

Setting the Course for
Improved Water Quality –
Tackling a
Biological Impairment:
The Groundhouse
River TMDL Study
Case Example

Minnesota Pollution Control Agency

*A TMDL training program for local government leaders and other
water managers – Session 10b*



In this presentation

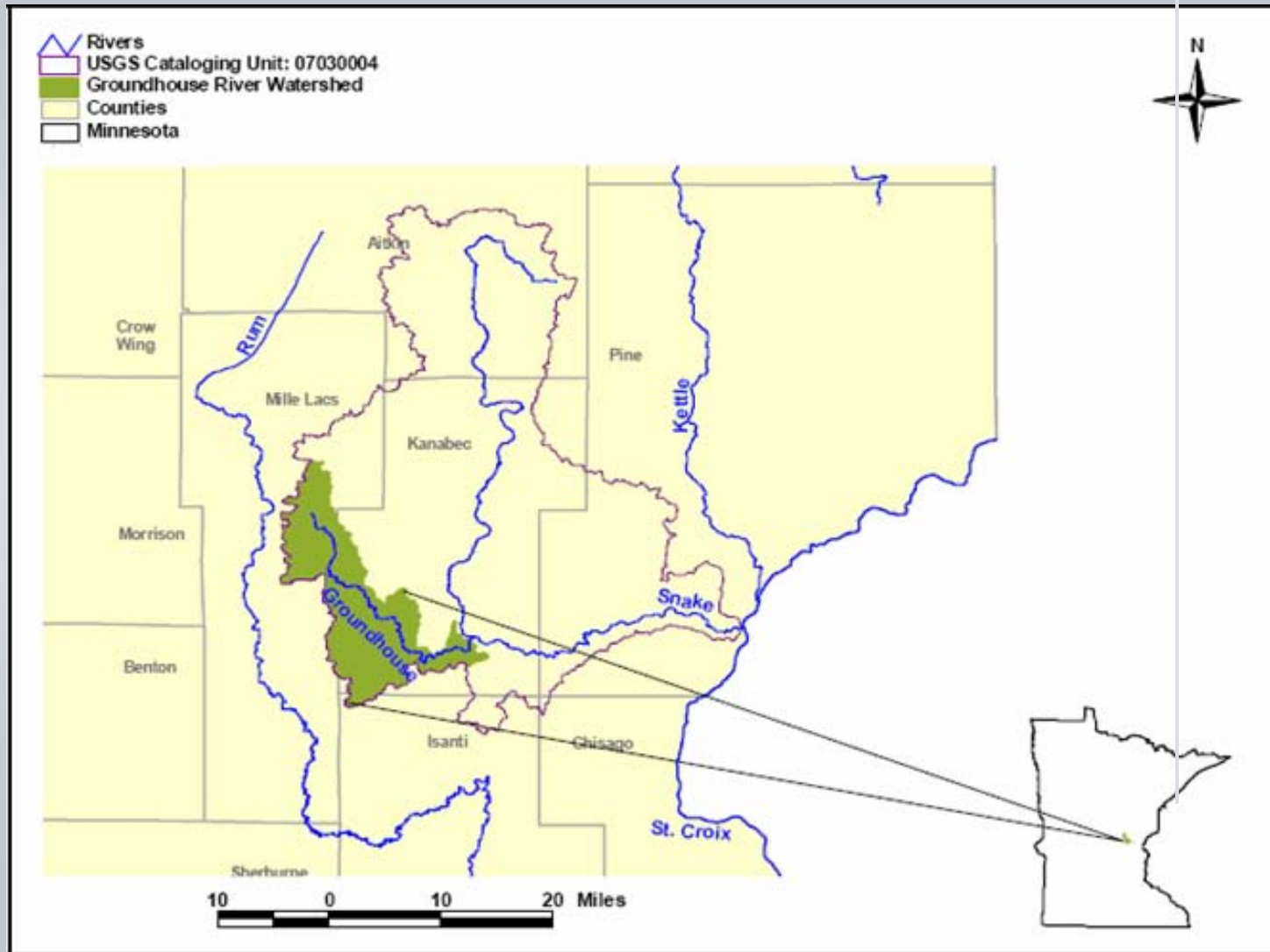
- An overview of the Groundhouse River TMDL study process
- Lessons learned

The Groundhouse River





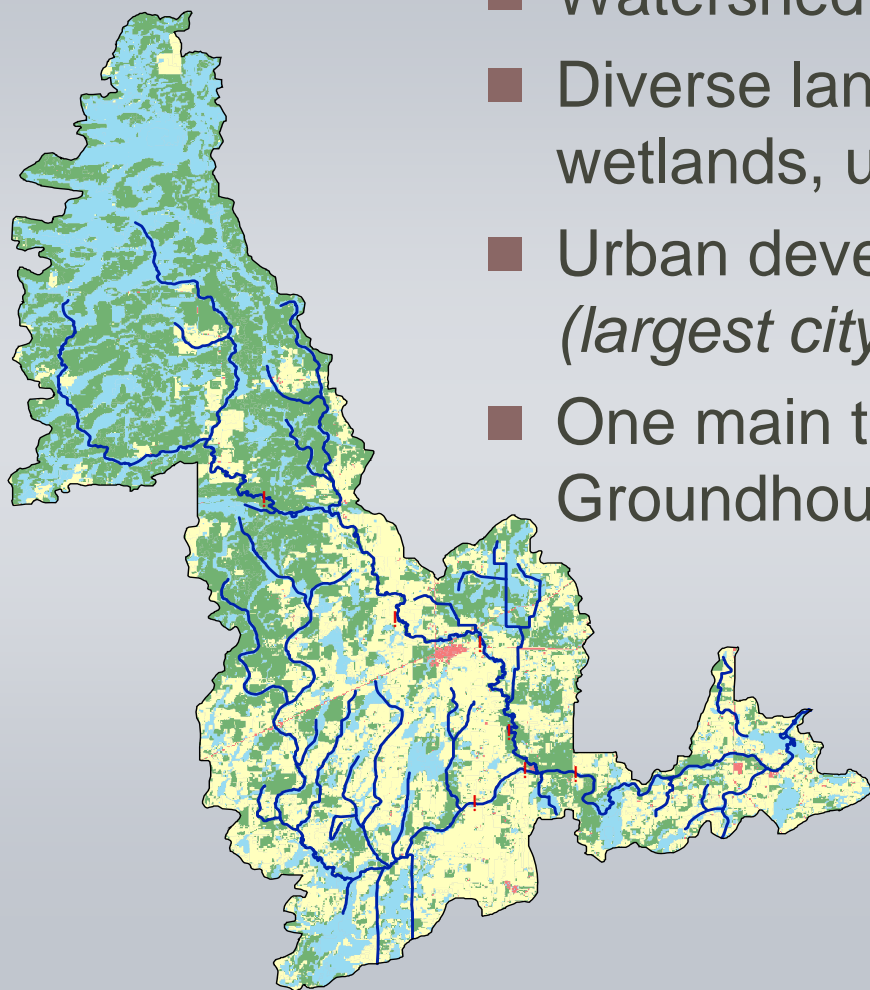
Background: The Groundhouse River





Background: Land use in the watershed

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- Watershed drainage: ~139 square miles
- Diverse land use: forests, agriculture, wetlands, urban
- Urban development: generally limited (*largest city – Ogilvie: pop. 500*)
- One main tributary: South Fork Groundhouse River

Legend

Land Use Type

- developed
- forest/grassland
- agriculture
- lake/wetland

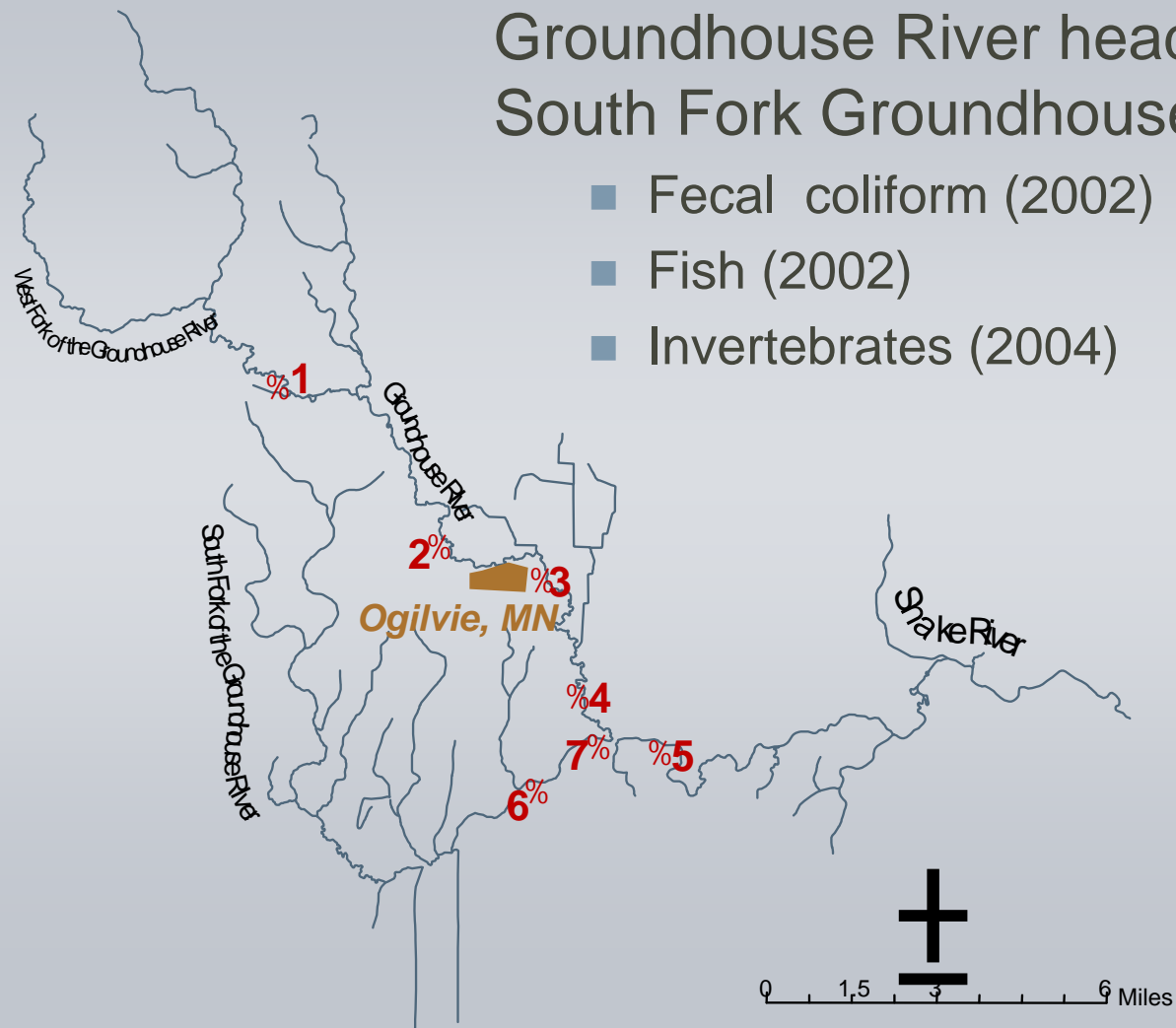


Water quality impairments

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Groundhouse River headwaters to the South Fork Groundhouse River (1-4)

- Fecal coliform (2002)
- Fish (2002)
- Invertebrates (2004)



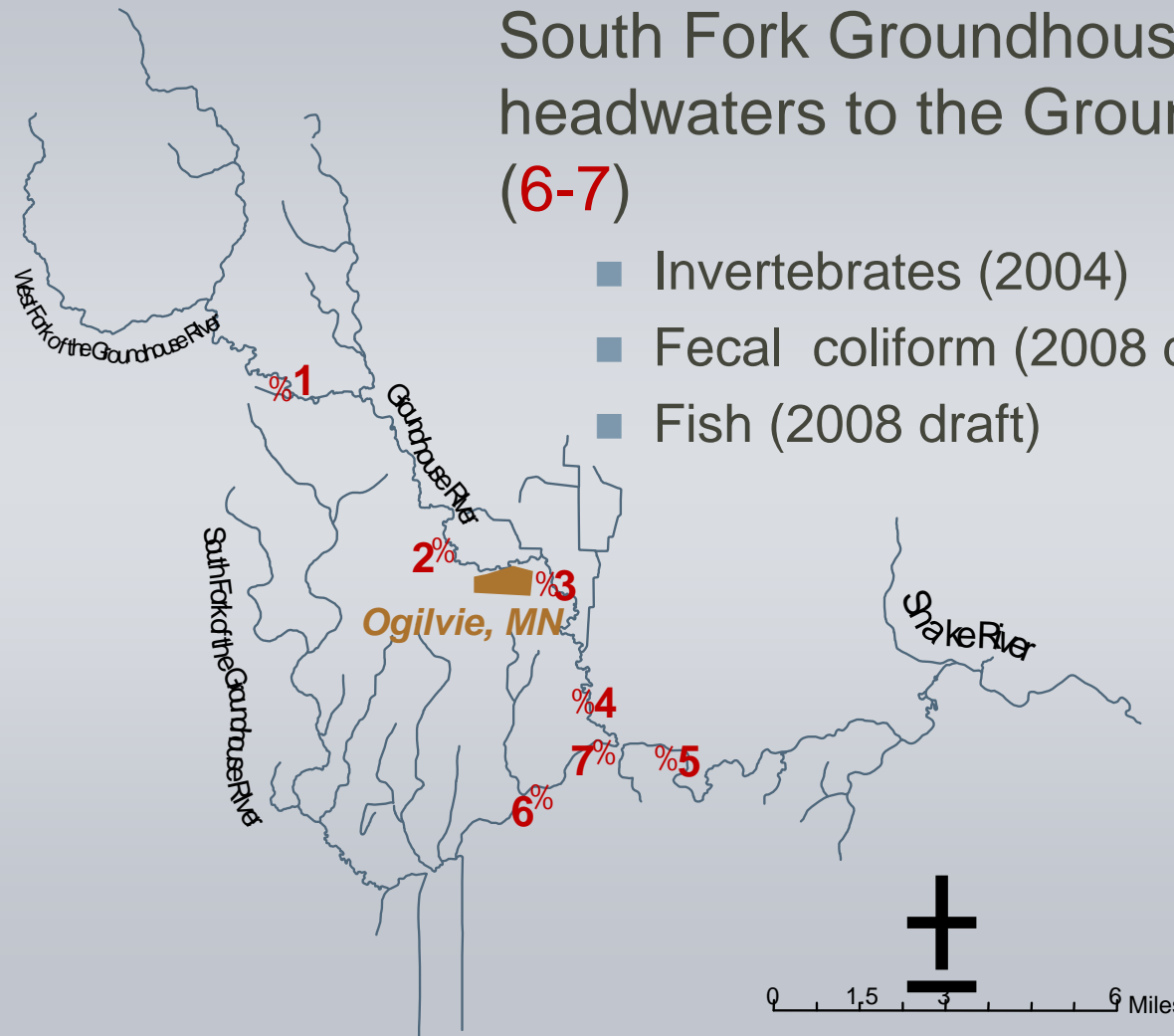


Water quality impairments

Minnesota Pollution Control Agency

South Fork Groundhouse River headwaters to the Groundhouse River (6-7)

- Invertebrates (2004)
- Fecal coliform (2008 draft)
- Fish (2008 draft)



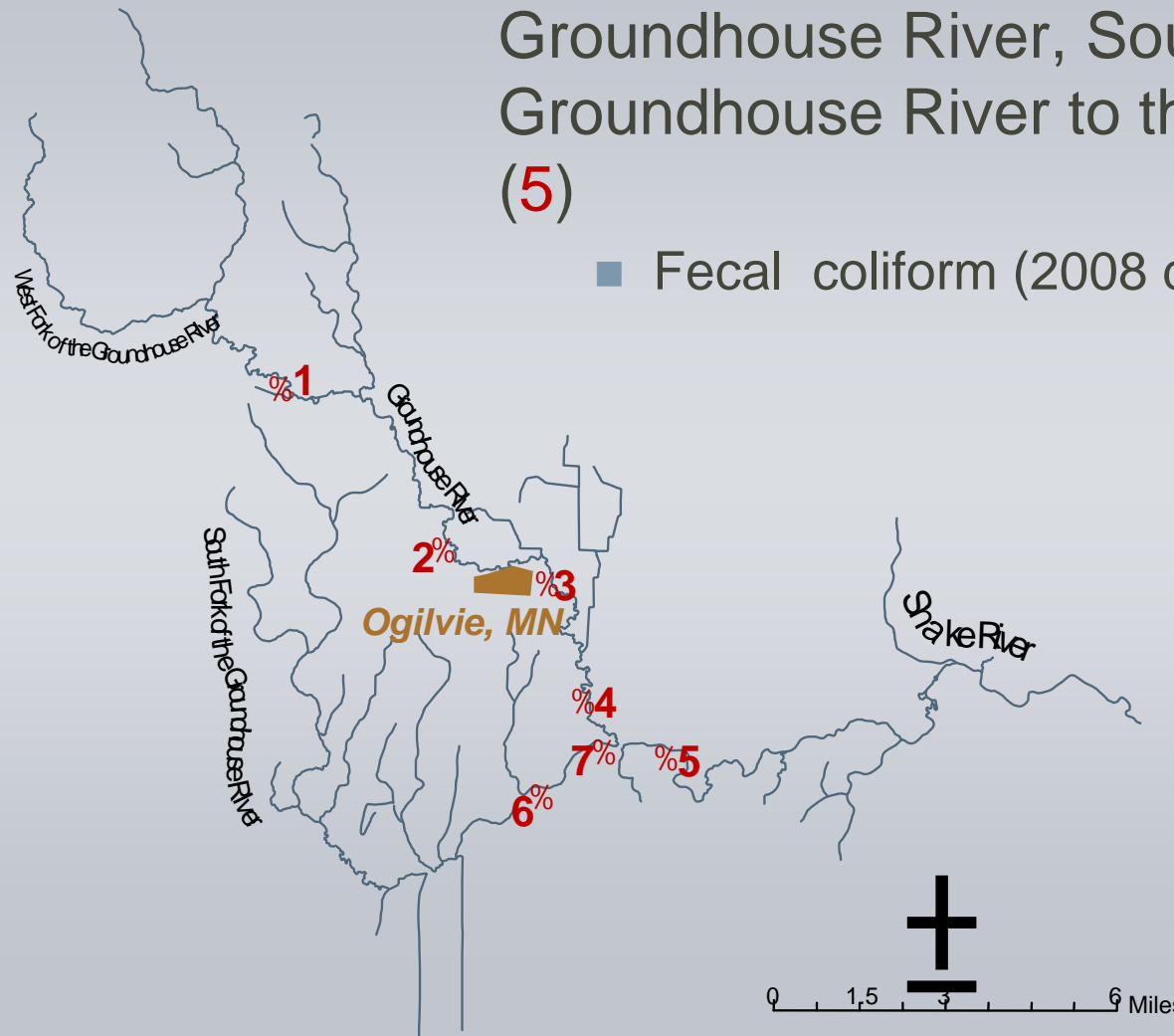


Water quality impairments

Minnesota Pollution Control Agency

Groundhouse River, South Fork
Groundhouse River to the Snake River
(5)

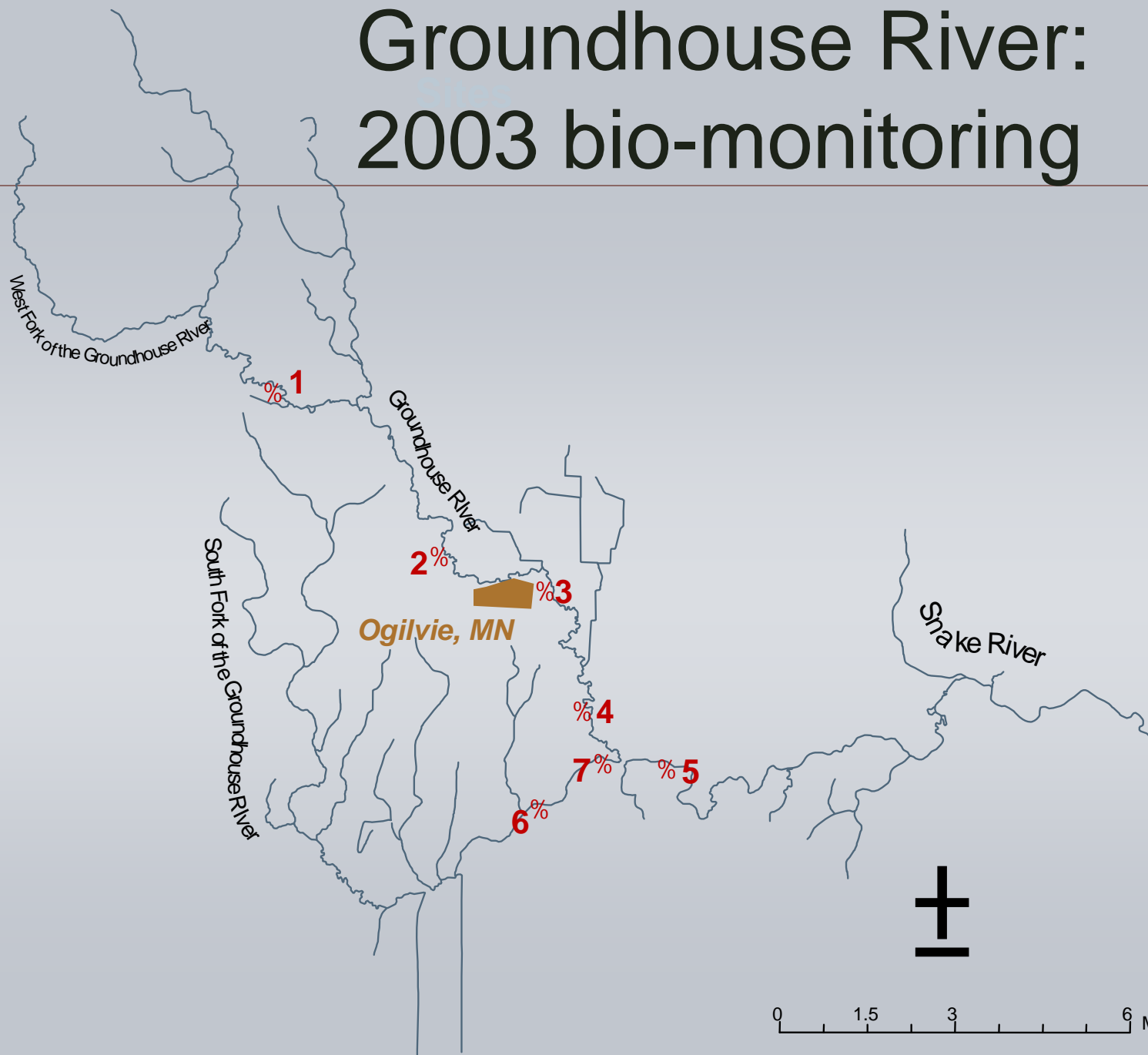
■ Fecal coliform (2008 draft)





Groundhouse River: 2003 bio-monitoring

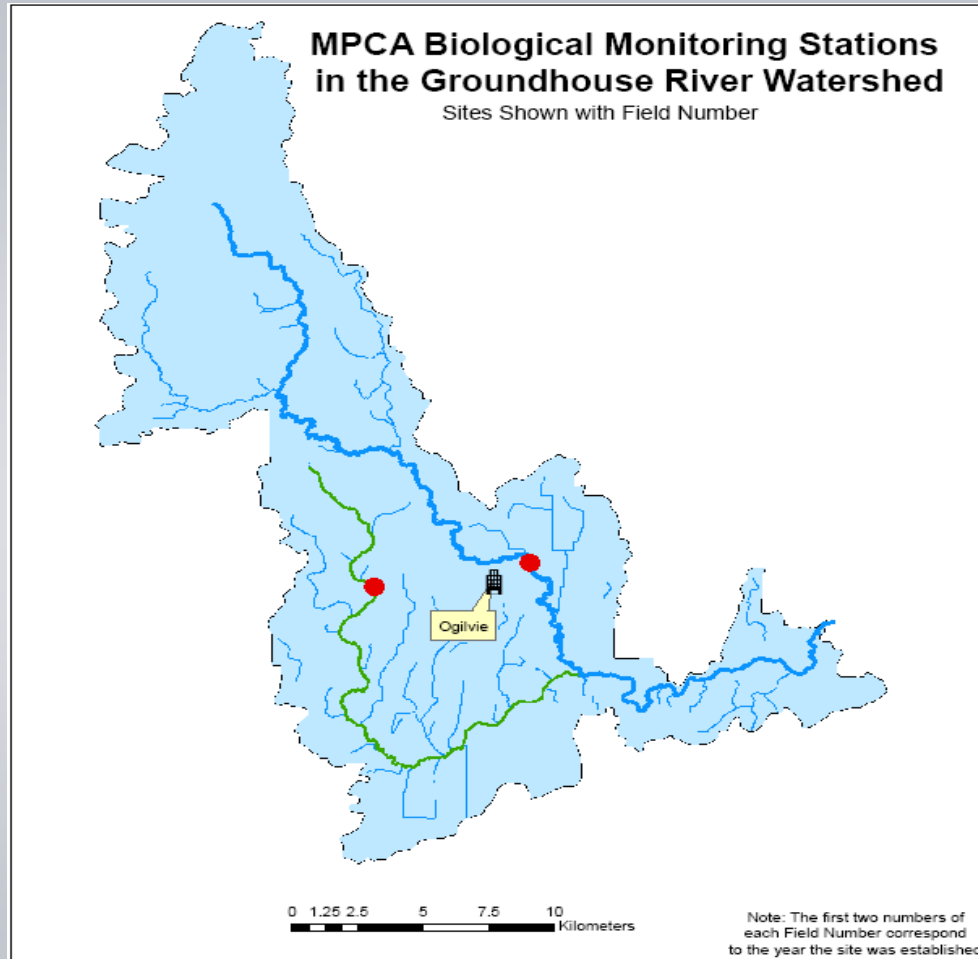
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Groundhouse River: biologically impaired sites

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Scale- 1:175,000
Projection- NAD83, UTM Zone 15N



- Groundhouse River
- South Fork Groundhouse River
- Streams
- Groundhouse Watershed



Addressing biological impairments

Determine impairment:

- location
(spatial analysis)
- extent
(severity)
- change over months, seasons, years
(temporal analysis)





TMDL study goals

Understand
why & to what extent
the Groundhouse River is impaired for aquatic life

Assess *existing* fish and macroinvertebrate community data

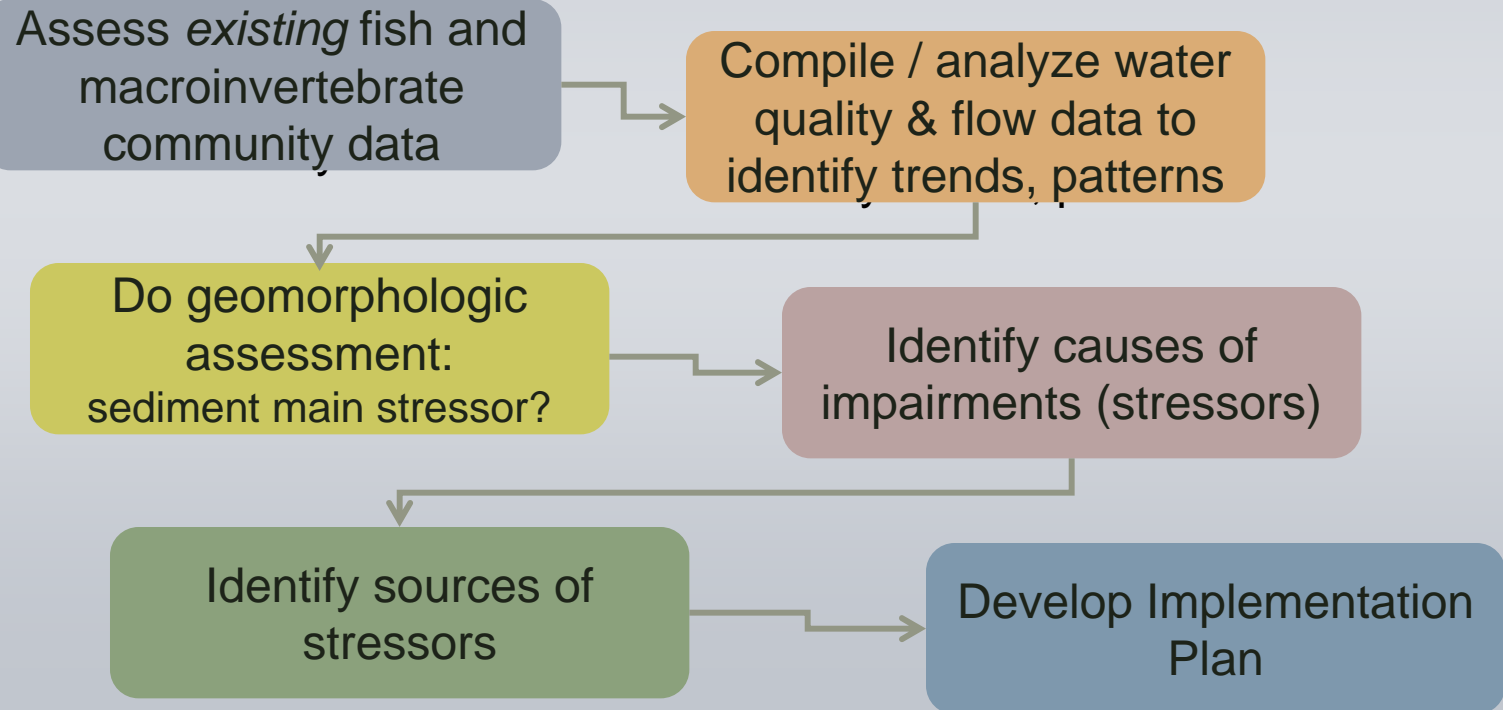
Compile / analyze water quality & flow data to identify trends, patterns

Do geomorphologic assessment: sediment main stressor?

Identify causes of impairments (stressors)

Identify sources of stressors

Develop Implementation Plan





Major TMDL study activities

(RETROSPECTIVE)

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2003-2004 Stressor identification process

April-Oct 2005 Monitoring Program

April 2006 Hired consultant

June 2006 Water Quality Interim Report

Jan 2007 Watershed & Modeling Approach Interim Report

May 2007 Biological Assessment Interim Report

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Stressor identification process

1. Needed model to address multiple impaired biota listings in Snake River watershed
2. USEPA developed a systematic evaluation method for factors that may affect biological communities
3. Decided to use **Stressor ID** process for Groundhouse River impairments



Stressor identification process

- Examines land use, biological, chemical, physical data at same time
- Amount of data/effort needed varies by number, extent and types of biological impairments
- High quality data collected/analyzed results in identification of the correct causes of impairment



Stressor identification process

- Stressor identification is iterative, beginning with analysis of available data *(may need new data)*
- Process helps to reduce bias or logical lapses among technical team members
- Stressor ID is a formal process that may alleviate skepticism among stakeholders



Stressor identification process

Encouraged stakeholder involvement:

- A good deal of existing data allowed project manager to initiate stressor ID process early
- 2003 workshop to familiarize local stakeholders with existing biological data
- USEPA trained stakeholders on stressor ID process
- Training brought many people together, representing diverse areas of expertise



Stressor identification process: definitions

Cause of the impairment:
chemicals, effluent, thermal
energy, siltation, excess
nutrients, low dissolved oxygen,
etc.)

Example: siltation

Source: entity or action that
releases a pollutant into a
waterbody

Example: cattle crossing

Response: biological change or
effect traceable to a cause

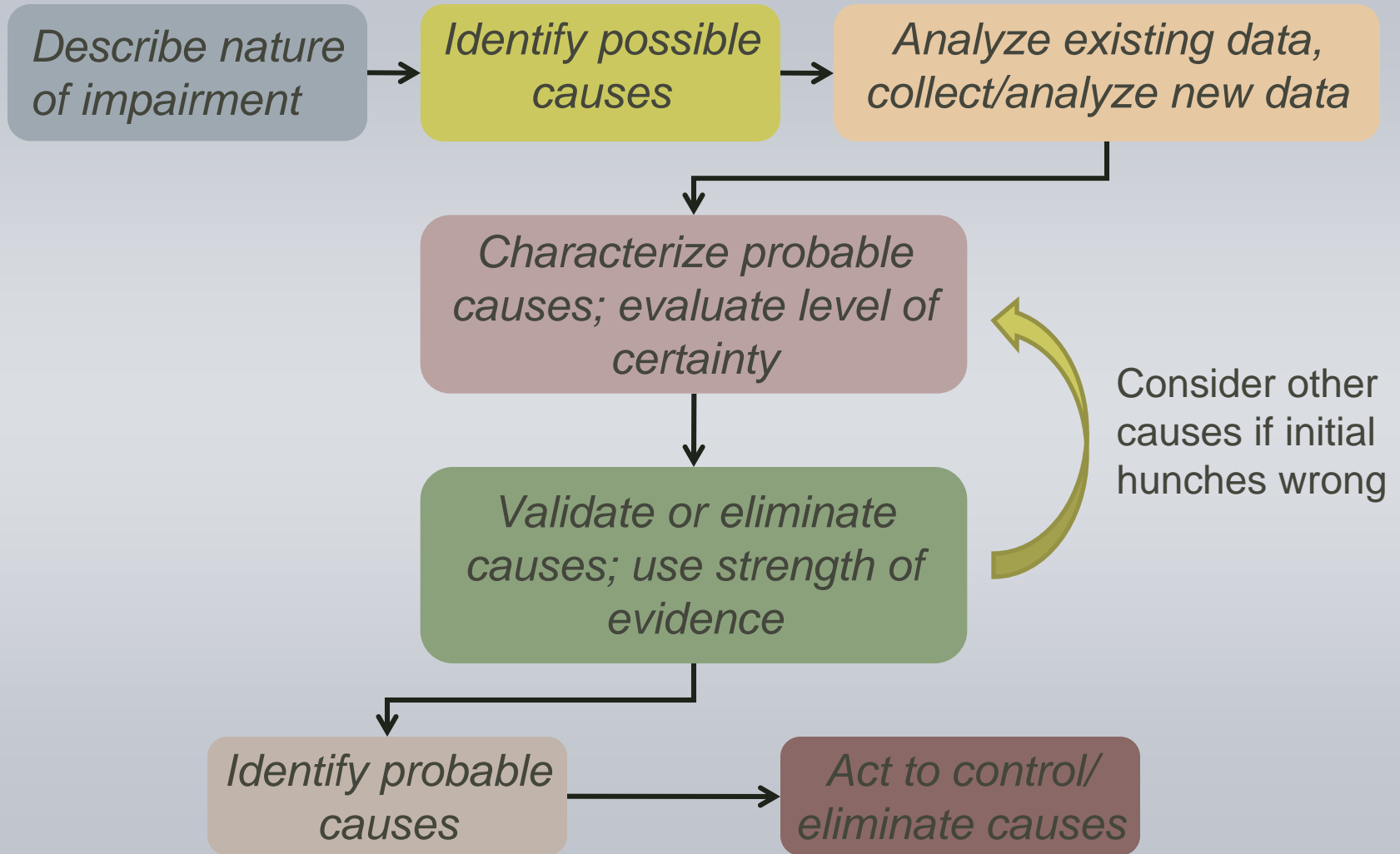
Example: decrease in gravel
spawning fish





Stressor identification process: stakeholder involvement

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Determine nature of impairment

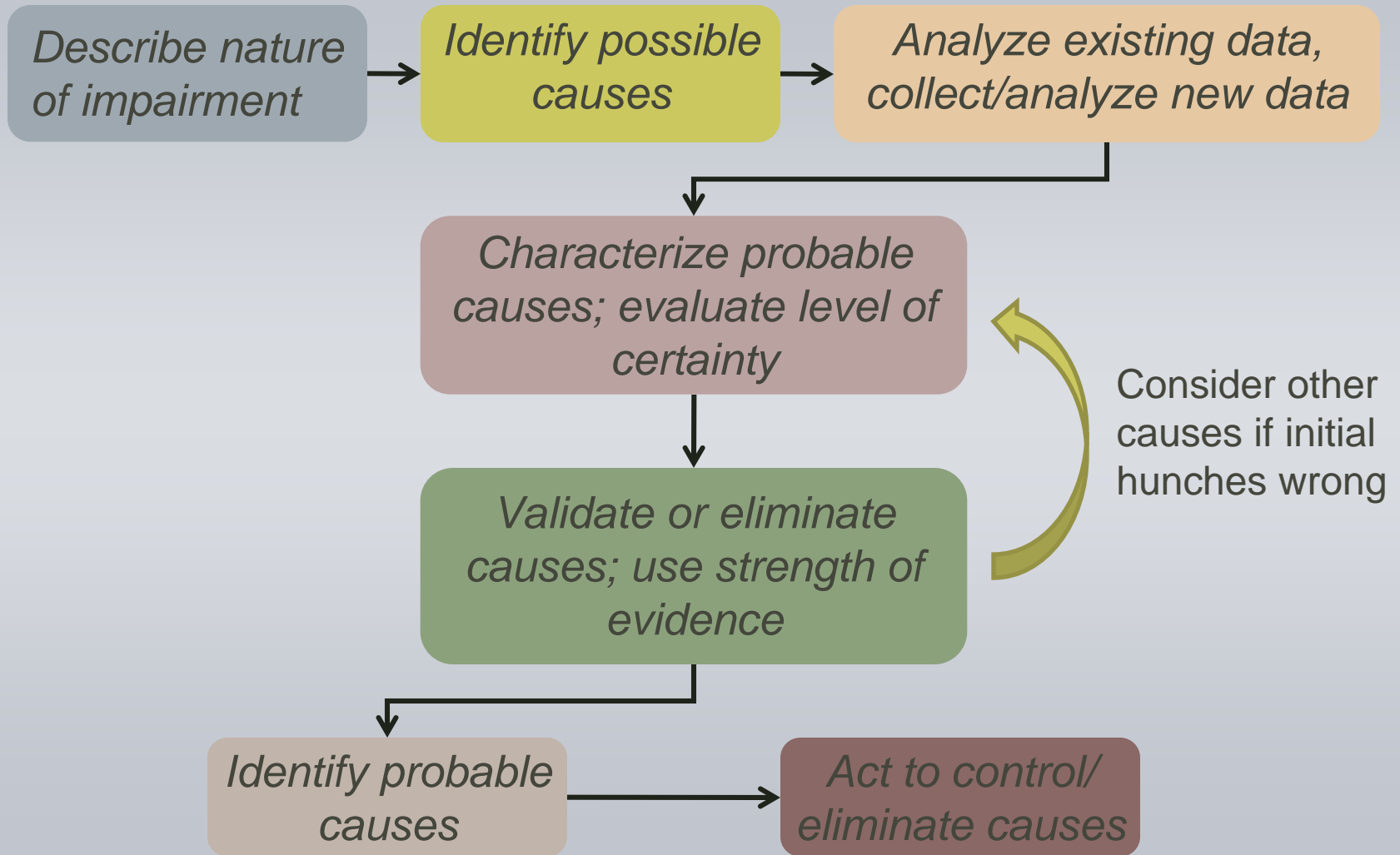
For low IBI score

- Ask:
 - What caused the river reach to get a low IBI score?
 - Where & under what conditions did impairment(s) occur?
- Look at individual metrics
- Use data to eliminate possible causes



Stressor identification process: stakeholder involvement

Minnesota Pollution Control Agency





Identified/examined possible causes

1. Temperature*
2. Excess fine sediment causing habitat loss**
3. Decreased dissolved oxygen levels*
4. Altered food sources due to excess nutrients*
5. Chronic or acute toxicity from chemical compounds*

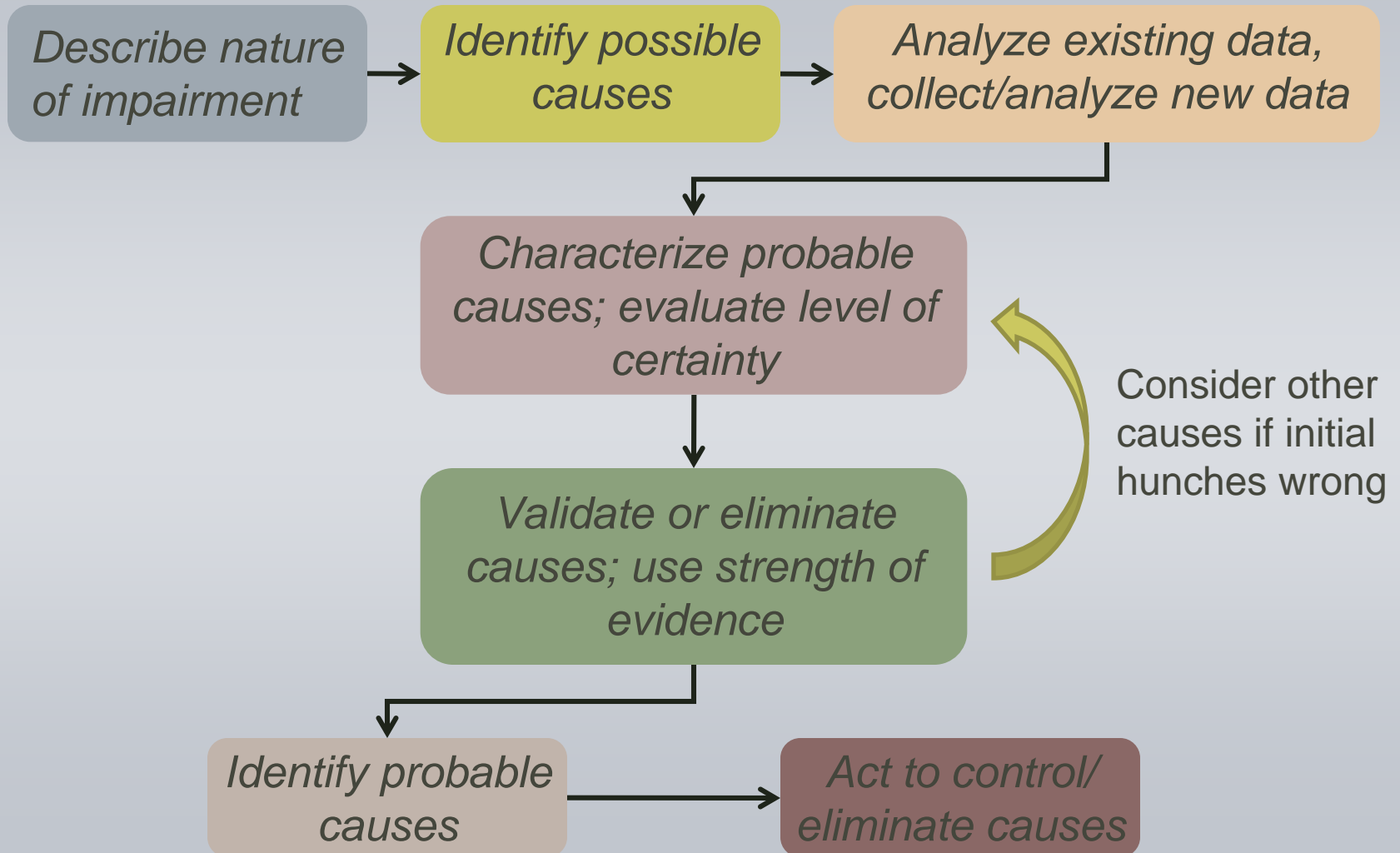
*not ruled out; needed more data

**identified as likely cause



Stressor identification process: stakeholder involvement

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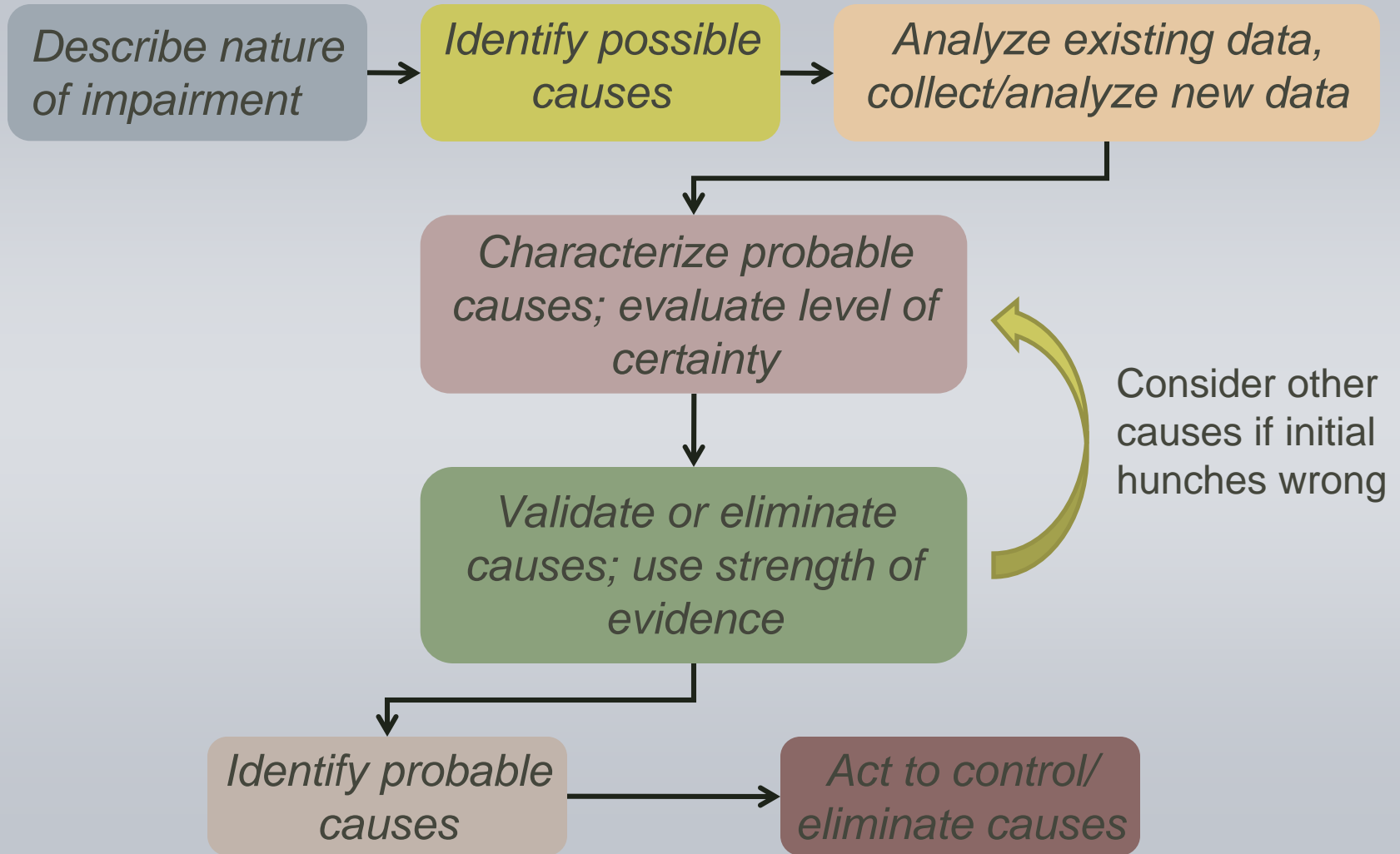
Newly-collected data analyzed

1. Identified data gaps
2. Collected/analyzed new data
 - DO
 - Toxics
 - Water quality
 - Additional IBI data



Stressor identification process: stakeholder involvement

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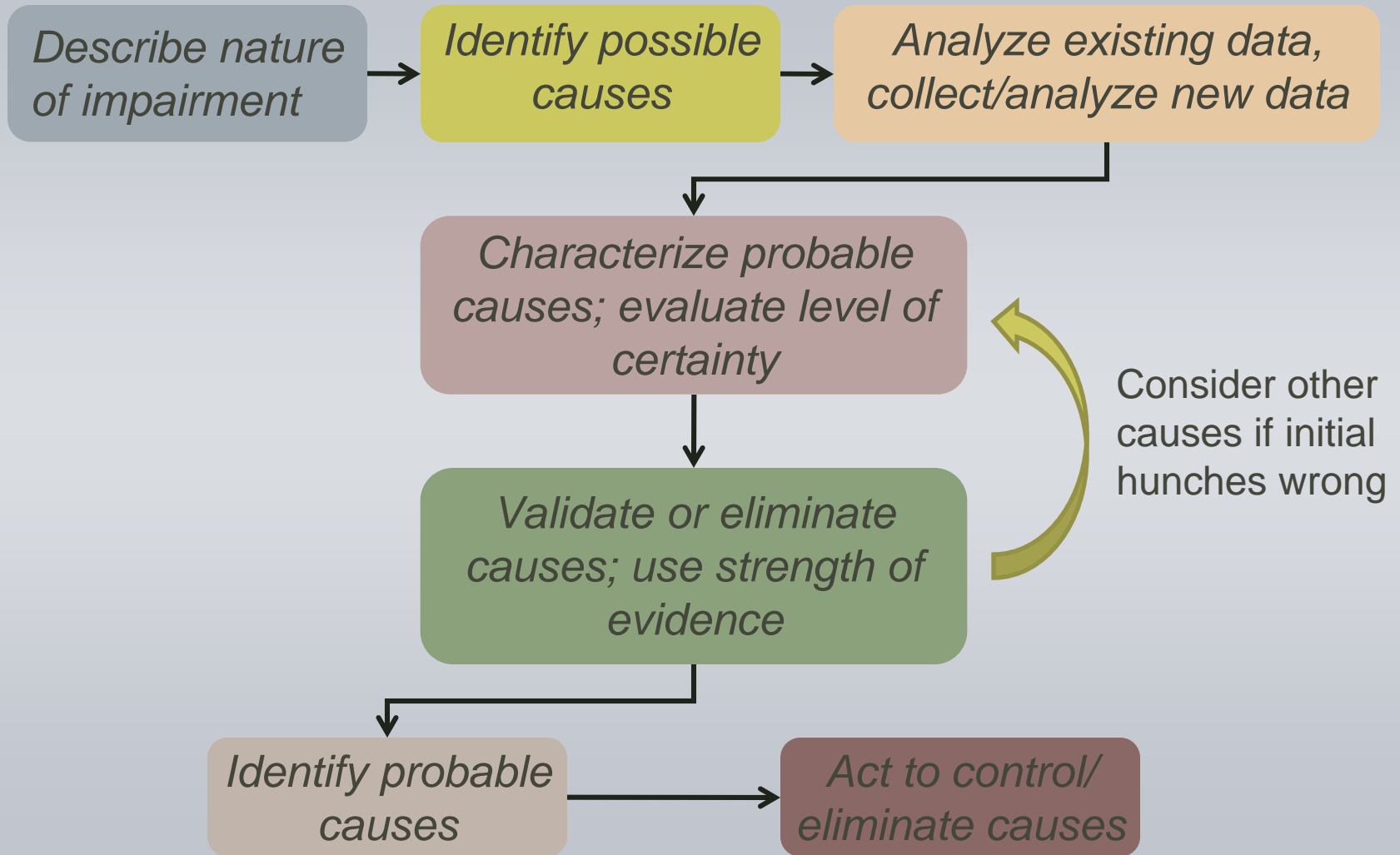
Characterized candidate sources of impairment

1 wastewater treatment facility	X Ruled out
16 gravel pits	? Not ruled out
Power right-of-way	X Ruled out
27 feedlots	? Not ruled out
Channel erosion	? Not ruled out
Streambed deposition	? Not ruled out



Stressor identification process: stakeholder involvement

Minnesota Pollution Control Agency





Validated or eliminated probable sources

Validated or eliminated sources based on

strength of evidence

(The point at which experts believe sufficient justification exists for a decision, despite a lack of hard data)



Validated or eliminated probable sources

Validated or eliminated sources based on
new data

Eliminated

- X Toxicity (acute & chronic)
- X Excess nutrients
- X Temperature
- X Low dissolved oxygen
- X Altered food resources due to excess nutrient loadings

Validated

- Loss of habitat due to unsuitable and unstable substrates and bank erosion



Probable cause of impairment

Fine sediment from bank erosion is believed to cause loss of habitat
(due to unstable or unsuitable stream substrates)





Stressor Identification Report

Screening Level Causal Analysis and Assessment
of an Impaired Reach of the Groundhouse River,
Minnesota

October 14, 2004

U.S. Environmental Protection Agency
National Exposure Research Lab
26 W. Martin Luther King Dr.
Cincinnati OH 45268

and

Minnesota Pollution Control Agency
520 Lafayette Rd.
St. Paul, MN 55155

- Screening Level Report
- Eliminated several possible causes of impairment
- Identified fine sediment as a candidate cause of impairment
- Identified data gaps where more information was needed to address other candidate causes



Stressor identification process: determined primary data gaps

Limited data

- Water quality data
- Geomorphic data

Spatial extent of impairment not understood (more bio-monitoring needed)



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2005: Developed a monitoring plan

- Water quality monitoring – 8 stations
- Winter dissolved oxygen survey
- Stream reconnaissance – DNR update
- Summer DO survey
- Stream flow monitoring
- Invertebrate monitoring – 12 sites
- Fish sampling – additional year
- Geomorphic data collection

~75% of data gaps filled at the end of 2005



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Developed interim water quality report

- Review of available data
(fecal coliform, TSS & VSS, conductivity, dissolved oxygen, nitrogen species, phosphorus)
- Temporal analysis
(year, season)
- Detailed fecal coliform analysis of 2005 data
- Flow analysis



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Watershed & Modeling Approach Interim Report

- Describes watershed characteristics
- Discusses development of watershed model
- Recommends field reconnaissance and gathering geomorphic data



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Biological Assessment Interim Report

- Further assessment of candidate causes
- Data review
- Detailed assessment of fish and macroinvertebrate data
- Update of stressor identification process



Candidate causes eliminated / validated based on new data

Eliminated

- X Toxicity (acute & chronic)
- X Excess nutrients
- X Temperature
- X Low dissolved oxygen
- X Altered food resources due to excess nutrient loadings

Validated

- Loss of habitat due to unsuitable and unstable substrates and bank erosion



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Next steps

Next Steps

1. Prepare draft TMDL report for EPA approval
2. Develop implementation plan
3. Conduct effectiveness monitoring
4. CWP/319 continuation grant to Snake River Watershed Management Board
5. Determine sources of impairment (detailed)
6. Document TMDL study (2008?)
7. Develop implementation plan



Summary – lessons learned

- Need a good, interdisciplinary team
- Important to keep technical team engaged throughout the process
- Developing a good monitoring plan is important
- It is a challenge to assemble data for a stressor ID process, however...





Summary – lessons learned

- The Stressor ID process works! (Helps to eliminate causes and sources, focuses attention on critical issues)
- Be disciplined! Don't jump ahead to conclusions before your Stressor Identification process is complete





For More Information

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