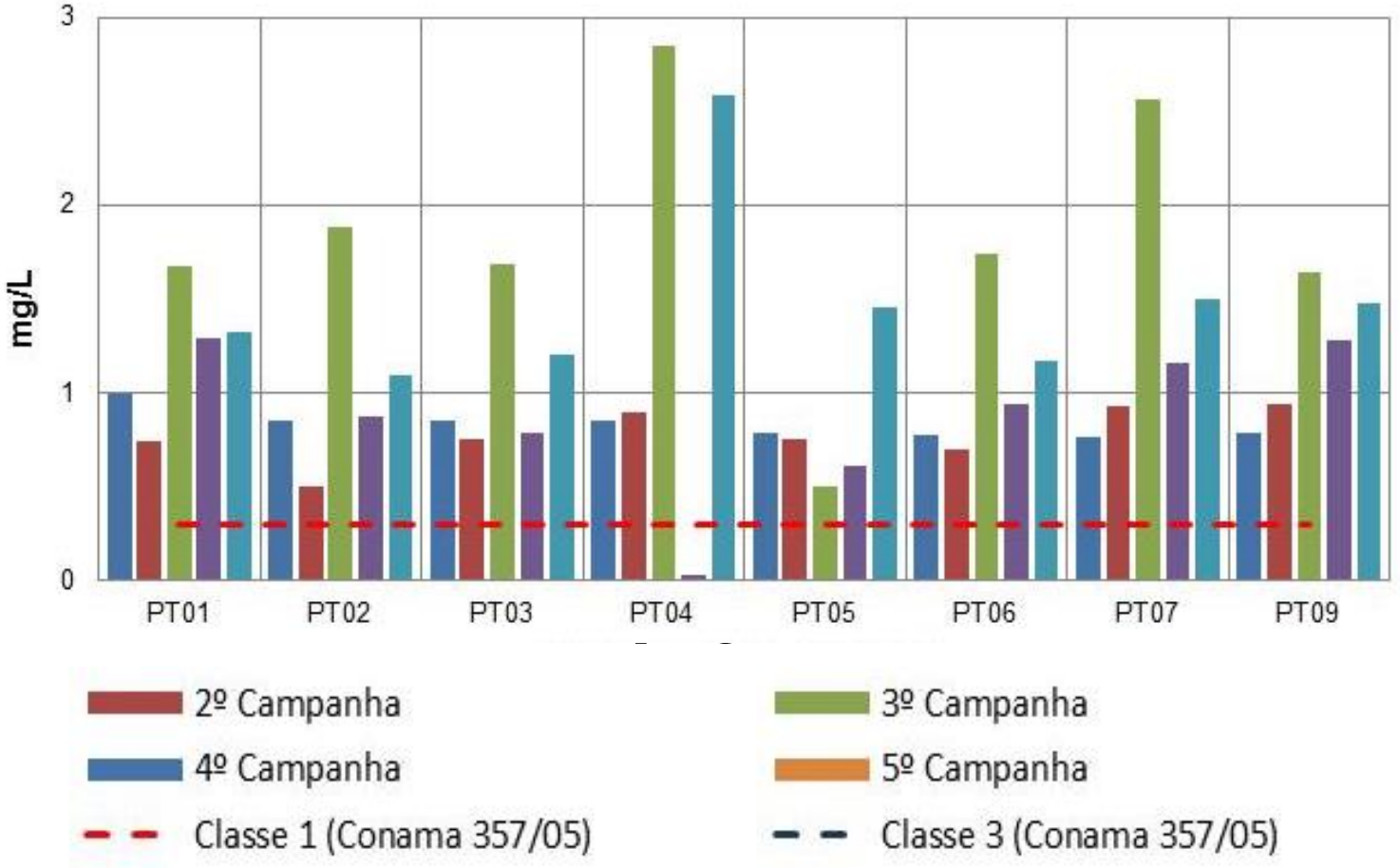
Water Quality Trends @ Marrecas

Phenols

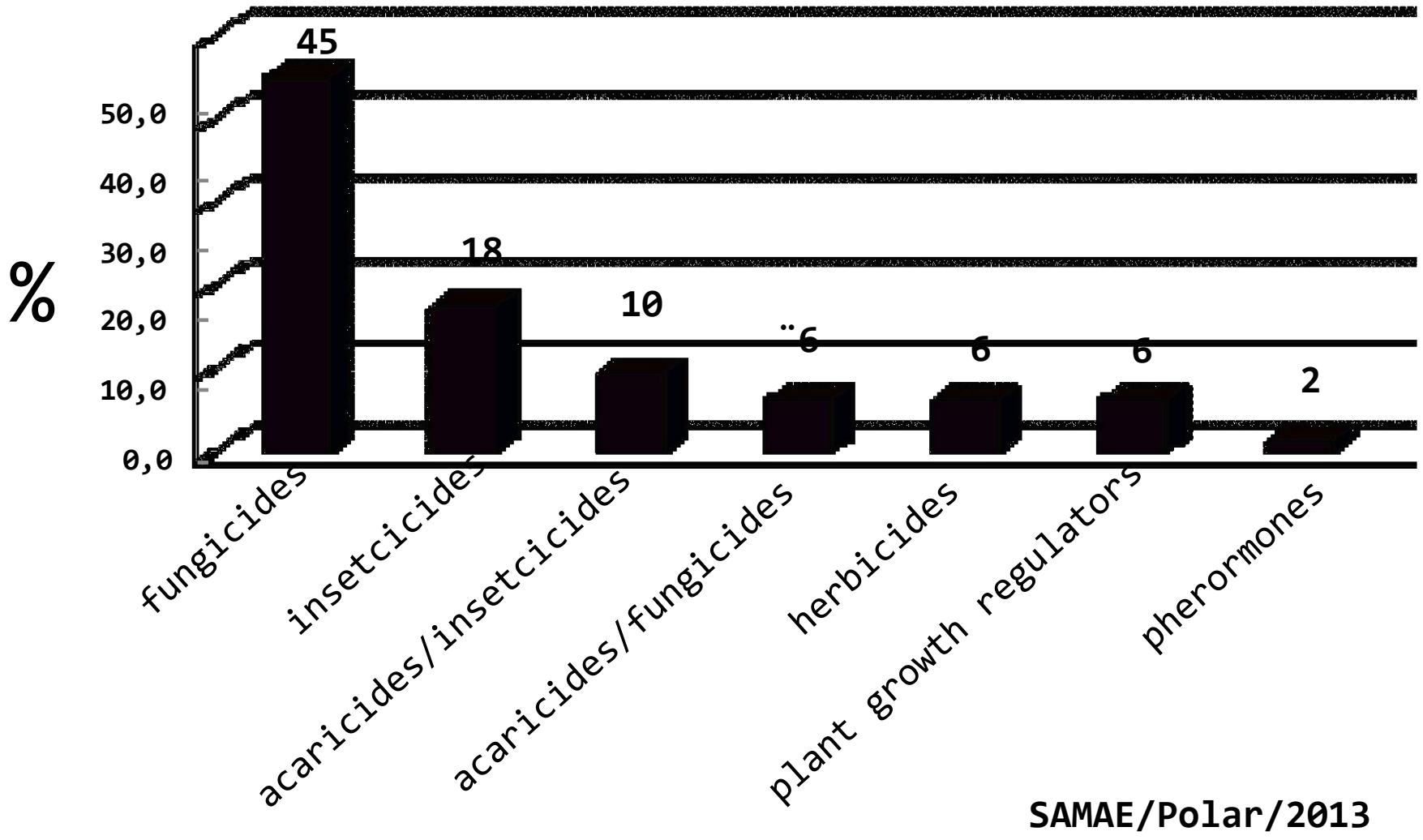


Water Quality Trends @ Marrecas

Iron

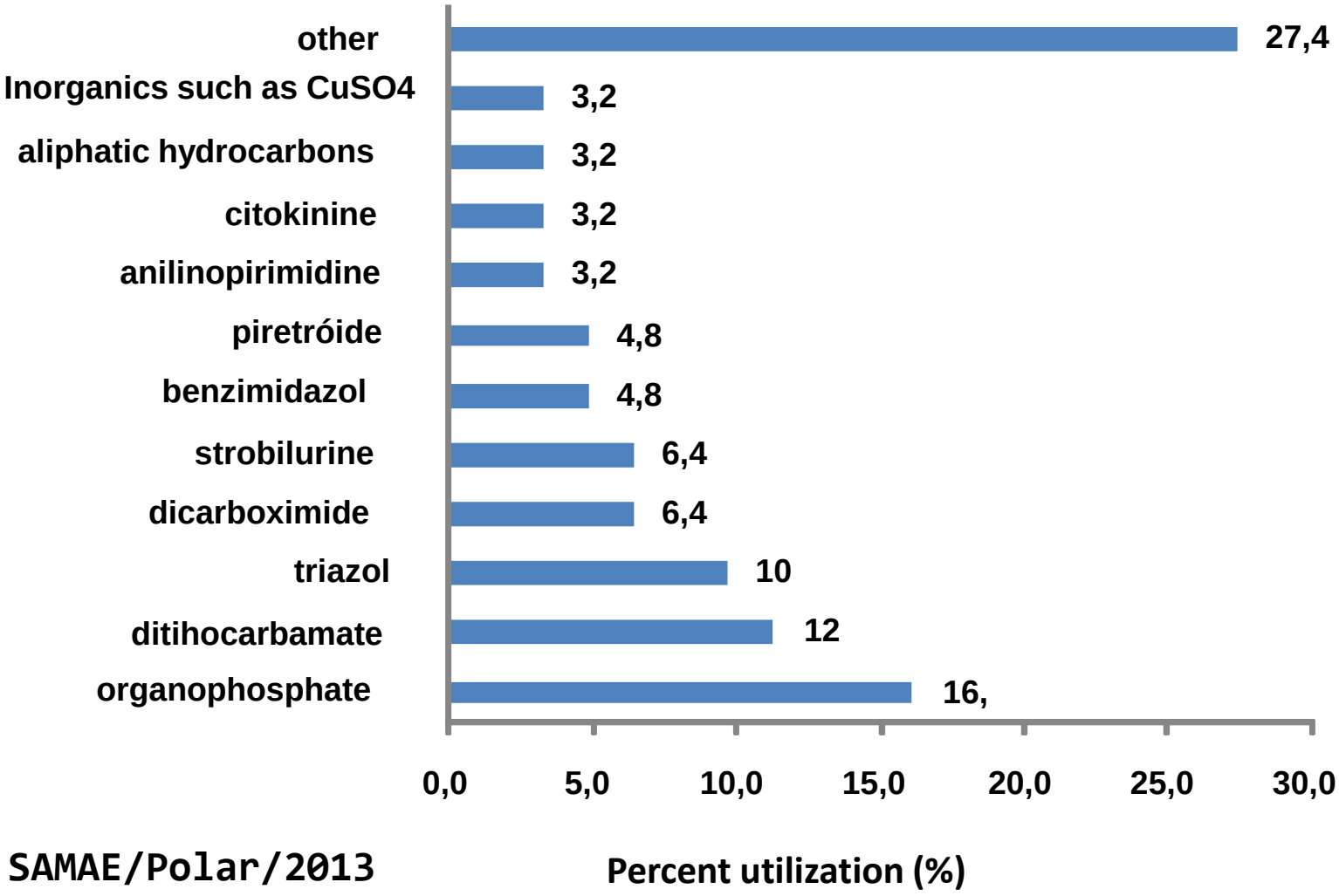


Farm Chemicals by Type



SAMAE/Polar/2013

Farm Chemical Use



SAMAE/Polar/2013

Objectives

Short term

- evaluate data needs for SWAT simulations

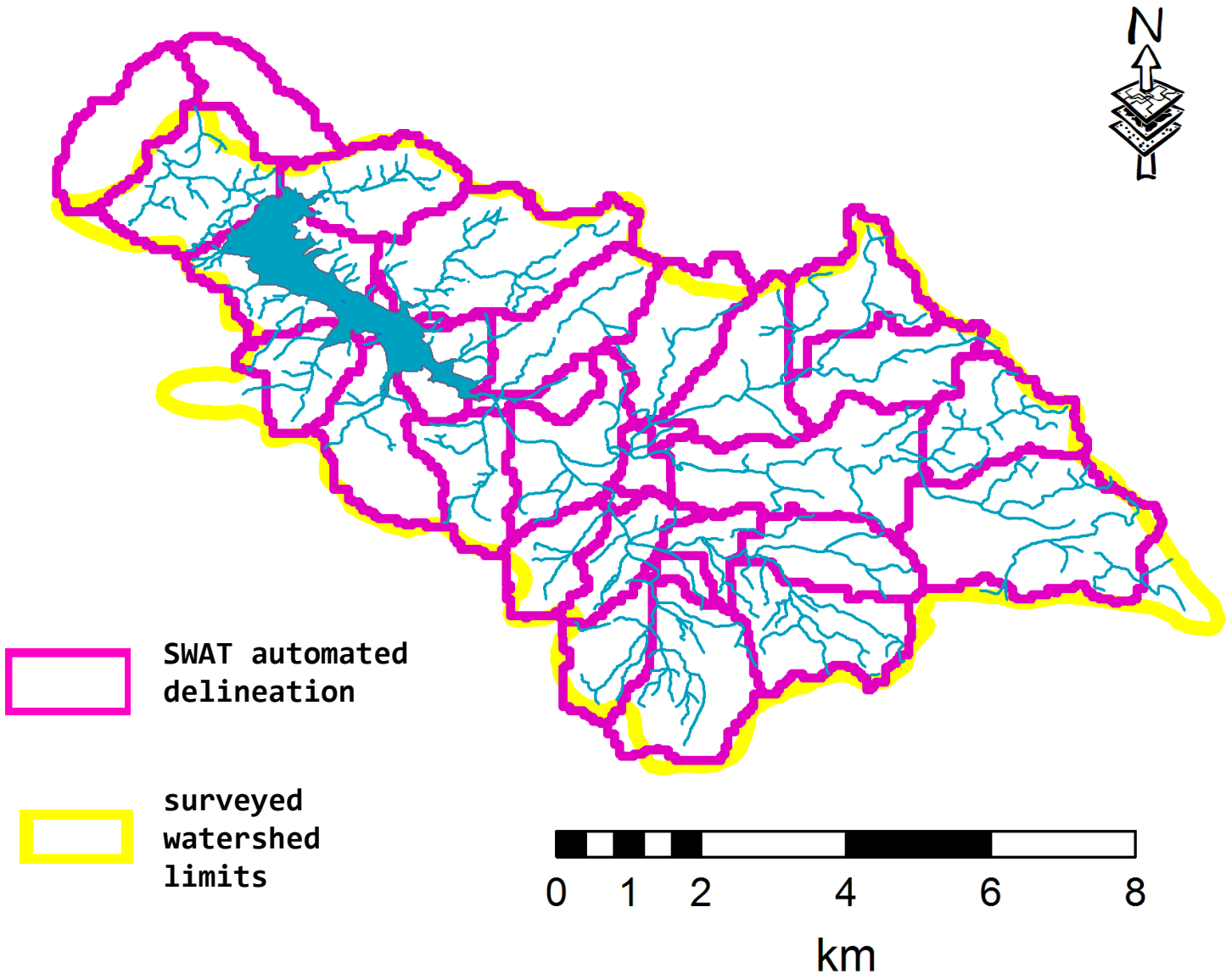
Long term

- Calibrate and validate SWAT @Marrecas watershed to assist monitoring and long term planning watershed management.
- Variables of interest: sediment, N, P, farm chemicals.

Initial ArcSWAT application

- ArcSWAT build 612 (for ArcGIS 10.2) runs SWAT 2012.

SWAT watershed delineation



HRU Analysis

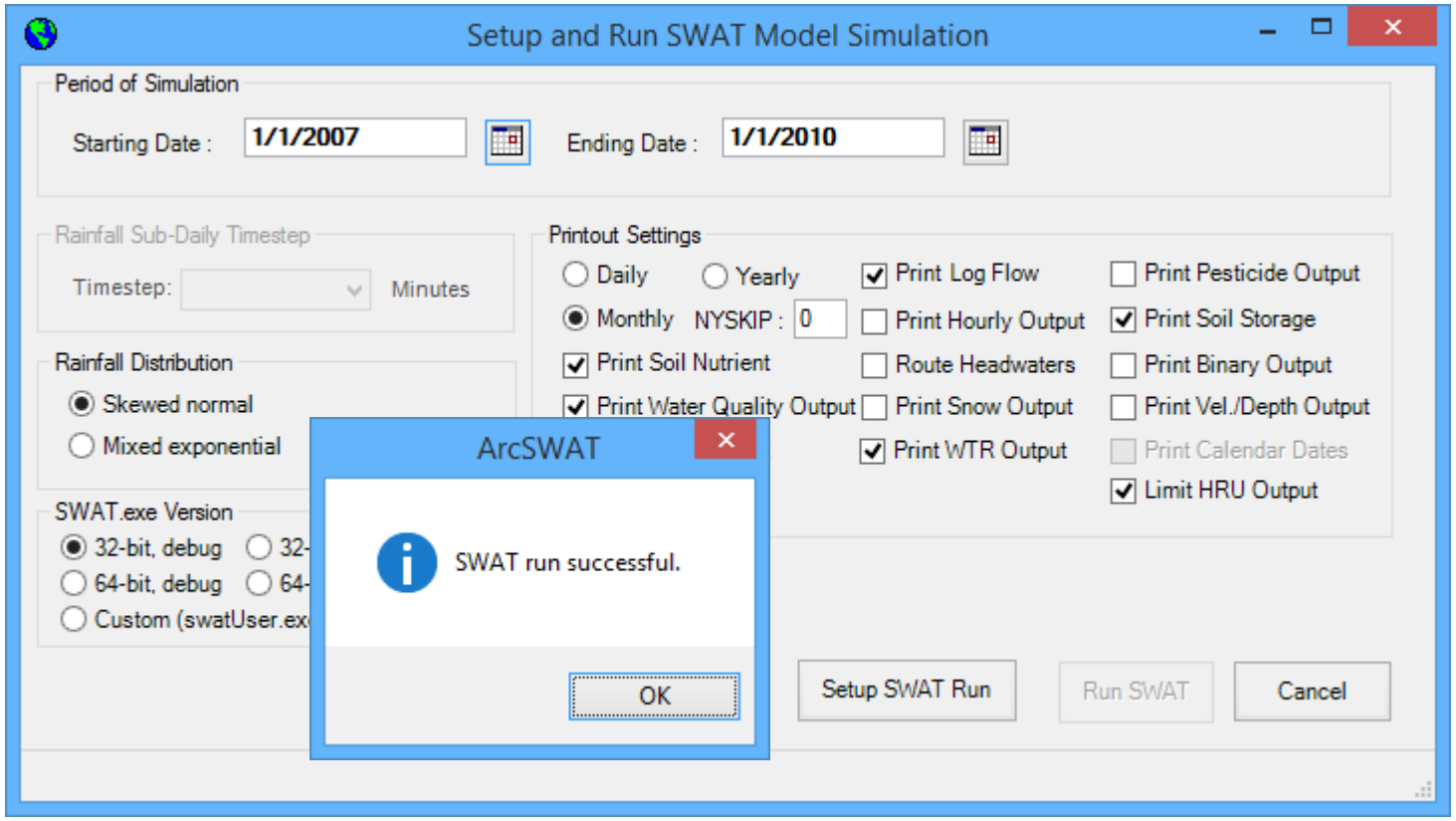
HRULandUseSoilsReport.txt - Notepad

File Edit Format View Help

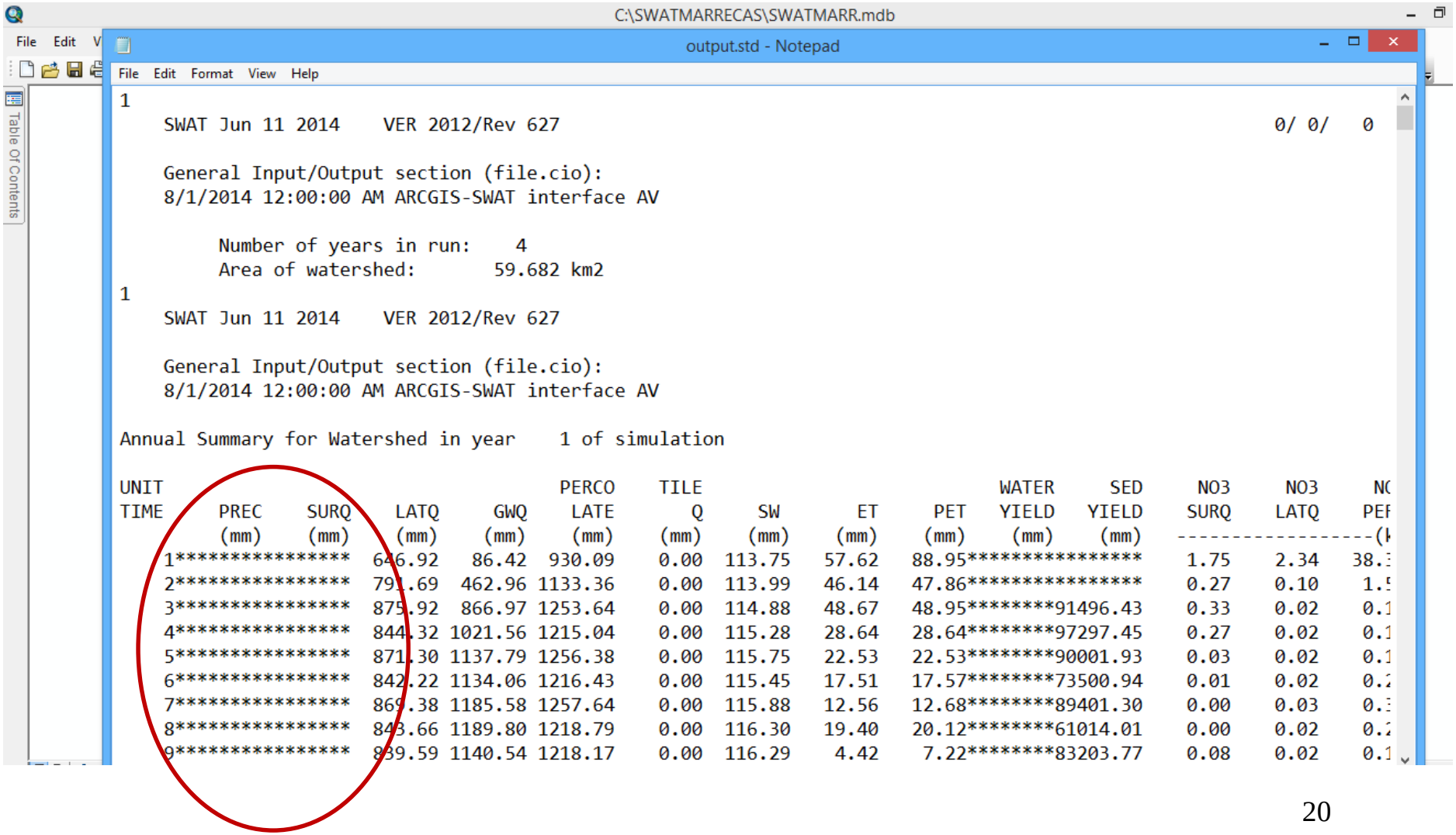
SWAT model simulation Date: 7/23/2014 12:00:00 AM Time: 00:00:00
MULTIPLE HRUs LandUse/Soil/Slope OPTION THRESHOLDS : 5 / 0 / 0 [%]
Number of HRUs: 253
Number of Subbasins: 33

	Area [ha]	Area[acres]	
Watershed	5968.1734	14747.6550	
	Area [ha]	Area[acres]	%Wat.Area
LANDUSE:			
Range-Grasses --> RNGE	4099.4518	10129.9503	68.69
Forest-Mixed --> FRST	837.0986	2068.5125	14.03
Forest-Evergreen --> FRSE	524.3990	1295.8162	8.79
Agricultural Land-Generic --> AGRL	22.1571	54.7512	0.37
Wetlands-Mixed --> WETL	415.2566	1026.1197	6.96
Range-Brush --> RNGB	19.9924	49.4023	0.33
Orchard --> ORCD	49.8179	123.1026	0.83
SOILS:			
ABRAM	371.1028	917.0137	6.22
DUANE	2237.8055	5529.7293	37.50
LIVINGSTON	427.7081	1056.8880	7.17
WEIDER	86.2112	213.0322	1.44
MASSENA	53.4799	132.1516	0.90
HOOSIC	105.6757	261.1299	1.77

Initial SWAT Run



Some input data to check…

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1
    SWAT Jun 11 2014    VER 2012/Rev 627                                        0/ 0/   0

    General Input/Output section (file.cio):
    8/1/2014 12:00:00 AM ARCGIS-SWAT interface AV

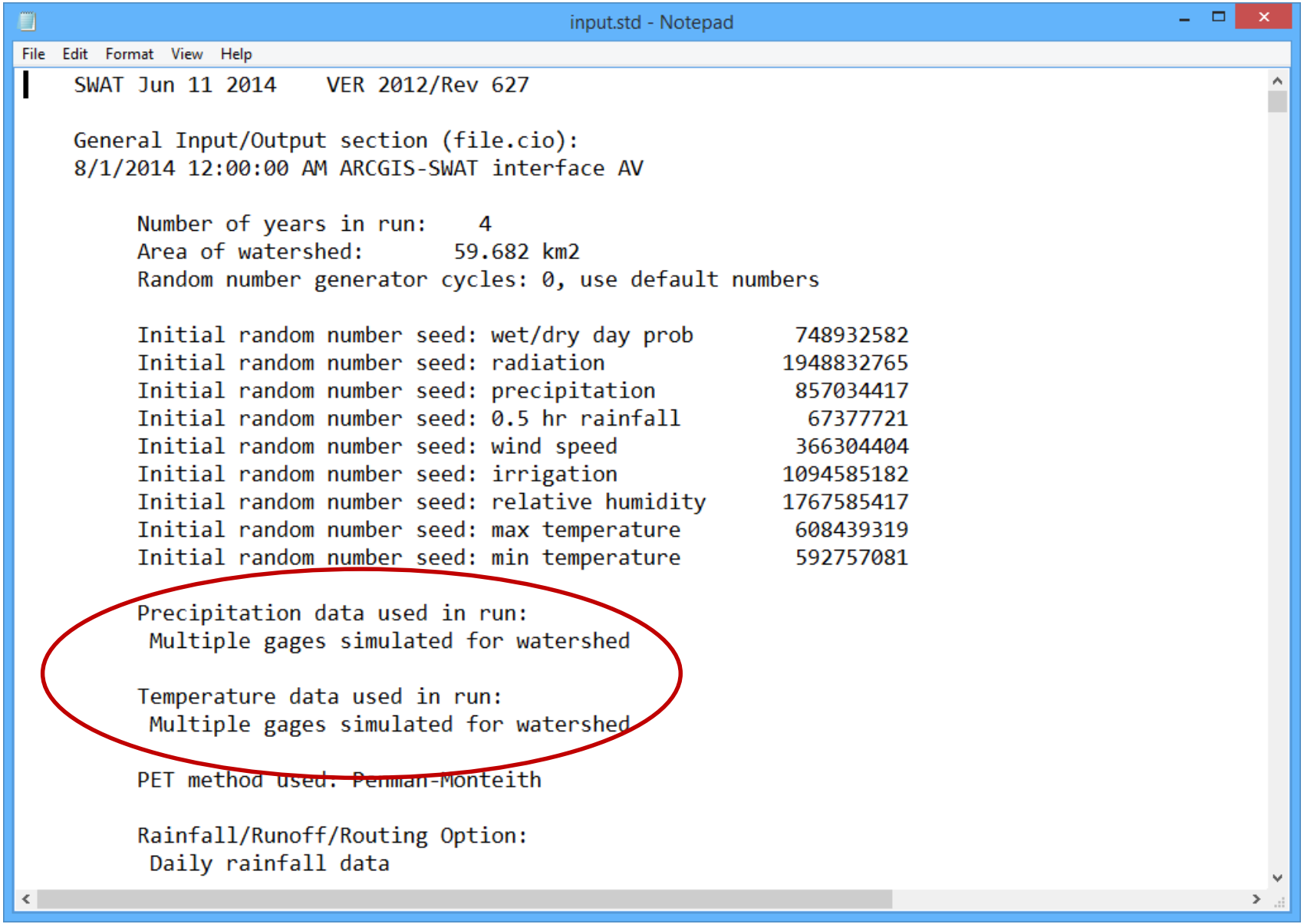
         Number of years in run:    4
         Area of watershed:       59.682 km2
1
    SWAT Jun 11 2014    VER 2012/Rev 627

    General Input/Output section (file.cio):
    8/1/2014 12:00:00 AM ARCGIS-SWAT interface AV

Annual Summary for Watershed in year    1 of simulation

UNIT                                      PERCO    TILE                              WATER     SED     NO3     NO3     NO
TIME      PREC     SURQ     LATQ     GWQ    LATE       Q      SW      ET     PET    YIELD   YIELD    SURQ    LATQ    PER
          (mm)     (mm)     (mm)     (mm)    (mm)    (mm)    (mm)    (mm)    (mm)    (mm)    (mm)  ----------------(k
    1*************  646.92   86.42  930.09    0.00  113.75   57.62   88.95*************    1.75    2.34   38.3
    2*************  791.69  462.96 1133.36    0.00  113.99   46.14   47.86*************    0.27    0.10    1.5
    3*************  875.92  866.97 1253.64    0.00  114.88   48.67   48.95********91496.43    0.33    0.02    0.1
    4*************  844.32 1021.56 1215.04    0.00  115.28   28.64   28.64********97297.45    0.27    0.02    0.1
    5*************  871.30 1137.79 1256.38    0.00  115.75   22.53   22.53********90001.93    0.03    0.02    0.1
    6*************  842.22 1134.06 1216.43    0.00  115.45   17.51   17.57********73500.94    0.01    0.02    0.2
    7*************  869.38 1185.58 1257.64    0.00  115.88   12.56   12.68********89401.30    0.00    0.03    0.3
    8*************  843.66 1189.80 1218.79    0.00  116.30   19.40   20.12********61014.01    0.00    0.02    0.2
    9*************  839.59 1140.54 1218.17    0.00  116.29    4.42    7.22********83203.77    0.08    0.02    0.1
```

Possible solution?



Input Data Challenges

- no streamflow gages in watershed yet, however there is some flow info from dam spillway and pumping station intake and reservoir storage;
- Key water quality parameters with sparse sampling (quarterly);


Obrigado!
(Thanks)