Arid West and Western Mountains Streamflow Duration Assessment Methods:
Riffle-pool sequence and particle size or stream substrate sorting

Video Training

2025

The Arid West and Western Mountains SDAMs are based on 11 indicators:

All indicators are measured in the **field**

7 are shared by both SDAMs, plus:
- One only used in AW SDAM
- Three only used in WM SDAM

In recommended order of data collection
1. Bankfull channel width
2. Aquatic macroinvertebrate indicators
   - Abundance of perennial indicator taxa
   - Abundance of Ephemeroptera, Plecoptera, and Trichoptera (WM only)
4. Slope
5. Shading (WM only)
6. Number of hydrophytic plant species
7. Prevalence of rooted upland plants in the streambed
8. Algal cover (AW only)
9. Differences in vegetation
10. Riffle-pool sequence
11. Particle size or stream substrate sorting (WM only)

Riffle-pool sequence for Arid West & Western Mountains

Riffle-pool sequence

- Longer flow durations are associated with larger peak flow magnitudes, which foster the formation of in-stream structures (riffles and pools) and repeating sequences of structures.

- Riffles are zones of faster flowing water where the channel gradient is higher and bed material is coarser. Pools are zones of slow-flowing deep water where the channel gradient is low and bed material is finer.

- Any repeating sequence of bed forms counts for this indicator (step-pool, riffle-run, etc), the sequence formed will differ based on gradient and bed material.

- Even in a dry reach, the sequence of features can be observed by examining the local profile and patterns of sediment deposition (easier in non-sand bed streams).

Riffle-pool sequence for Arid West & Western Mountains

Riffle-Pool Sequence

This indicator is based on a visual estimate of distinction and number of structures (riffles and pools) through the assessment reach scored on an ordinal scale, where half scores are allowed:

- **Poor (0): No riffle-pool sequences observed.**

No structural definition is apparent throughout the reach.

Riffle-pool sequence for Arid West & Western Mountains

Riffle-Pool Sequence

Indicator is based on a visual estimate of distinction and number of structure sequences (riffles and pools) through the assessment reach scored on an ordinal scale, where half scores are allowed:

- Poor (0): No riffle-pool sequences observed.

- Weak (1): **Mostly has areas of pools <u>or</u> of riffles.**

The reach is largely comprised of pools and transitions to other structures infrequent or not distinct.

Riffle-pool sequence for Arid West & Western Mountains

Riffle-Pool Sequence

Indicator is based on a visual estimate of distinction and number of structure sequences (riffles and pools) through the assessment reach scored on an ordinal scale, where half scores are allowed:

- Poor (0): No riffle-pool sequences observed.

- Weak (1): Mostly has areas of pools or of riffles.

- **Moderate (2): Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult to observe.**

More structural definition is apparent, but distinctions are subtle.

Riffle-pool sequence for Arid West & Western Mountains

Riffle-Pool Sequence

Indicator is based on a visual estimate of distinction and number of structure sequences (riffles and pools) through the assessment reach scored on an ordinal scale, where half scores are allowed:

- Poor (0): No riffle-pool sequences observed.

- Weak (1): Mostly has areas of pools <u>or</u> of riffles.

- Moderate (2): Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult to observe.

- **Strong (3): Demonstrated by a frequent number of structural transitions (e.g., riffles followed by pools) along the entire reach. There is an obvious transition between riffles and pools.**

A sequence of structures is present throughout the reach and transitions between them are obvious.

Riffle-pool sequence for Arid West & Western Mountains

Record on the field form

10. Riffle-pool sequence (AW and WM)

____(0-3) *Half-scores (0.5, 1.5, 2.5) are allowed.*	Evaluate the prevalence of riffles, pools, and other microhabitats in the streambed. 0. (Poor) No riffle-pool sequences observed. 1. (Weak) Mostly has areas of pools <u>or</u> riffles. 2. (Moderate) Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult to observe. 3. (Strong) Demonstrated by a frequent number of structural transitions (e.g., riffles followed by pools) along the entire reach. There is an obvious transition between riffles and pools.
Notes about riffle-pool sequence:	

Riffle-pool sequence for Arid West & Western Mountains

Particle size or stream substrate sorting

- Response to erosional and sediment transport forces that are a result of streamflow. Stronger particle size differentiation and evidence of sorting is associated with longer streamflow duration.

- Two ways to evaluate:
  - Compare particle size/sediment texture between bottom of channel and areas outside the channel. Bedrock counts!
  - Degree of substrate sorting- distribution/variability of particle sizes in channel.

- May be able to visually assess, though some features with finer sediments may require other methods (pebble count, sand gage reference card).

- May be difficult to assess when channel ice is present.

Particle size or substrate sorting for Western Mountains

Particle size or stream substrate sorting

Indicator is based on comparison of in-channel to out-of-channel sediments and/or degree of substrate sorting in the channel. This indicator is scored on an ordinal scale, where half scores are allowed:

- **Poor (0): Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the channel.**

Sediment texture is similar between channel and surrounding uplands; no sorting apparent.

Particle size or substrate sorting for Western Mountains

Particle size or stream substrate sorting

Indicator is based on comparison of in-channel to out-of-channel sediments and degree of substrate sorting in-channel. This indicator is scored on an ordinal scale, where half scores are allowed:

- Poor (0): Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the channel.

- **Moderate (1.5): Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the channel and are represented by a higher ratio of larger particles (gravel/cobble).**


Coarse substrate present in the channel, more differentiation between in-channel and out-of-channel sediments.

Particle size or substrate sorting for Western Mountains

Particle size or stream substrate sorting

Indicator is based on comparison of in-channel to out-of-channel sediments and degree of substrate sorting in-channel. This indicator is scored on an ordinal scale, where half scores are allowed:

- Poor (0): Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the channel.

- Moderate (1.5): Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the channel and are represented by a higher ratio of larger particles (gravel/cobble).

- **Strong (3): Particle sizes in the channel are noticeably different from particle sizes in areas close to but not in the channel. There is a clear distribution of various sized substrates in the channel with finer particles accumulating in the pools, and larger particles accumulating in the riffles/runs.**
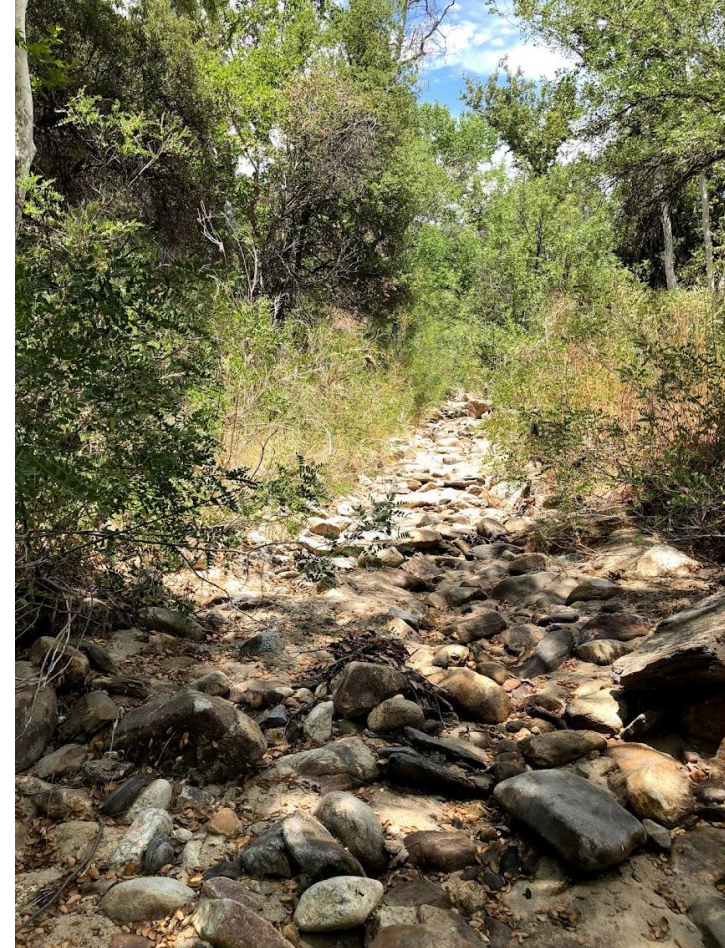
High degree of size differentiation between in-channel and out-of-channel particles; sorting apparent in riffle.

Particle size or substrate sorting for Western Mountains

Record on the field form

This only appears on the WM and combined field forms

11. Particle Size or Stream Substrate Sorting (WM only)

____Particle Size or Stream Substrate Sorting score *Half scores (0.75, 2.25) are allowed.*	Evaluate the extent of substrate sorting. Compare substrate on the channel bed to the banks and adjacent floodplain. Look for sorting within the channel bed (e.g., along bars and islands). 0. (Poor) Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the channel. 1.5 (Moderate) Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the channel and are represented by a higher ratio of larger particles (gravel/cobble; coarse sand in low-gradient streams). 3 (Strong) Particle sizes in the channel are noticeably different from particle sizes in areas close to but not in the channel. There is a clear distribution of various sized substrates in the channel with finer particles accumulating in the pools, and larger particles accumulating in the riffles/runs
Notes about substrate sorting:	

Particle size or substrate sorting for Western Mountains

Knowledge check!

What should be the order of these photos, representing poorest to strongest for riffle-pool sequence?

1

2

A. 1, 2   C. Roughly equal

B. 2, 1

Photo 2 does not have an observable riffle-pool sequence, while the reach in photo 1 has some transition from pools to riffles.

Knowledge check!

Are riffle-pool sequence and particle size or stream substrate sorting *responses* to streamflow duration?

A. Riffle-pool sequence only is a response
B. Particle size or stream substrate sorting only is a response
C. Both are responses
D. Neither are responses

These geomorphological indicators are *associated* with streamflow duration, but not necessarily a response

For more information about SDAMs visit

https://www.epa.gov/streamflow-duration-assessment