Source Water Protection Fund Experience in Lima, Peru

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A project of:

FOREST TRENDS

In collaboration with:

CONDESAN
Consorcio para el Desarrollo Sostenible de la Ecorregión Andina

KIESER & ASSOCIATES
ENVIRONMENTAL SCIENCE & ENGINEERING

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INVERSIÓN EN AGUA PARA LIMA

With support from:

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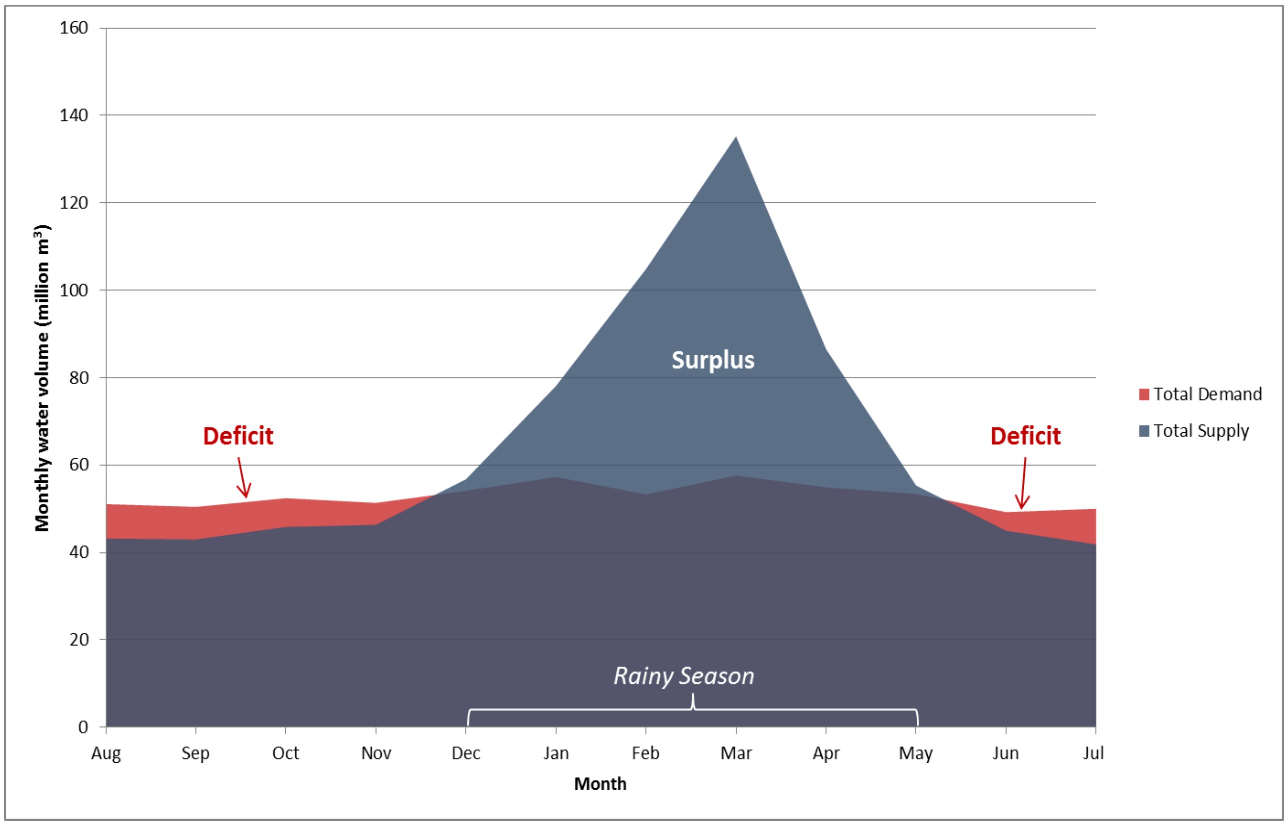
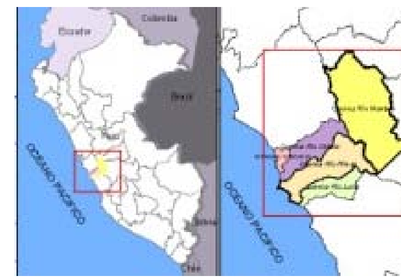
Preview

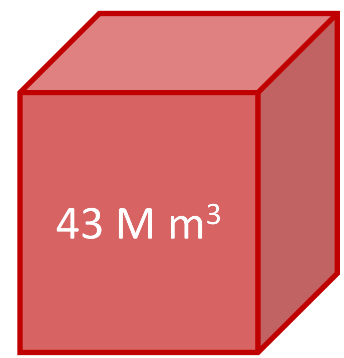
- The Water Problem for Lima
- Development of a Water Fund
- ~~Answering the critical questions of expected benefits~~
- Quantifying expectations
- Critical needs for successful water funds

Lima, the second-largest desert city in the world, experiences a dry season deficit of over 40 million m^3 of water each year.



Average Water Supply and Demand, Rimac River Basin.
Source: Peru Ministry of Agriculture (2010)





Dry season deficit

Lima: Second largest city in the desert

CAIRO

- 16 Million people
- 25 mm Annual Precipitation
- Nile River: 2,830 m^3/s

LIMA

- 9 Million people
- 10 mm Annual Precipitation
- Rímac River: 26 m^3/s

Recognized need to address water deficit

Grey Infrastructure:
- Water efficiency measures
- Water transfers
- Desalinization facility

Green Infrastructure:
- Education
- Watershed management
- Watershed interventions

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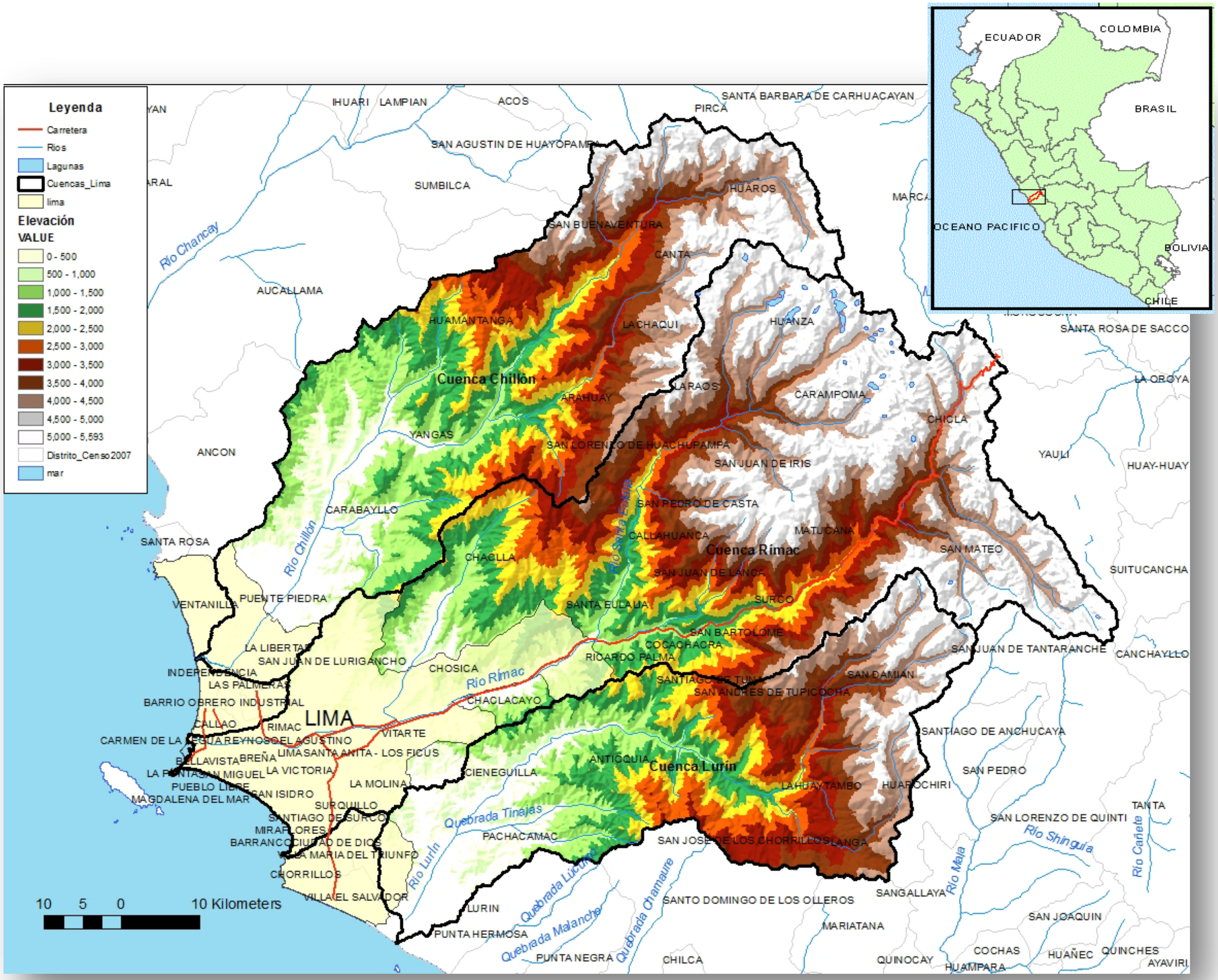
CONSERVATION FUND FOR WATERSHEDS AND WATER RESORUCES OF LIMA AND CALLAO – AQUAFONDO

LOCATION

AREA:
Chillon: 2210 km^2
Rimac: 3485 km^2
Lurin: 1634 km^2
TOTAL: 7329 km^2

ALTITUDE :
0-5,500 msnm

LAND USE:
Forest or Paramo (58%)
Agriculture (6%)
Animal Husbandry (16%)
Mining (1%)
Poulated Land (6%)
Desert (14%)



PARTNERING

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- DATE OF CREATION:
  November 15th, 2010

- Technical Secretariat:
  May 6th, 2011
  GEA Group

- Administrator or Treasurer
  FONDAM

Steering Committee and Founding Members

GRUPO GEA Desarrollo Sustentable
FONDO DE LAS AMERICAS PERU
Backus
PONTIFICIA UNIVERSIDAD CATÓLICA DEL PERÚ
SPDA Sociedad Peruana de Derecho Ambiental
The Nature Conservancy
Conservando la naturaleza. Protegiendo la vida.

Advisory Committee

AUTORIDAD NACIONAL DEL AGUA
MUNICIPALIDAD METROPOLITANA DE LIMA
PERÚ Ministerio del Ambiente

COMPONENTS

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Managment and conservation of water resources in the watersheds of Lima			Water Culture		Participatory Approach and Governance	
Quantity	Quality	Sustainable Activities	Urban Efficiency	Agricultural Practices	Managing Authoritiees	Strategic Partnerships

Cross-cutting Areas

- Communications
- Knowledge Managment
- Support

PILOT PROJECTS

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Ancient Infiltration Channel Restoration

- An infiltration ditch of 1.3 km was restored
- Cost US$ 19,500

Drip Irrigation System

The efficient use of water will allow a second crop year, also helping improve the economic conditions of the users.

ONGOING EFFORTS

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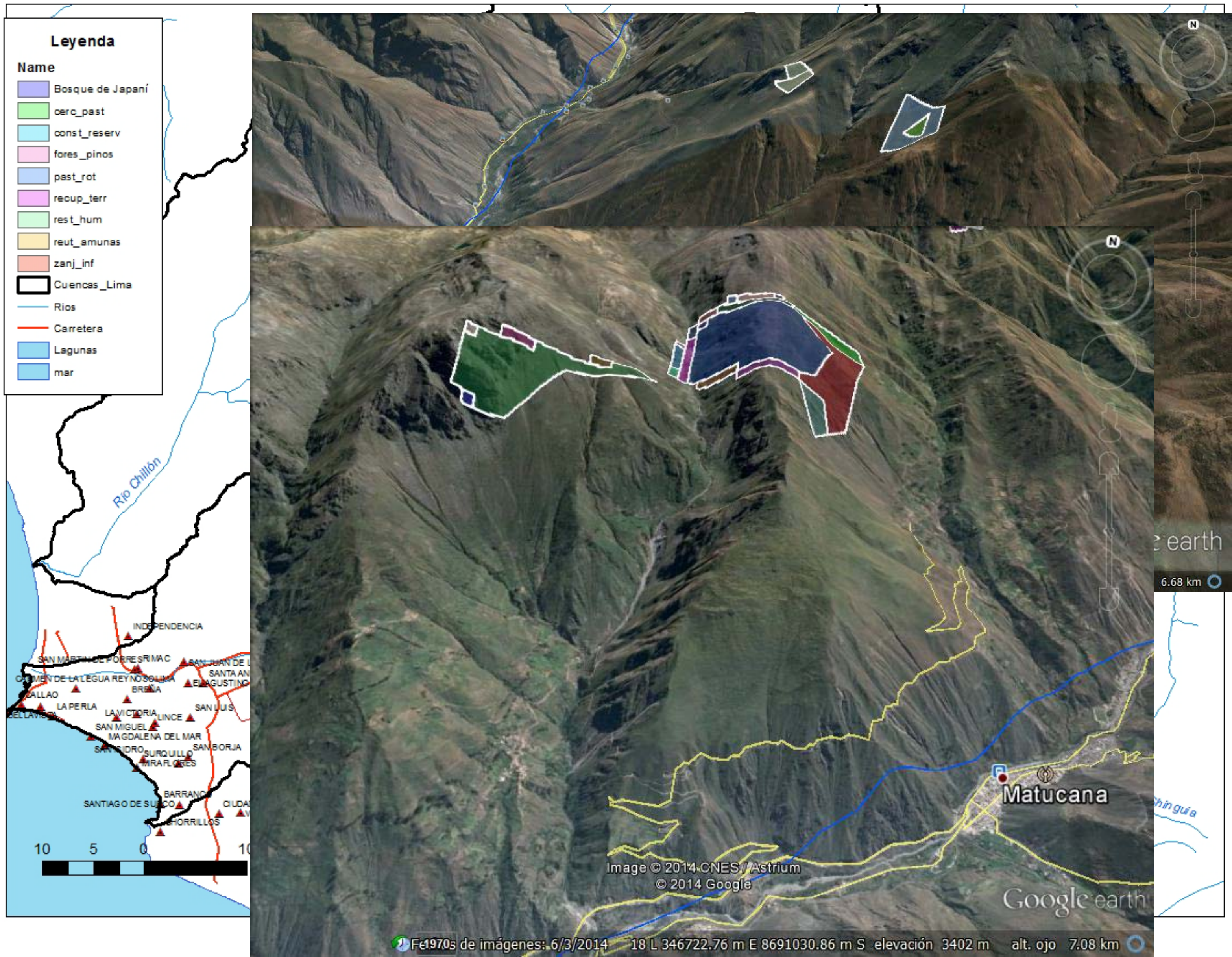
Management and improvement of Natural Grasslands

Amount US$ 47,000

PROJECT PORTFOLIO

- 34 projects identified for municipal water company investments

Total Cost: 11,966,456



Key public authorities with the power to support watershed investments need to see credible demonstration of cost-effectiveness *in terms of* ***hydrological benefit*** from Aquafondo investment in "Green" infrastructure.

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REPÚBLICA DEL PERÚ
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Green infrastructure can work like a sponge, turning excess water in the wet season into crucial dry season flows.

Benefits of "Green" Infrastructure

- **Water Quality** – Pollution reductions
  - Sediments (correcting erosion)
  - Nutrients (riparian buffers)
  - Heavy metals (mine tailing covers)

- **Water Quantity** – Dry season river flow increase
  - Increased infiltration (infiltration ditches)
  - Increased soil moisture (grassland restoration)
  - Increased GW recharge (wetland restoration)


Quantifying Expectations
- Project specific
- Cumulative

Green Intervention Project Example: *Hydrological Restoration of Wetlands*

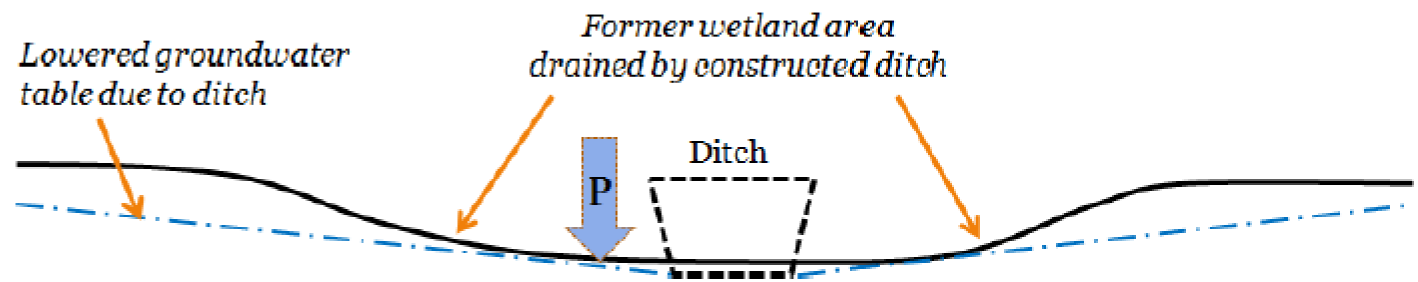


Figure 1a. Conceptual cross-sectional diagram illustrating a drained wetland via a constructed ditch which eliminates surface storage (that would otherwise be contributing to groundwater recharge), and a dewatering (lowering) of the local groundwater table. (P = precipitation)

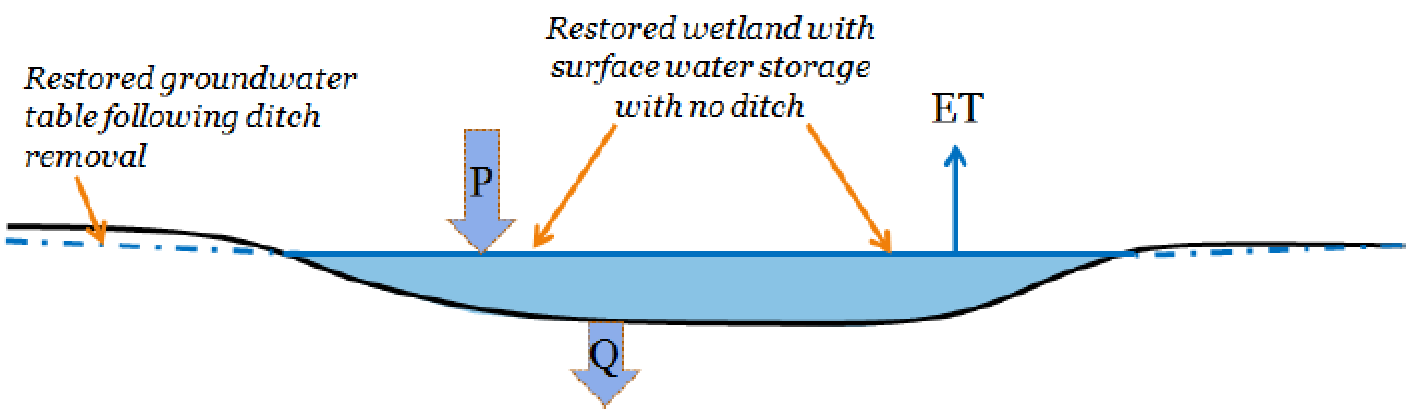


Figure 2b. Conceptual cross-sectional diagram of a wetland restored by removing the drainage ditch. This allows for surface storage, groundwater recharge and restored local groundwater levels. (P = precipitation; ET = evapotranspiration; Q = stream baseflow)

Estimating wetland project benefits

Estimate amount of dry season precipitation that will be stored/infiltrated in restored wetland

↓

This becomes baseflow volume (m^3)

↓

Calculate increase in dry season baseflow (m^3/s)

Five Reasons Why these Calculations are Important for the Water Fund

1) Ability to evaluate green interventions before rigorous hydrological monitoring results are available

Mass Budget Equation

A watershed-scale water mass budget is represented by the following equation: [5]

$$P = Q + ET + \Delta S + \Delta G + \Delta L \qquad (1)$$

Where:

P = precipitation
Q = streamflow
ET = evapotranspiration
S = soil moisture
G = groundwater
L = leakage

2) Project investments can be prioritized

Groundwater recharge projects are needed to increase drinking water supplies.

Aquafondo could fund several different types of project options.

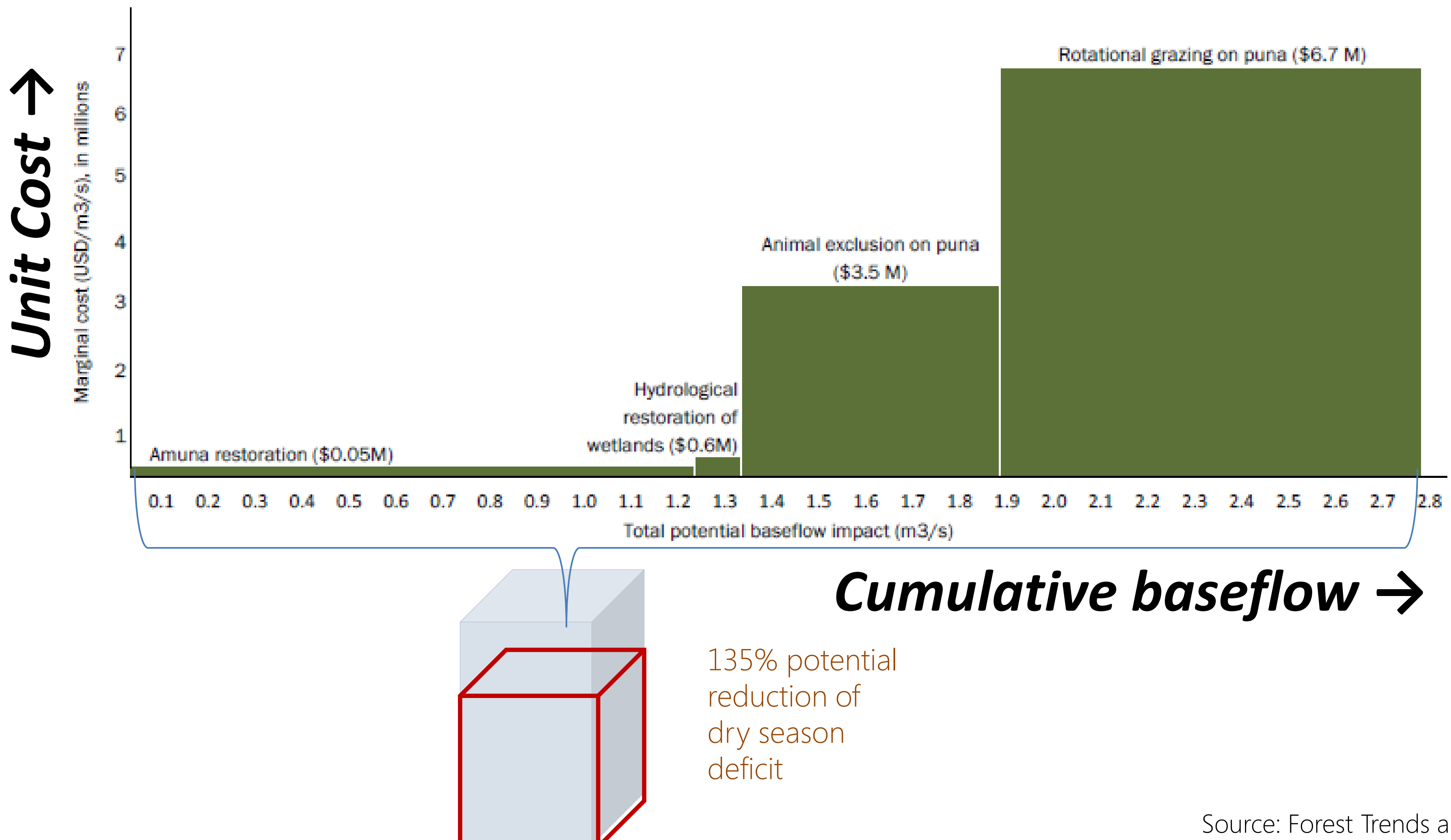
Which project option is the most cost-effective for addressing recharge?

Metric = $m^3 \cdot sec^{-1}$

Project 1	\$22,000	4.5 $m^3 \cdot sec^{-1}$	\$4,900/$m^3 \cdot sec^{-1}$
Project 2	\$17,000	4 $m^3 \cdot sec^{-1}$	\$4,300/$m^3 \cdot sec^{-1}$
Project 3	\$3,000	0.2 $m^3 \cdot sec^{-1}$	\$15,000/$m^3 \cdot sec^{-1}$

Prioritized Project

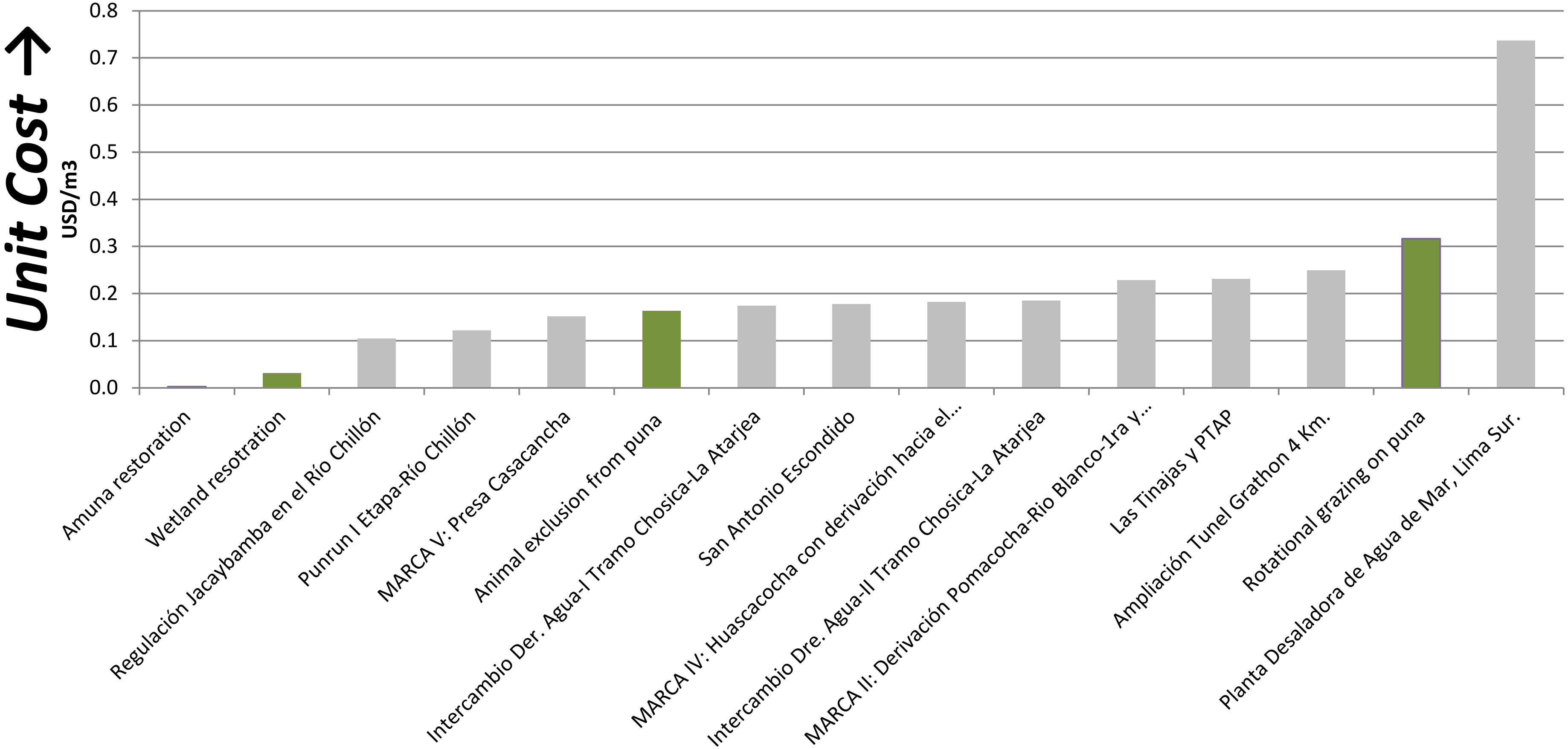
3) Cumulative estimation of potential watershed benefits of the green investments



135% potential
reduction of
dry season
deficit

Source: Forest Trends analysis

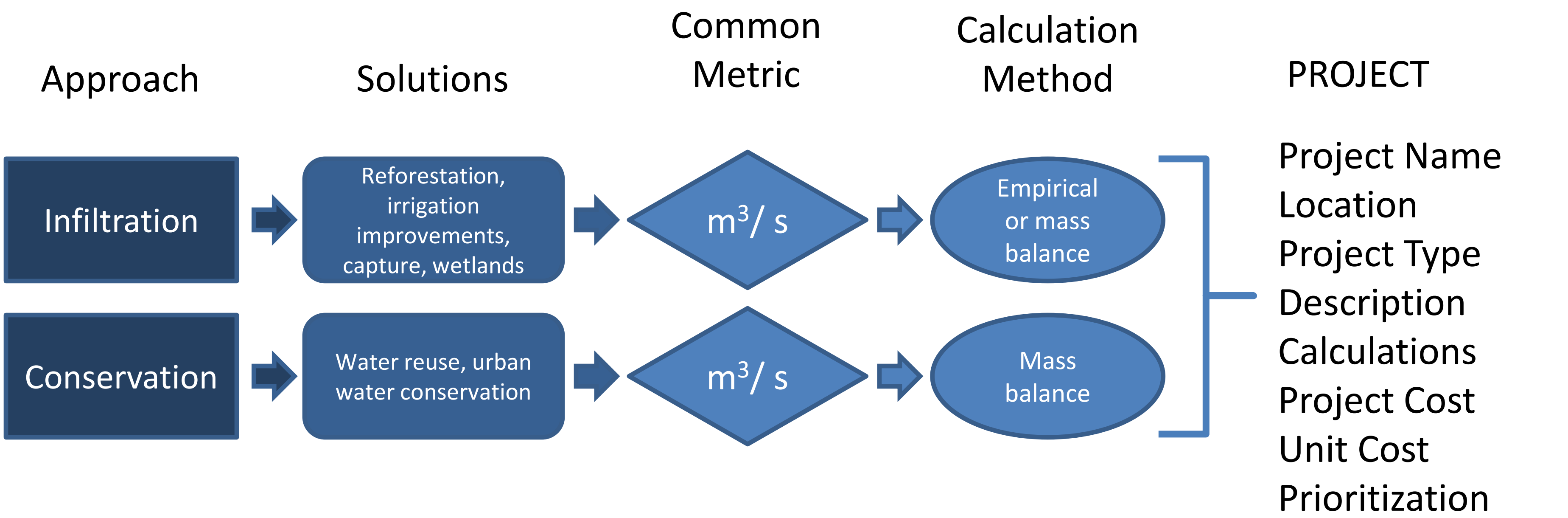
4) Comparisons of cost-effectiveness with gray infrastructure



Sources: Forest Trends analysis
Gray infrastructure costs: Nippon Koei (2011).

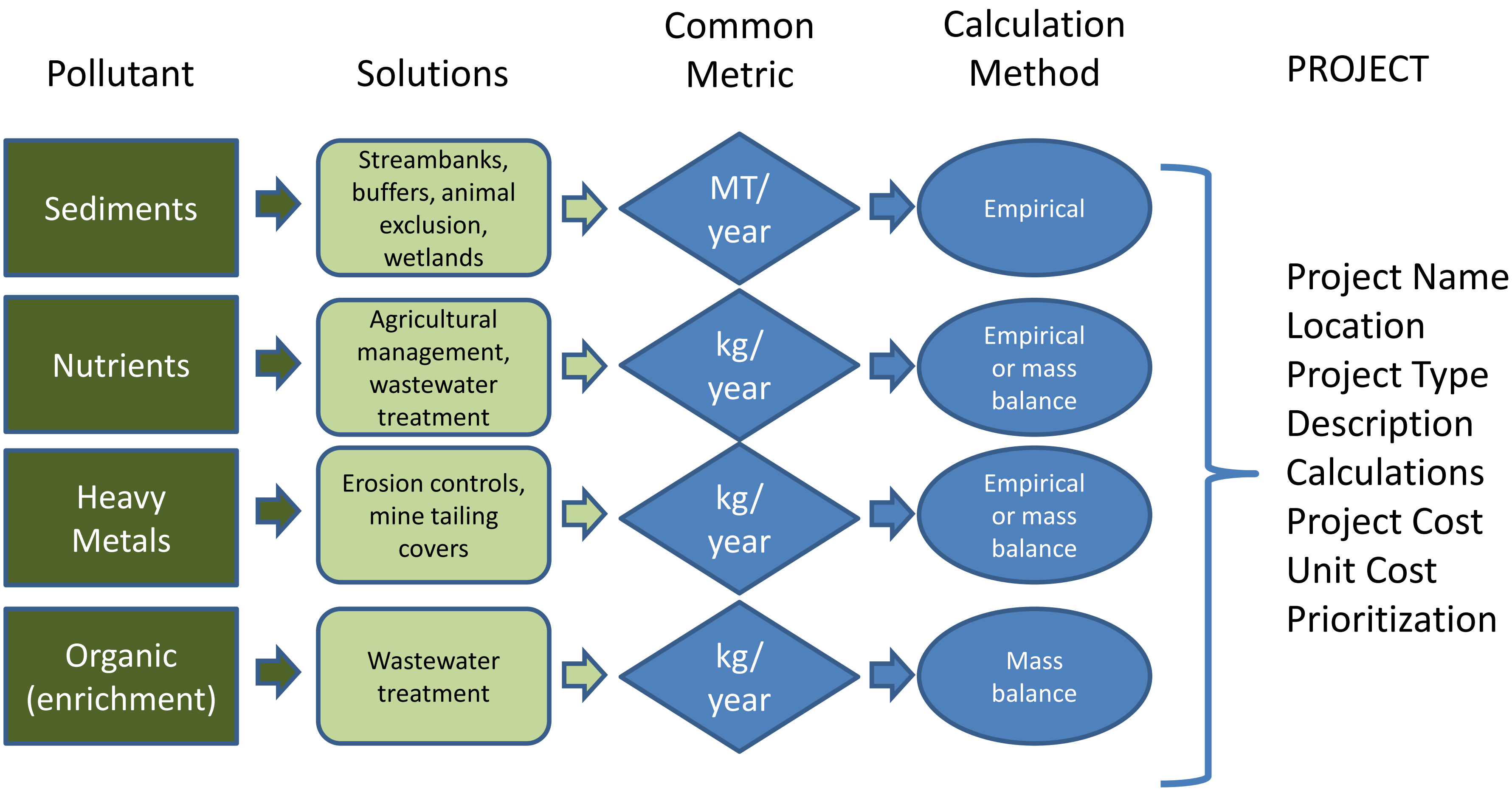
…and 5) Consistent assessment of project opportunties with consistent metrics for:

Water Quantity Projects



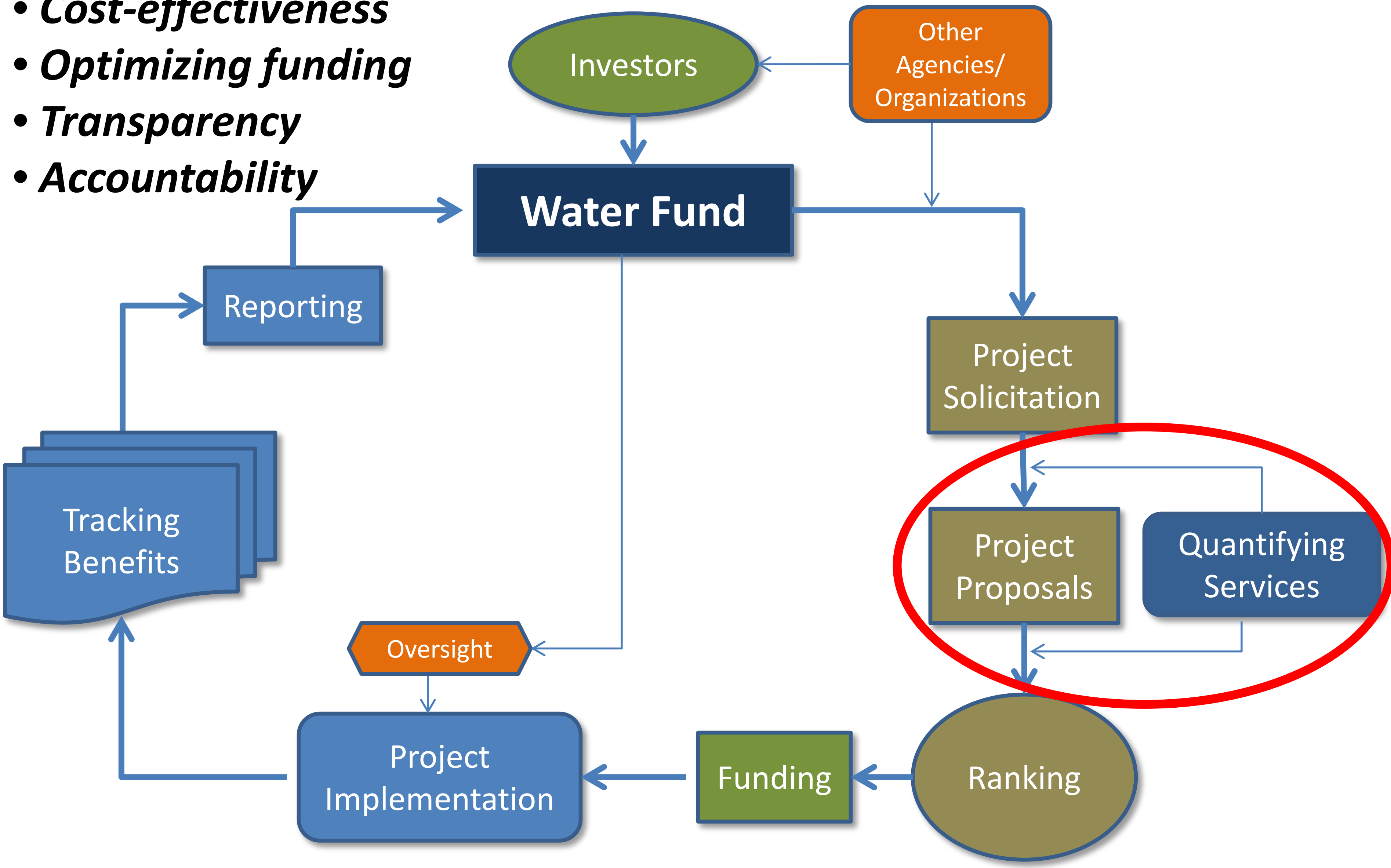
…and

Water Quality Projects



Application in the Water Fund Framework

- ***Cost-effectiveness***
- ***Optimizing funding***
- ***Transparency***
- ***Accountability***



Critical Water Fund Needs

- Appropriate and consistent metrics for describing quantity and quality issues
- Consistent and defensible methods to quantify benefits of interventions
- Understanding the magnitude and scale of:
  - Quantity and quality problems
  - Cumulative benefits that can be achieved
  - Costs that will make a real difference