Protecting The Source

Land Based Measures vs. Water Utility Upgrades and Advanced Treatment to Meet Future Drinking Water Standards

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Two Main Sources of Water

- Ground Water and Surface Water
  - Nationally 95% of rural population used groundwater in the early 1980-90s
  - Missouri 37% of population uses groundwater
  - Nationally the trend is growing towards more surface water use in high population areas. Many rural areas and rural water districts now depend on surface water reservoirs for public drinking water supplies.

Major Contaminants Found in Drinking Water Supplies

- Ground Water
  - Microorganisms – bacteria, parasites, etc
  - Pesticides – through leaching, direct conduit, etc
  - Nitrates – fertilizer, manure, naturally occurring
  - Radionuclides – present in underlying rock and ground water (can create Radon gas issues)
  - Heavy metals – from rocks and soil may contain arsenic, cadmium, chromium, lead, selenium, etc

Major Contaminants Found in Drinking Water Supplies

- Surface Water
  - Microorganisms – cryptosporidium, bacteria, etc
  - Pesticides – atrazine, etc.
  - Nitrates
  - Sediment
  - Organics of any type
  - Etc.

Where it Works

- Many examples exist of areas where BMP implementation is more cost effective than having to put in new treatment systems.
  - New York City watershed project is best known
- Disinfection By-Products Two - rule makes DBP harder to meet in public drinking water supplies. Once DBP are in the water there isno effective way to remove them. Prevention becomes the best form of keeping them out of water supplies.

Common Practices For Removing Contaminants

- Use of Powdered Activated Carbon for removing organics and pesticides. In Missouri normal carbon use and contact time can remove 12-16 ppb atrazine with no extra cost
  - 2ppm carbon can remove 1 ppb atrazine
- Chlorine – for controlling organics and bacteria.
  - Causes concerns with Dis-infection By-Products (DBP)
    - Trihalomethanes (TTHM)
    - Holoacetic Acids (HAA5)
    - These must be stopped at the source – there is no effective way to remove them from drinking water supplies.
- Filtering – crypto removal
- Settling Basins -

Is Water Quality Important?

- Trust for Public Land – 89% of Americans agree that federal investment to guarantee clean and safe water is a critical component of our environmental well-being.
- State Source Water Assessment Program – urban sprawl and land use issues have greatest impact of source water Land use accounts for 60% of water quality impairment.

Protecting the Source

- Trust for Public Land and the American Water Works Assoc study :
  - 50-55% variation in operating treatment costs can be explained by the % of forest cover in the source area
  - Decrease treatment and chemical cost by 20% for every 10% increase in forest cover (up to 60%)
  - Most effective way to ensure the long-term protection of water supplies is through land ownership by the water supplier and its public jurisdictions. (AWWA Journal, 1995)

Protecting Water Supplies

- Practices associated with protection of ground water
  - Irrigation timing, scheduling, amounts, etc. (retro-fitting nozzles)
  - Fertigation and chemigation
  - Over application of nutrients that then leach or run-off into water supplies
  - Abandoned well plugging
  - Soil testing
  - IPM and NMP
  - other

Protecting Water Supplies

- Practices associated with protecting surface water:
  - Soil testing
  - ICM and NMP
  - ICM
  - Irrigation management
  - Terraces (tile outlet and others)
  - Waterways
  - Fencing livestock from streams
  - others

Protecting Water Supplies

- Nutrient Loading – creates higher organics, algae growth, etc.
  - Causes increase in carbon and chlorine to treat water
  - 1 extra lb. of phosphorus can produce 300-500 lbs of algae bloom
  - TTHMs and HAA5s increase due to use of chlorine
  - Enhanced coagulation to remove % total organic carbon so TTHMs and HAA5 are in compliance or remove organics from the source.

Disinfection By-Products (DBPs)

To control organics, chlorine or chlormine are used. But heavy loads of organics causes the production of Trihalomethanes (TTHM) and Holoacetic Acids (HAA5). There is no effective way to remove them so organics must be reduced or removed from the raw water. It is more effective to remove organics at the source than to do coagulation at the plant. The more that can be removed from the source the more efficient the water plant can be at treating the water.

Protecting Water Supplies

- Scenerio – rural community of 2,400 population has 820 acre lake in a 13,800 acre watershed
- High corn production area
- High levels of atrazine in raw water (>60 ppb)
- Cost an extra $32/day for 2 years to remove atrazine to acceptable levels = $23,360
- Cost of new carbon contact unit = $127,000
- Cost of electricity associated with removal $300/month for 2 years = $7,200
- Overtime for employees 100 hrs/mn x $15 x 2 years = $36,000
- Total extra cost for reducing atrazine loading = $193,560

Protecting Water Supplies

- Scenerio – rural community of 2,800 population with a 28 acre lake in a 3,638 acre watershed.
- High corn and soybean production area
- High atrazine loading (80 ppb) and sedimentation in lake
- Cost associated with atrazine removal = $66,000
- Cost associated with dredging of lake that is 30 years old Bid = $1.2 million
- Total cost associated with atrazine and sediment removal = $1.266 million

Protecting Water Supplies

- Best Management Practices and cost share
- IPM and NMP = $15 / acre
- Terraces = $1.85/ running foot (75%-25%)
  - Average cost in Missouri $370/acre treated
  - Average cost for tile outlet $1,300/acre treated
- Grass waterways and Buffer Strips =$3/running ft (75%-25%)
  - Average cost in Missouri $4,500

Practices to Reduce Soil Erosion and Improve Water Quality

- For reducing soil erosion(2005) –
  - Terrace system with tile placed on 20,000 acres estimated soil savings of 1m ton @ cost of $7m
  - Permanent Vegetative Cover Establishment and Improvement placed on 27,000 acres estimated soil savings of 800,000 ton @ cost of $1.6m
  - Planned Grazing Systems on 28,000 acres estimated soil savings of 51,000 ton @ cost of $1.1m
  - Others

Protecting Water Supplies

- In many states the largest percentage of land is owned by private citizens. (Missouri – 93%)
- Smaller communities with public drinking water reservoirs have a strong agricultural base for economic stability.
- Land surrounding drinking water reservoirs is mainly agricultural.
- Business base for financing water treatment is small so where do dollars do the most good?
- Is taking land out of production a win-win situation for the communities that rely on agriculture for an economic base and surface water for public drinking water supplies?

Where do we draw the line

- CREP – drinking water reservoir in the Long Branch Watershed. Had 4,100 acres go into CREP as a way of protecting water quality.
- Brought more money into area but in the hands of fewer people.
- CREP cost 21 part-time or low income jobs associated with agriculture.
- What should have been done different?

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- TPL – place-based strategies can increasingly be linked to individual parcels and pollutant loads.

  Conservation is permanent and works across jurisdictional boundaries.
- EPA Source Water Stewardship Project – demonstrate the use of land conservation and forest management as drinking water protection strategies. Foster a sustainable locally-based forum for land and water protection

Where do we see the most good?

Producers desire to become educated and make changes as we move up the arrow

Land not sensitive, owner wants to do something	Land very sensitive owner wants to do something
Land not sensitive owner doesn't care	Land very sensitive owner doesn't care

Land becomes more environmentally sensitive as we move to the right

Credit to P. Novak

What does this graph tell us?

- Placing BMPs on non-sensitive land has some benefit but may not reduce heavy contaminant loading.
- Producers owning sensitive land who are willing to learn and try something will adapt practices and have a larger impact on source water protection compared to non-sensitive land BMPs
- Need to reach producers in sensitive land areas that aren't interested in doing or maintaining BMPs
- Is this what they can the 90-10 rule? 90% of contaminants coming from 10% of the land – is this a true statement?

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- Targeting critical areas in a watershed could dramatically reduce the cost associated with BMPs being applied and reduce a larger amount of contaminants entering into the water supply.
- Targeting critical areas can concentrate funds into those areas that will yield the most good without destroying the agriculture economic baseline and viability of a rural community.

Protecting the Source

- Paying for BMPs isn't enough for long-term water quality protection. For each BMP that a land owner implements, there should be an educational course that goes with it. Doing without understanding is a short-term fix. Understanding why something is done and the importance of it for human and environmental health is the long-term key.

Is there a Correct Plan of Action to Achieve Water Quality Improvement

- Identify the need – is this to control soil erosion and nutrient loading?
- Identify possible practices that would reduce the problem – terraces, filter strips, IPM, irrigation management, etc.
- Determine if funding or cost-share is available to assist producer with implementing practice.
- Have producer attend training session to explain use of practices and how to maintain and why it is important.
- Implement practice and maintain practice to improve water quality without hurting economic viability of producer.

What About the Watershed Level Source Water Protection Concept

- Even though most BMPs are placed on individual properties and on a field-by-field basis the accumulative affect of each individual producer is needed to show total watershed level source water protection.
- Get the community together to look at all the issues in the watershed and determine a plan of action for source water protection. The producers will have a voice in the selection of practices while other aspects of source water protection can also be addressed.

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- EPA SWSP –
  - Be place-based with commonly available GIS
  - Do landowner outreach from the beginning
  - Identify priority areas for conservation, restoration and stormwater management.
  - Build support for project with consensus, political commitment and requisite funding

Mine – build local capacity and ownership in working with the problem and taking responsibility to do something about it.

Conclusions and Observations

- In most situations BMP implementation is more cost effective than having to add additional treatment facilities to remove contaminants.
- Removal or reduction of contaminants at the source (the field level) is more effective than trying to remove the contaminants once they have entered the water supply (ground or surface).
- To be more effective we should be targeting those critical areas that are more likely to create contaminant loading.

Conclusions and Observations

- An educational component should be developed for each BMP that a producer is implementing so the producer understands why it is important to him and for human and environmental health.
- Building local ownership and capacity of watershed citizens in needed for long-term success of BMPs in reducing, controlling or eliminating contaminants from entering water supplies.

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- Questions
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