

# **Tools for Prioritisation of Targets:** Rapid Assessment of Drinking Water Quality

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Federal Environment Agency

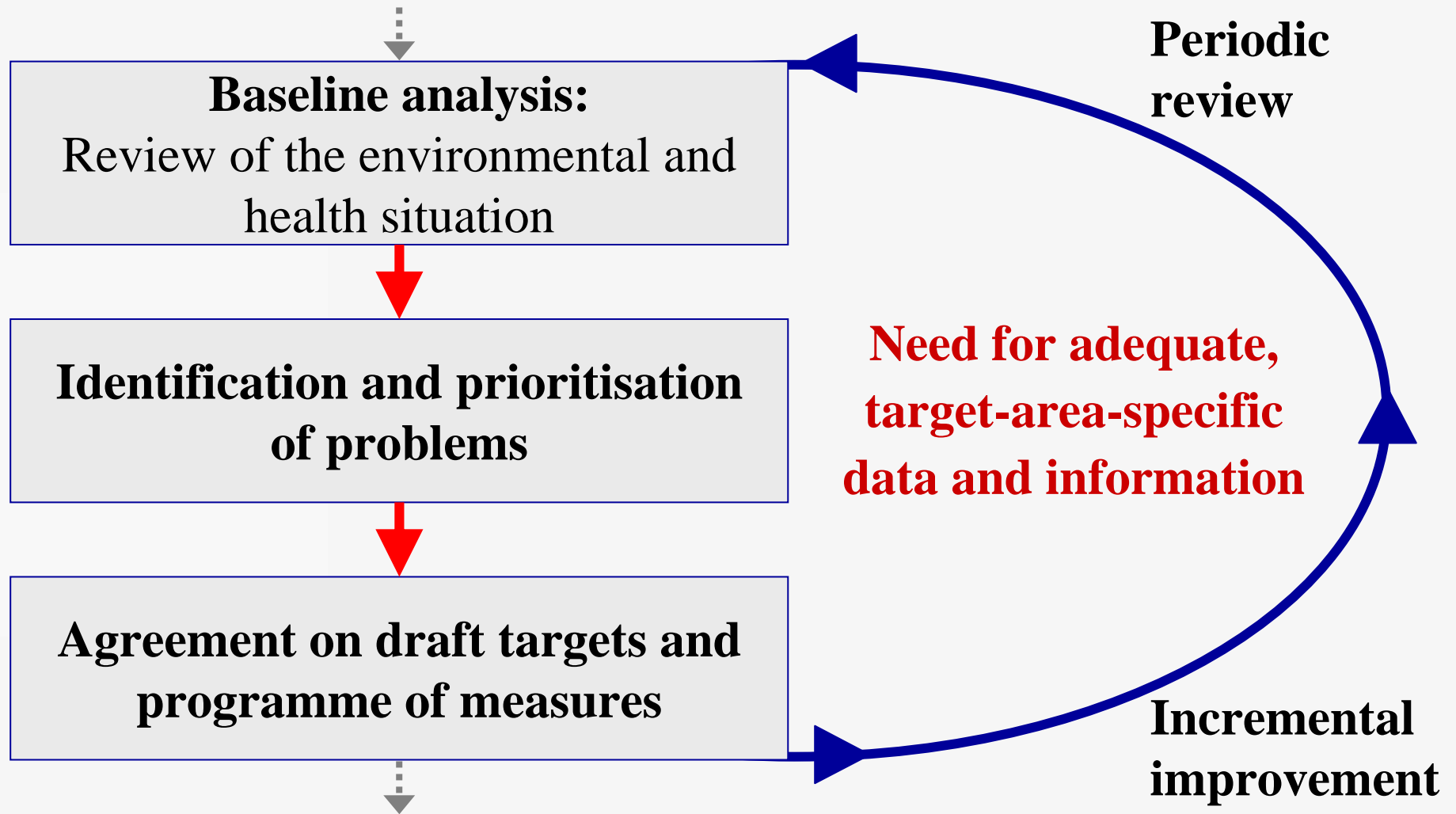
Bad Elster, Germany

10 February 2009

Geneva, Switzerland

**Umwelt  
Bundes  
Amt**   
Für Mensch und Umwelt

# Steps in target setting (*excerpt*)



# Typical challenges (*drinking-water*)

- Systematic routine surveillance is not existent or not functioning
- Non-representative surveillance findings:
  - Biased to urban areas
  - Random data
- Data are not ready for analysis:
  - Scattered between institutions
  - Varying structures and formats
  - Outdated



# Possible targets

## Long-term

- Systematic and routine drinking-water quality surveillance
- Established procedures for data collection, reporting and storage
- Established procedures for routine data analysis

## Short-term

- Collection of data available from different sources
- Initial screening of data and their quality
- Definition of reporting and storage requirements

## Rapid assessment of drinking-water quality (RADWQ)

# RADWQ studies

- Provision of **statistical representative snapshot**
- **Rapid** procedures:
  - One-off exercise
  - Limited time-span
- **Cluster sampling** strategy:
  - Reduction of costs and time at maximum sampling efficiency
- Limited range of **health relevant parameters**

# Critical parameter approach

Microbial and related	Physical and chemical
Thermotolerant coliforms Turbidity pH Chlorine residuals	Appearance Conductivity Iron Nitrate Arsenic Fluoride

# Use of field testing methods



# Use of sanitary inspections

## PROTECTED SPRING

### I General information

- a. WSS No:.....
- b. Community Name.....
- c. Date of visit: .....
- d. Water sample - TTC/100ml .....

### II Specific Diagnostic Information for Assessment

- 1. Is the spring unprotected?
- 2. Is the masonry protecting the spring faulty
- 3. Is the backfill area eroded?
- 4. Does spilt water flood the collection area?
- 5. Is the area around the spring unfenced?
- 6. Can animals have access within 10m of the spring?
- 7. Is there a latrine within 30m and uphill of the spring?
- 8. Does surface water collect uphill of the spring?
- 9. Is the diversion ditch absent or faulty?
- 10. Are there nay other sources of pollution uphill of the spring (e.g. solid waste, animal kraal etc)?

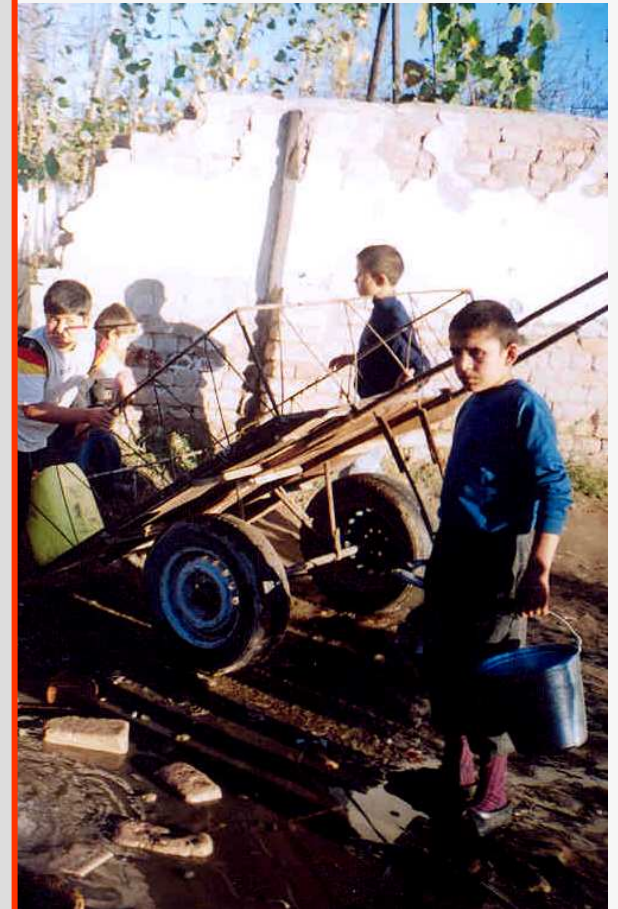
**Total risk score**

Results and comments  
Signature of inspector

### Risk

- Y/N
- Y/N
- Y/N
- Y/N
- Y/N
- Y/N
- Y/N
- Y/N
- Y/N
- Y/N

**/10**



# Data storage and management

**SanMan - Sanitary Risk Manager V2.21**    Rapid Assessment of Drinking Water Quality - [Water Scheme Details]

File Edit View Reports Utilities Window Help

**Scheme Details**

WSS No:       WSS Type:   
 Local Name:       SRI Category:   
 Country:       Water Source Identity:   
 Broad Area:       Pop. Band:   
 Town/Village:       Consumption:     Piped     Disinfection   
 Zone:

**Sanitary Risk Inspections**    **Geographic Location**

Wss No	Insp No	Date	Inspector	Risk %	No Tests	Min Count	Max Count	Median	Log Mean	Q1
TEST0101	000001	19/07/2004	MEG	50	2	5	35	20	13	.T.
TEST0101	000002	19/07/2004	femi	50	1	53	53	53	53	.T.
TEST0101	000011	19/07/2004	femi	30	1	5	5	5	5	.F.

# RADWQ survey design?



# Elements of survey design

**How many water supplies do we have to test to be confident of our results?**



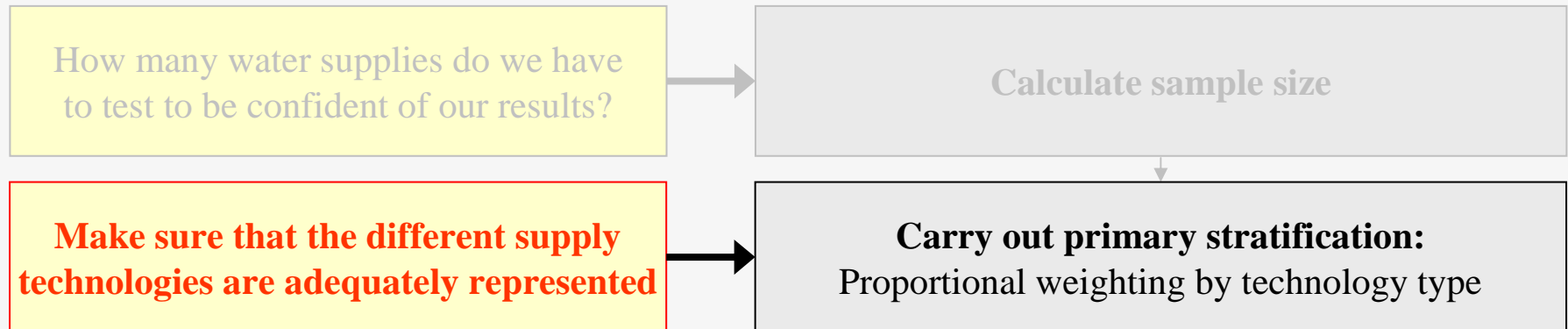
**Calculate sample size**

# Calculating sample size

$$n = \frac{4P(1 - P)D}{e^2}$$

- n** Required number of water supplies
- 4** Factor to achieve 95% level of confidence
- P** Assumed proportion of water supplies with a water quality exceeding the target established
- D** Design effect
- e** Acceptable precision

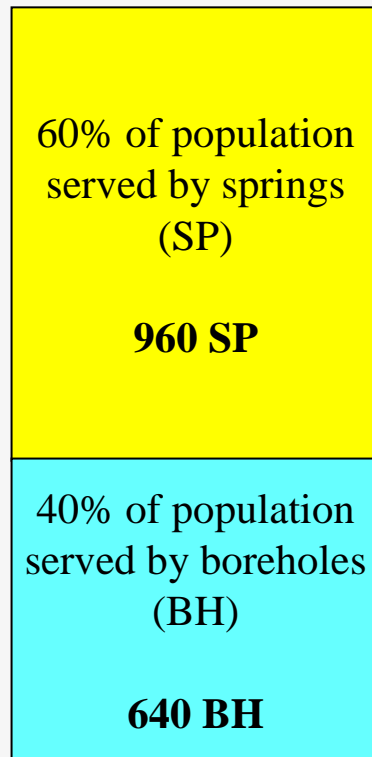
# Elements of survey design



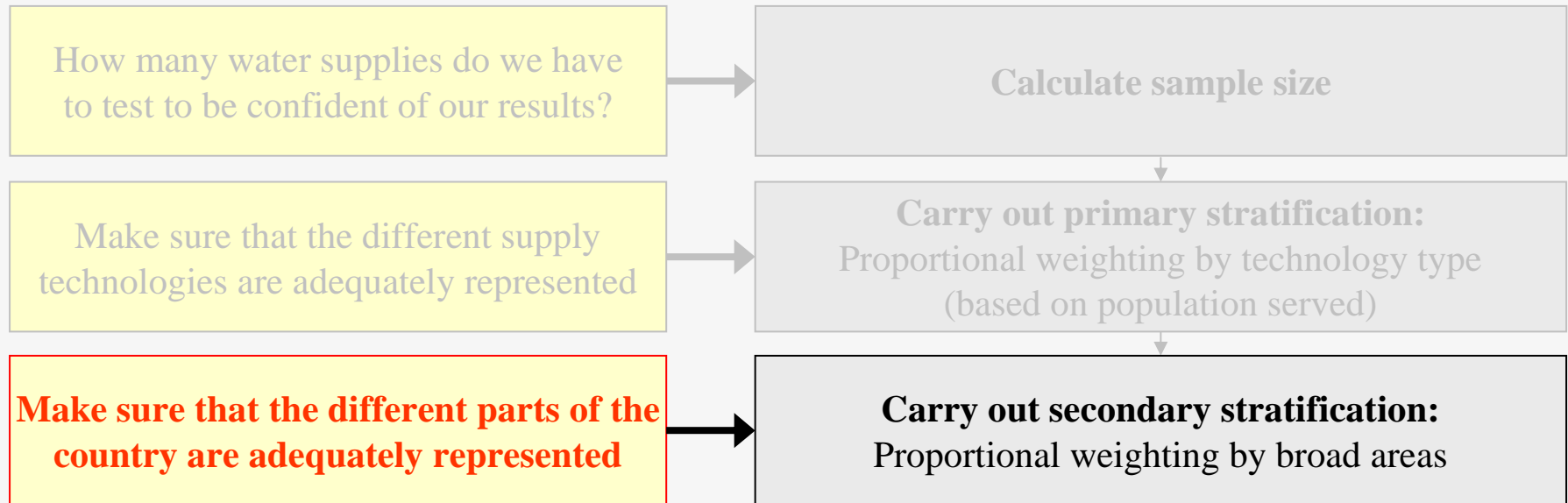
# Survey design in simple

## Primary stratification

Sample size: 1,600 supplies



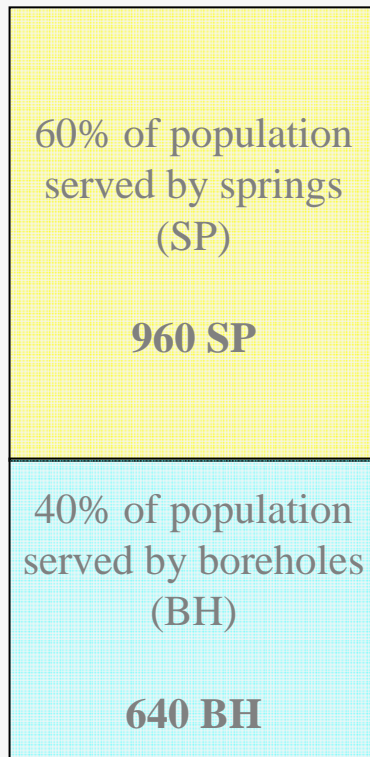
# Elements of survey design



# Survey design in simple

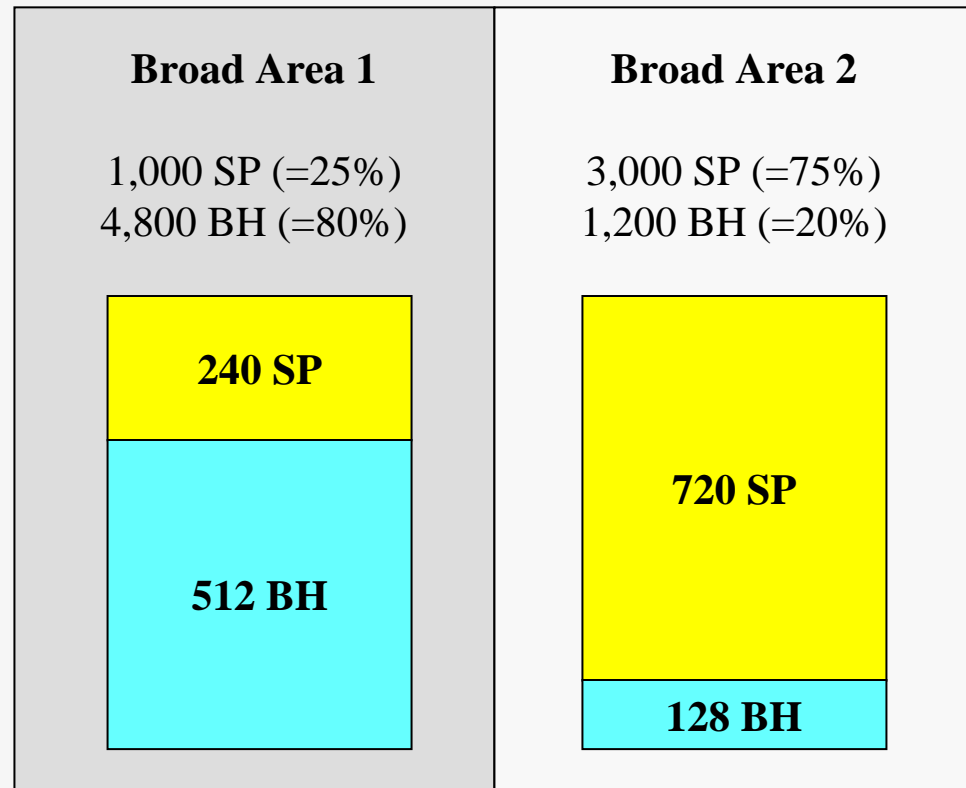
## Primary stratification

Sample size: 1,600 supplies

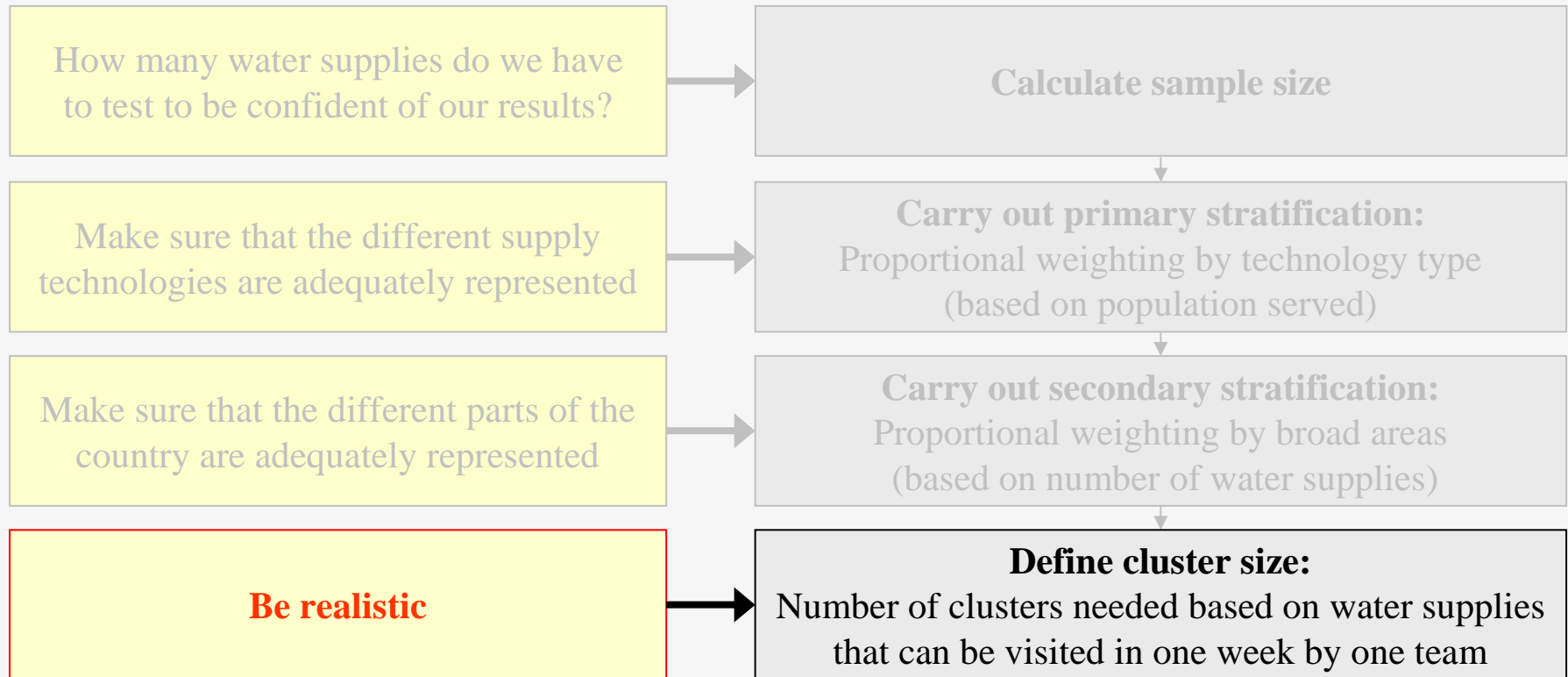


## Secondary stratification

4,000 SP and 6,000 BH

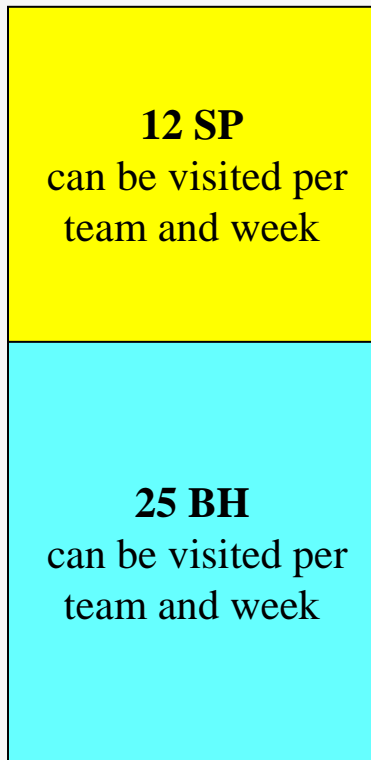


# Elements of survey design

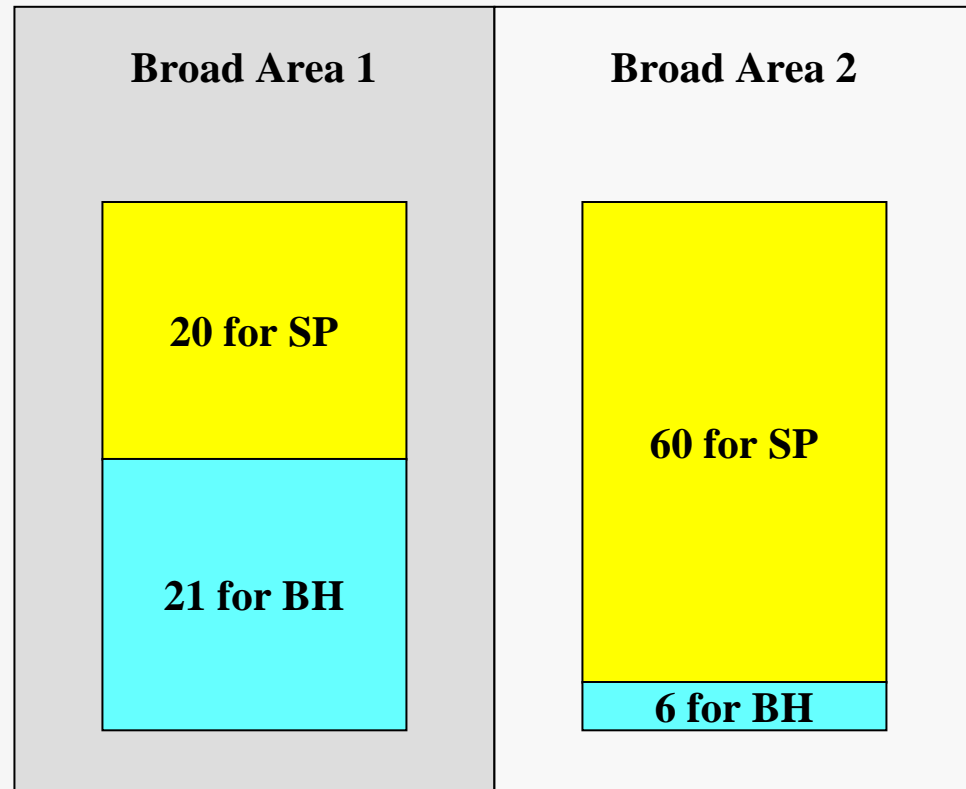


# Survey design in simple

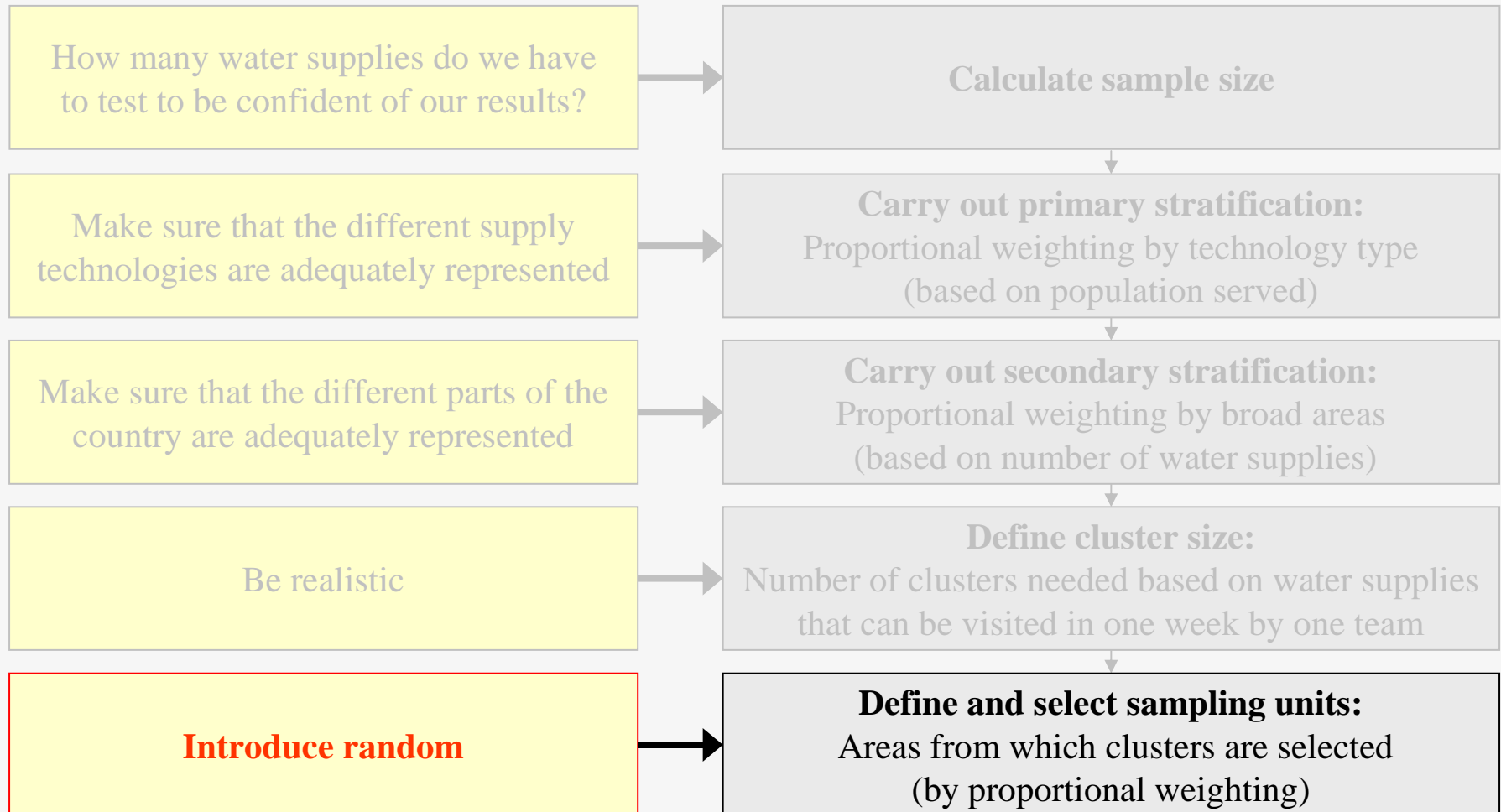
## Cluster size



## Number of clusters required



# Elements of survey design



# Survey design in simple

## Broad Area 1

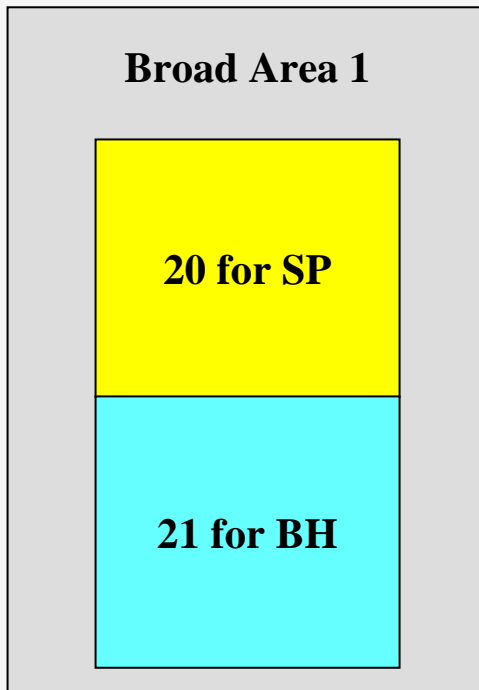


## Districts in Broad Area 1

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80	81	82	83	84
85	86	87	88	89	90	91	92	93	94	95	96

# Survey design in simple

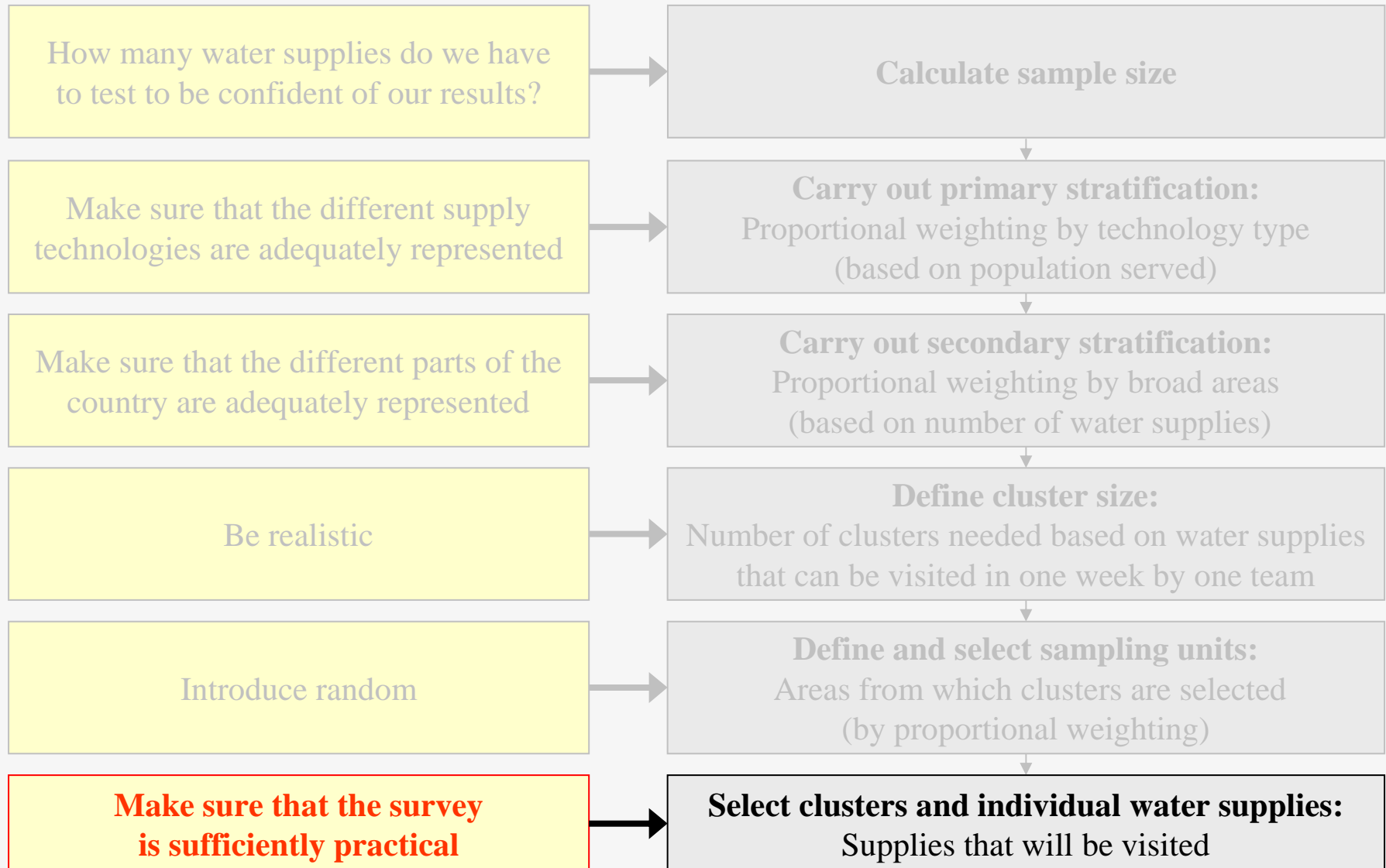
## Proportional weighting



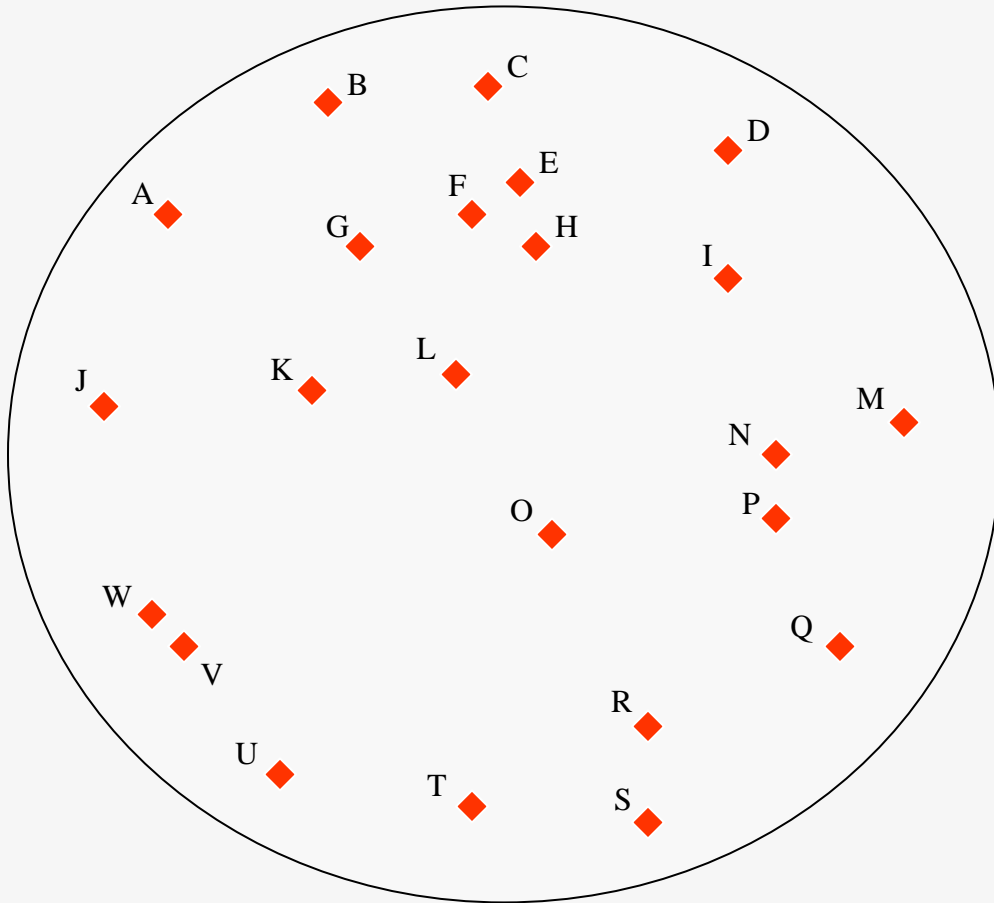
**Districts in Broad Area 1**

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80	81	82	83	84
85	86	87	88	89	90	91	92	93	94	95	96

# Elements of survey design



# Survey design in simple



## Inventory of springs in District 14 in Broad Area 1

Name SP A

Name SP B

Name SP C

Name SP D

Name SP E

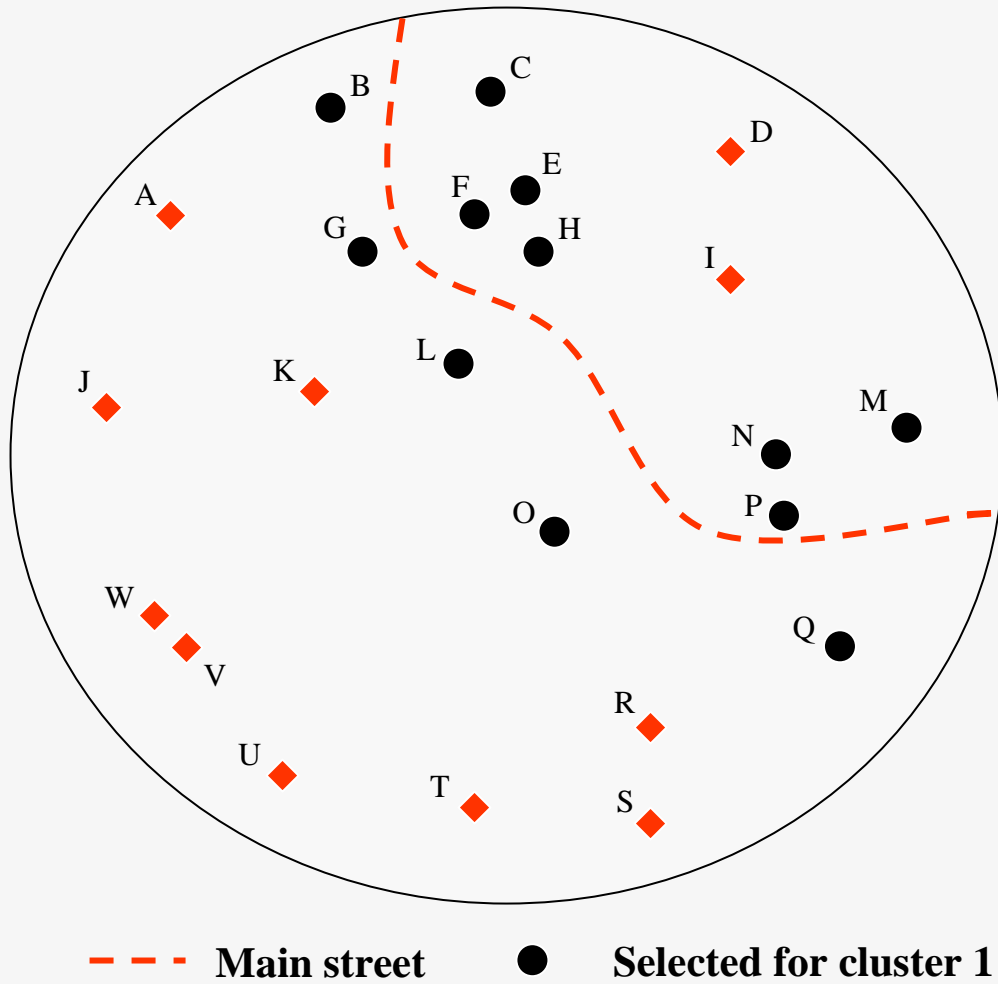
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Name SP Z

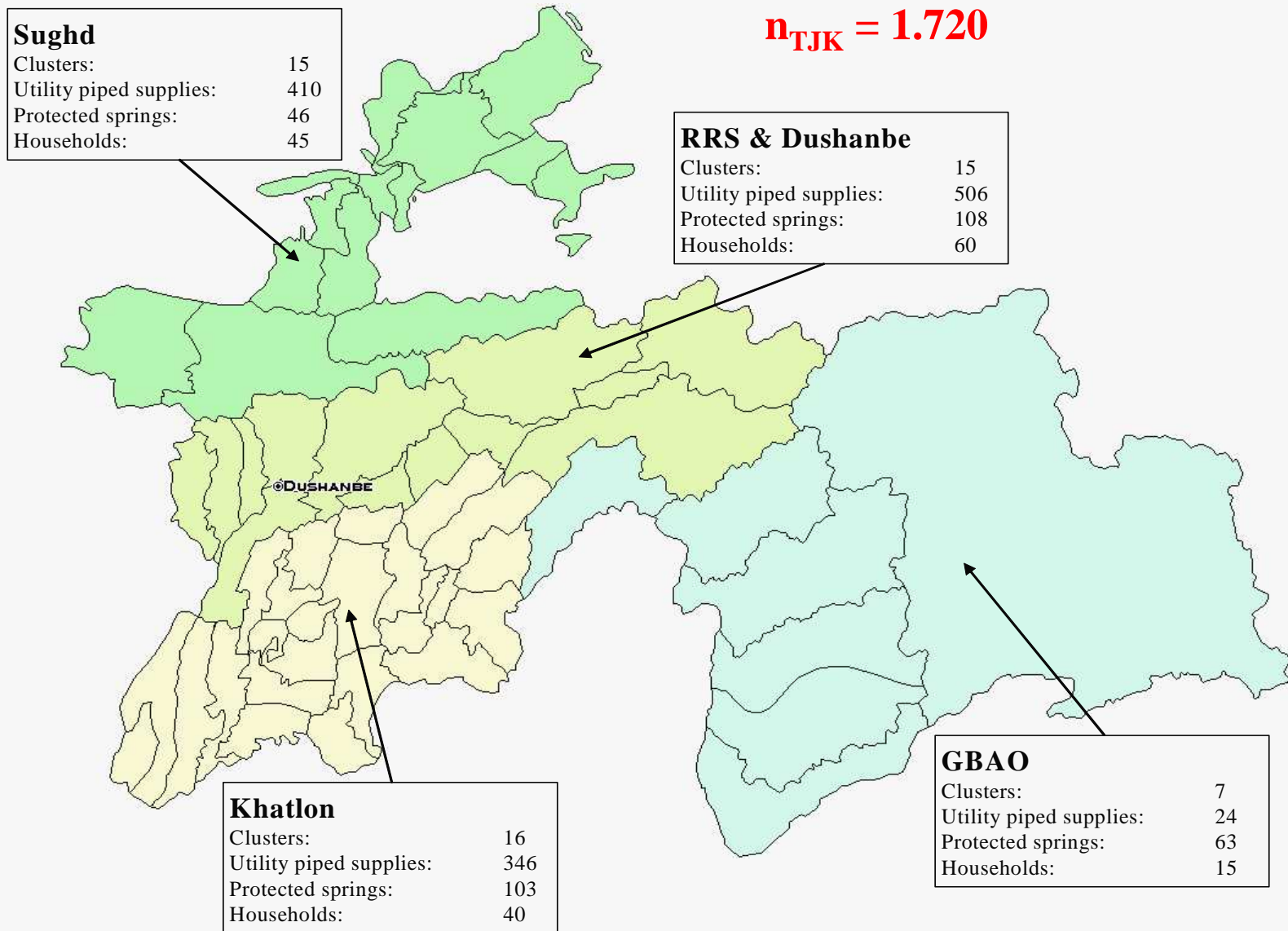
# Survey design in simple



**Springs in District 14 in  
Broad Area 1 selected for cluster 1**

Name	Code
PS B	TJK10101
PS C	TJK10102
PS E	TJK10103
PS F	TJK10104
PS G	TJK10105
PS H	TJK10106
PS L	TJK10107
PS M	TJK10108
PS N	TJK10109
PS O	TJK10110
PS P	TJK10111
PS Q	TJK10112

# Example Tajikistan



# Assessment of overall compliance

Broad area	Utility piped supplies			Protected springs			Total		
	Total no. of samples	Overall compl. WHO GV	Overall compl. Nat. std.	Total no. of samples	Overall compl. WHO GV	Overall compl. Nat. std.	Total no. of samples	Overall compl. WHO GV	Overall compl. Nat. std.
RRS & Dushanbe	506	93.3%	77.7%	108	86.1%	77.8%	614	92.0%	77.7%
Khatlon	346	85.3%	60.7%	103	94.2%	91.3%	449	87.3%	67.7%
Sughd	410	85.6%	44.9%	60	58.3%	33.3%	470	82.1%	43.4%
GBAO	24	66.7%	66.7%	63	77.8%	73.0%	87	74.7%	71.3%
<i>NATIONAL</i>	<i>1,286</i>	<i>88.2%</i>	<i>62.4%</i>	<i>334</i>	<i>82.0%</i>	<i>73.1%</i>	<i>1,620</i>	<i>86.9%</i>	<i>65.9%</i>

# Risk-to-health matrix

Sanitary Inspection Score	Utility piped supplies				Protected springs				Total			
	TTC count (cfu/100 ml)				TTC count (cfu/100 ml)				TTC count (cfu/100 ml)			
	<1	1-10	11-100	>100	<1	1-10	11-100	>100	<1	1-10	11-100	>100
0-2	1,038	100	0	0	121	28	6	2	1,159	128	6	2
3-5	91	35	1	0	146	15	3	0	237	50	4	0
6-8	10	11	0	0	7	4	1	1	17	15	1	1
9-10	0	0	0	0	0	0	0	0	0	0	0	0

No action	Low risk: low action priority	Intermediate to high risk: higher action priority	Very high risk: urgent action
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# Sanitary risks

<b>PROTECTED SPRINGS: 334 sites inspected</b>		
1	Is the spring unprotected?	44.3%
2	Is the masonry protecting the spring faulty?	37.7%
3	Is the backfill area behind the retaining wall eroded?	7.8%
4	Does spilt water flood the collection area?	12.9%
5	Is the fence absent or faulty?	63.2%
6	Can animals have access within 10 m of the spring?	52.4%
7	Is there a latrine uphill and/or within 30 m of the spring?	1.5%
8	Does surface water collect uphill of the spring?	7.2%
9	Is the diversion ditch above the spring absent or non-functional?	18.6%
10	Are there any other sources of pollution uphill of the spring?	12.3%

# Benefits of RADWQ in target setting /1

- Provision of a **statistical representative snapshot** of drinking-water quality:
  - Assessment of compliance with standards or guidelines
  - Assessment of public health risks to the population
  - Local, regional and national level
- Provision of **baseline information** for:
  - Building national surveillance needs
  - Focusing routine monitoring programmes
  - Identifying and prioritising remedial and preventative actions

# Benefits of RADWQ in target setting /2

- Information for **policy makers** of the status of the water supply sector
- Triggers collection of **existing data**:
  - Coverage, water quality and health
  - Building of a national database
  - Improvement of reporting requirements
- Method usable for a **variety of purposes**:
  - Special focus on small supplies or individual technologies
  - Special focus on particular regions

# Outlook

- 6 pilot country reports available
- Implementation handbook to be published in 2009

