

# **MT. BAKER-SNOQUALMIE NATIONAL FOREST**

**CONTEMPORARY RESTORATION PLANNING AND DESIGN  
PROCEDURES FOR AQUATIC RESOURCES AT WATERSHED SCALES**

## First, I'd like to acknowledge:

Emily Johnson: Fisheries Biologist (Oka-Wen NF)

Matt Karrer: Hydrologist (Oka-Wen NF)

Pierre Dawson: Aquatic Data Steward, Analyst and Statistician (WO NRIS AqS)

Karen Chang: Snoqualmie Ranger District Fisheries Biologist

David Keenum: GIS Specialist

MBS NF Partners in watershed restoration

# MBS Integrated Watershed/Landscape Restoration: General Framework

What is in need of restoration and why?

&

Where do we go to implement it?



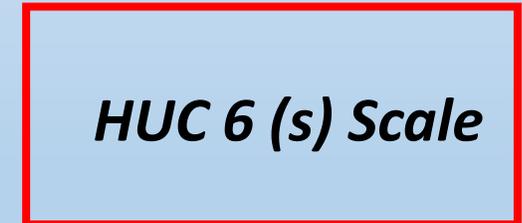
What is the order in which we plan/implement?



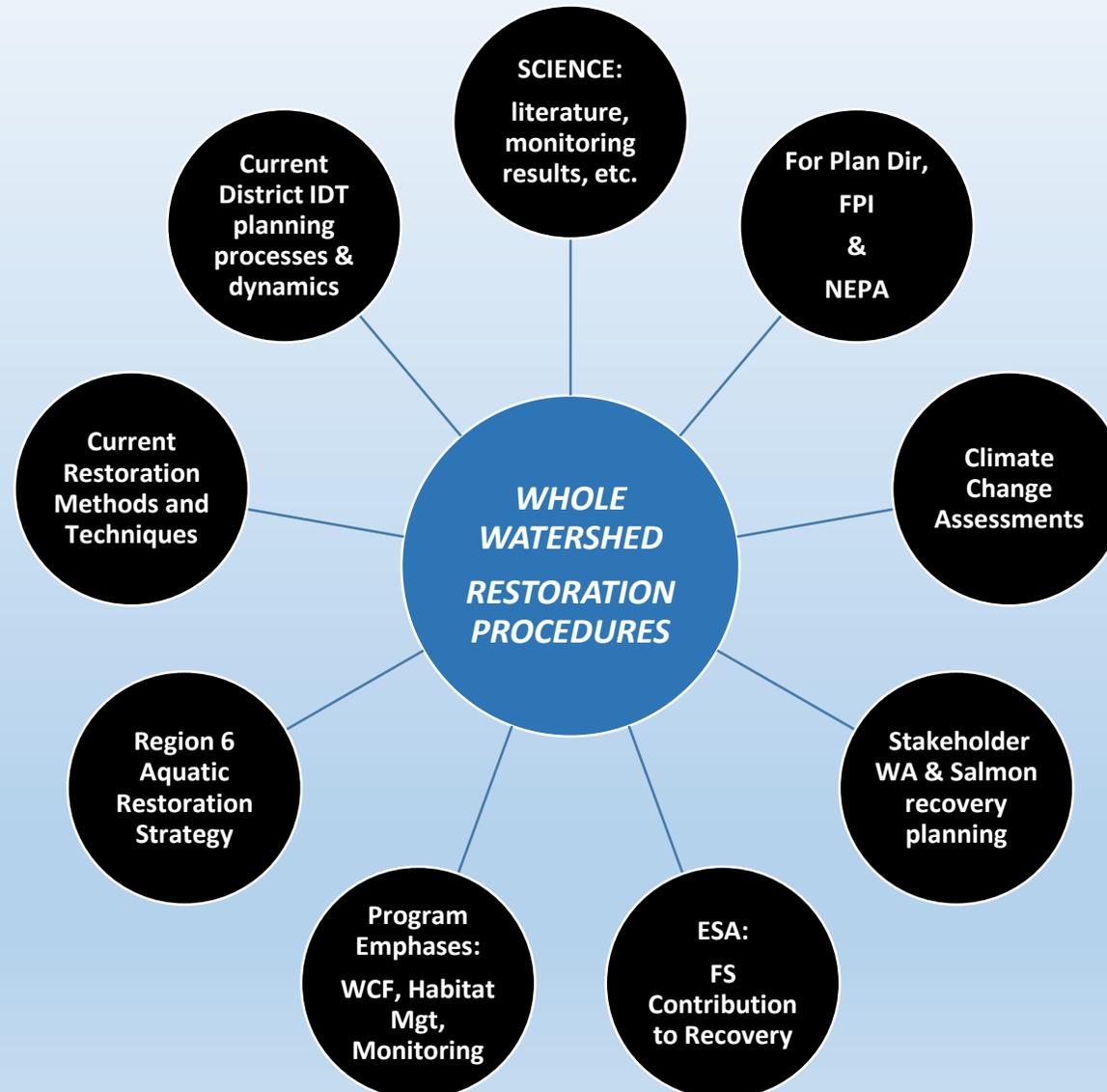
To what degree are aquatic resources impaired?

&

What type of project design is needed to decrease or eliminate that impairment?



# Developing the Restoration Procedures: *What's considered?*



# Overview: The Needs & The Reasons

## *Why Is Proactive Restoration Needed?*

Watershed Assessments/Analyses/WCF



**ROADS**

Project Scale Effects Analysis, etc...

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Need for Restoration Strategy & Assessment (examples):

- Puget Sound Federal Task Force: Puget Sound Recovery - emphasis on supporting salmon and steelhead recovery, decreasing WQ impacts from surface runoff, etc.
- Legacy Impacts - Direct, Indirect AND Cumulative Effects on WA function, water quality, aquatic habitat, and fish populations.
- ESA Consultation – undesired long-term adverse effects to fish with no positive outcomes linked to actual recovery.

## *Science & Technical Rational*

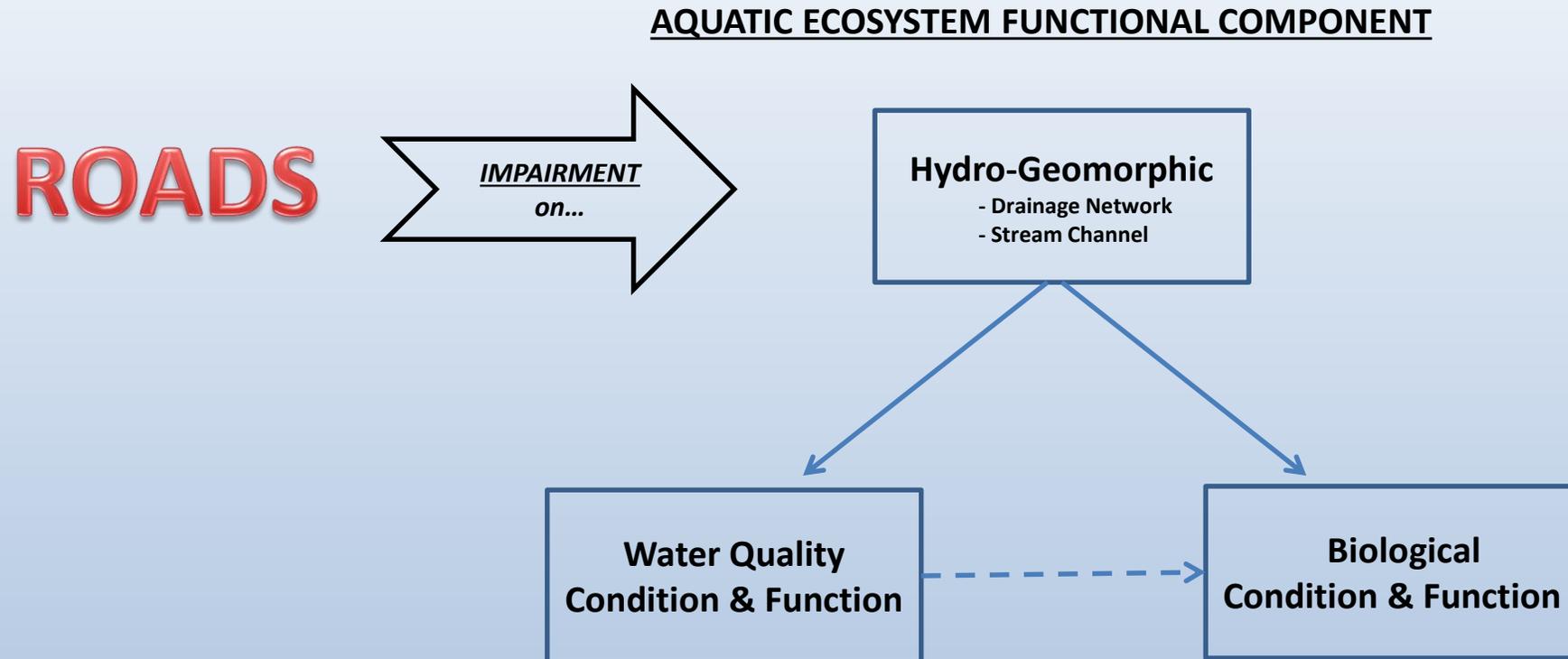
Roads can cause impairment on physical, chemical and biological processes.

Restoration needs to be based in a watershed scale approach accounting for both causal mechanisms and indicators of impairment....it's not just a sediment issue! Signatures of where altered hydrologic regimes are having effects.

Climate Change: Increasing the efficiency in which watersheds drain themselves result in -

- High drainage density;
- Increase in water quality impairment variables, such as stream temperature & sediment;
- Decrease and limit areas where fish species spawn, rear and forage.

# The Basis For The Approach: (adaptation from EPA and CWA principles, current science, etc.)



## Conceptual Relationship

DI = (RN) HG + WQ + BC -----> Magnitude of road influence on aquatic ecosystem function.

DI: Degree of Impairment

RN: Road Network (density and location)

HG: Hydro-Geomorphic Functional Impacts

WQ: Water Quality Functional Impacts

BC: Biological Condition Functional Impacts

## Forest Service Road 50 - Snow Creek



# What this approach is....

- Watershed based (vs. stream channel centric or stream reach approach) with emphasis on watershed function and riparian and aquatic ecosystems.
- Attempts to highlight to what degree and where chronic functional processes are leading to a series of impacts:  
For instance,

Road Derived increase In Drainage Area → Accelerated Channel Scour → Lack of spawning habitat

- These are a set of procedures, which based in watershed restoration principles and are primarily targeted at answering the questions such as:

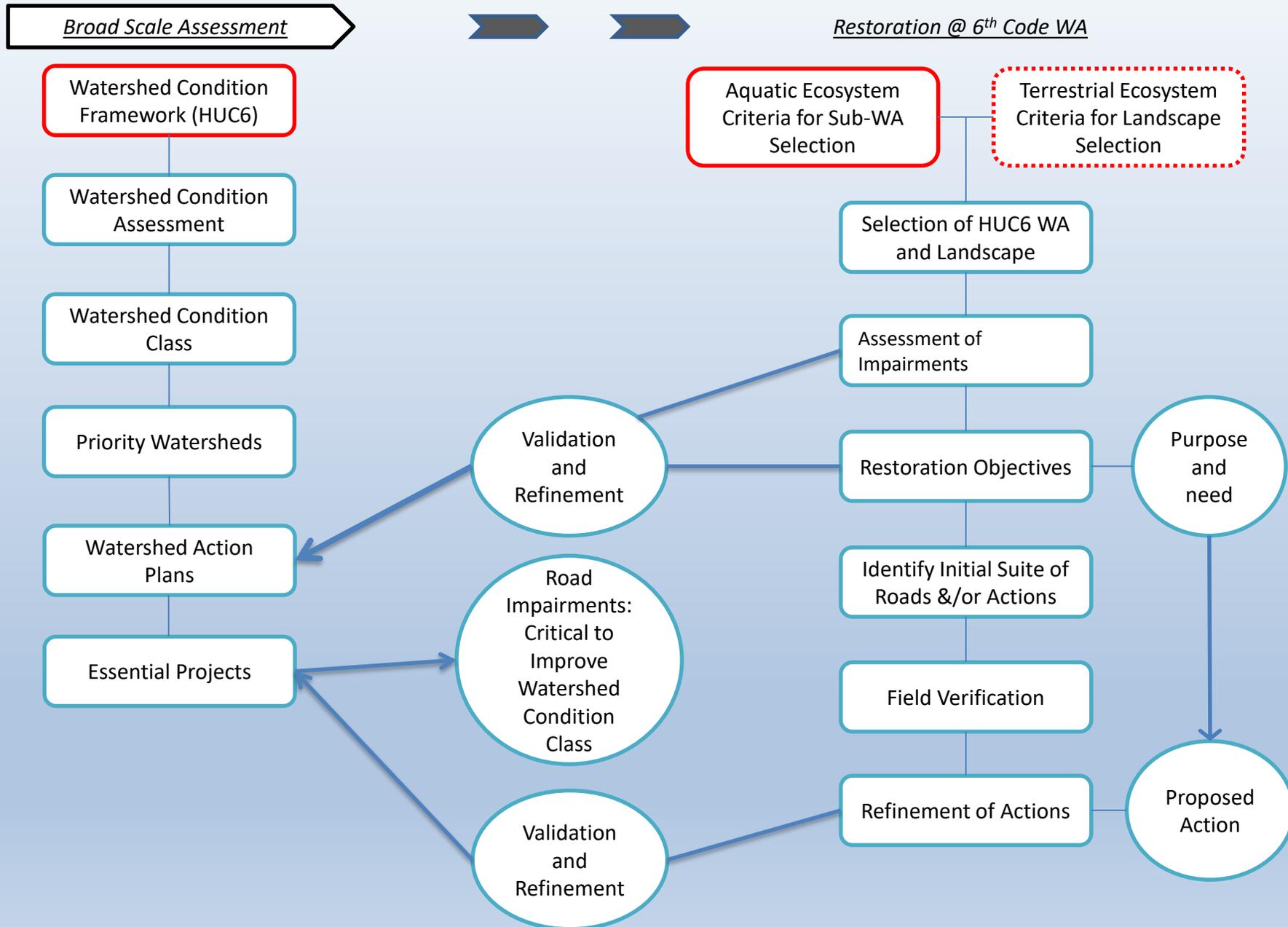
***WHICH ROADS ARE CAUSING THE PROBLEMS?***

***WHAT NEEDS TO BE DONE ABOUT THEM?***

***WHAT OTHER PROCESSES NEED TO BE ADDRESSED SOONER THAN LATER?***

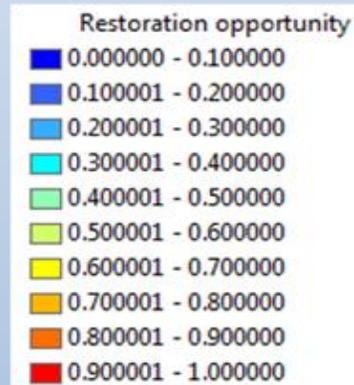
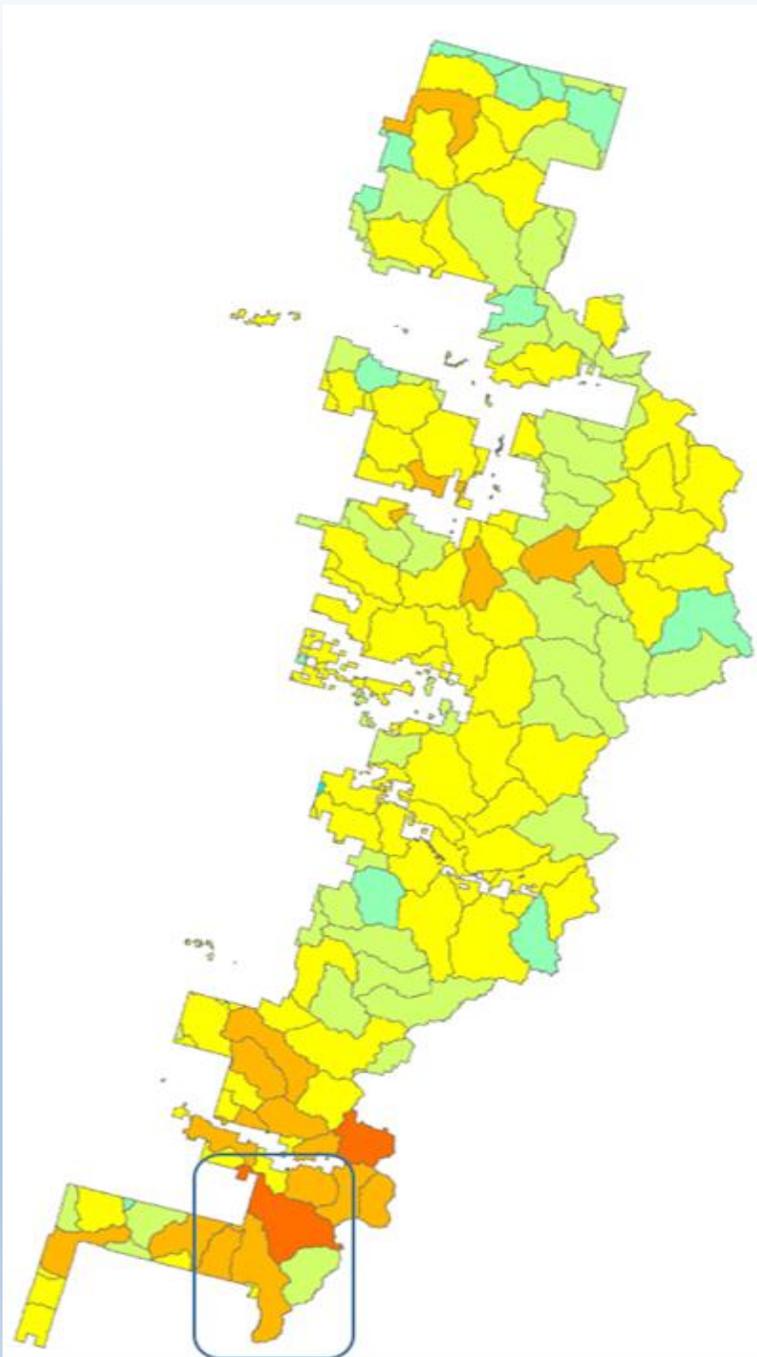
- Support Watershed Restoration Practitioners ability to communicate more effectively to Line Officers and IDTs, ESA consultation Level I Teams and external stakeholders working in watershed and fish recovery.
- Allows Watershed Restoration Practitioners to balance between applying science and technique, while recognizing the art in conducting project scale restoration design.

# Conceptualizing How Everything Works Together: WCF, FPI & NEPA

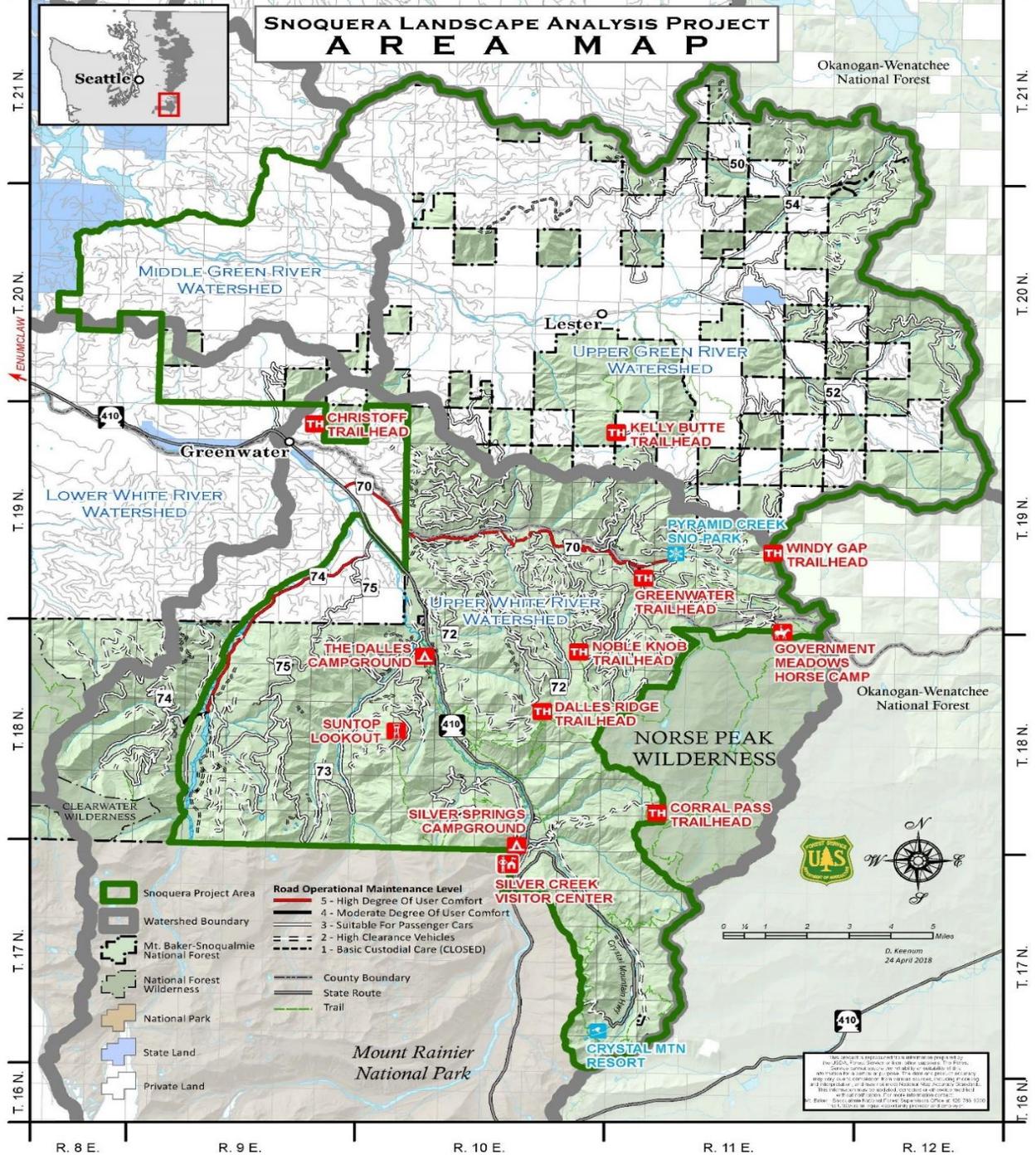


## INTEGRATED LANDSCAPE EVALUATION:

**Aquatic + Terrestrial Eco Factors = RESTORATION OPPORTUNITY**



# SNOQUERA LANDSCAPE ANALYSIS PROJECT AREA MAP



- |                                      |                                     |
|--------------------------------------|-------------------------------------|
| Snoquera Project Area                | Road Operational Maintenance Level  |
| Watershed Boundary                   | 5 - High Degree Of User Comfort     |
| Mt. Baker-Snoqualmie National Forest | 4 - Moderate Degree Of User Comfort |
| National Forest Wilderness           | 3 - Suitable For Passenger Cars     |
| National Park                        | 2 - High Clearance Vehicles         |
| State Land                           | 1 - Basic Custodial Care (CLOSED)   |
| Private Land                         | County Boundary                     |
|                                      | State Route                         |
|                                      | Trail                               |



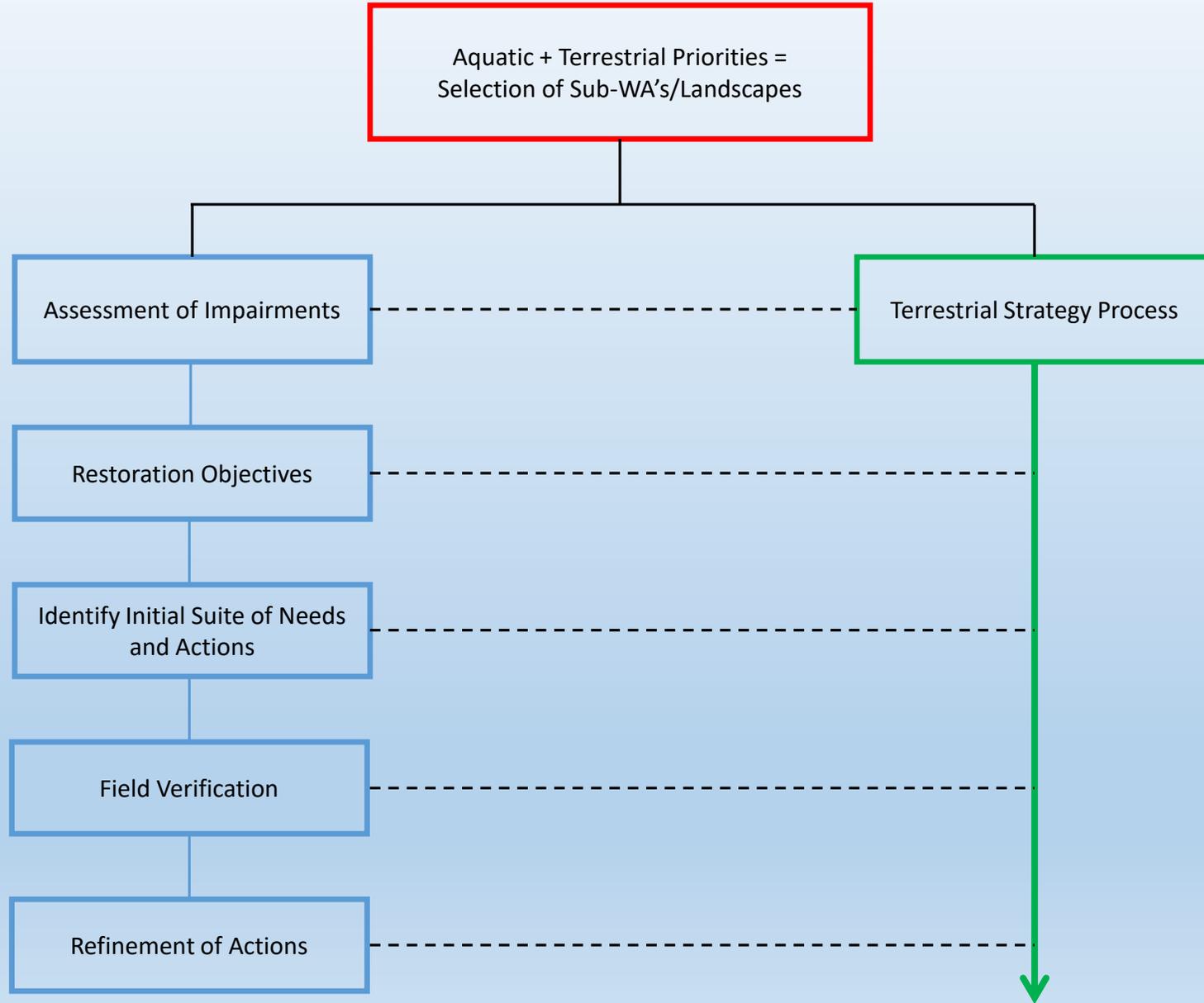
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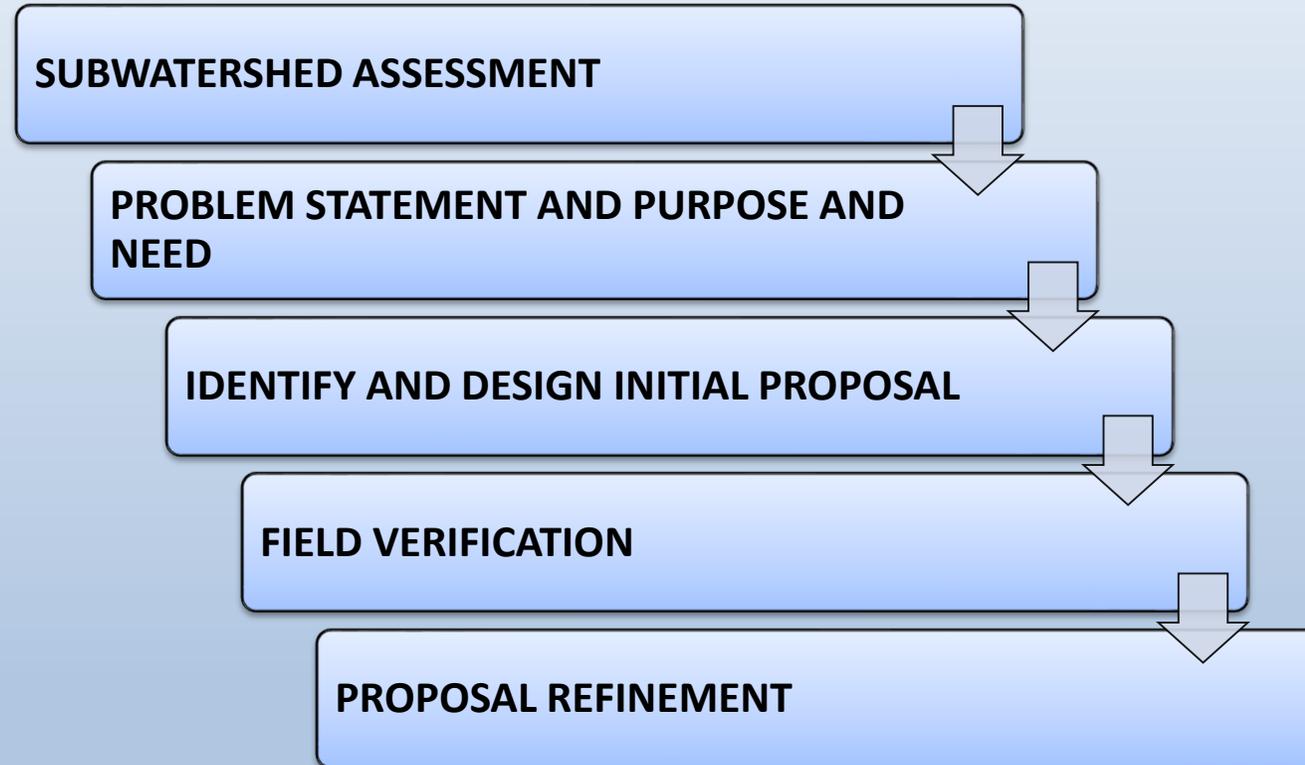
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# Integration at the Project Scale: Linking the IDT and Procedures



# Summary of the Whole WA Restoration Procedures



# Sub-Watershed Assessment: Catchment Delineation

Delineate catchments into approx. 500-1200 acres.

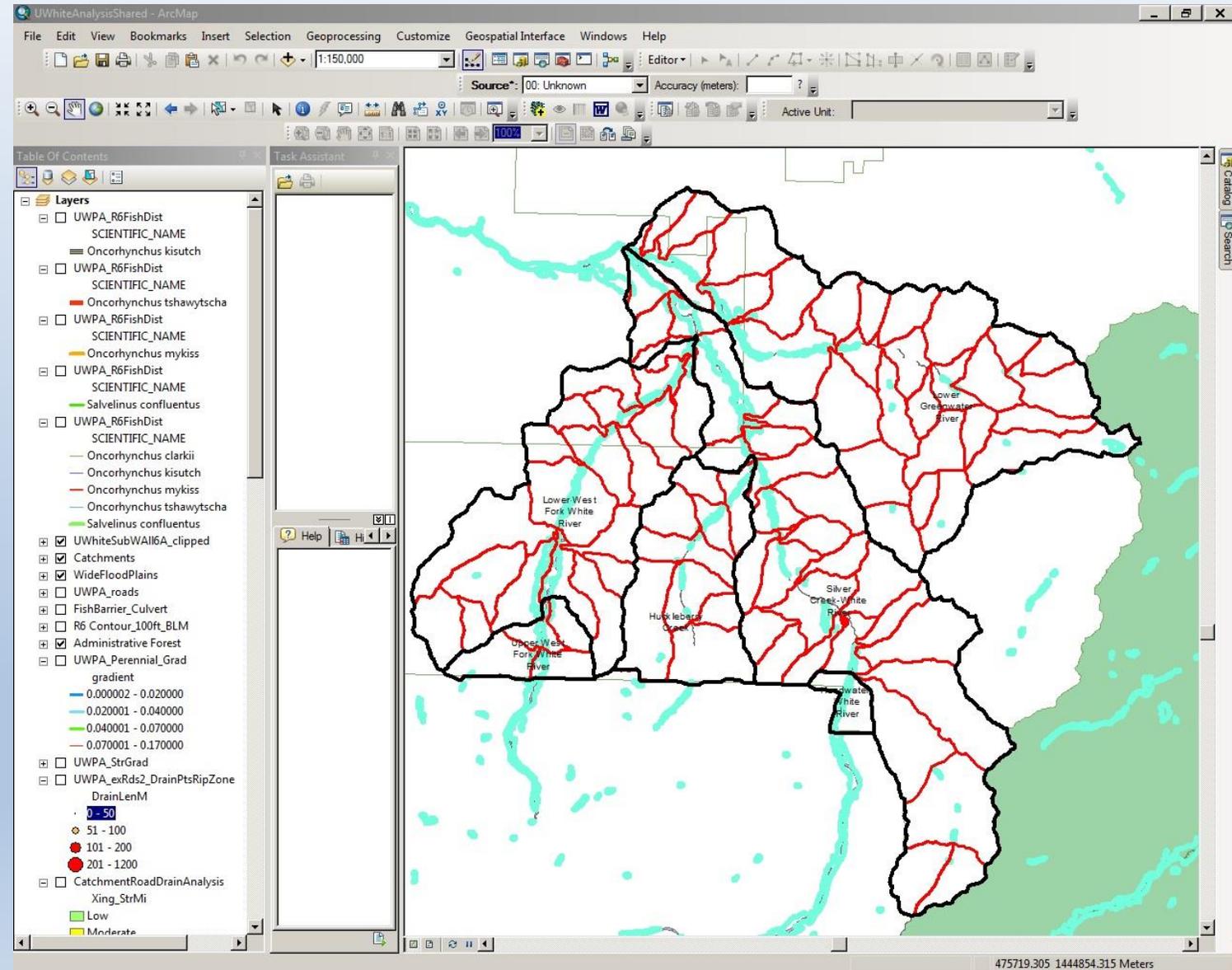
Rate catchment priority for treatment based on:

## *Causal Mechanisms Metrics*

- % increase in drainage area from roads
- % of roads within riparian areas (300 ft of streams)
- % of roads within mapped floodplains
- No. of road crossings per mile

## *Indicator Metrics*

- Geomorphic Channel Condition – bank instability, w/d ratio, entrenchment ratio
- Biological Condition – current vs. potential distribution



# Sub-Watershed Assessment: Physical and Biological Evaluations In Each Catchment

## CAUSAL MECHANISMS

Percent increase in drainage area from roads

Low = <10%

Med = 10-30%

High = >30%

Percent of roads within riparian areas

Low = <10%

Med = 10-30%

High = > 30%

Percent of roads within mapped floodplains

Low = <10%

Med = 10-20%

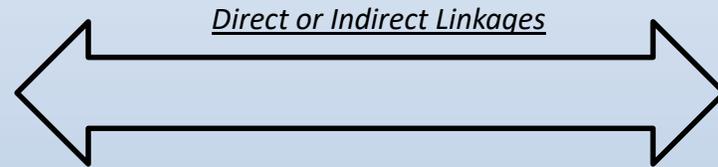
High = >20%

No. of road crossings per stream mile

Low = 0-1

Med = 1-3

High = >3



## INDICATORS

Miles of current focal fish species known distribution

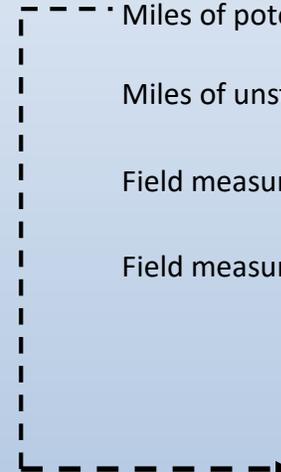
Location of designated critical habitat

Miles of potential focal fish species habitat

Miles of unstable stream banks

Field measured channel width/depth ratio to predicted

Field measured entrenchment ratio to predicted



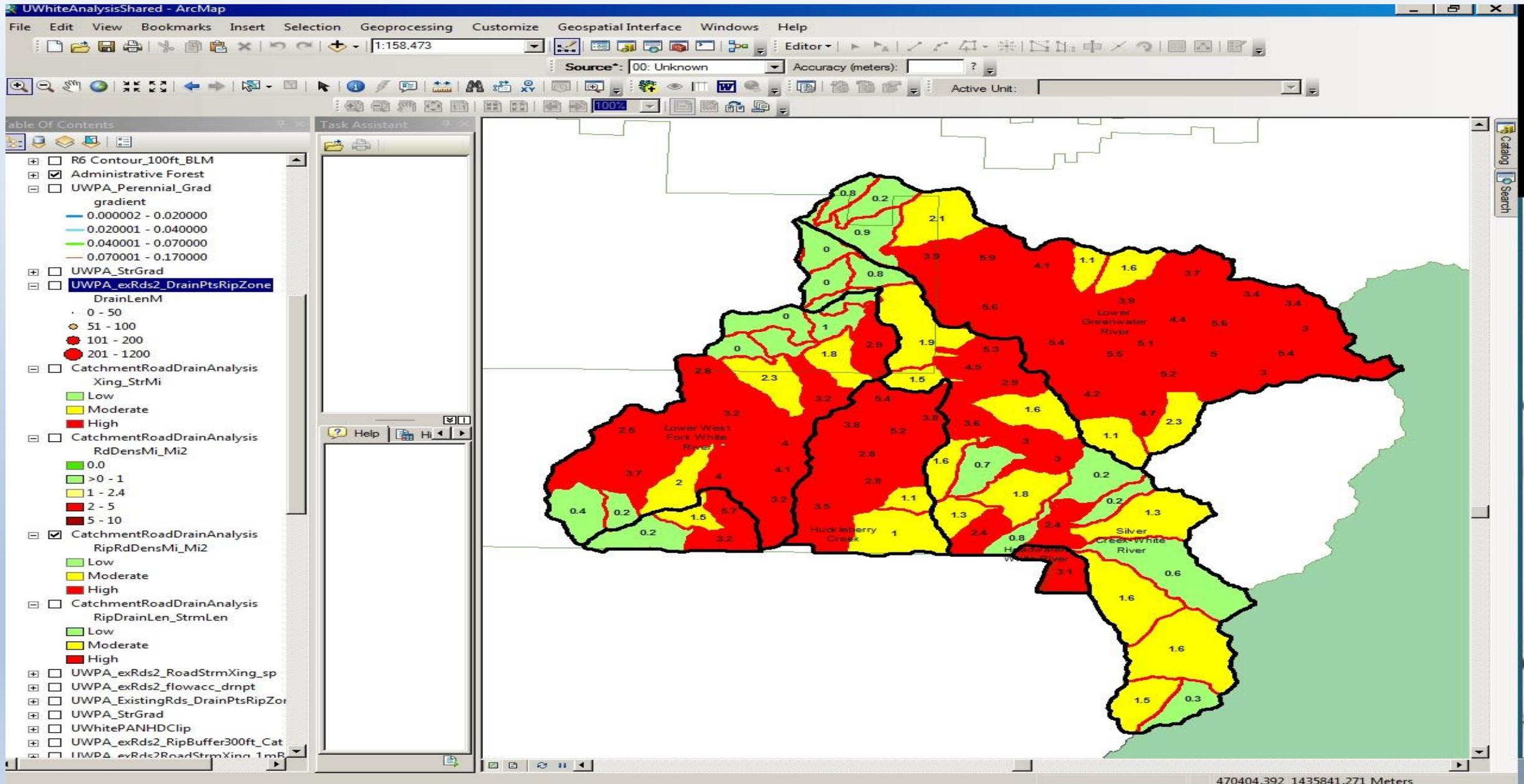
POTENTIAL HABITAT

Stream Class = Perennial

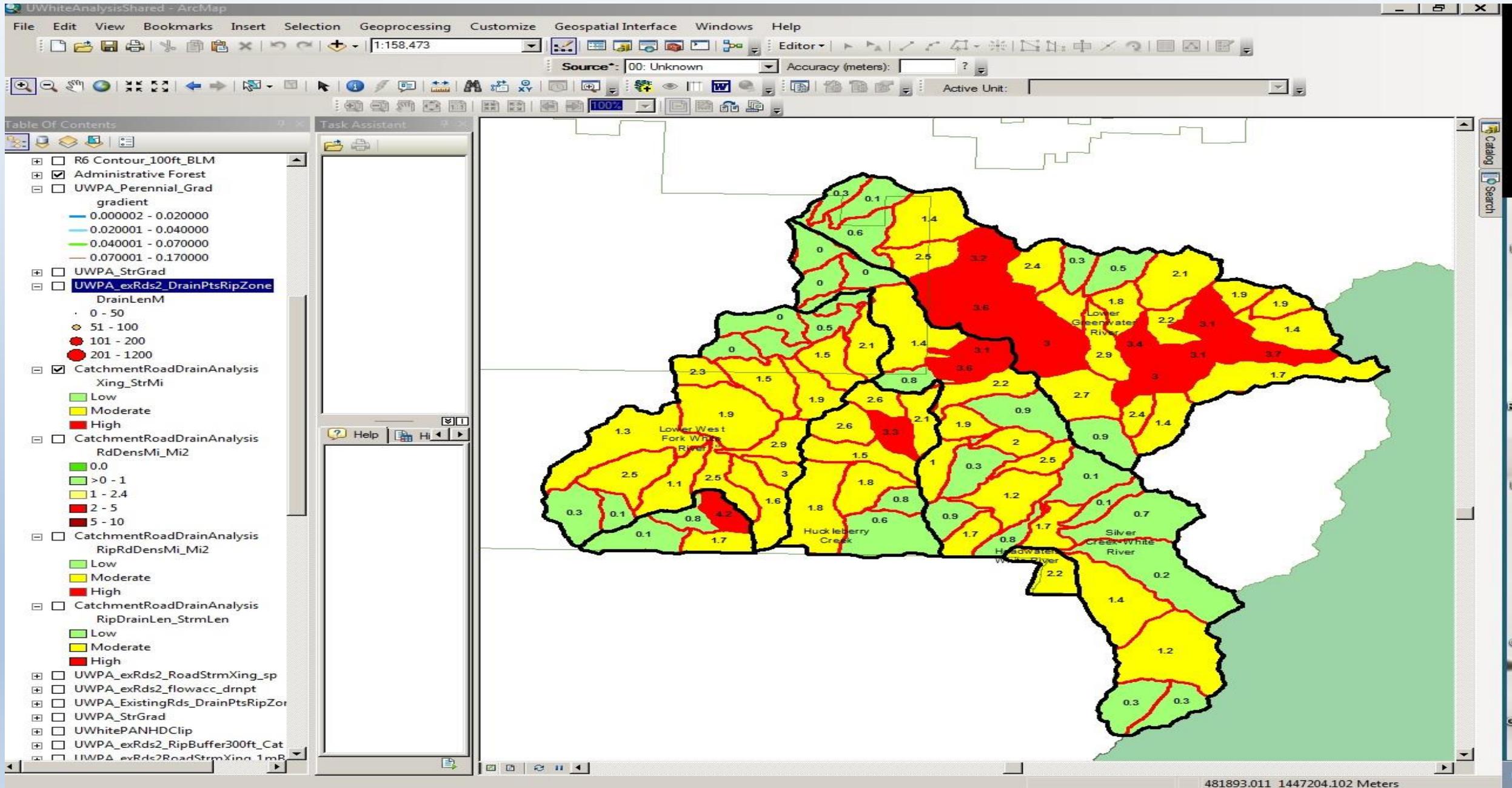
Stream Slope =  $\leq 7\%$  (ST & BT);  $\leq 3.5\%$  (SC)

Passage Barriers = natural vs. man made

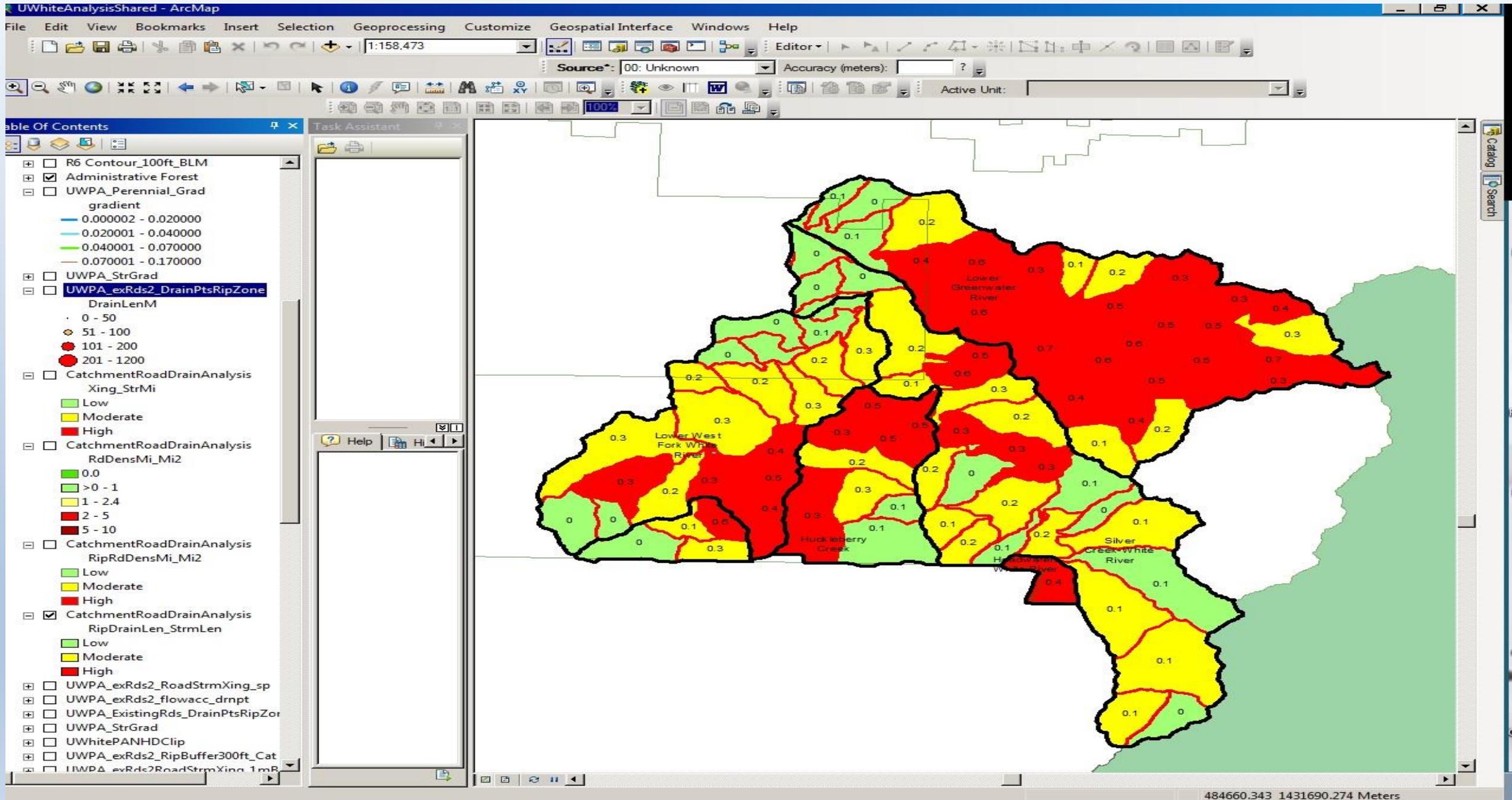
# Sub-Watershed Assessment Outputs: Causal Mechanisms



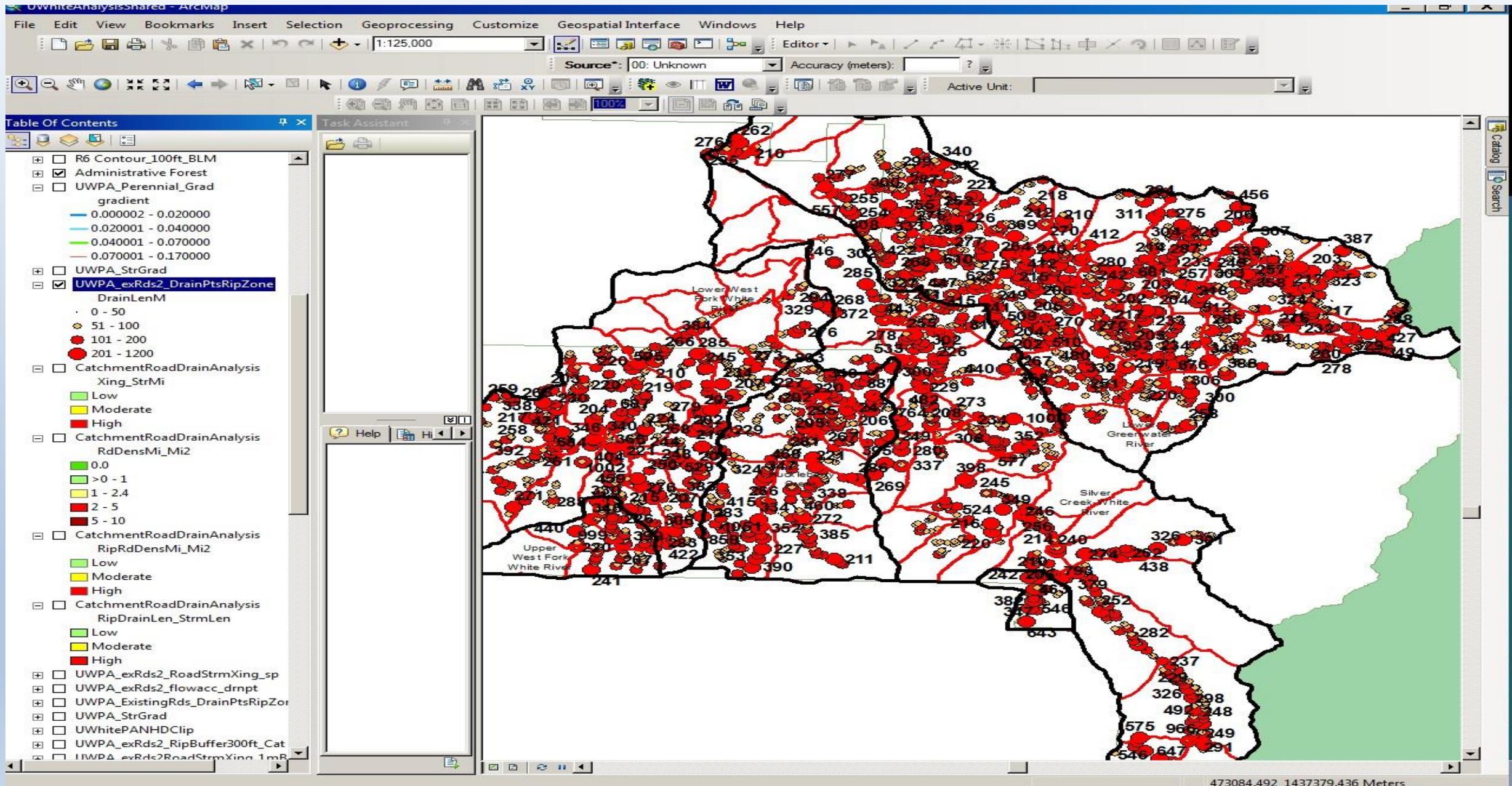
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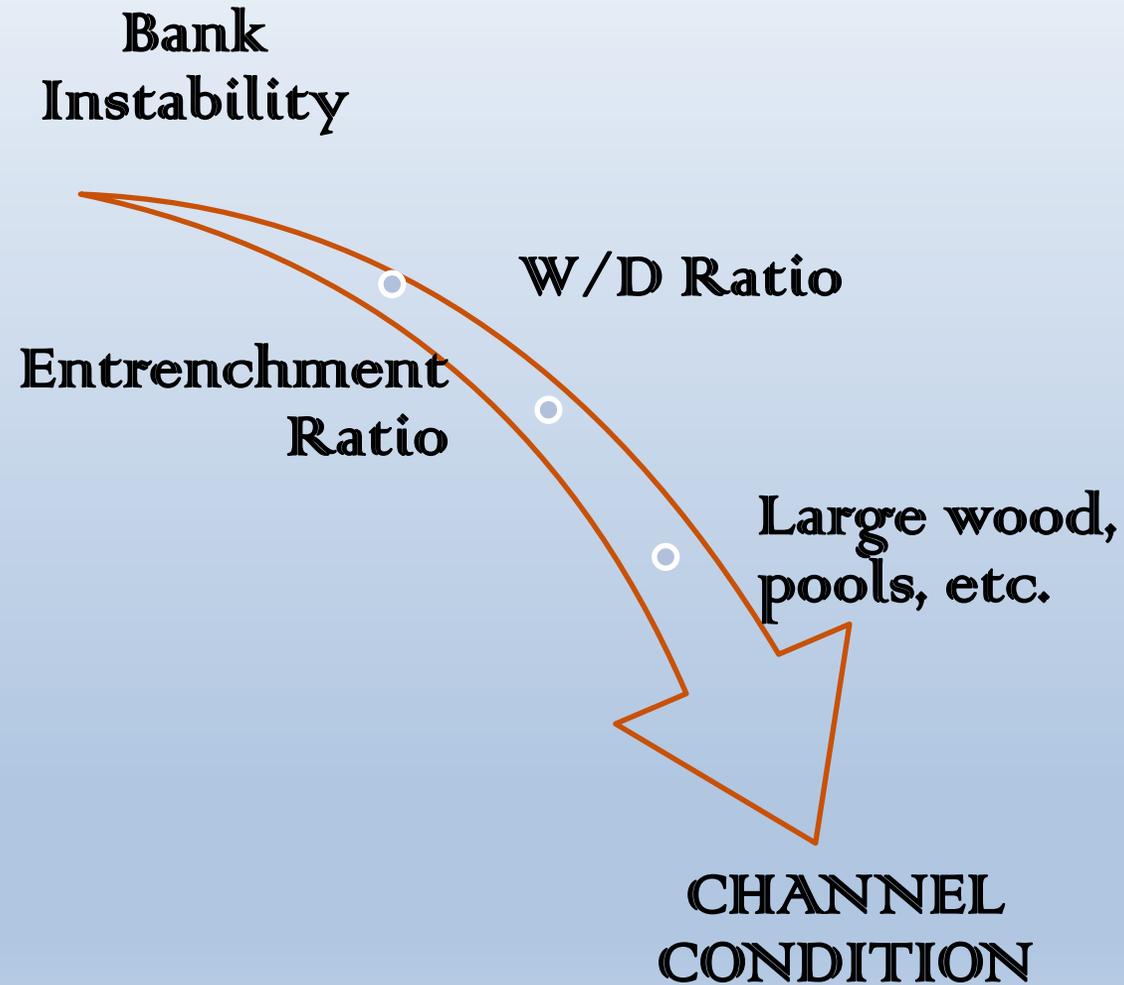
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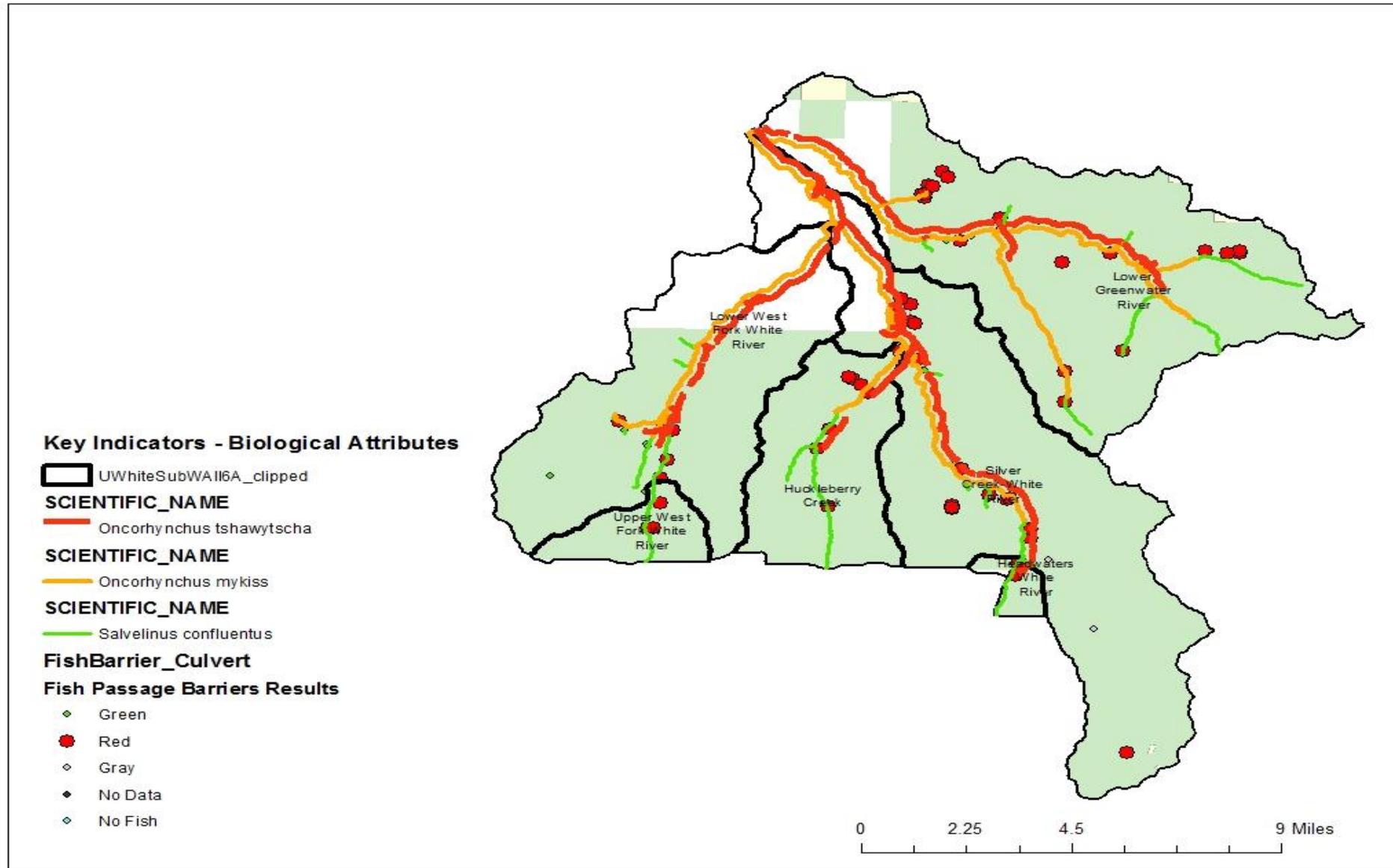
# Sub-Watershed Assessment Outputs: Causal Mechanisms



# Subwatershed Assessment Outputs: Key Indicators



# Sub-Watershed Assessment Outputs: Biological Indicators



# Problem Statement

## Problem Statement:

- Summarizes the results of the sub-watershed assessment, gives indication to the degree of cumulative effects, outlines consequences to key watershed and aquatic ecosystem functional relationships and provides a foundation for desired conditions. For example.....

*The existing conditions of the aquatic ecosystem in Greenwater River sub-watershed demonstrate a high degree of physical and biological functional impairment. The sub-watershed assessment demonstrates high road-related values for increase in drainage area, roads in floodplains and road crossings per mile within 17 of 26 catchments. Historically this area supported spawning populations of steelhead and bull trout and provided other salmonid species, such as Chinook salmon, rearing and foraging habitats. Large-scale land disturbances, especially the building of roads and associated timber harvest, have led to undesired impacts on aquatic habitat and severely diminished fish distribution and abundance, which some species are now listed under the Endangered Species Act (ESA). Of the 98 miles of estimated potentially occupied steelhead trout habitat in Greenwater River, only 36 miles remain currently occupied. Of the 90 miles of estimated potentially occupied bull trout habitat, only 4.7 miles remain currently occupied.*

- The Problem Statement can incorporate other key elements of the sub-watershed assessment (i.e. consequences to the watershed and aquatic habitat from increasing drainage area and runoff efficiency), as well as Forest Plan direction (i.e. “Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species populations and communities are uniquely adapted”).

# Purpose and Need

## Purpose and Need:

- Builds on the problem statement and forms the basis for designing and implementing various site-specific restoration actions. For example....

*A purpose of the project is to change the current state of watershed and aquatic ecosystem function by targeting impaired hydrologic and geomorphic processes and conditions throughout the Greenwater River sub-watershed.*

*To meet the purpose in the Greenwater River sub-watershed, there is a need to:*

- *Decrease the impacts of road crossing streams in headwater tributaries,*
- *Reduce barriers to steelhead, bull trout and juvenile chinook salmon migration caused by roads crossing streams,*
- *Reduce water flow alterations caused by roads that primarily existing within 300 feet of streams,*
- *Alleviate other altered flow regimes caused by roads which have impacted stream channel stability, especially where connected to altered aquatic biological processes such as spawning,*
- *Reduce stream channel confinement caused by roads in floodplains,*
- *Reduce surface road and dispersed campsite generated sediment as well as floodplain and stream channel impingement.*

# Developing an Initial Proposal

**DEVELOP A LIST OF ROADS**



**GOOGLE EARTH FLY-OVER, LiDAR**



**PRIORITY RESTORATION SCALE MODEL**



**BIN ROADS INTO TREATMENT TYPES**

|            |    | CAUSAL MECHANISMS |    |    |    |   |   |  |
|------------|----|-------------------|----|----|----|---|---|--|
|            |    | L                 | LM | M  | MH | H |   |  |
|            | L  | L                 | LM | M  | MH | M |   |  |
|            | LM | L                 | LM | M  | MH | M | Highest Need for Restoration Priority 3 and 4   |  |
| INDICATORS | M  | M                 | M  | MH | MH | H |   |  |
|            | MH | MH                | MH | MH | MH | H | Highest Need for Restoration Priority 1, 2 or 3 |  |
|            | H  | M                 | M  | H  | H  | H |   |  |

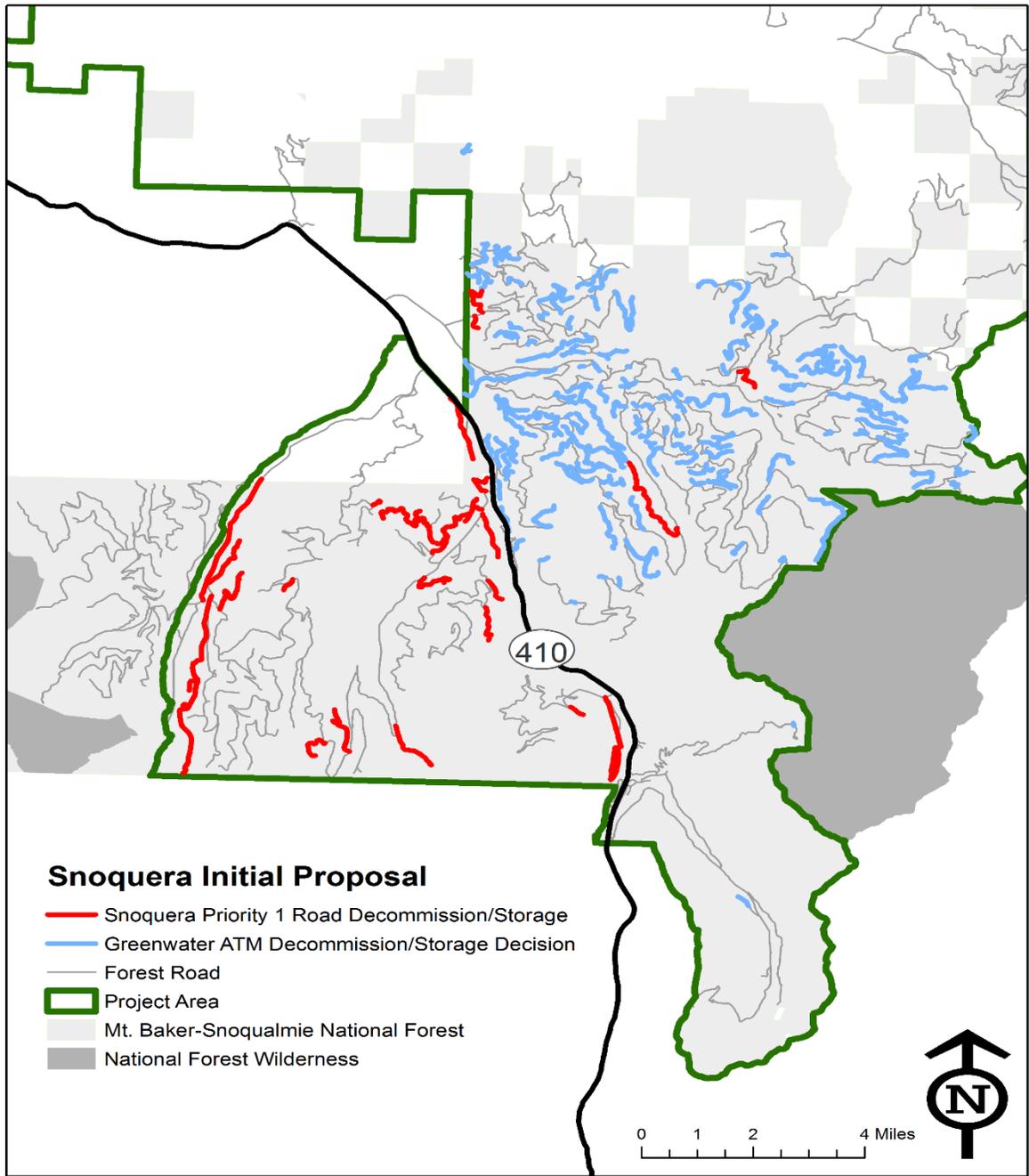


What does conditions look like on the ground?

| Restoration Method   | Estimated Percent of Impairment Reduced |
|--|---|
| Priority 1: DECOMMISSION (could be any ML) that have long-standing impairment on watershed/aquatic resources.  | 90-95 %                                 |
| Priority 2: RELOCATE ML 2-5 roads where access to a site or area is deemed necessary AND DECOMMISSION the abandoned road segment.  | 80-90 %                                 |
| Priority 3: HYDROLOGICALLY CLOSE system roads (i.e. ML-2 to ML-1; ML-3 to ML-1, etc.) as a part of a sustainable future road network need AND where that need isn't immediate and streams and associated water quality/biological components can be resilient to effects of road re-opening. | 60-80 %                                 |
| Priority 4: UPGRADE roads determined to stay on the system.  | 50-70 %                                 |



Storage...Decommission...Relocate...Storm Proof....Other

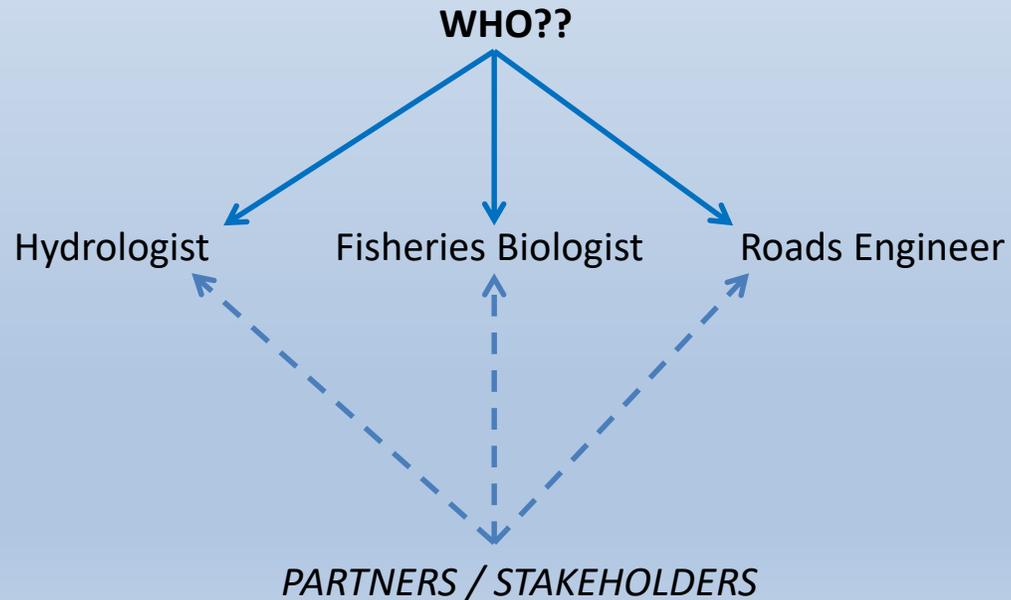


# Field Verification

## PURPOSE:

- Ensure that observations in the office portion of the restoration analysis are consistent with both resource and road conditions on-the-ground.
- Validate various components of the initial proposal.

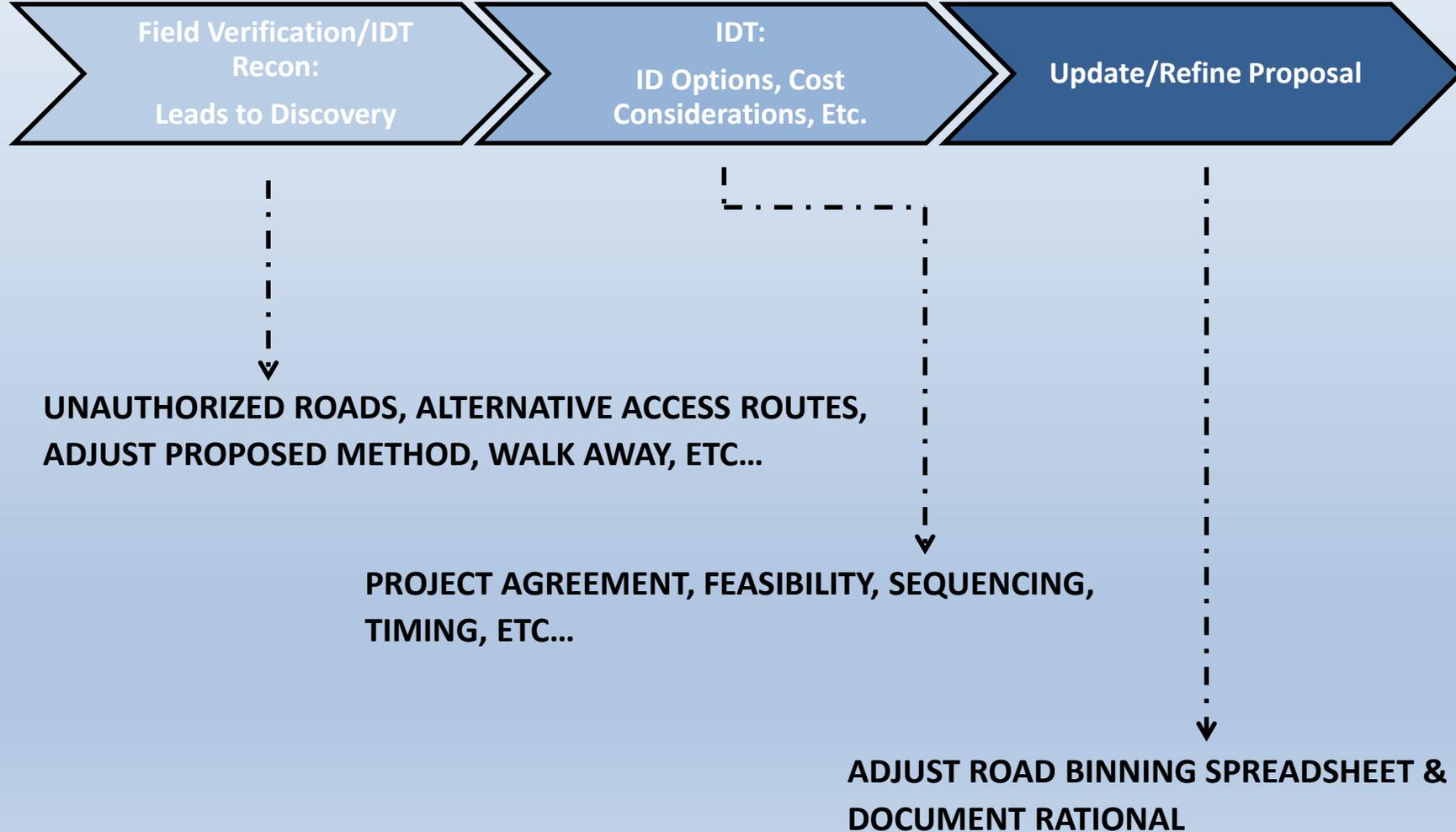
**HOW:** Field verification form/procedure – MBS CURRENTLY REFINING



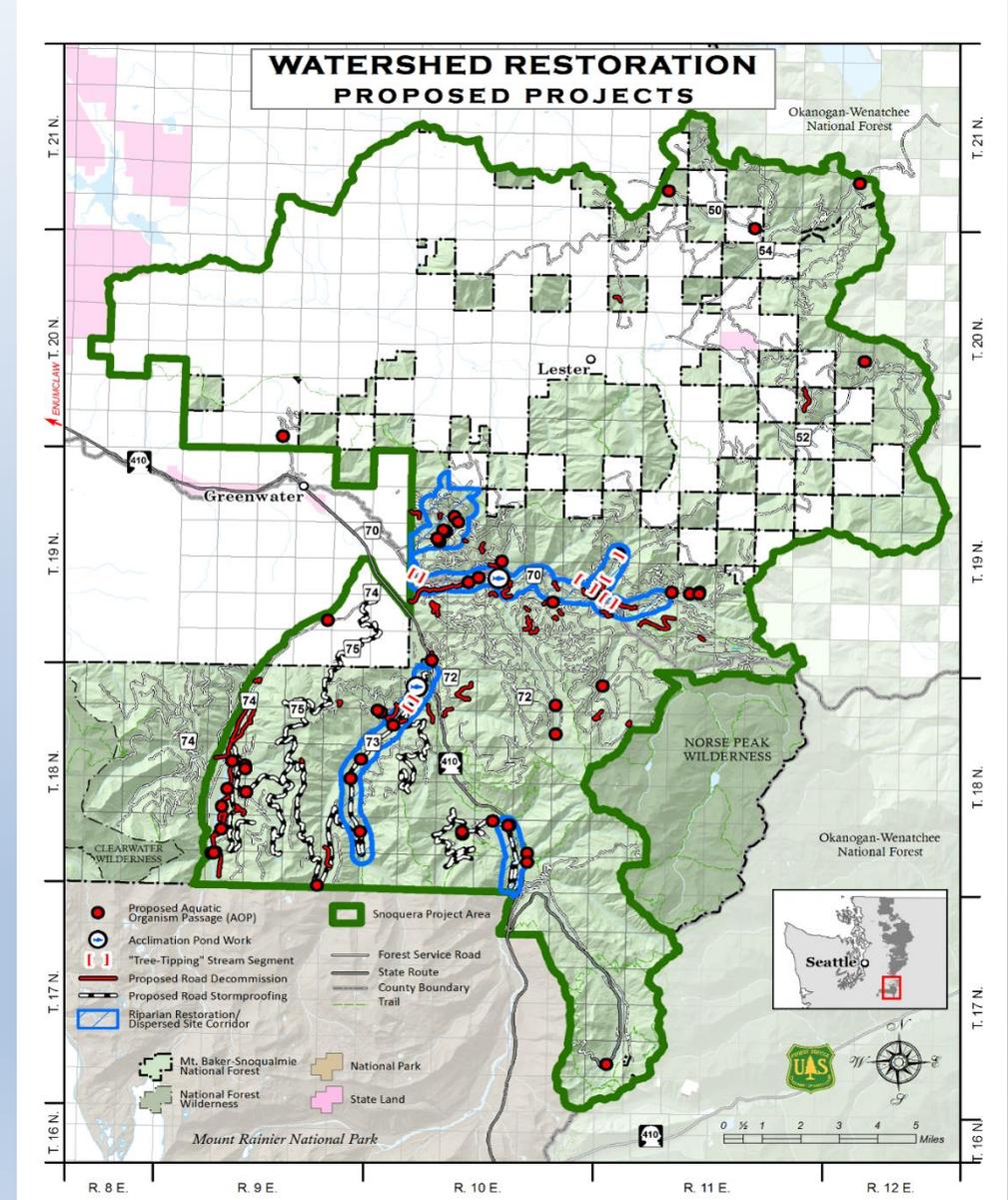
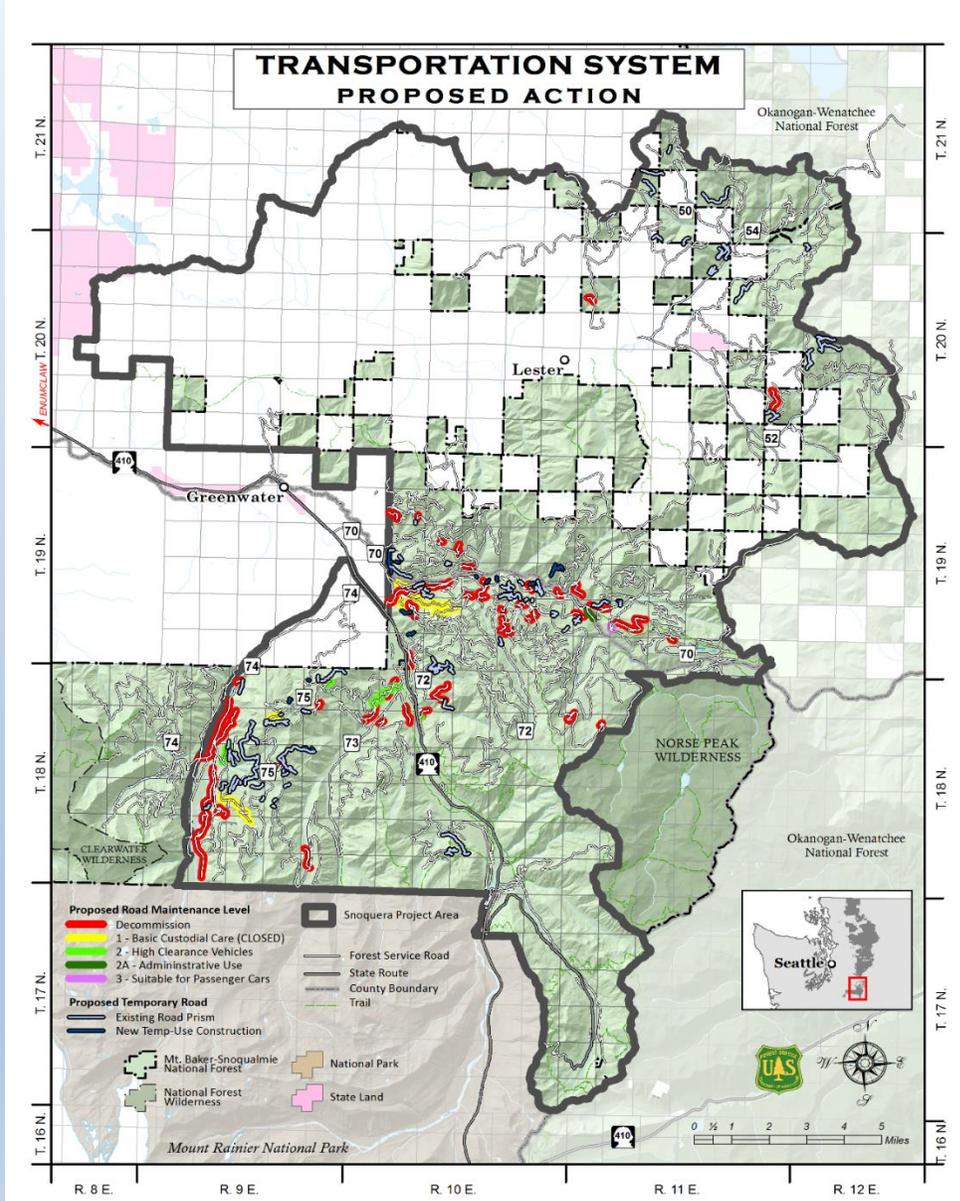
# Will the Analysis Lead to Identifying Other Needed Actions?

| <i>Watershed and Aquatic Restoration Action Examples/Groupings</i>  |  |   |   |
|---|--|---|---|
| <b>Floodplain, Stream Channel and Wetland</b>   | <b>Soil Stability and Productivity</b>   | <b>303d Listed Streams or Other Water Quality Issues</b>  | <b>Fish Distribution and Population Resiliency</b>  |
| Channel relocation<br>Channel aggradation<br>Headcut and/or stream bank stabilization<br>Levee removal<br>In-stream structures<br>Riparian planting and protection<br>Prescribed fire and/or thinning | Soil de-compaction<br>Placement of organic ground cover<br>Seeding<br>Floodplain, stream channel and wetland actions | Floodplain, stream channel and wetland actions<br>Water diversion upgrades<br>Eliminating point source contaminants | Floodplain, stream channel and wetland actions<br>303d listed stream actions<br>Management of non-native fisheries<br>Protection of native resident and anadromous fishes |

# Proposal Refinement



# Aquatics Proposed Action

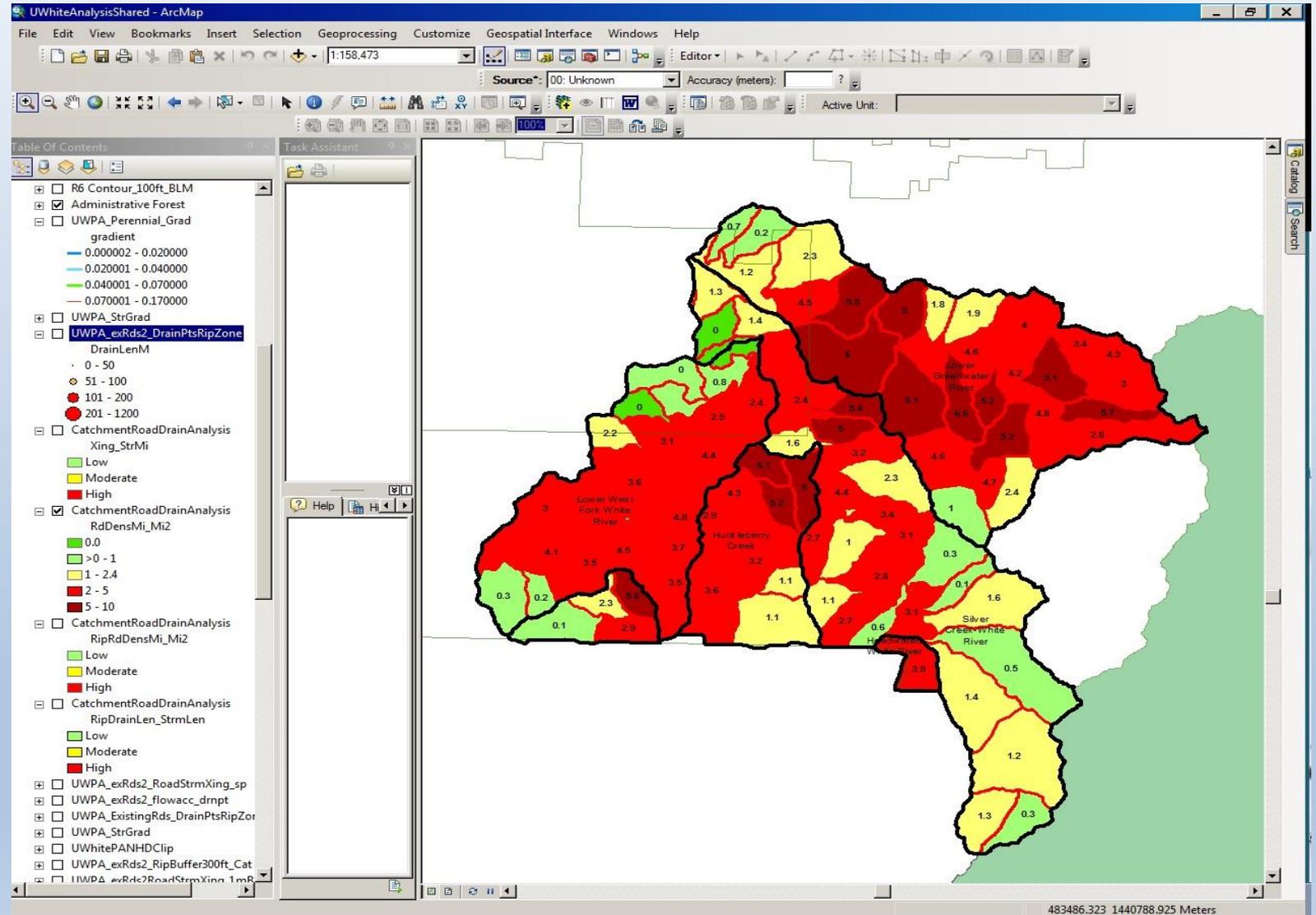


# How does the WA Practitioner know a proposal = restoration??

➤ Does a proposal turn:

- Red catchments to yellow?
- Red catchments to green?
- Yellow catchments to green?
- How many catchments were affected in a positive way?
- How miles of habitat were positively affected?

➤ The procedures are built so a WA Practitioner can re-run the sub-watershed assessment on the outcome of an initial proposal, proposed action or any alternatives to a proposed action.



# MBS NF Integrated Restoration Approach: Next Steps

- 2<sup>nd</sup> Iteration of Landscape Prioritization Model

Incorporate Puget Sound recovery factors (as specific to NFS land) for ESA listed fishes.

Incorporate other potential factors, such as landslide prone areas.

- Continue refinement of the restoration procedures (i.e. create better linkages between habitat data and model outputs).

- Upper White EA; Greenwater ATM; Snoquera EA:

Implement projects – Upper White River

What about Upper Green River?

- Update WCF: Priority WA = Greenwater River



QUESTIONS??

