

# WATER USE IN THE UPPER YELLOWSTONE



KERRI STRASHEIM

MT DNRC

# THREE MAIN TAKE-HOME POINTS

- THE WATER IS MOSTLY ALL SPOKEN FOR
- DEVELOPMENT IMPACTS THE SYSTEM (PAST, PRESENT, AND FUTURE)
- THE FUTURE WILL BRING CHANGE - HOW WILL WATER USERS ADAPT AND REMAIN RESILIENT?

# THE WATER IS MOSTLY ALL SPOKEN FOR

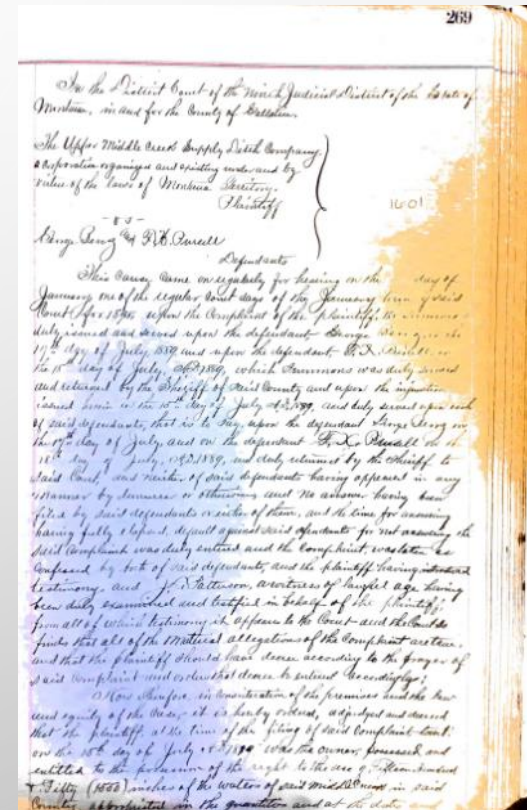
- HOW WE CAN COME TO THIS CONCLUSION
- WHAT DOES THIS MEAN?
- WHAT IS THE WATER USED FOR?



# THE WATER IS MOSTLY ALL SPOKEN FOR

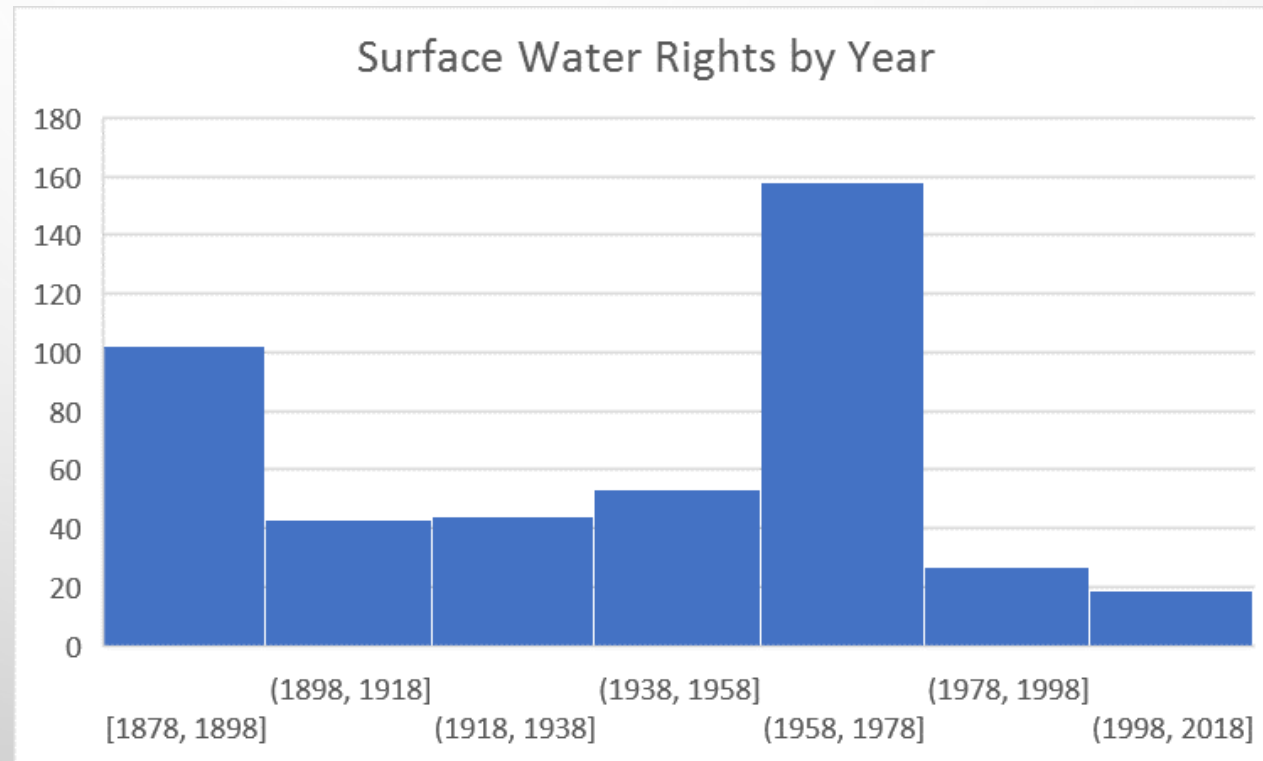
## WATER RIGHT BACKGROUND

- PRIOR APPROPRIATION DOCTRINE (WESTERN)
- WATER RIGHTS ALREADY DEFINED BY PRIORITY
- ADAPTABLE SYSTEM FOR THE ARID WEST
- LATE SEASON WATER SHORTAGES COMMON



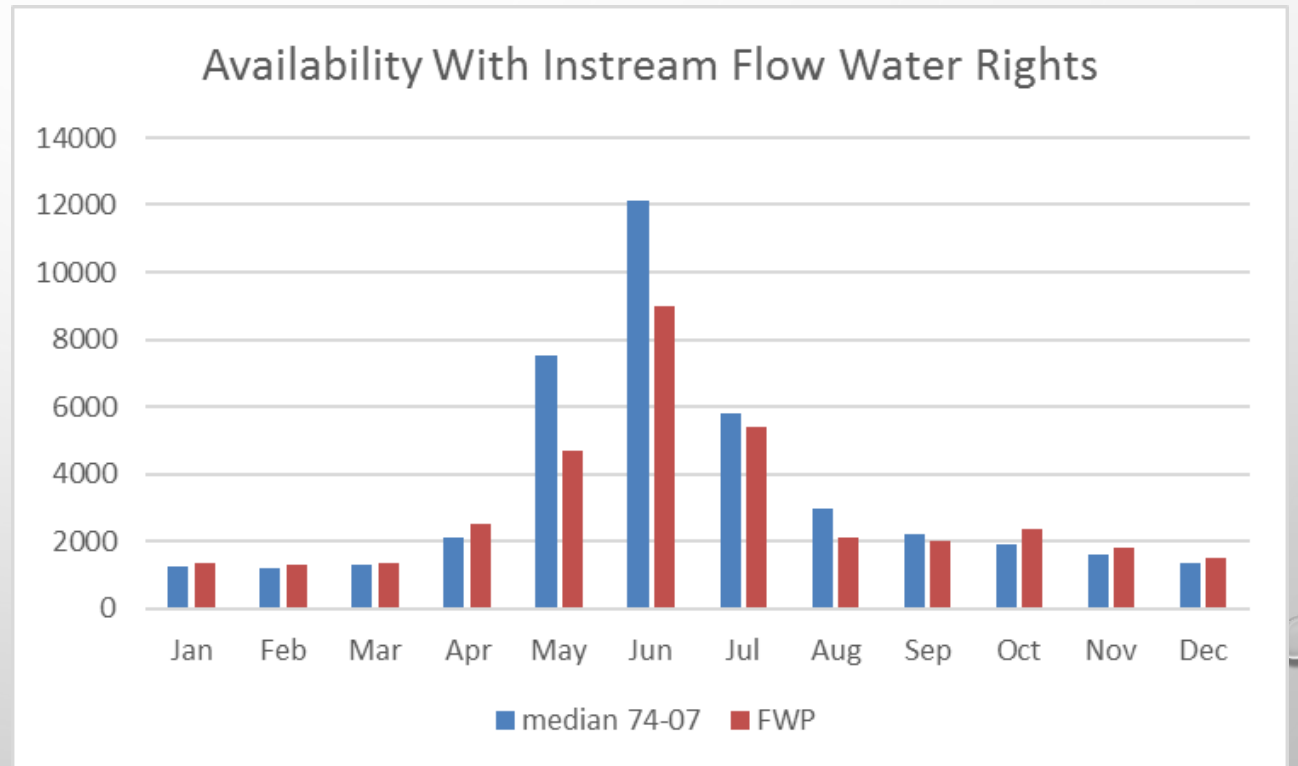
# THE WATER IS MOSTLY ALL SPOKEN FOR

SURFACE WATER DEVELOPMENT  
BY PRIORITY DATE IN THE  
UPPER YELLOWSTONE  
(1878 – 2018 = 140 YEARS)



# THE WATER IS MOSTLY ALL SPOKEN FOR

COMPARISON OF MEDIAN OF THE  
MEAN MONTHLY FLOWS IN THE  
YELLOWSTONE RIVER AT LIVINGSTON  
WITH MT FWP INSTREAM FLOW  
WATER RIGHTS (PRIORITY OF 1970  
AND 1978)



# THE WATER IS MOSTLY ALL SPOKEN FOR

## WHAT DOES THIS MEAN? CLOSED BASIN VS OPEN BASIN

- IN A **CLOSED BASIN:**
  - ALL SURFACE WATER HAS ALREADY BEEN APPROPRIATED, GENERALLY
  - GROUNDWATER CONNECTED TO SURFACE WATER, SO GROUNDWATER ALSO ESSENTIALLY “CLOSED”
  - PERMIT EXEMPTIONS (“EXEMPT WELLS”) STILL ALLOWED (SMALL GROUNDWATER USES)
  - PERMITTING A NEW USE HAS TO MITIGATE WITH AN OLD USE
  - PERMIT/CHANGE PROCESS IS LENGTHY



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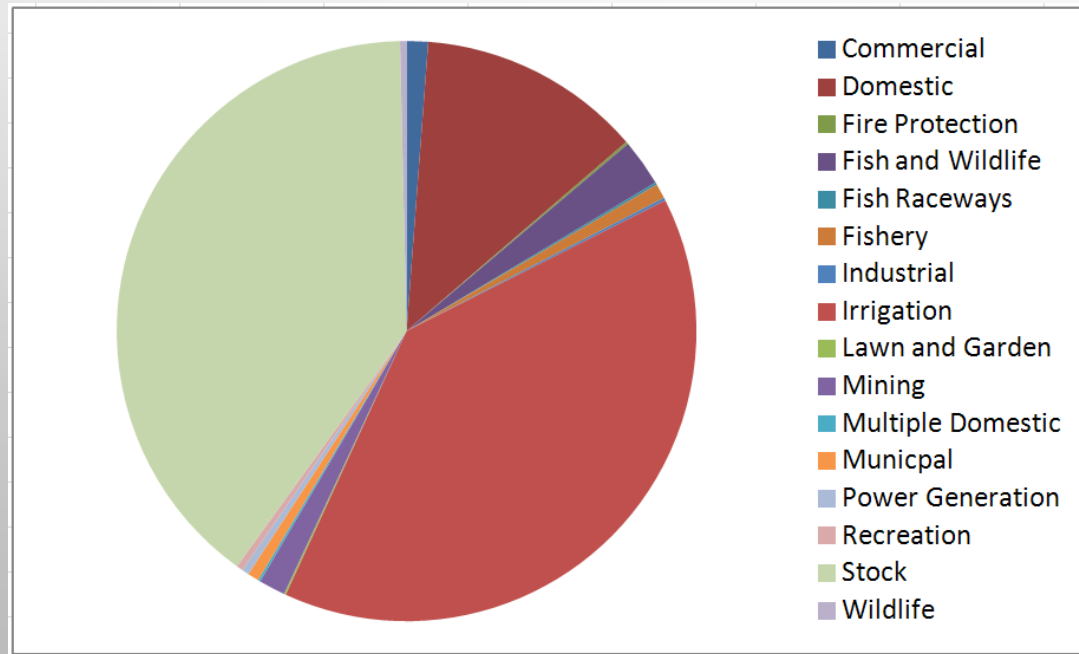
## WHAT DOES THIS MEAN? CLOSED BASIN VS OPEN BASIN

- IN AN **OPEN BASIN**:
  - SAME PROCESS FOR DETERMINING AVAILABILITY
  - GROUNDWATER ANALYSIS IS THE SAME
  - BECAUSE SOME WATER IS AVAILABLE, MITIGATION ISN'T REQUIRED FOR FULL CONSUMPTION
  - UPPER YELLOWSTONE HAS MONTHS WHERE WATER IS NOT AVAILABLE, SO PARTIAL MITIGATION FOR NEW LARGE GROUNDWATER USES IS NOW REQUIRED



# THE WATER IS MOSTLY ALL SPOKEN FOR

- WHAT IS THE WATER USED FOR?
- BASED ON NUMBER OF WATER RIGHTS – NOT VOLUME



<u>PURPOSE</u>	<u># WRs</u>
Commercial	36
<b>Domestic</b>	<b>379</b>
Fire Protection	4
Fish and Wildlife	79
Fish Raceways	4
Fishery	25
Industrial	5
<b>Irrigation</b>	<b>1190</b>
Lawn and Garden	3
Mining	45
Multiple Domestic	4
Municipal	19
Power Generation	12
Recreation	11
<b>Stock</b>	<b>1202</b>
Wildlife	11
<b>Total</b>	<b>3029</b>

# THE WATER IS MOSTLY ALL SPOKEN FOR

- WHAT IS THE WATER USED FOR?
- THIS REPRESENTS VOLUME OF DIVERTED USE

## Water Use 2010 (gallons/day)

**Irrigation** (mostly surface water) 273,800,000 (98%)

**Public supply** (groundwater) 2,400,000 (1%)

**Aquaculture** (surface water) 1,000,000

**Self-supplied domestic** (groundwater) 430,000

**Mining:** 40,000

**Industrial:** 29,000

**Total water use:** 278,530,000

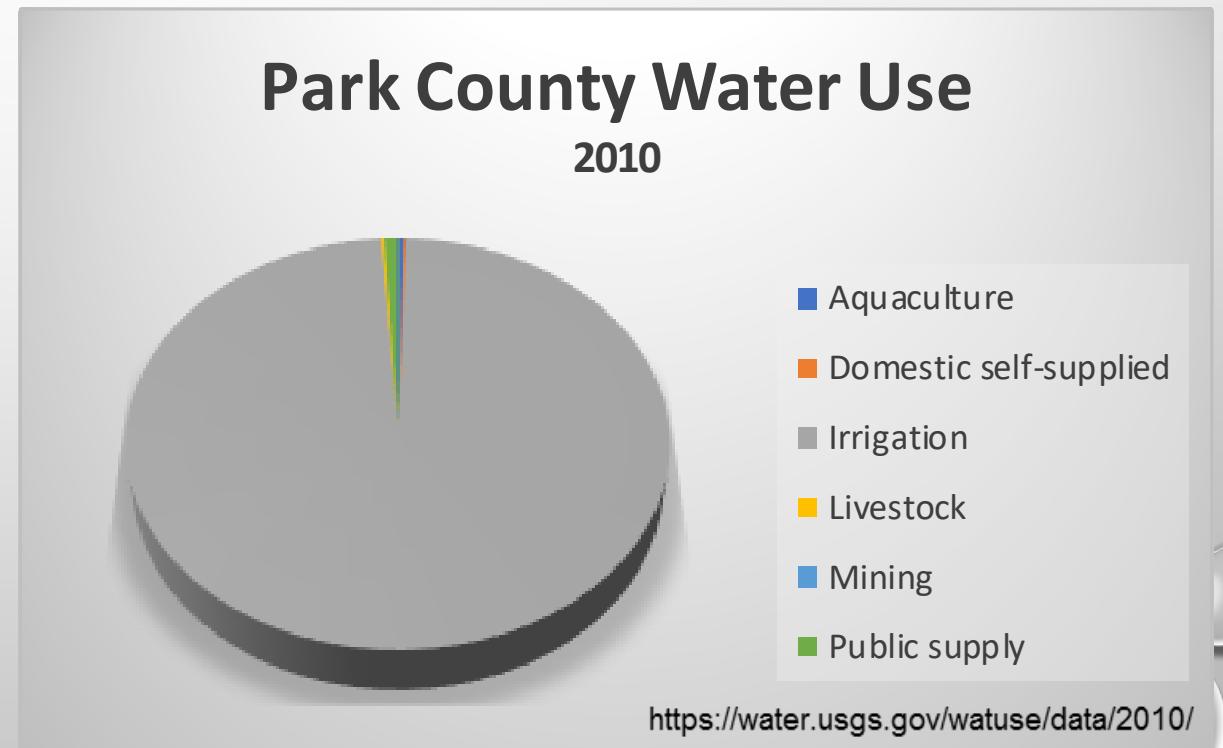
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**Residents served by public supply:** 10,154

**Residents served by domestic wells:** 5,482

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**Irrigated acreage:** 61,459 acres (2007, DNRC); 45,870 acres, 20% flood irrigation (2010, USGS) \*Note that irrigated acreage varies yearly based on constraints ranging from water availability to market factors.



# THE WATER IS MOSTLY ALL SPOKEN FOR

- IN THE UPPER YELLOWSTONE WATERSHED
  - FLOW RATES FOR ALL DIVERSIONARY WATER RIGHTS TOTAL 2228.18 CFS
  - FLOW RATES FOR ALL IRRIGATION WATER RIGHTS TOTAL 2152.4 CFS (96.6%)
  - *(UNPERFECTED CONSERVATION DISTRICT IRRIGATION = 433.9 CFS UP TO 62,538.6 AF)*
- SOME ILLUSTRATIVE BUT NOT ROBUST MATH:

	Median of the Mean Monthly Gage Flow at Livingston (CFS)	Maximum Diversion Amount (CFS)	Possible Maximum Full Flow (CFS) (70% Efficiency Factor)	<b>ROUGH</b> Percentage of Flow Diverted (CFS)
May	7518	2228.2	9077.7	<b>25%</b>
June	12125	2228.2	13684.7	<b>16%</b>
July	5800	2228.2	7359.7	<b>30%</b>
August	2981	2228.2	4540.7	<b>49%</b>
September	2221	2228.2	3780.7	<b>59%</b>

# DEVELOPMENT IMPACTS THE SYSTEM (PAST, PRESENT, AND FUTURE)

- BACK BEFORE SETTLEMENT BUT AFTER GLACIERS
  - BEAVERS! STORING WATER NATURALLY
  - (NO WATER RIGHT NEEDED)



Beaver dams create and maintain wetland habitat.



Pictures from MT FWP:

<http://fwp.mt.gov/fishAndWildlife/livingWithWildlife/beavers/ecology.html>

# DEVELOPMENT IMPACTS THE SYSTEM (PAST, PRESENT, AND FUTURE)

- IRRIGATION SYSTEMS (1870'S TO 1970'S)
  - COMPLEX NETWORKS OF DITCHES
  - FLOOD IRRIGATED FIELDS
  - LOTS OF WATER SPREAD OVER THE LAND, DELAYING RETURN TO THE RIVER AND SUPPLEMENTING THE AQUIFER AND LATE SEASON FLOWS
- CHANGING IRRIGATION SYSTEMS (1970S TO PRESENT)
  - DITCHES GETTING PIPED AND LINED AND CONSOLIDATED
  - SPRINKLER/PIVOT IRRIGATED FIELDS
  - LESS WATER DIVERTED AND RETURNED TO THE RIVER, LESS AQUIFER SUPPLEMENTATION



# DEVELOPMENT IMPACTS THE SYSTEM (PAST, PRESENT, AND FUTURE)

- CURRENT WATER USE TRENDS IN THE UPPER YELLOWSTONE
  - INSTREAM FLOW
    - YELLOWSTONE CUTTHROAT TROUT
  - PONDS
  - CLEAN-UP OF IRRIGATION WATER RIGHTS TO REFLECT CHANGES IN THE PLACE OF USE, GENERALLY RESULTING FROM CONVERSIONS TO PIVOTS
  - DOMESTIC DEVELOPMENT (INDIVIDUAL HOUSE WELLS)



# THE FUTURE WILL BRING CHANGE

- CURRENTLY, WHO MANAGES UPPER YELLOWSTONE WATER?
  - DNRC WATER RESOURCES AND THE MONTANA WATER COURT PROVIDE THE LEGAL FRAMEWORK FOR USE OF THE WATER (WATER RIGHTS)
  - WATER USERS AND LANDOWNERS ARE MANAGING THE WATER ON THE GROUND
  - OTHER STATE AND FEDERAL AGENCIES (US NPS, CLEAN WATER ACT, ETC.)
  - DNRC WATER RESOURCES ALSO MANAGES COMPACTS AND TREATIES, DAM SAFETY, FLOODPLAIN EFFORTS
  - CONSERVATION DISTRICTS AND WATERSHED GROUPS



# THE FUTURE WILL BRING CHANGE

- MOUNTAIN VALLEY SYSTEMS ARE SEEING THE FOLLOWING CHANGES
  - CHANGES IN RUNOFF PATTERNS – EARLIER PEAKS
  - CHANGES IN RAIN PATTERNS
  - CHANGES IN AQUIFER LEVELS
    - CHANGES IN LATE SEASON FLOW (LESS RETURN FLOWS DUE TO LESS FLOOD IRRIGATION?)
    - CHANGES IN WATER CONVEYANCES (LESS SEEPAGE FROM DITCHES?)
  - CHANGES IN LAND USE



# THE FUTURE WILL BRING CHANGE



# THE FUTURE WILL BRING CHANGE

- BENEFITS OF PLANNING, SUCH AS A **DROUGHT MANAGEMENT PLAN**
  - RECOGNITION OF SHARED RESOURCE
  - COLLABORATIVE EFFORT
  - MUTUALLY-AGREED-UPON PLAN IN PLACE WHEN NOT ALL WATER USES CAN BE SATISFIED
  - CAN PRESENT A UNIFIED FRONT
  - CAN HAVE A PROCESS IN PLACE TO ASSIST WITH CONFLICT RESOLUTION
  - CAN TRIGGER PUBLIC AWARENESS/OUTREACH BEFORE REACHING CRISIS STAGE



# THE FUTURE WILL BRING CHANGE

- DEVELOP TOOLS AND TRIGGERS SPECIFIC TO THE UPPER YELLOWSTONE
- EXISTING TOOLS IN PLACE, WITH RESPECT TO WATER RIGHTS
  - CONTROLLED GROUNDWATER AREAS
  - TEMPORARY LEASING FOR INSTREAM FLOW
  - TEMPORARY LEASING FOR ANY USE



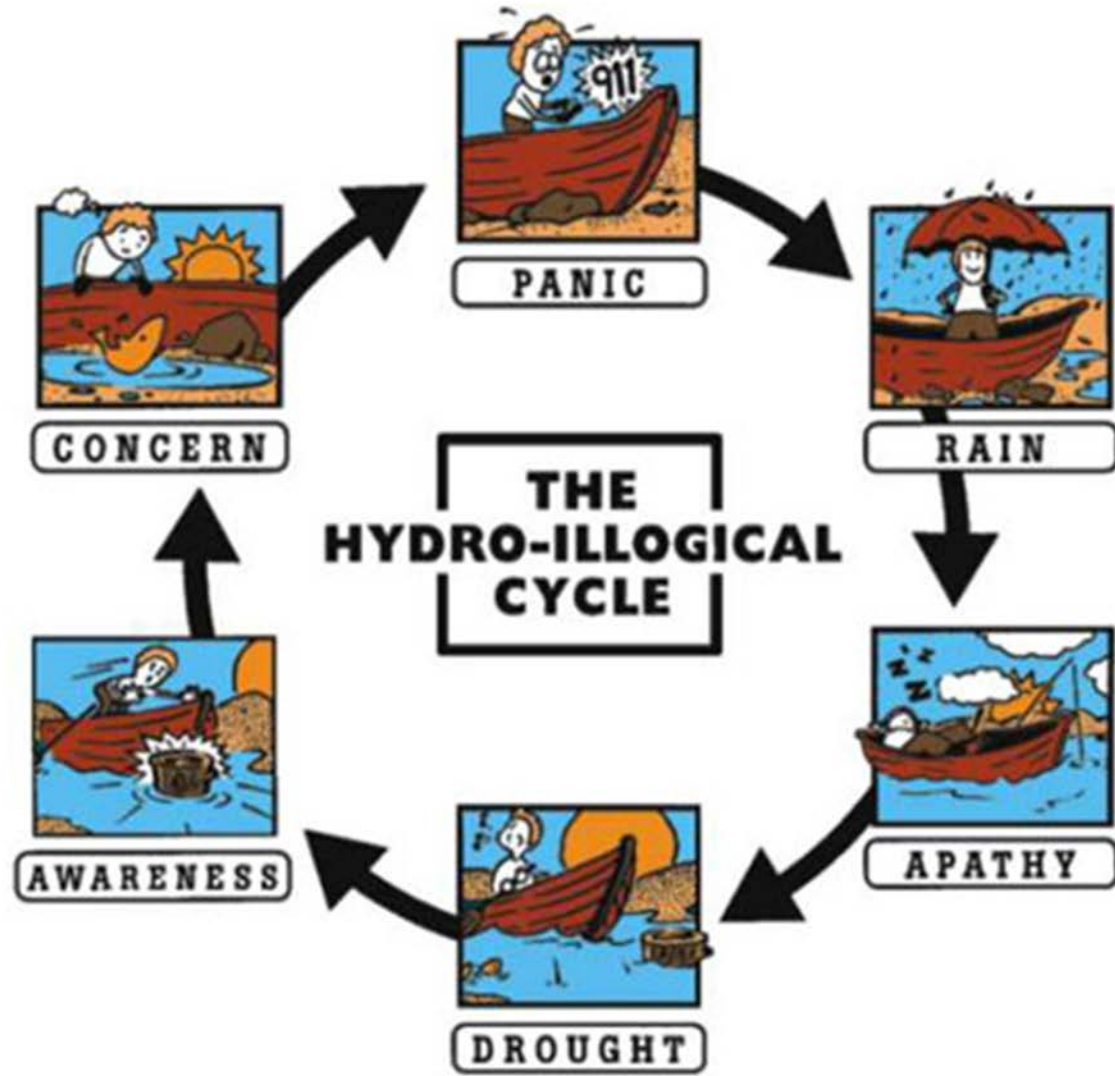
# THE FUTURE WILL BRING CHANGE

## PLANNING CAN TAKE PLACE AT ALL LEVELS

- INTEGRATED WATER PLANNING TOOLBOX WILL BE AVAILABLE (UPPER MISSOURI DROUGHT PLANNING PROJECT)
- STATE LEVEL – STATE WATER PLAN, STATE DROUGHT PLAN
- COUNTY LEVEL
- WATERSHED LEVEL AND WATER USER GROUP LEVEL
- PUBLIC WATER SUPPLY LEVEL
- INDIVIDUAL LEVEL (LANDSCAPE PLANNING, KNOW YOUR WELL, ETC.) (RANCH DROUGHT PLAN EXAMPLES AVAILABLE:

[HTTP://DROUGHT.UNL.EDU/RANCHPLAN/WRITEAPLAN/SAMPLEDDROUGHTPLANS.ASPX](http://drought.unl.edu/ranchplan/writeaplan/sampleddroughtplans.aspx) )





# MAINTAINING RESILIENCE THROUGH CHANGE

- CONSERVATION!
- WORKING TOGETHER TO USE THE WATER MOST EFFECTIVELY
- DEFINING DESIRED CONDITIONS TO MAINTAIN AND LOCAL PRIORITIES
- TALK TO YOUR NEIGHBORS TO INCREASE AWARENESS
- BE WATER AWARE





# Questions?



DNRC Photo – Passage Creek



Kerri Strasheim  
Regional Manager  
406-556-4504  
[kstrasheim@mt.gov](mailto:kstrasheim@mt.gov)