

Preliminary Analysis of Modified Streams

City of San Diego

Transportation and Storm Water Department

April 23, 2014



think **BLUE**

SAN DIEGO

Bio-objectives Support



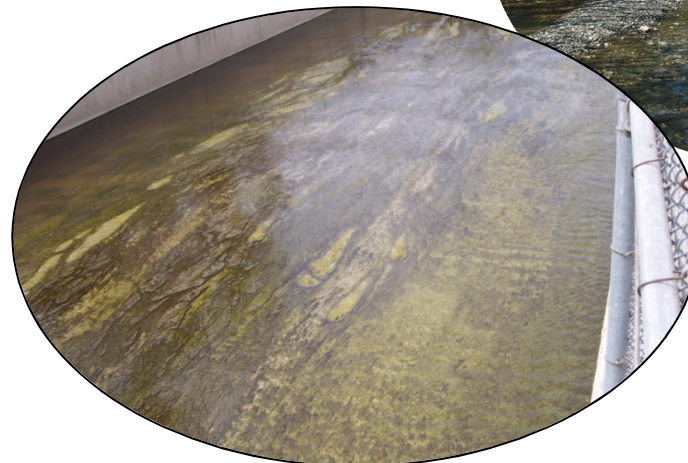
- **City of San Diego support (over past 2+ years)**
 - Policy support:
 - Workgroup participation
 - Definitions, Issues Paper, Implementation flow chart, States' experience
 - Identified additional potential reference sites
 - Flow analyses to help determine perenniality
- **Current work**
 - SoCal focus, but potential for statewide application
 - Refining reference site selection using species traits
 - **Preliminary method for identifying modified streams**
 - Performing additional analyses to identify perennial and non-perennial streams
 - Causal Assessment improvements and analytical tools
 - San Diego River CADDIS follow-up



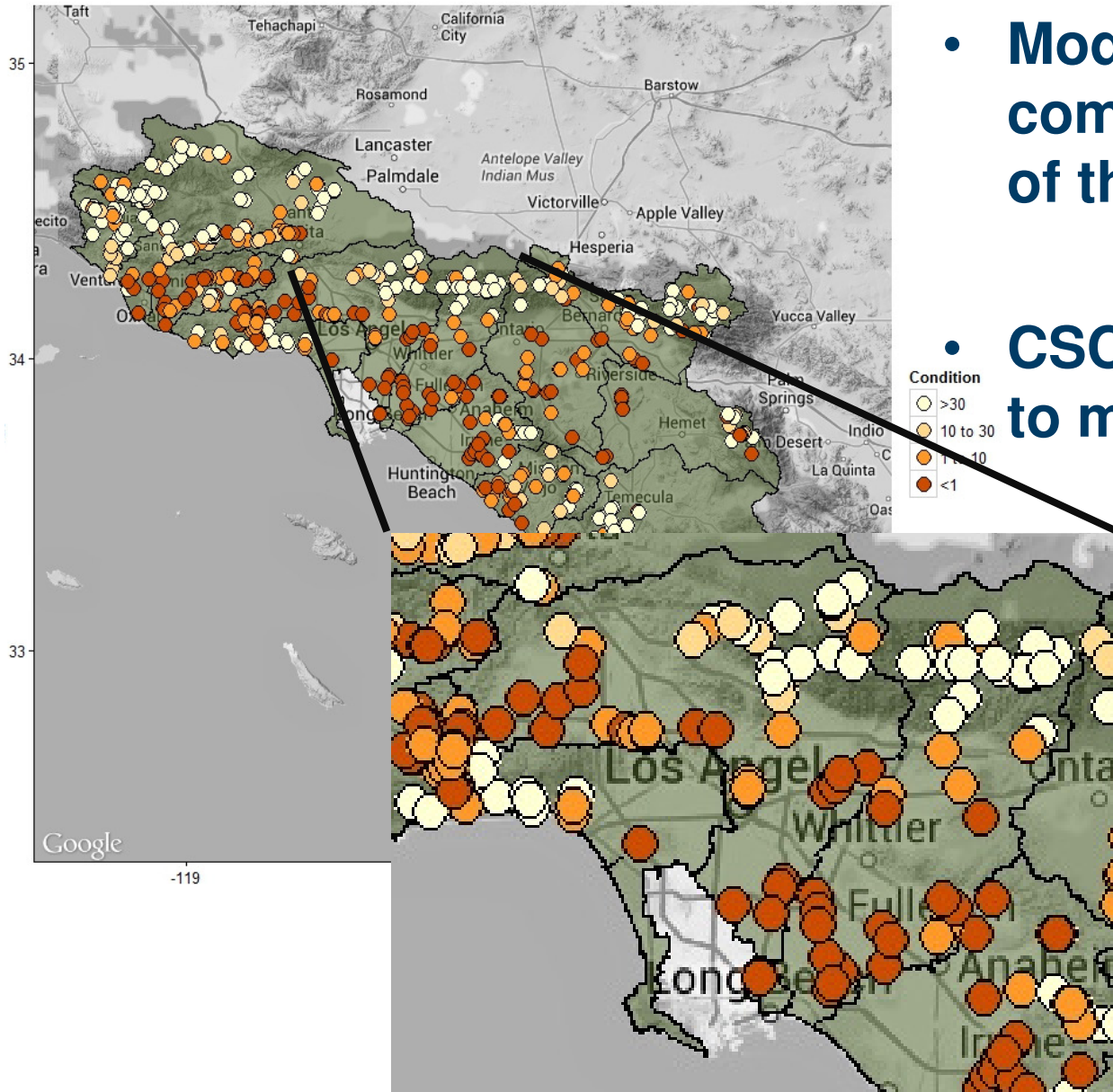
Modified Channels Intro

Pervasive Question of Modification

- **State/Federal wetland policies**
- **Hydromodification**
- **Nutrient numeric endpoints**
- ***Bio-objectives***

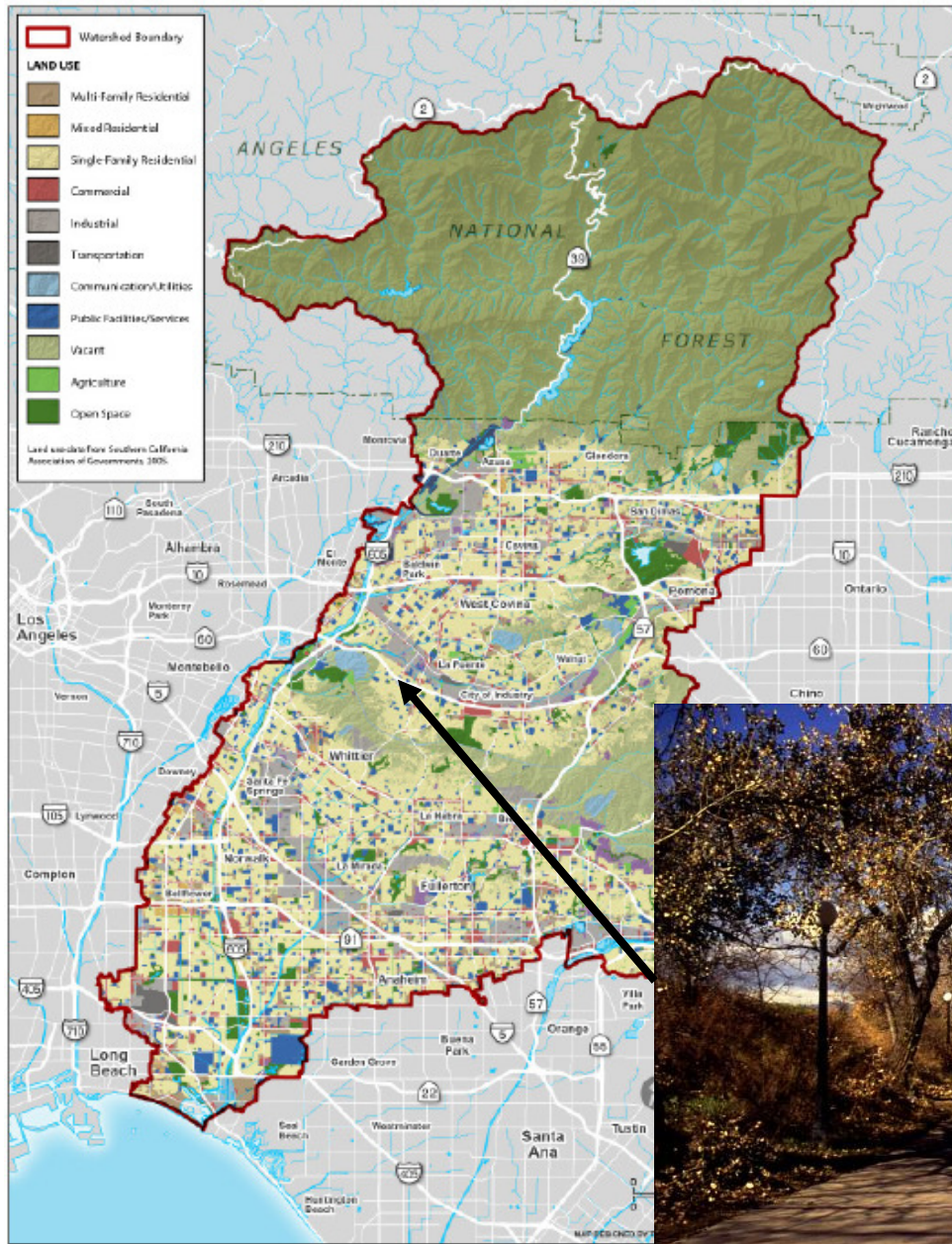


Overview of the Issue



- Modified streams are common in some regions of the State
- CSCI scoring tool applies to modified streams

Overview of the Issue



- What is an appropriate management expectation for modified streams?
- How can the CSCI (and other tools) be used to help set priorities for modified streams?



Key Questions

- What are the different types of modified streams?
 - How can we define/identify each “class” of modified streams?
 - How can we map each class of modified streams?
-

1st Phase

- What is the range of biological conditions that occur within each class?
- What management actions can be used to maximize biological condition within the range of expectations?

2nd Phase

Types of Modification

- **Structurally modified (i.e. channelized)**
- **Modified due to agricultural practices**
- **Modified due to forestry practices**
- **Hydrologically modified**
- **Others??**

Modified - Urban



Modified – Agriculture/Grazing



Modified - Timber



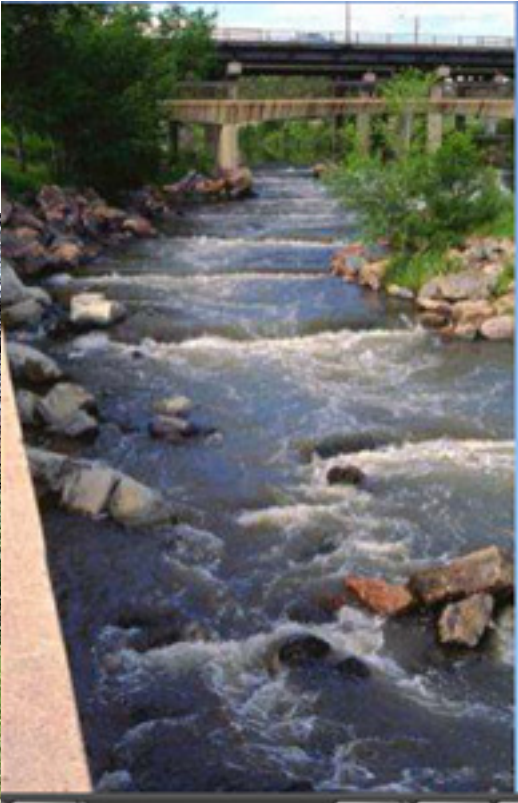
Modified – Floodplain/Armored



What About These?



Are These Modified?

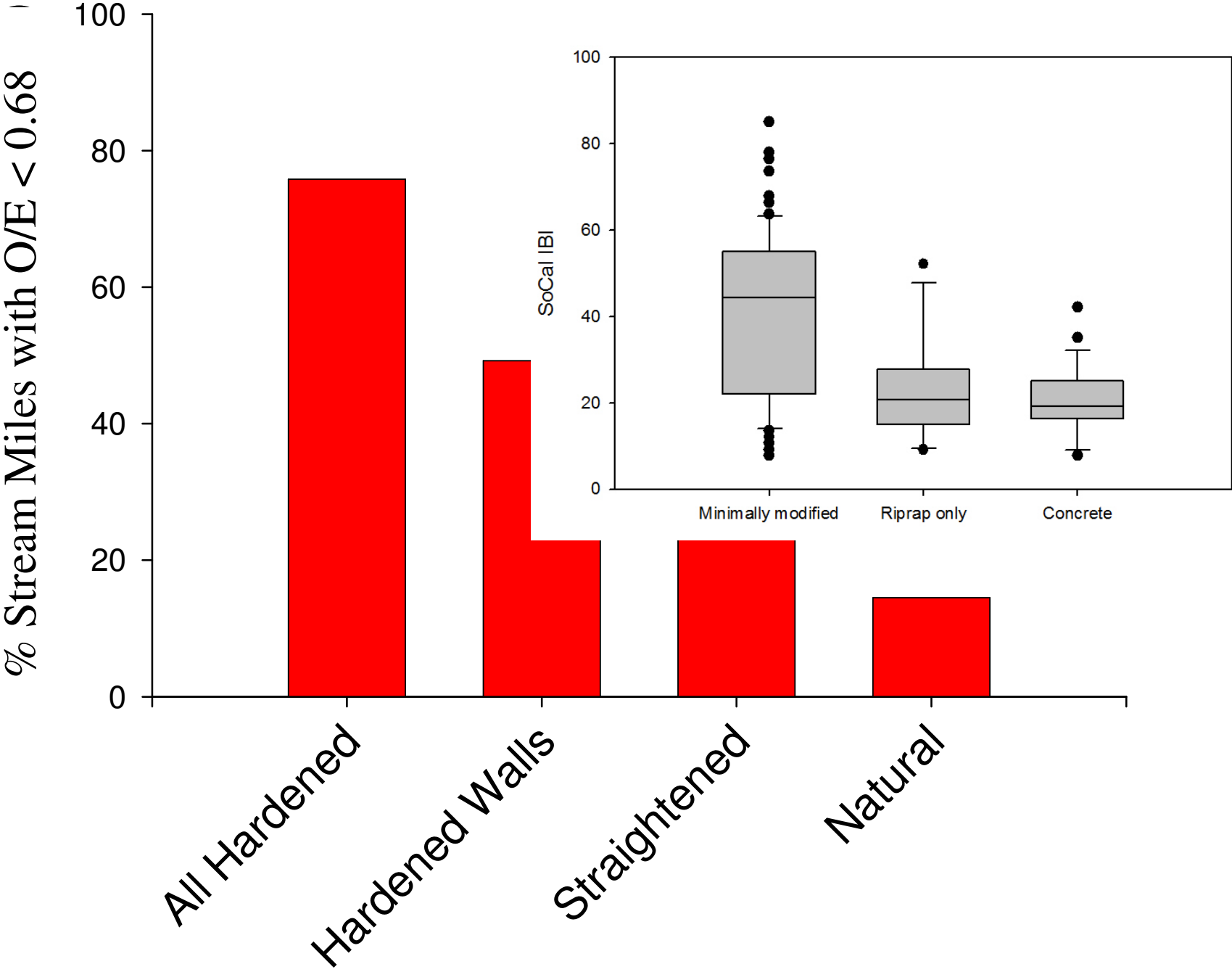


SMC Pilot Study



Hardscape Classification	All Stream	SMC Mountain	SMC Xeric
Concrete Walls and Bottom	5%	0%	7%
Concrete Walls, Soft Bottom	5%	0%	7%
Unlined, But Straightened	14%	1%	20%
Natural Watercourse	77%	99%	66%

ALL SMC



Current SMC Project:

Expected Products

- **Agreement on priority classes of modified streams for focus of initial efforts**
- **Agreement on definition(s) for priority classes**
- **Standard approach to identify and map priority classe(s)**
- **Preliminary analysis of ranges of biological conditions**
 - Relationships of key stressors and/or management actions

Key Questions – Phase 1

- **What are the different types of modified streams?**
- **How can we define/identify each “class” of modified streams?**
- **How can we map each class of modified streams?**

Approach



- Classify **stream reaches** in the Southern California coastal region (Ecoregion 85) using readily-available GIS data
 - NHD Plus version 2 (1:100,000 scale)
- Classify **monitoring sites** using site-specific physical habitat data and GIS reach information
 - 382 sites in the Southern California coastal region with biological data, sampled 2000-2011 (obtained from SWAMP/CEDEN)
 - Applied weight-of-evidence approach
- Compared GIS stream reach and site-specific results
 - Evaluate agreement/differences between the two methods
 - Identify additional analyses and field verification needs



Identifying Modified Stream Reaches



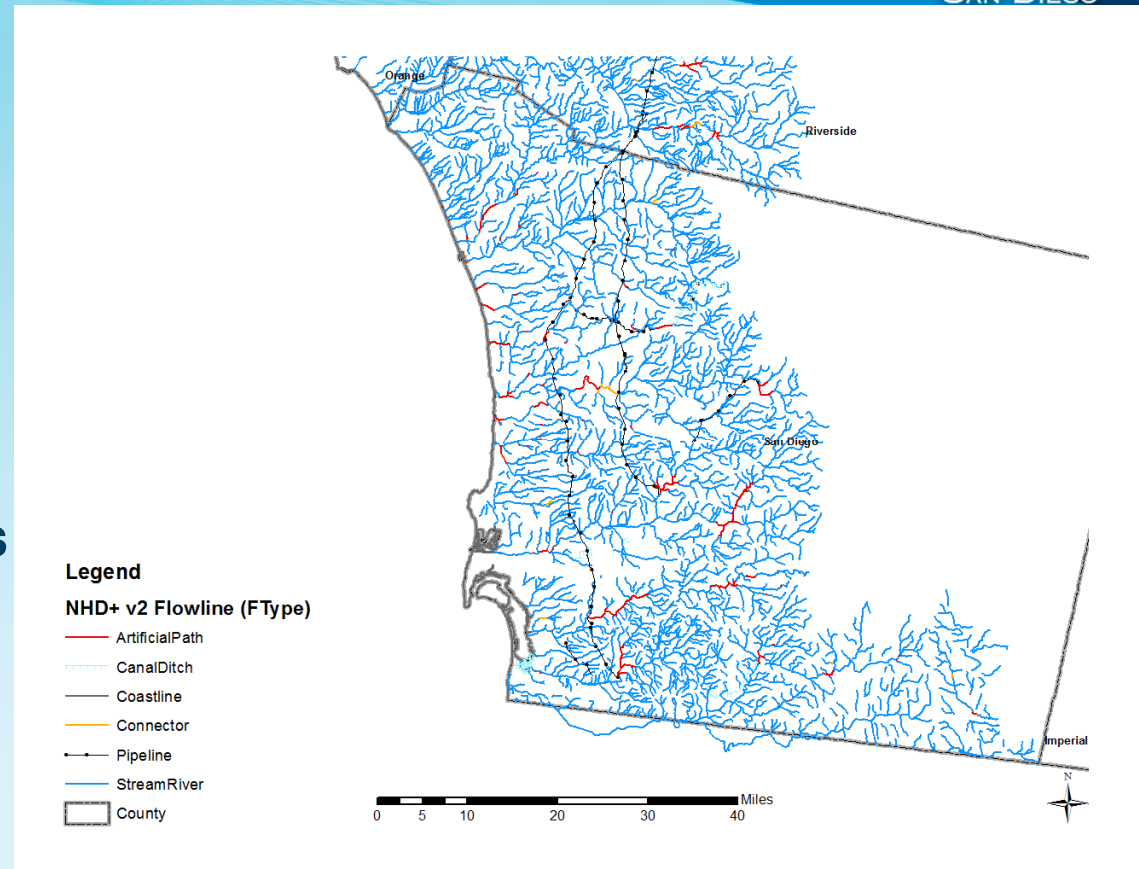
- **GIS-based desktop analysis**
- **Decision-tree approach**
- **Ecoregion 85**
- **Readily available regional data**
 - NHD Plus version 2 (1:100,000 scale)
 - National Dam Inventory (part of the National Atlas)
 - National Land Cover Database 2006
- **Possible outcomes:**
 - Natural
 - Likely Natural
 - Likely Modified
 - Modified
 - Unknown



1. Excluded & Man-made



- **Reaches excluded**
 - Artificial Paths
 - Pipelines
 - Coastline
 - Lakes, Reservoirs
 - 2,468 stream km are EXCLUDED
- **Man-made or straightened reaches**
 - Connector
 - Canal/ditch
 - 1,045 stream km are MODIFIED



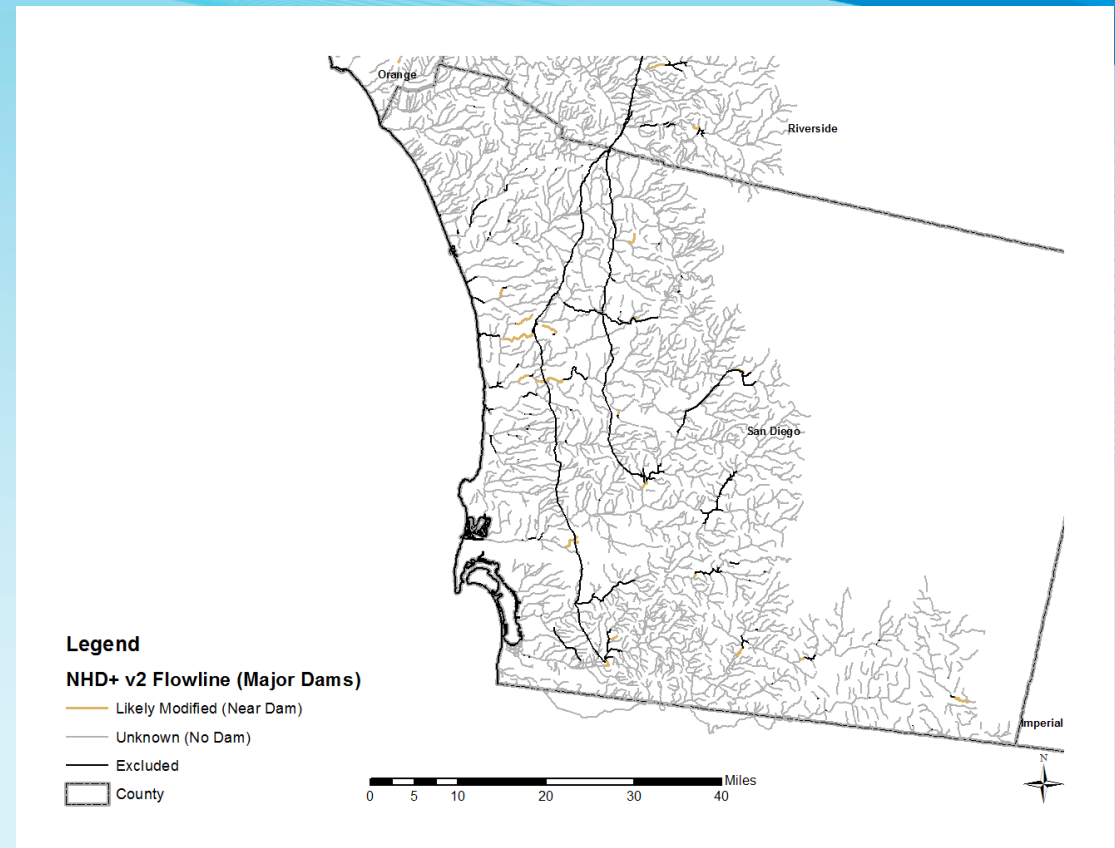
Data Source: NHD Plus version 2



2. Influenced by Dams



- The first reach immediately below a dam is considered to be likely modified.
- 355 stream km are **LIKELY MODIFIED**



Data Source: National Dam Inventory



3. Sinuosity and Land Cover



Sinuosity (stream order 1-3)	Sinuosity (stream order 4-6)	Land Cover in 20m buffer	Modification Status	# Stream km
> 1.5	> 1.3	>= 50% natural	Natural	303
		>= 25% natural & < 25% ag or heavily developed	Likely Natural	6
		Other	Unknown	285
> 1.1 and <= 1.5	> 1.1 and <= 1.3	>= 50% natural	Likely Natural	4,896
		>= 50% ag or heavily developed	Likely Modified	4,328
		Other	Unknown	78
<= 1.1	<= 1.1	>= 50% ag or heavily developed	Modified	3,531
		>= 25% ag or heavily developed & < 25% natural	Likely modified	33
		Other	Unknown	2,685

Data Sources: NHD Plus version 2; National Land Cover Database, 2006



Land Use

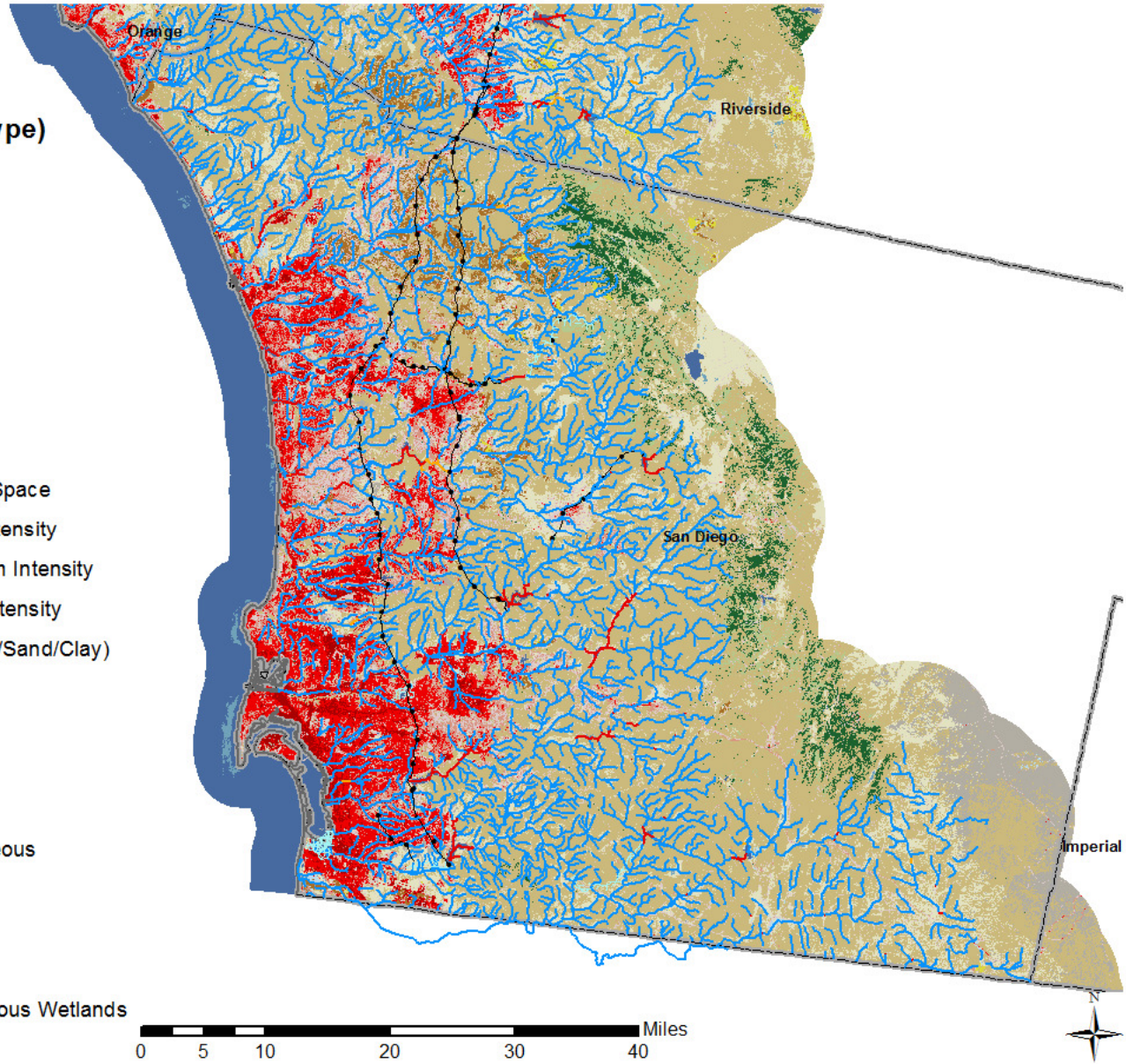
Legend

NHD+ v2 Flowline (FType)

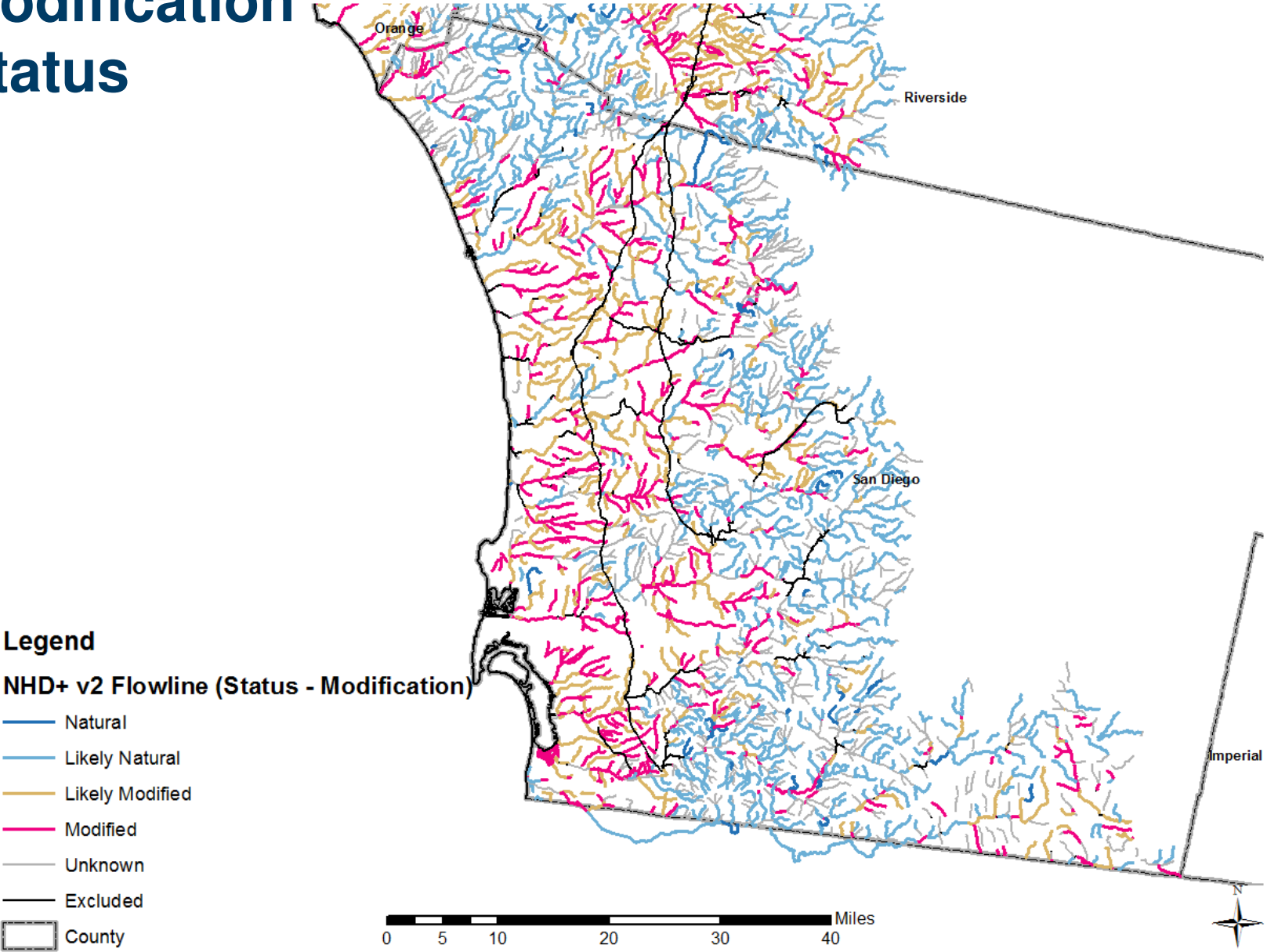
- ArtificialPath
- CanalDitch
- Coastline
- Connector
- Pipeline
- StreamRiver

LULC (MRLC 2006)

- 11, Open Water
- 21, Developed, Open Space
- 22, Developed, Low Intensity
- 23, Developed, Medium Intensity
- 24, Developed, High Intensity
- 31, Barren Land (Rock/Sand/Clay)
- 41, Deciduous Forest
- 42, Evergreen Forest
- 43, Mixed Forest
- 52, Shrub/Scrub
- 71, Grassland/Herbaceous
- 81, Pasture/Hay
- 82, Cultivated Crops
- 90, Woody Wetlands
- 95, Emergent Herbaceous Wetlands
- County



Modification Status



Overall Reach Results



- Number of stream kilometers in each classification

Type	Reach Length (km)	% of Total Reach Length
Excluded (e.g. lakes, reservoirs, artificial paths, pipelines, coastline, etc.)	2,468	N/A (these were excluded from analysis)
Natural	303	2%
Likely Natural	4,902	28%
Likely Modified	4,716	27%
Modified	4,576	26%
Unknown	3,048	17%



Identifying Modified Stream Sites



- **Classified monitoring sites using site-specific physical habitat data and GIS reach information (382 sites with biological data)**
 - **Applied weight-of-evidence approach**
 - **Assigned score to each metric:**
 - Natural = -1
 - Likely Natural = -0.5
 - Likely Modified = 0.5
 - Modified = 1
 - Unknown = 0
 - **Calculated aggregate score across all metrics (table on right)**
- * Not all sites had data for each metric**

Aggregate Site Score	Final Site Classification
≤ -0.5	Natural
≥ -0.5 and < 0	Likely Natural
≥ 0 and < 2.5	Unknown
≥ 2.5 and < 4	Likely Modified
≥ 4	Modified

Data Source: CEDEN, data from 2000 to 2011



Site-specific Data Included



Metric	Natural	Likely natural	Likely modified	Modified
Channel alteration	16 to 20	11 to 15	6 to 10	1 to 5
Sediment deposition	16 to 20	11 to 15	6 to 10	1 to 5
Embeddedness	0 – 25%	25 – 50%	50 – 75%	75 – 100%
Dominant land cover in the area of the site	Forest, rangeland	Suburb/town; agriculture (status unknown)		Urban/ industrial



Reach-based Data Included



Metric	Natural	Likely natural	Likely modified	Modified
Reach type	N/A	N/A	N/A	Canal/ditch, connector, artificial path*
Sinuosity	> 1.5 (stream orders 1-3) > 1.3 (stream orders 4-6)	> 1.3 and <= 1.5 (stream orders 1-3)	> 1.1 and <= 1.3 (stream orders 1-3)	<= 1.1 (stream orders 1-6)
Land cover in 20-m reach buffer	>= 50% natural	>= 25% natural and < 25% ag or heavily developed	>= 25% ag or heavily developed and < 25% natural	>= 50% ag or heavily developed
Dams present	N/A	N/A	Dam on the same reach as the site	Dam within 250 m of the site
MS4 channel material**	N/A	N/A	N/A	Concrete or rock basket

* Artificial path was retained because 7 sampled stations lie on these reaches.

** Data source: City of San Diego Stormwater Department, MS4 data layer.



Example Site Score



Metric	Value	Category	Score
Channel alteration	15	Likely natural	-0.5
Sediment deposition	6	Likely modified	0.5
Embeddedness	90	Modified	1
Dominant land cover	N/A	Unknown	0
Reach type	Stream/River	Unknown	0
Sinuosity	1.11	Likely modified	0.5
Reach land cover	54% natural 46% disturbed	Natural	-1
Dams	No dams	Unknown	0
MS4 materials	N/A	Unknown	0
TOTAL			0.5 (Unknown)



Modification Status

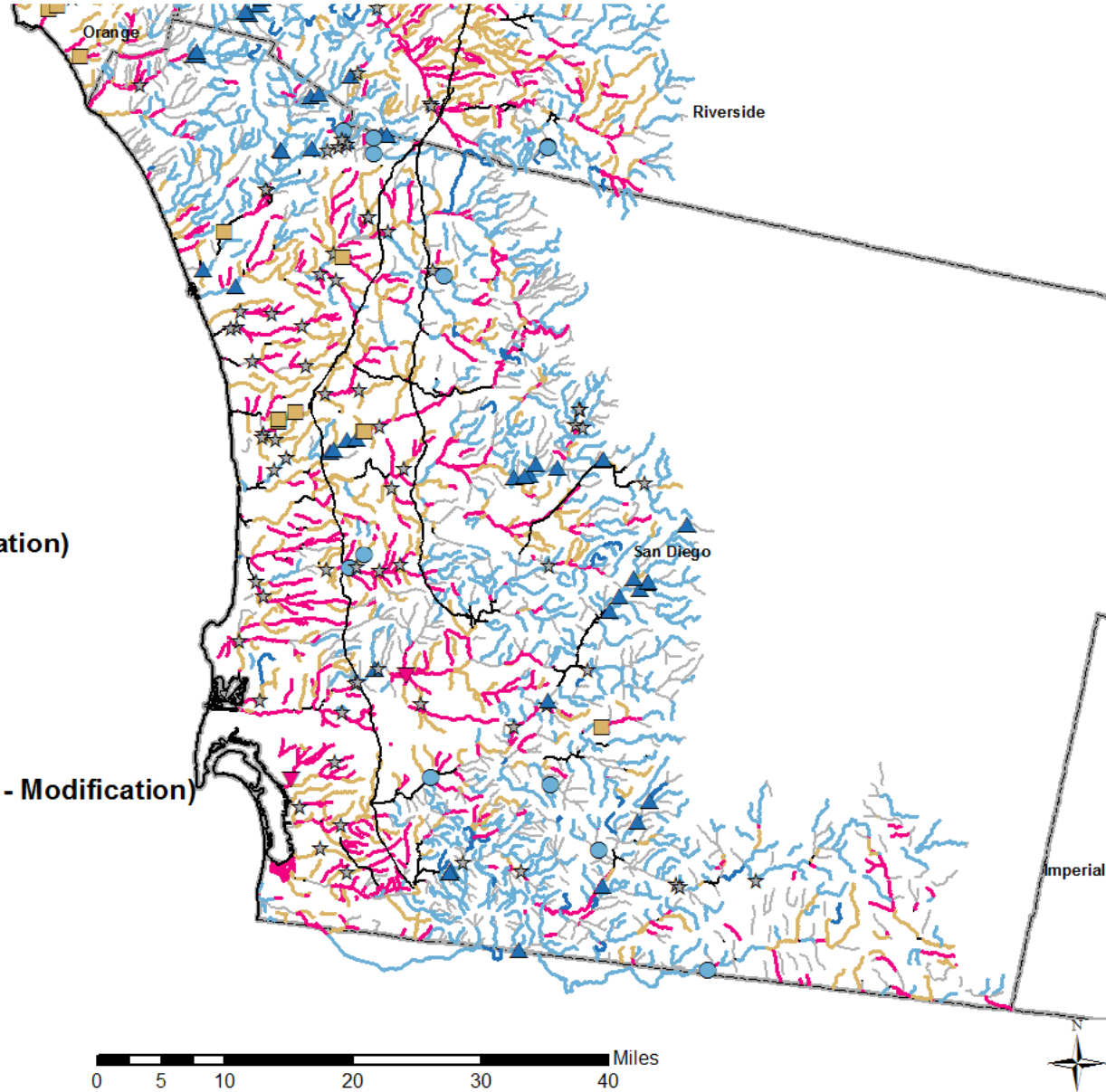
Legend

Stations (Status - Modification)

- ▲ Natural
- LikelyNat
- LikelyMod
- ▼ Mod
- ☆ Unk

NHD+ v2 Flowline (Status - Modification)

- Natural
- Likely Natural
- Likely Modified
- Modified
- Unknown
- Excluded
- County



Comparing Reach & Site Classifications

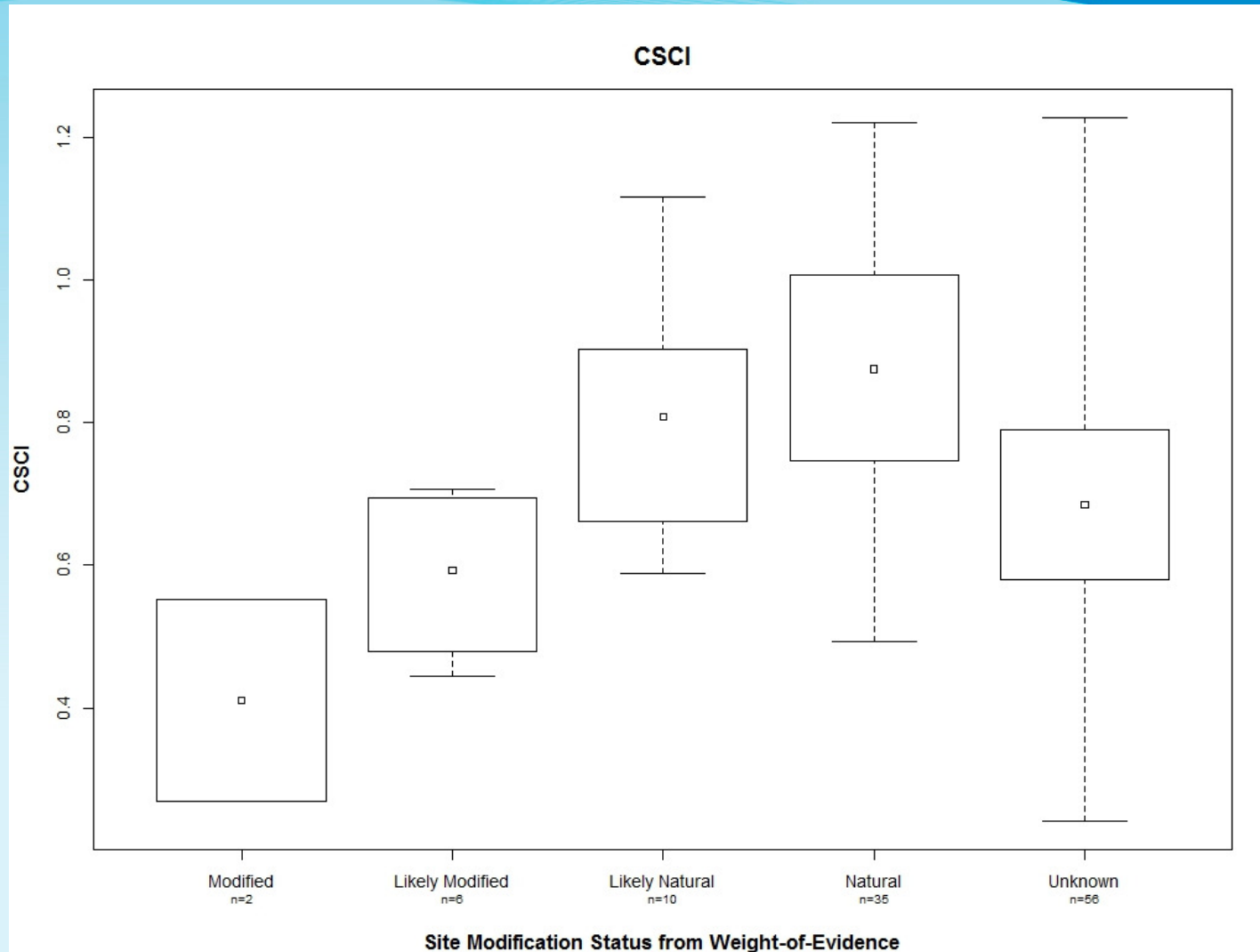


- GIS reach-based and site-specific results generally agree, within classifications other than Unknown (see shading)
- Table below lists # of sites within each category from the site-specific analysis, compared to the GIS classification for the associated reach

		Site Classification (numbers below are from the site-specific analysis – compared to GIS reach results)				
		Natural	Likely Natural	Likely Modified	Modified	Unknown
Reach Classification	Natural	5	1	0	0	0
	Likely Natural	46	33	0	0	18
	Likely Modified	2	6	18	0	60
	Modified	0	0	18	6	82
	Unknown	25	10	2	0	32
Sites occur on excluded reaches		0	1	4	1	6
Sites not near a reach		6	0	0	0	0



Modification Status and CSCI scores



Next Steps



- **GIS-based reach screening**
 - Incorporate additional data that would allow better identification of natural stream reaches and reduce unknowns
 - Include NHD catchment % land cover indicator
 - Optimize GIS thresholds (e.g. buffer width, % land cover type)
- **Site-specific weight-of-evidence**
 - Incorporate additional metrics, if available (e.g., habitat metrics measured at each transect, currently not in the database)
 - Optimize GIS thresholds and incorporate additional information
 - Greater consideration of GIS reach and site results (and discrepancies)
 - Incorporate CRAM and NWI mapping data
 - Develop indicator taxa
- **Field verification (pilot study)**
- **Collaboration – related efforts**
 - SMC and Flow Ecology teams
 - Additional collaboration and application to multiple programs

