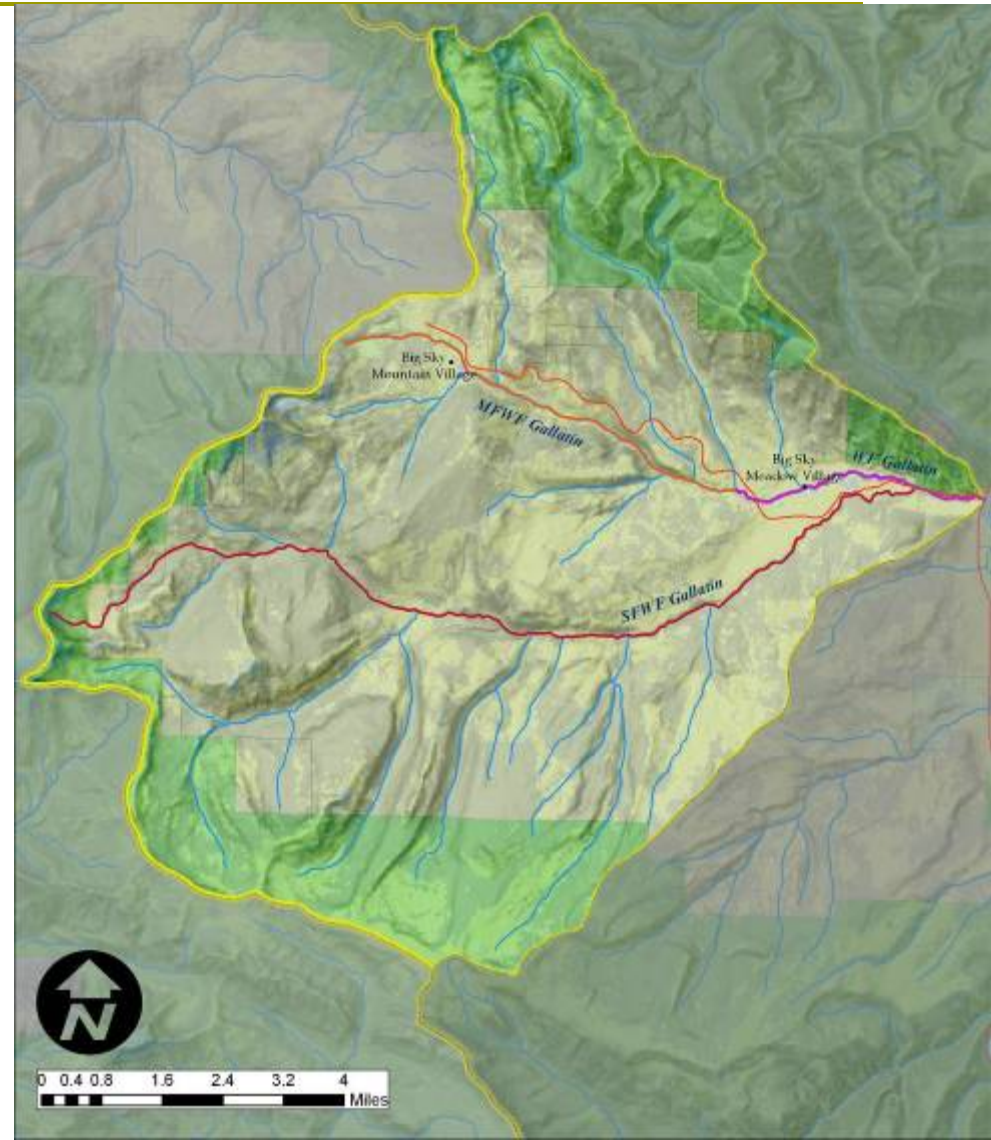


# SEDIMENT

- Middle Fork West Fork
- South Fork West Fork
- West Fork



# Sediment – Water Quality Standard

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- State water quality standards for sediment are 'narrative'
  - No increases are allowed above naturally occurring concentrations of sediment or suspended sediment, (except as permitted in 75-5-318, MCA), settleable solids, oils, or floating solids, which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish or other wildlife.
  - "Naturally occurring" = conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil and water conservation practices have been applied

# Sediment – Water Quality Targets

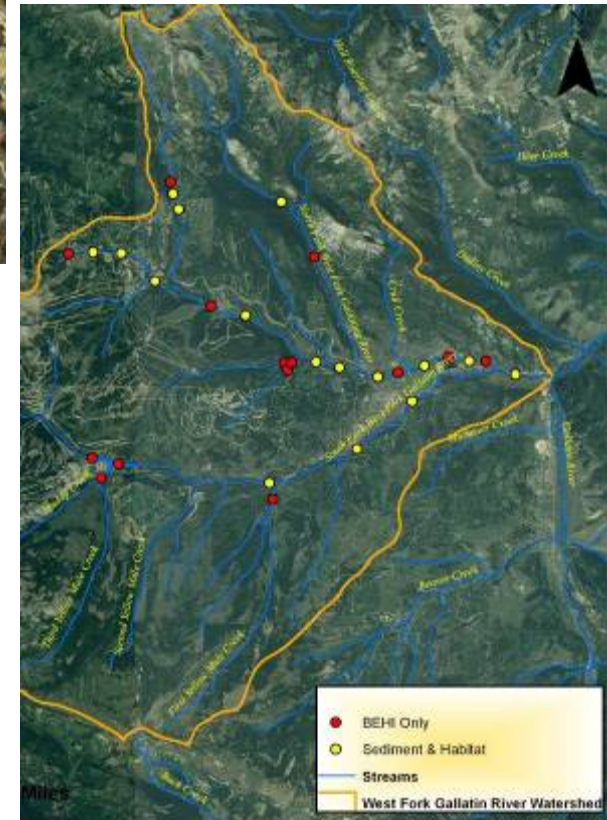
- ❑ To aid in the translation of the narrative standard, water quality targets are developed for a suite of sediment related parameters
- ❑ Water quality targets help define the degree of impact from sediment
- ❑ Values based on reference data, literature values, and sample data

Targets	Parameter Type
Percentage of <u>fine surface sediment &lt;6mm and &lt;2mm</u> in riffles based the reach <i>average of riffle pebble counts</i>	Fine sediment
Percentage of <u>fine surface sediment &lt;6mm</u> based on the reach <i>average of grid tosses</i> in riffles and pool tails	
Bankfull <u>width/depth ratio</u> , based on <i>median</i> of the channel cross-section measurements	Channel form and stability
<u>Entrenchment ratio</u> , based on <i>median</i> of the channel cross-section measurements	
LWD/mile; Pools/mile; Reach <i>average residual pool depth</i>	Instream habitat
Percent of <u>streambank with understory shrub cover</u> , expressed as the <i>average</i> of the greenline measurements	Riparian health
Macroinvertebrates	Biological indices
<i>Mean riffle stability index (RSI)</i>	Sediment supply & sources
Anthropogenic sediment sources	

# 2008 Sediment and Habitat Assessment



- 16 Full Assessment Sites
- 14 Bank erosion assessment sites



# Comparison to Targets

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- ❑ MFWF: failed to meet several targets, predominantly upstream of L. Levinsky
  - ❑ SFWF: borderline target compliance, largely habitat issues
  - ❑ WF: borderline target compliance, largely habitat issues
    - Significant controllable human sources identified
    - High risk of loading due to future growth
- Pursue TMDL for all listed water bodies

# Sediment – Source Assessment

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- ❑ Natural erosion as a result of climatic and hydrologic processes
  
- ❑ Human Influenced Sediment/Erosion
  - Roads
  - Upland Sources
    - ❑ Residential/Resort Development
    - ❑ Ski areas
  - Bank Erosion
    - ❑ Riparian Degradation/Removal
    - ❑ Timber Harvest
    - ❑ Residential/Resort Development
  - Point Sources
    - ❑ Construction Stormwater

# Roads Assessment

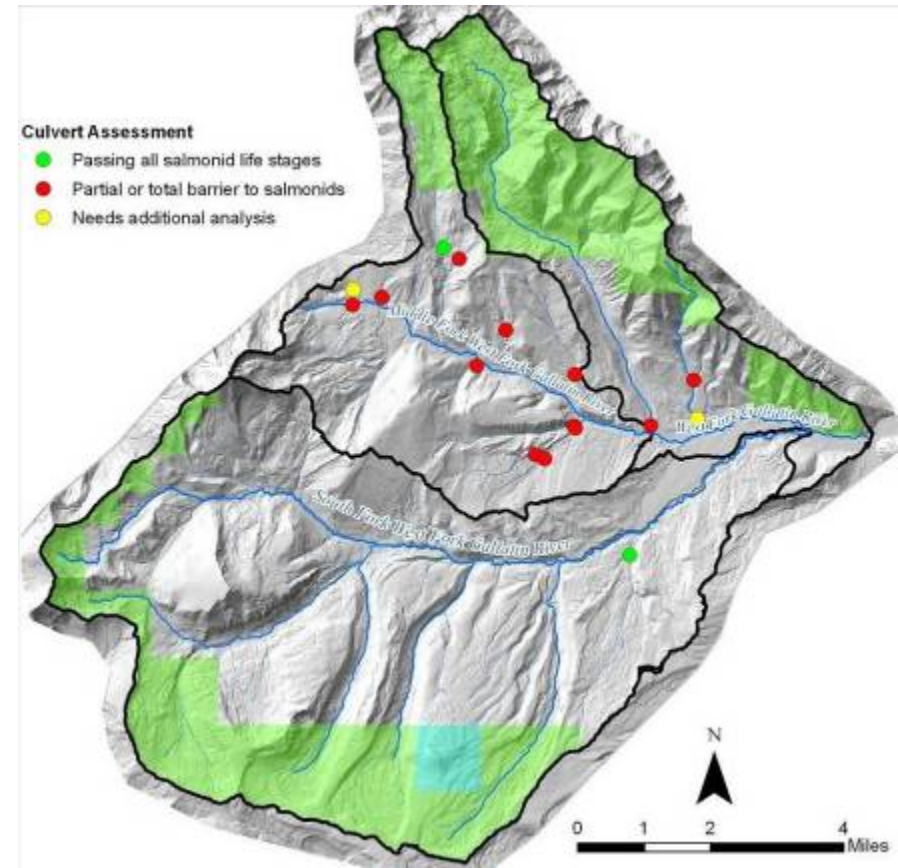
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- Paved and unpaved crossings
- Traction sand



# Culvert Assessment

- Fish passage and risk of failure
  - 13/17 failed fish passage criteria
  - 47% of culverts evaluated as <25 year event





# Upland Erosion

- Modeled upland contribution from natural, residential, and ski area sources



# Bank Erosion



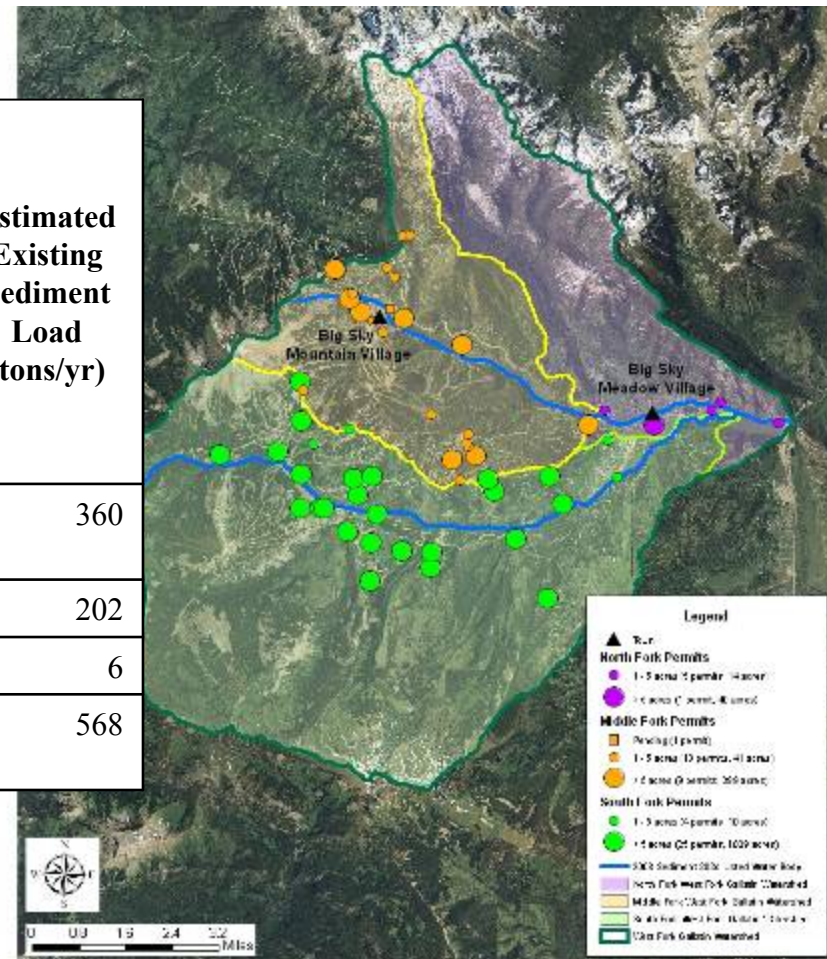
- Assessed eroding banks during field assessments and extrapolated to similar reaches
- Evaluated sources



# Point Sources

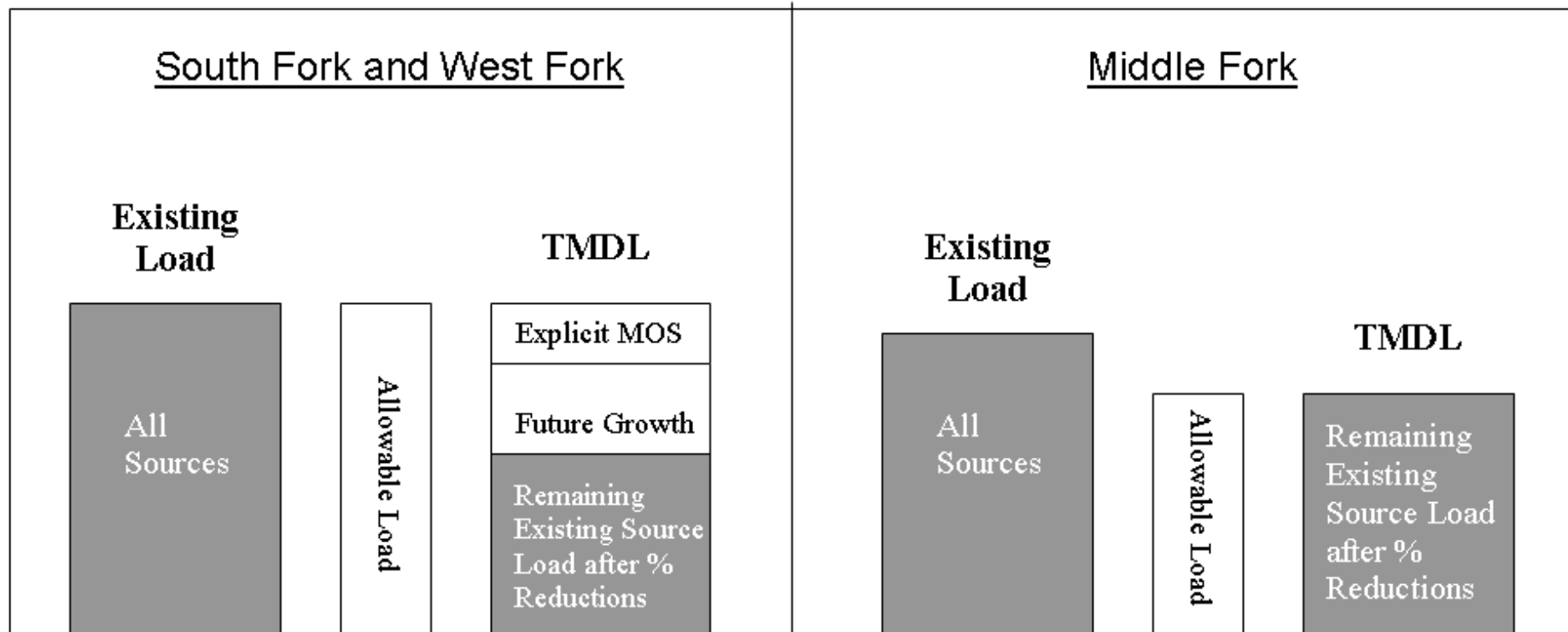
- No municipal or individual sediment point sources
- 58 construction stormwater permits

Sub-watershed	Permitted Total Acreage	Adjusted Annualized Disturbed Acres for Permits	Total Acres Disturbed/ Sparsely Vegetated Soil from Upland Model	Percent of Annualized Permitted Acres to Modeled Disturbed Acres	Estimated Existing Sediment Load (tons/yr)
Middle Fork	440	214	613	35%	360
South Fork	1,039	449	489	92%	202
West Fork	54	34	150	23%	6
Entire West Fork*	1,532	697	1,252	56%	568



# TMDL Approach

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# TMDL and Allocations Example: Middle Fork West Fork

Sediment Sources		Current Estimated Load (Tons/Year)	Total Allowable Load (Tons/Year)	Sediment Load Allocation (% reduction)
<b>Roads</b>	Culverts	Not quantified	No loading from undersized, improperly installed, or inadequately maintained culverts	
	Road Crossings	4.8	1.7	65%
	Traction Sand	84	23	73%
	<b>Total</b>	<b>89</b>	<b>25</b>	<b>72%</b>
<b>Streambank Erosion</b>	Human Caused	145	86	41%
	Natural	349	349	N/A
	<b>Total</b>	<b>494</b>	<b>435</b>	<b>12%</b>
<b>Upland Erosion</b>	Natural	1,661	1,661	N/A
	Residential	3,915	2,623	37%
	Ski Area	2,092	1,152	
	<b>Total</b>	<b>7,668</b>	<b>5,436</b>	<b>29%</b>
<b>Point Sources</b>	Construction Stormwater Permits	<b>360</b>	<b>229</b>	<b>36%</b>
<b>Total Sediment Load</b>		<b>8,611</b>	<b>6,125</b>	<b>TMDL = 29%</b>

# TMDL and Allocations Example: West Fork

Sediment Sources		Current Estimated Load (Tons/Year)	Total Allowable Load (Tons/Year)	Sediment Load Allocation (% reduction)
<b>Roads</b>	Culverts	Not quantified	No loading from undersized, improperly installed, or inadequately maintained culverts	
	Road Crossings	8.1	2.9	64%
	Traction Sand	155	42	73%
	<b>Total</b>	<b>163</b>	<b>45</b>	<b>72%</b>
<b>Streambank Erosion</b>	Human Caused	604	418	31%
	Natural	1,217	1,217	N/A
	<b>Total</b>	<b>1,821</b>	<b>1,635</b>	<b>10%</b>
<b>Upland Erosion</b>	Natural	16,991	16,991	N/A
	Residential	8,580	5,565	36%
	Ski Area	2,915	1,843	
	<b>Total</b>	<b>28,486</b>	<b>24,399</b>	<b>14%</b>
<b>Point Sources</b>	Construction Stormwater Permits	<b>568</b>	<b>364</b>	<b>36%</b>
<b>Future Growth</b>	All Sources	N/A	<b>3,043</b>	<b>N/A</b>
<b>5% Explicit Margin of Safety</b>			<b>1,552</b>	<b>N/A</b>
<b>Total Sediment Load</b>		<b>31,038</b>	<b>31,038</b>	<b>0%</b>

# TMDL Implementation

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- ❑ Overall...excess sediment is associated with historical land management practices and rapid land development
  - Key Factors:
    - ❑ Smart planning relative to stormwater and floodplain management that considers cumulative impacts
    - ❑ Consistent application and maintenance of BMPs during residential and commercial construction
      - Follow permit requirements and SWPPP to meet WLA
    - ❑ Utilize BMPs during road construction and traction sand application. Consider fish and aquatic organism passage during culvert installation/replacement
    - ❑ Riparian BMPs