

The Watersheds of Flagstaff

A brief overview of the streams and washes of Flagstaff

Friends of the Rio meeting

September 5th, 2019



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City of Flagstaff Stormwater



Organization of the presentation

- **Background** – Flagstaff Stormwater, Watershed Management Plan, Floodplain Management Plan
- **Background** – geology, physiographic province
- **Stream and watershed basics**
- **Watersheds of Flagstaff**
- **Current Watershed health**
- **2019 Flagstaff maintenance**
- **Museum Fire mitigation details**
- **Questions, Answers, and Shoulder Shrugs**

City of Flagstaff Stormwater

Who are we?

5 staff mandated with maintaining city drainage, open channel maintenance, FEMA floodplain program, EPA Clean Water Act (NPDES), IBC building code, and state mandates. Additional duties include stream restoration, open space improvements, and disaster response.

Why this talk now?

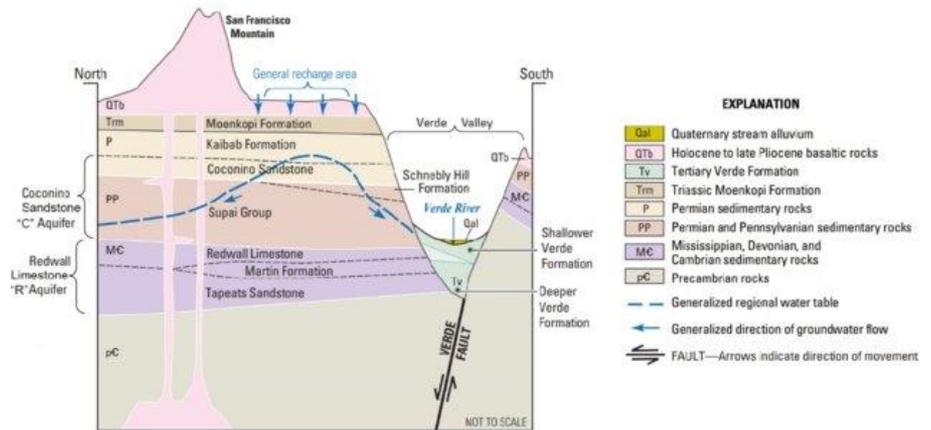
Friends of the Rio Watershed Management Plan

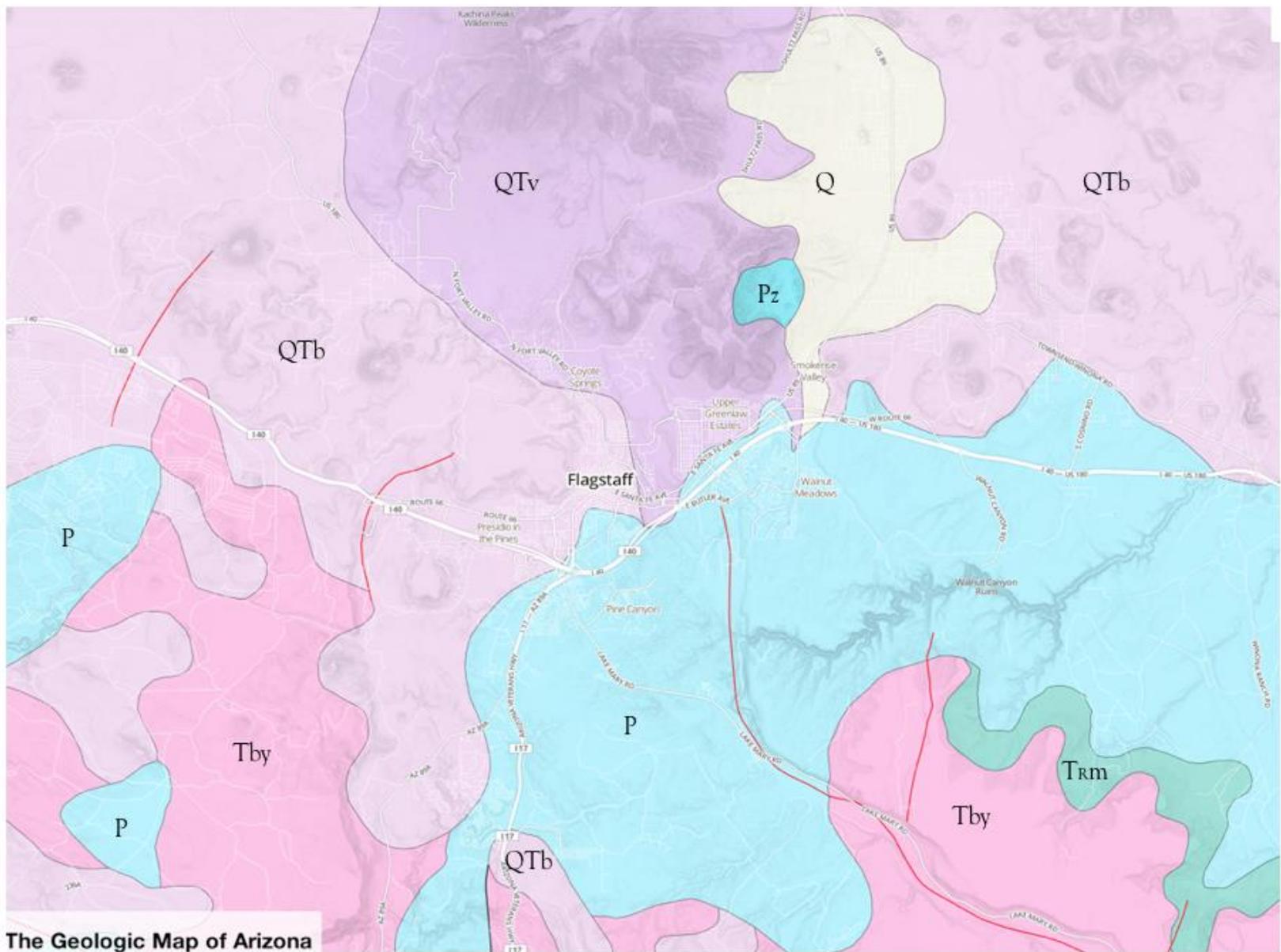
City Floodplain Management Plan (FEMA mandated)

City administered Rio de Flag hydrology study

Physiographic province

Geology





The Geologic Map of Arizona

Pz	P	TRm	Tby	QTv	QTb	Q
sedimentary rock 248-544 Ma	Kaibab Limestone 270-280 Ma	Moenkopi 230-245 Ma	basalt 4-8 Ma	rhyolite - andesite 0-4 Ma	basalt 0-4 Ma	alluvial deposits 0-2 Ma



Jawbone Cave (photo credit: Ben Tobin), basalt ceiling, limestone floor

Some take aways:

The streams of Flagstaff are ephemeral, largely due to geology and not climate.

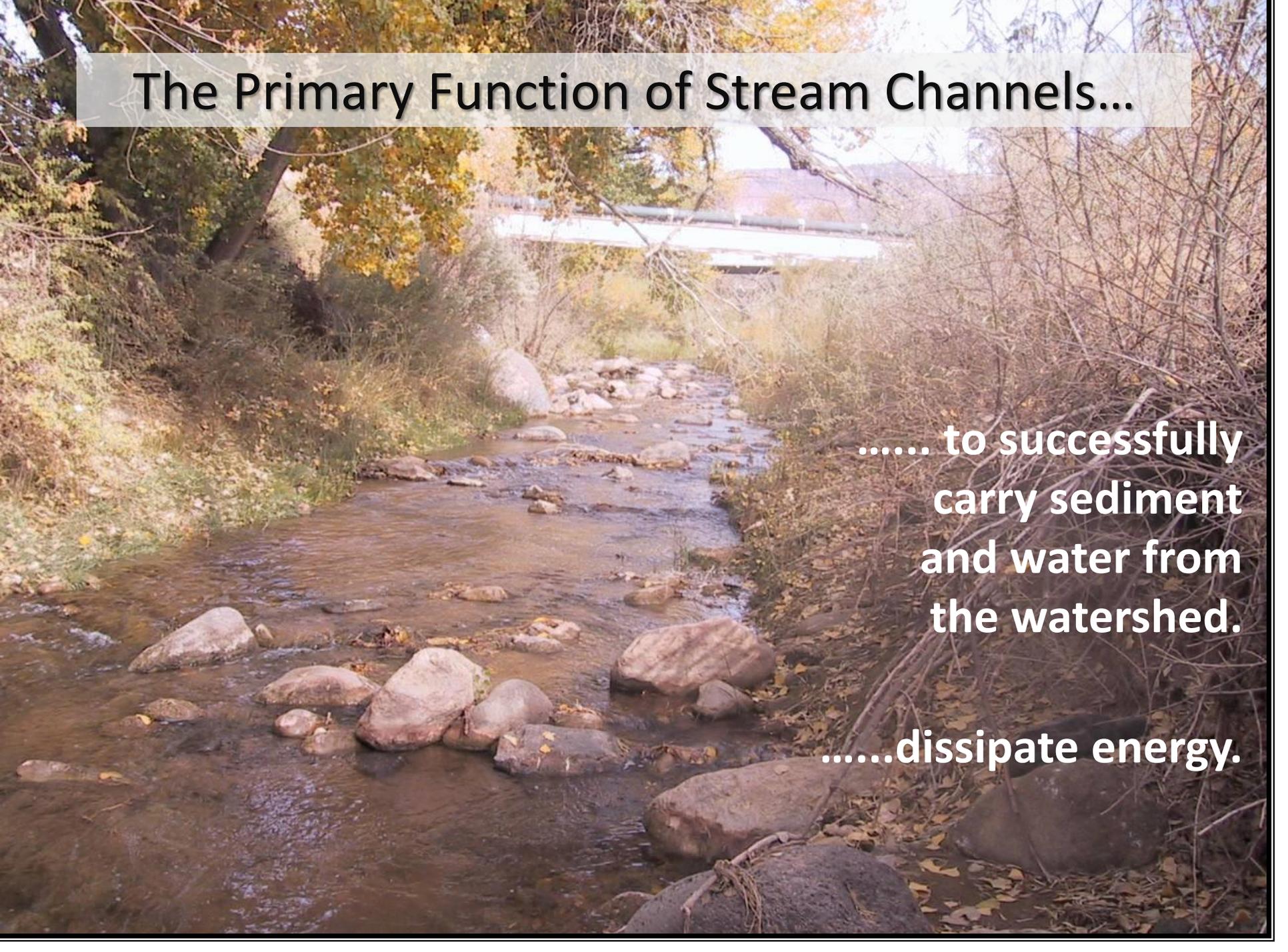
Our watersheds are historically “complacent” for the same reason and due to forest type

Disturbances, such as fire and urbanization, drastically change the watershed and stream behavior

The Primary Function of Stream Channels...

..... to successfully
carry sediment
and water from
the watershed.

.....dissipate energy.



Streams Create Specific Features In The Course Of Their Work

The purpose of a stream is to carry water and sediment...

GEOMORPHIC
FLOODPLAIN

Carries high flows



TERRACE

Abandoned floodplain
Carries very high flows

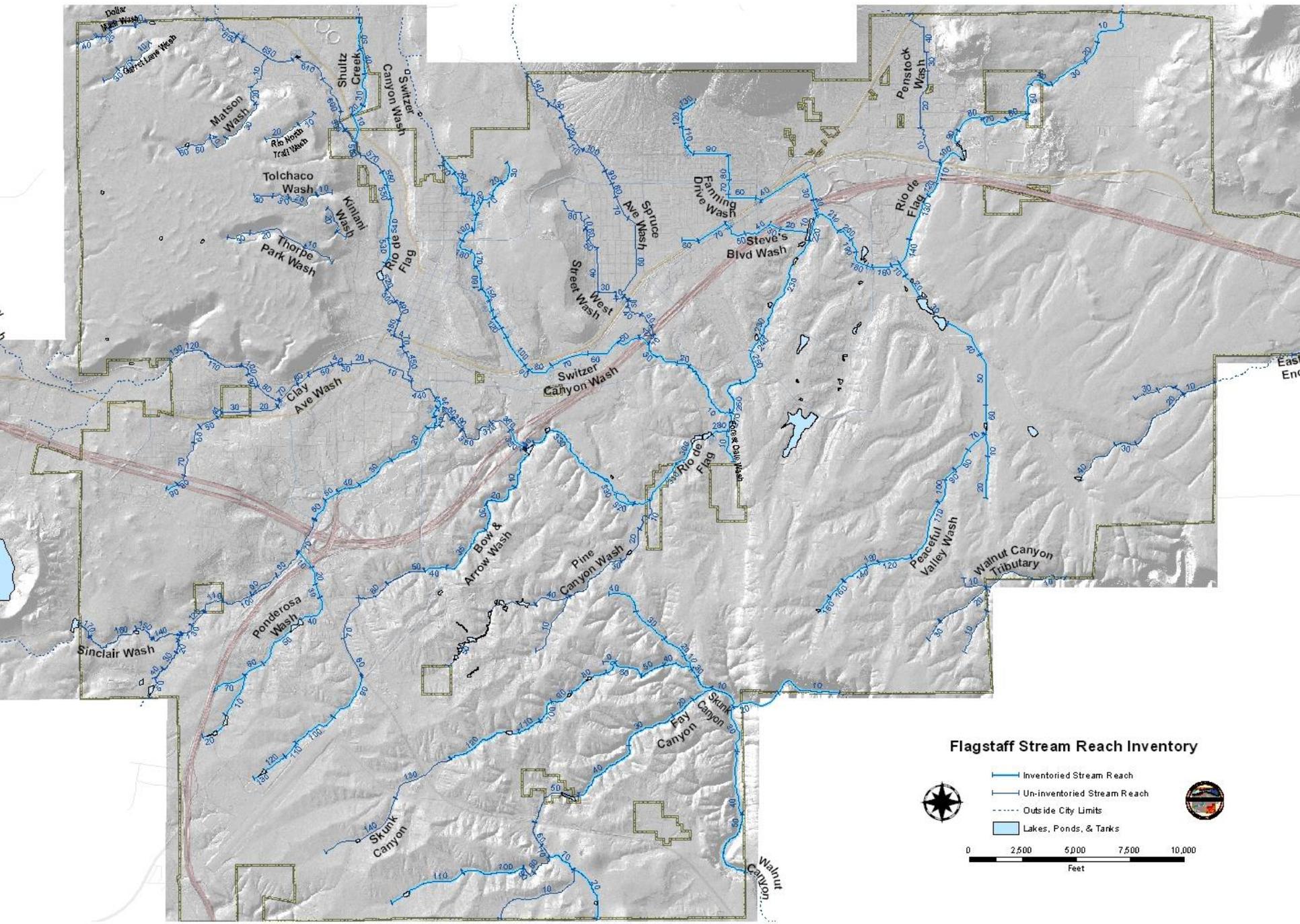


BANKFULL CHANNEL
Carries bedload sediment



Streams Provide A Diverse Range Of Services

- Channel systems are more than water conveyance.
- They provide a platform for ecosystem function (nutrient cycling, flood attenuation, pollutant attenuation and sequestration).
- They provide habitat for both plants and animals not found in the surrounding uplands. (Enhanced diversity)
- They can also provide open space with natural aesthetic and recreation opportunities for the public.

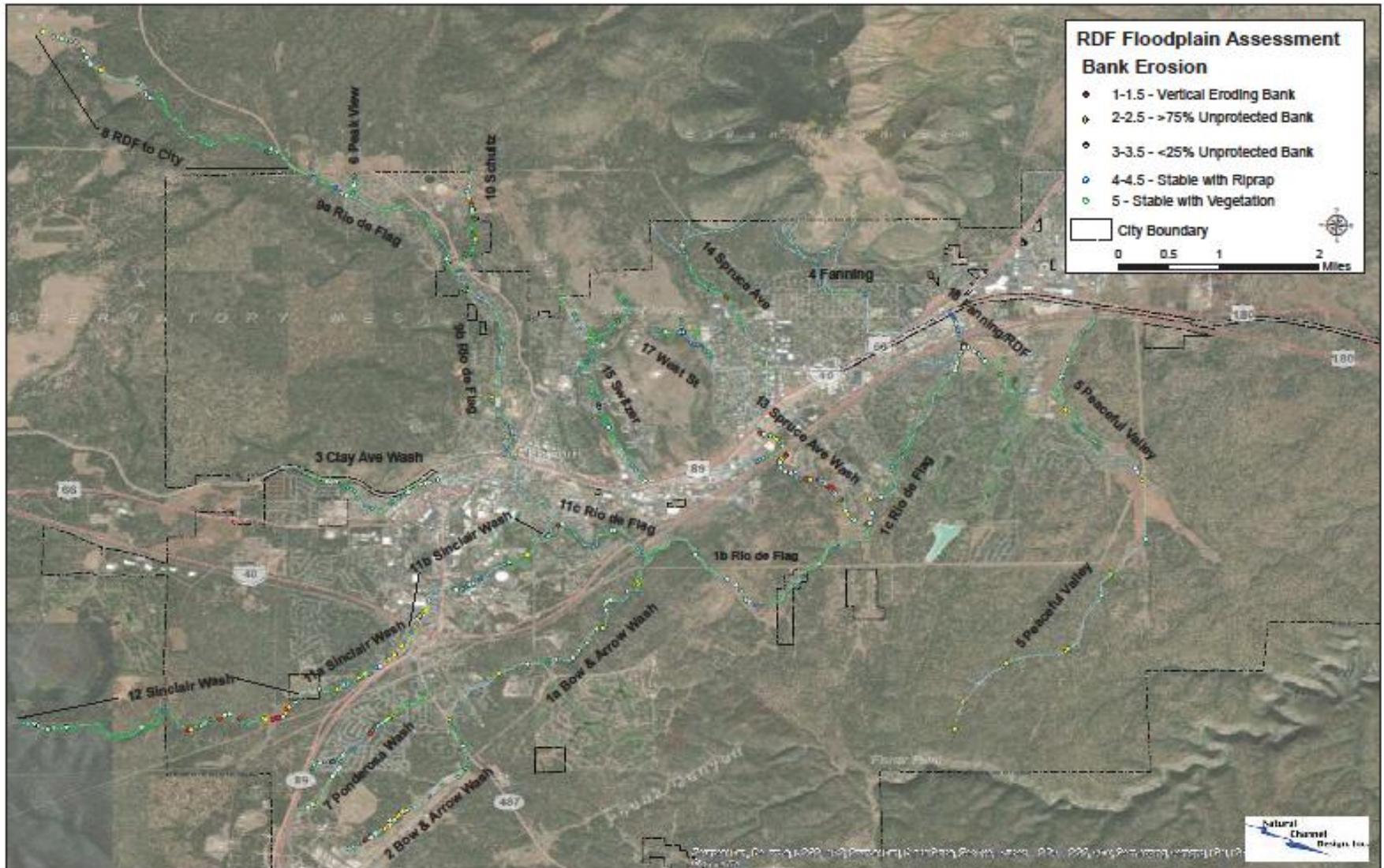


Flagstaff Stream Reach Inventory

-  Inventoried Stream Reach
-  Un-inventoried Stream Reach
-  Outside City Limits
-  Lakes, Ponds, & Tanks

0 2,500 5,000 7,500 10,000
Feet

Current watershed health

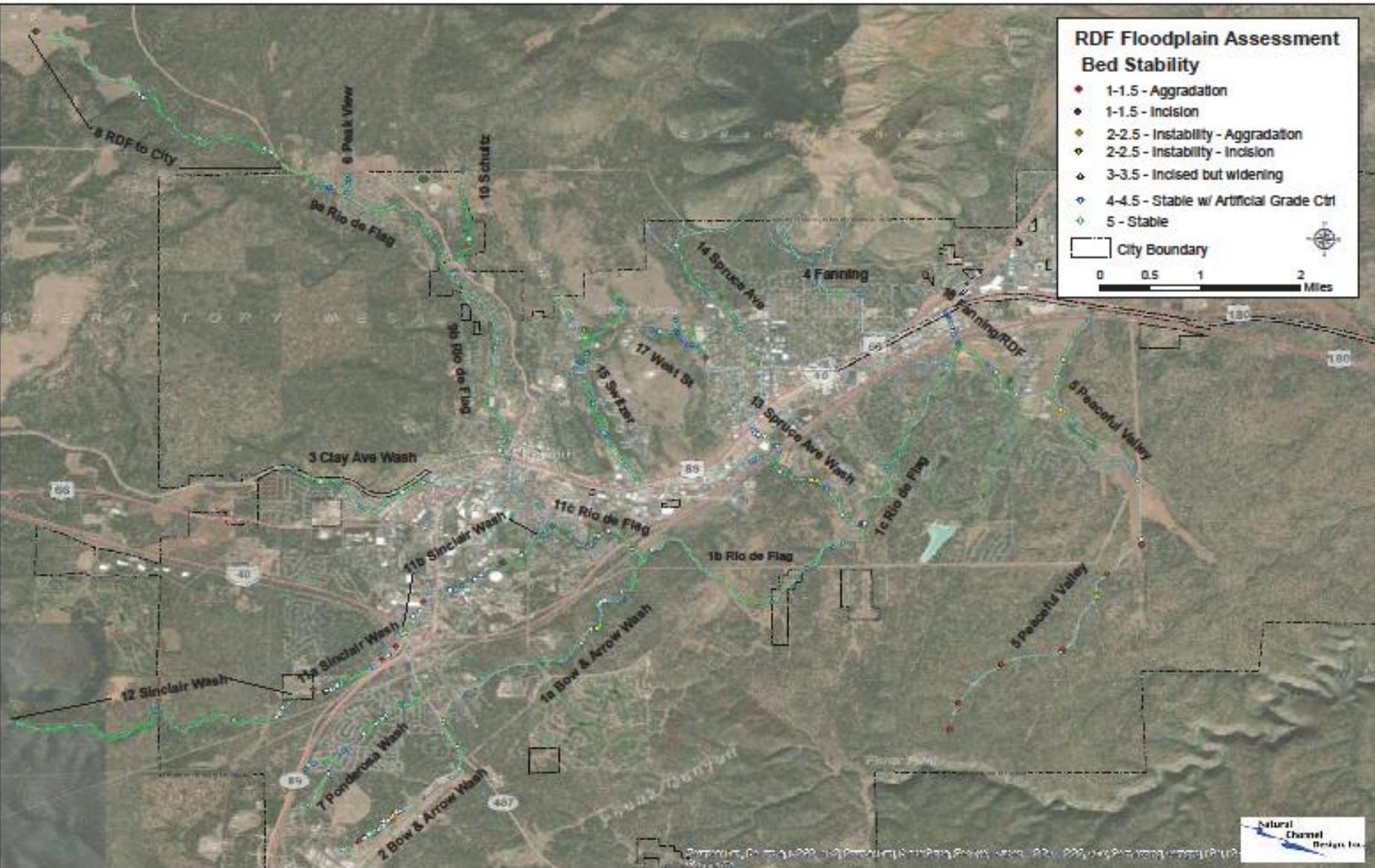


RDF Floodplain Assessment Bed Stability

- ◆ 1-1.5 - Aggradation
- 1-1.5 - Incision
- ◆ 2-2.5 - Instability - Aggradation
- ◆ 2-2.5 - Instability - Incision
- ◆ 3-3.5 - Incised but widening
- ◆ 4-4.5 - Stable w/ Artificial Grade Ctrl
- ◆ 5 - Stable

City Boundary

0 0.5 1 2
 Miles



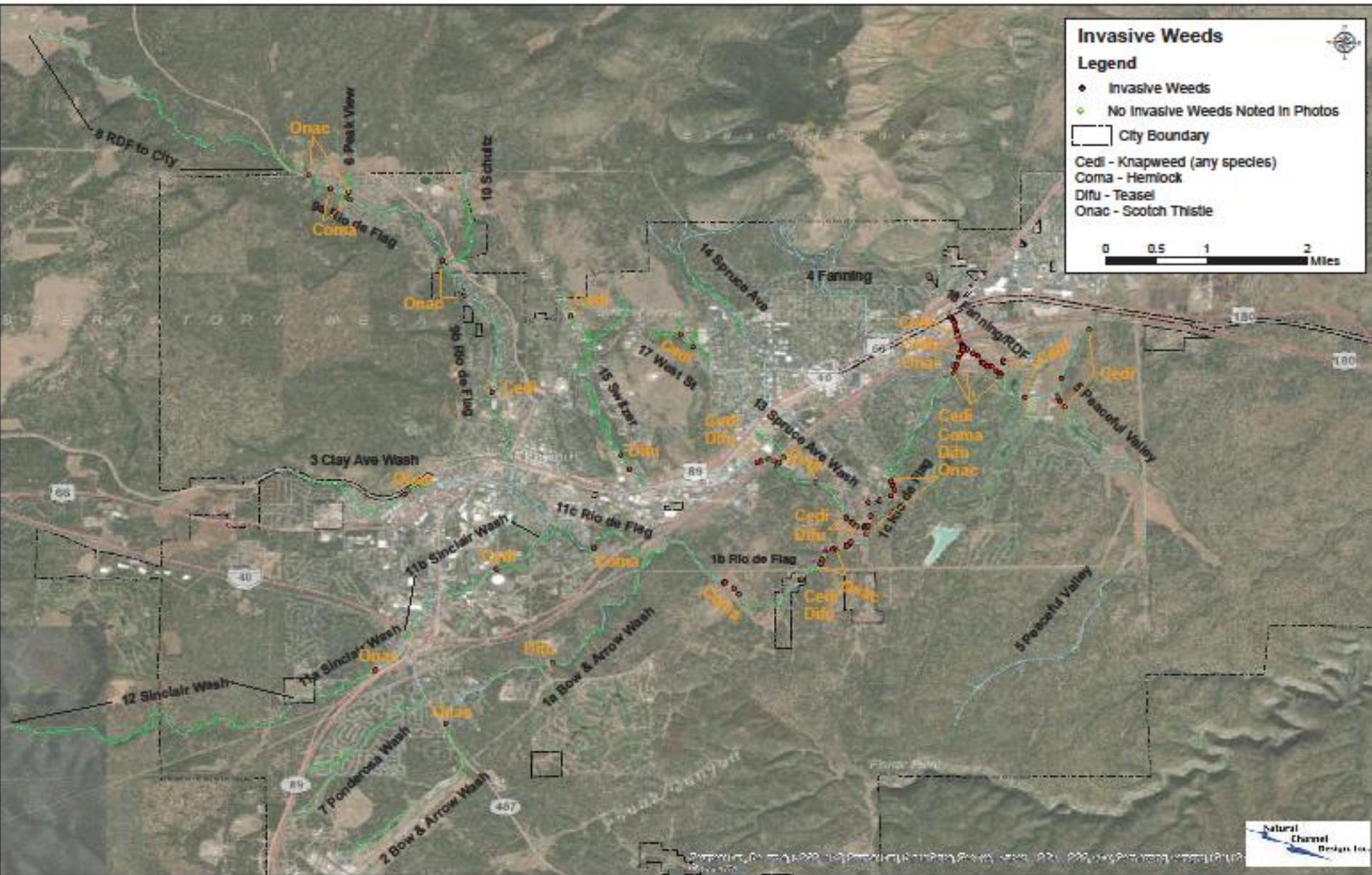
Invasive Weeds

Legend

- ◆ Invasive Weeds
- No Invasive Weeds Noted In Photos
- City Boundary

Cedi - Knapweed (any species)
 Coma - Hemlock
 Difu - Teasel
 Onac - Scotch Thistle

0 0.5 1 2 Miles



2019 Stream Cleanups

Led by Flagstaff Sustainability Program & COF Stormwater



Join us on
Sunday, May 5th

9:00 am - 12:00 pm

Meet at Willow Bend
703 E Sawmill Rd



Saturday, June 15th

9:00 am - 12:00 pm

Meet at west-side Walmart
2750 S Woodlands Village Blvd



Bring closed-toed shoes!

With questions, contact:
Edward.Schenk@flagstaffaz.gov
(928) 213-2470



All photos taken by Tom Bean

Examples of 2019 city led initiatives







Unsuccessful Rip-Rap Treatment of a Meadow Headcut











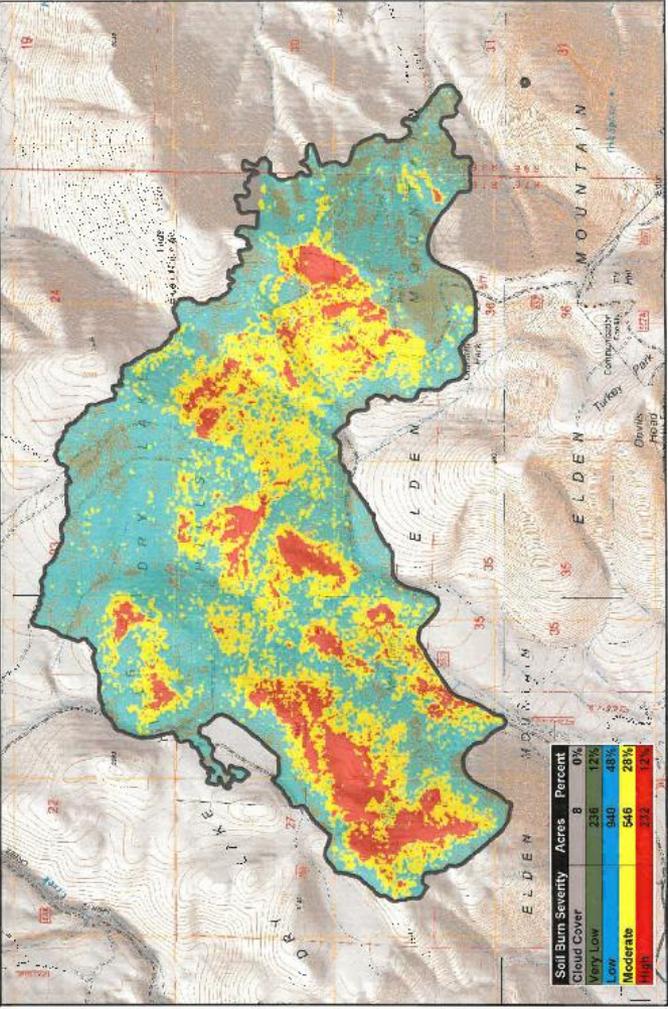
Stormwater responses to the Newman & Museum Fires



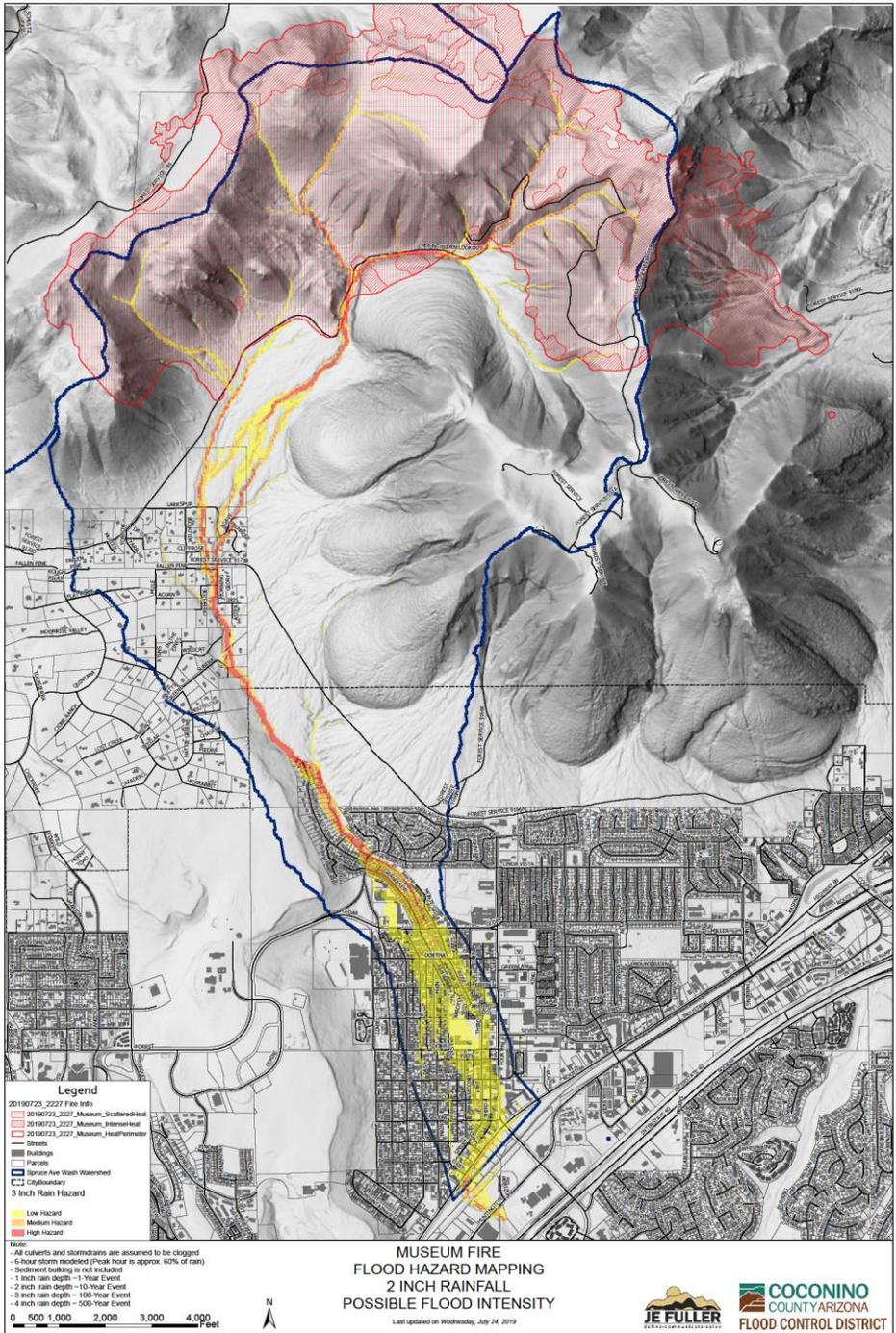


Museum Fire 2010 Soil Burn Severity

Soilburn, 10/20/2010, J. & P. Fuller, 3011 Federal Blvd, El Paso, CO

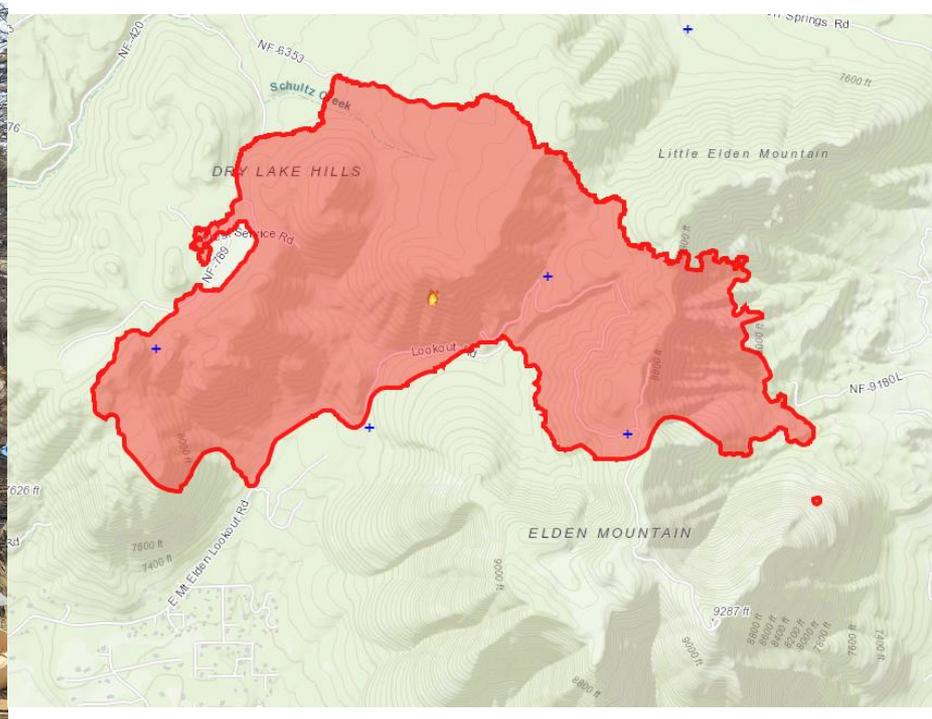


The fire area was mapped using aerial imagery, a Global Positioning System (GPS), and a Global Navigation Satellite System (GNSS). The fire perimeter was determined by the fire manager, and the soil burn severity was determined by the fire manager and the fire manager's staff. The fire manager's staff used a soil burn severity scale to determine the soil burn severity of the fire area. The fire manager's staff used a soil burn severity scale to determine the soil burn severity of the fire area.



- Assisted County with installation of 3 new precipitation alert gauges in the Museum Fire footprint
- Coordinating for the installation of 2 new stream and turbidity gauges in the ULM watershed
- Re-fitting 2 existing flood alert gauges in Spruce Avenue Wash as well as adding non-contact stage gauges (NAU camera gauges and radar units)
- Assisting with water main protection above Paradise Road
- New debris bollards at Linda Vista and Dortha
- Culvert design at Linda Vista to match capacity at Cedar Ave.
- Assisted with flood mitigation measures in Paradise, Grandview, and Sunnyside
- Assisting with debris flow monitoring (NAU, AZ Geological Survey)

- Assisted County with installation of 3 new precipitation alert gauges in the Museum Fire footprint



[\(https://rain.flagstaffaz.gov/jefmap/\)](https://rain.flagstaffaz.gov/jefmap/)

- Re-fitting 2 existing flood alert gauges in Spruce Avenue Wash as well as adding non-contact stage gauges (NAU camera gauges and radar units)



NAU



NOAA

- Assisting Water Production with water main protection at Paradise Road



- New debris bollards at Linda Vista and Dortha





- Culvert design at Linda Vista to match capacity at Cedar Ave.



- Assisted with flood mitigation measures in Paradise, Grandview, and Sunnyside





Moving into the future

- Lots of volunteer needs
- Lots of consultant needs
- Two large plans that will be formulated and need community input and innovative thoughts
- Threats and opportunities abound, it's a fun time to live in Flagstaff

Questions? Comments? Discussion?

