RURAL ROADS FOR GROUNDWATER RECHARGE: FINDINGS AND OPPORTUNITIES

Stakeholder Workshop
27-10-2014

(MetaMeta, The Netherlands)

Dream and opportunity

To have roads for systematically used for groundwater recharge and retention and storage in Ethiopia and all over Sub Saharan Africa

Because

Roads investment in Sub Saharan Africa is 7-10 Bn USD annually

Annual increase 70,000 km

Roads have major impact on run-off – now often causing local flooding, water logging and erosion

Roads damage from water

This can be turned around in large potential for groundwater recharge and retention

- **Project title**: Optimizing road development for groundwater recharge and retention.
- **Partners**: MetaMeta (The Netherlands), IDS (UK), and MU (Ethiopia).
- **Collaborating institutions in Ethiopia**: TBoWR, TBoTRC, TBoARD, REST, OBoWME, OBoRT, ERA.
- **UPGRO Catalyst Grant**: NERC ESRC, DFID (UK)
- **Follow up**: NWO – Feeder Roads for Inclusive Growth

Catalyst grant – some highlights

- Reconnaissance of 200 kilometer of roads in Tigray and Oromyia Regional State
- Research into socio-economic impact and road development governance
- Pilots
- Monitoring
  - Moisture levels
  - Groundwater levels
  - Water quality
  - Impact

Catalyst grant – some results

- In 200 kilometers:
  - Erosion and sedimentation: 150 locations
  - Flooding of houses and land: 45 locations
  - Persistent waterlogging: 65 location
- Deficiencies in governance process
  - Missing from guidelines
  - No coordination
  - No interaction with road-side communities
- Social impacts
  - Damage to land and houses, dust
  - Poor – most vulnerable least access to potential
  - No compensation, indirect litigation

Catalyst grant – some results

- Pilots: high acceptance - prepared in all 30 districts of Tigray by Regional Bureaus and communities
- Monitoring
  - Impact specific to location and specific intervention, compared with base year in different locations
  - Soil moisture content increases Shallow groundwater levels
  - Control of flood run-off (discharge reduced Surface water storage
  - Water quality (not traceable)

Urgent need to turn things around

Urgent need to turn things around

Triple Win

REDUCED WATER
DAMAGE
TO ROADS
(-35%)

WATER HARVESTED
FOR PRODUCTIVE USE
400,000M3 PER KM

REDUCED
DAMAGE FROM ROADS
THROUGH FLOODING,
EROSION AND SEDIMENT
DEPOSITION
(-30%)

RISING GROUNDWATER
LEVELS 1.9-5.8 MTR

INCREASED SOIL
MOISTURE
30-100%

NOW
1.3
PROBLEMSPOT
PER KILOMETRE

Triple Win

REDUCED MAINTENANCE COSTS
HIGHER RELIABILITY

REDUCED DISPLACEMENT
REDUCED LITIGATION

INCREASED PRODUCTION

HIGHER RELIABILITY

Many other opportunities to better use of roads for water!

Stage 1:

Adapting to the changed run-off generated

1. Spreading water from road surface
2. Harvesting water from culverts, side drains and depressions
   - Converted borrow pits
   - Infiltration ponds
   - Infiltration trenches/ pits
   - Swallows
   - Dug outs
3. Gully plugging for recharge
4. Spring capture

NIGER: STONE BUNDS ALONG ROAD T0 REDUCE EROSION

THE NETHERLANDS: SWALLOW for RECHARGE

YEMEN: ROAD SIDE CISTERNS

CHINA: ROAD SIDE PONDS

ITALY, SARDEGNA: SPRING CAPTURE

TIGRAY, MULEGAT: SPRING CAPTURE

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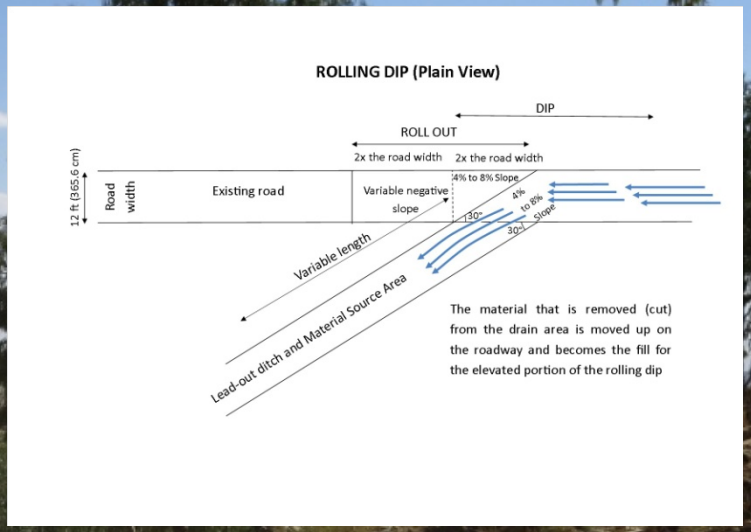
Stage 2:

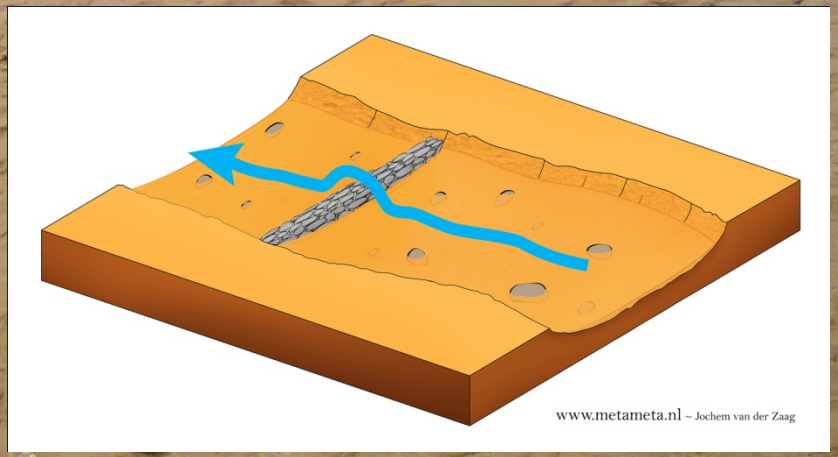
Optimizing road design for multiple functions

1. Rolling dips, proper cross drainage
2. Irish bridges/ fords:
   - for flood water spreading
   - for river bed stabilization
   - acting as sand dams
3. Changing road alignment to recharge areas
4. Change culvert location
5. Permeable road foundations

FEEDER ROADS – BIG CHALLENGES, SIMPLE SOLUTIONS – ROLLING DIP

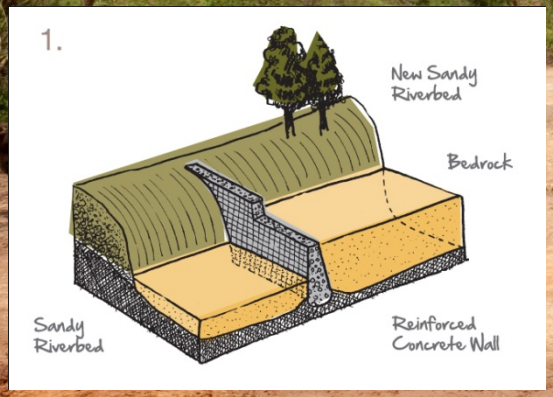


PAKISTAN: ROAD = SPATE IRRIGATION BED STABILIZER



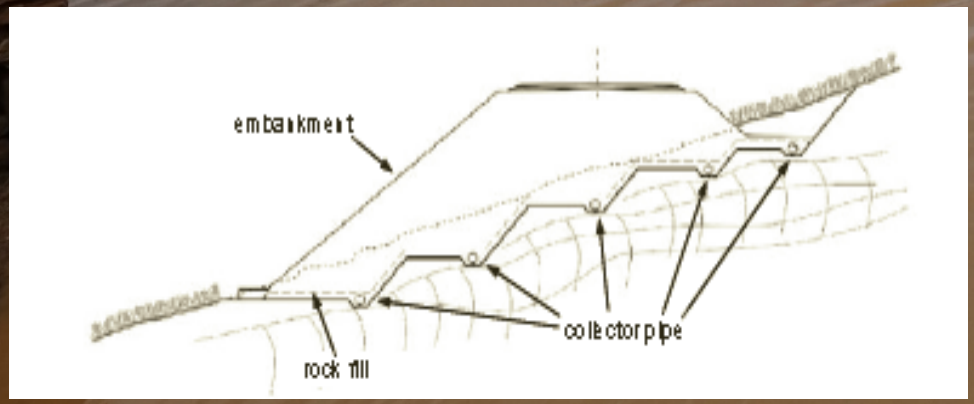
NIGER: FLOOD WATER SPREADING WEIR = ROAD

KENYA: ROAD CROSSINGS AS SANDDAMS



SOUTH SUDAN: CROSS DRAINAGE REGULATES SOIL MOISTURE, REGULATES BURNING AND REGENERATION: CULVERT PLACEMENT

WATER LOGGING CLOSE TO ROAD EMBANKMENT: NEED TO RETHINK CROSS DRAINAGE AND ROAD COMPACTION



Many other opportunities to better use of roads for water!

Additional

1. Reuse excavated bed material from roads for soil improvement
2. Sand harvesting along roads


We need to convert a problem
into an opportunity


We need to create new groundwater resources and transform the landscape, the economy and the livelihoods


Water and roads: friends not enemies

We need to change the governance

1. Integrate in road and water shed programs
2. Community engagement
3. Change procedures in roads development
   - Manuals
   - Investment budgets
   - Maintenance budgets
   - Cooperation
4. Capacity building
   - Short courses
   - Tools (run-off models)

Let‘s travel together

We need to convert a problem

into an opportunity