# Rapid Bioassessment Protocols for Use in Wadeable Streams and a Rivers: *Visual Habitat Assessment*

**Clean Water Team**

Bioassessment Protocols for Use in Wadeable Streams and Rivers
EPA 841-B-99-002

# **RBP Visual Assessment Scores:** For Basic Physical Habitat, or as an Optional Supplement to the Full Physical Habitat Assessment

- Use the EPA-Rapid Bioassessment Procedures.

  "This was part of prior California Steam Bioassessment Protocols (CSBP). Citizen Monitors are encouraged to continue to use this method. It will be useful for comparison with legacy data. The criteria also have a useful didactic role since they help force the user to quantify key features of the physical environment where bioassessment samples are collected."

  **From : SOP for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California. SWAMP, SWRCB, 2007**

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# EQUIPMENT/SUPPLIES OF USE FOR HABITAT ASSESSMENT AND PHYSICAL/WATER QUALITY CHARACTERIZATION

- Physical Characterization and Water Quality Field Data Sheet*
- Habitat Assessment Field Data Sheet*
- clipboard
- pencils or waterproof pens
- 35 mm camera (may be digital)
- video camera (optional)
- upstream/downstream "arrows" or signs for photographing and documenting sampling reaches
- Flow or velocity meter
- *In situ* water quality meters
- Global Positioning System (GPS) Unit

* It is helpful to copy field sheets onto water-resistant paper for use in wet weather conditions

# THE APPROACH

A generic habitat assessment approach based on visual observation can be separated into 2 basic approaches:

- one designed for high-gradient streams and
- one designed for low-gradient streams.

**A. High-gradient** or riffle/run prevalent streams are those in moderate to high gradient landscapes. Natural high-gradient streams have substrates primarily composed of coarse sediment particles (i.e., gravel or larger) or frequent coarse particulate aggregations along stream reaches.

**B. Low-gradient** or glide/pool prevalent streams are those in low to moderate gradient landscapes. Natural low-gradient streams have substrates of fine sediment or infrequent aggregations of more coarse (gravel or larger) sediment particles along stream reaches.

NOTE: The Same field data sheet is used regardless of the streams gradient.

# THE APPROACH CONTINUED

The entire sampling reach (150m if the stream's wetted width is 10m or the reach can be 250m if the wetted width is greater than *10m* is evaluated for each parameter.

Descriptions of each parameter and its relevance to instream biota are presented in the following discussions.

A brief set of decision criteria is given for each parameter corresponding to each of the 4 categories reflecting a continuum of conditions on the field sheet (optimal, suboptimal, marginal, and poor).

# PROCEDURE FOR PERFORMING HABITAT ASSESSMENT

1. Select the reach to be assessed. Some parameters require an observation of a broader section of the catchment than just the sampling reach.

2. Complete the station identification section of each field data sheet and habitat assessment form.

3. It is best for the investigators to obtain a close look at the habitat features to make an adequate assessment. If the physical and water quality characterization and habitat assessment are done before the biological sampling, care must be taken to avoid disturbing the sampling habitat.

4 Complete the **Habitat Assessment Field Data Sheet**, in a team of 2 or more, if possible, to come to a consensus on determination of quality. Those parameters to be evaluated on a scale greater than a sampling reach require traversing the stream corridor to the extent deemed necessary to assess the habitat feature. As a general rule-of-thumb, use 2 lengths of the sampling reach to assess these parameters.

# QUALITY ASSURANCE PROCEDURES

1. Each monitor is to be **trained** in the visual based habitat assessment technique.

2. The judgment criteria for each habitat parameter are **calibrated** for the stream classes under study. Some text modifications may be needed on a regional basis.

3. Periodic **checks of assessment results** are completed using pictures of the sampling reach and discussions among the monitors in the program.

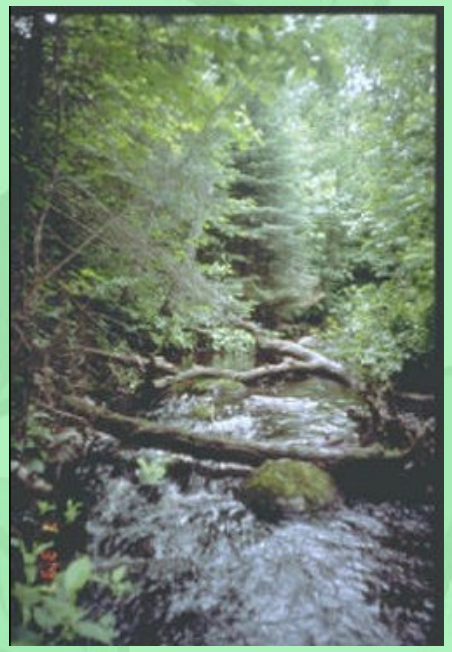
4. **Field audits** may be conducted by knowledgeable persons not affiliated with the monitoring program.

# EPIFAUNAL SUBSTRATE/AVAILABLE COVER

Includes the relative quantity and variety of natural structures in the stream, such as cobble (riffles), large rocks, fallen trees, logs and branches, and undercut banks, available as refugia, feeding, or sites for spawning and nursery functions of aquatic macrofauna. A wide variety and/or abundance of submerged structures in the stream provides macroinvertebrates and fish with a large number of niches, thus increasing habitat diversity. As variety and abundance of cover decreases, habitat structure becomes monotonous, diversity decreases, and the potential for recovery following disturbance decreases. Riffles and runs are critical for maintaining a variety and abundance of insects in most high-gradient streams and serving as spawning and feeding refugia for certain fish. The extent and quality of the riffle is an important factor in the support of a healthy biological condition in high-gradient streams. Riffles and runs offer a diversity of habitat through variety of particle size, and, in many small high-gradient streams, will provide the most stable habitat. Snags and submerged logs are among the most productive habitat structure for macroinvertebrate colonization and fish refugia in low-gradient streams. However, “new fall” will not yet be suitable for colonization.

# 1.Epifaunal Substrate/Available Cover

| Optimal | Suboptimal | Marginal | Poor |
|---|---|---|---|
| Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential. | 40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization. | 20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed | Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking. |
| **20 19 18 17 16** | **15 14 13 12 11** | **10 9 8 7 6** | **5 4 3 2 1 0** |



**Optimal**

**Poor**

# 2 (a) Embeddedness (high gradient)

| Optimal | Suboptimal | Marginal | Poor |
|---|---|---|---|
| Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provided diversity of niche space. | Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment. | Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment. | Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment. |
| **20 19 18 17 16** | **15 14 13 12 11** | **10 9 8 7 6** | **5 4 3 2 1 0** |

Optimal

Poor

# 2 (b) Pool Substrate Characterization

# (Optional-low gradient)

| Optimal | Suboptimal | Marginal | Poor |
|---|---|---|---|
| Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common. | Mixture of soft sand, mud, or clay: mud may be dominant; some root mats and submerged vegetation present. | All mud or clay or sand bottom; little or no root mat; no submerged vegetation. | Hard-pan clay or bedrock; no root mat or vegetation. |
| 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |

Optimal

Poor

# 3 (a) Velocity/Depth Regime (high gradient)

| Optimal | Suboptimal | Marginal | Poor |
|---|---|---|---|
| All four velocity/depth regime present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is <0.3m/s, deep is>0.5m) | Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than missing other regimes).. | Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low). | Dominated by 1 velocity/depth regime (usually slow-deep). |
| **20 19 18 17 16** | **15 14 13 12 11** | **10 9 8 7 6** | **5 4 3 2 1 0** |

Optimal

Poor

# 3 (b) Pool Variability (Optional-low gradient)

| Optimal | Suboptimal | Marginal | Poor |
|---|---|---|---|
| Even mix of large-shallow, large-deep, small-shallow, small-deep pools present. | Majority of the pools large deep; very few shallow. | Shallow pools much more prevalent than deep pools. | Majority of pools small-shallow or pools absent. |
| 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |

Optimal

Poor

# 4. Sediment Deposition

| Optimal | Suboptimal | Marginal | Poor |
|---|---|---|---|
| Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition. | Some new increase in bar formation, mostly from gravel, sand or fine sediment: 5-30% of the bottom affected; slight deposition in pools. | Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constructions and bends; moderate deposition o pools prevalent. | Dominated by 1 velocity/depth regime (usually slow-deep). |
| 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |

Optimal

Poor

# 5. Channel Flow Status

| Optimal | Suboptimal | Marginal | Poor |
|---|---|---|---|
| Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. | Water fills >75% of the available channel; or <25% of channel substrate is exposed. | Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. | Very little water in channel and mostly present as standing pools. |
| 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |

Optimal

Poor

# 6. Channel Alteration

| Optimal | Suboptimal | Marginal | Poor |
|---|---|---|---|
| Channelization or dredging absent or minimal; stream with normal pattern. | Some channelization present, usually in areas of bridge, abutments; evidence of past channelization, i.e. dredging, (greater than past 20 yrs) may be present but recent channelization is not present. | Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted, | Bank shored with gabion or cement; over80%fo the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely. |
| 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |

Optimal

Poor

# 7(a) Frequency of Riffles (or bends)

| Optimal | Suboptimal | Marginal | Poor |
|---|---|---|---|
| Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important. | Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to15. | Occasional riffle or bend; bottom continuous provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25. | Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ration of >25 |
| **20 19 18 17 16** | **15 14 13 12 11** | **10 9 8 7 6** | **5 4 3 2 1 0** |

**Optimal**

**Poor**

# 7(b) Channel Sinuosity (Optional-low gradient)

| Optimal | Suboptimal | Marginal | Poor |
|---|---|---|---|
| The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note- channel braiding is considered normal in coastal plains and other low lying areas. This parameter is not easily rated in these area) | The bends in the stream increase the stream length 1 to 2 times longer than if it was in straight line. | The bends in the stream increase the stream length 1 to 2 times longer than if it was in straight line. | Channel Straight; waterway has been channelized for a long distance. |
| **20 19 18 17 16** | **15 14 13 12 11** | **10 9 8 7 6** | **5 4 3 2 1 0** |

**Optimal**

**Poor**

# 8. Bank Stability

| Optimal | Suboptimal | Marginal | Poor |
|---|---|---|---|
| Bank stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected | Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. | Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. | Unstable; many eroded areas; “raw” areas infrequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. |
| Left Bank * 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| Right Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |

Optimal

Poor

* Note: determine left of right side by facing downstream

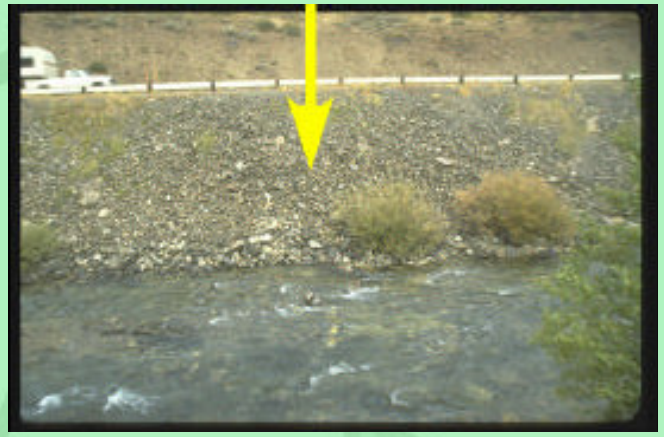
# 9. Vegetative Protection

| Optimal | Suboptimal | Marginal | Poor |
|---|---|---|---|
| More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. | 70-90% of streambank surfaces covered by native vegetation, but one class of plants is not well represented; disruption evidence but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. | 50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. | Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5centimeters or less in average stubble height. |
| Left Bank 10 9 | **8 7 6** | **5 4 3** | **2 1 0** |
| Right Bank 10 9 | **8 7 6** | **5 4 3** | **2 1 0** |


# 10. Riparian Vegetative Zone Width

| Optimal | Suboptimal | Marginal | Poor |
|---|---|---|---|
| Width of riparian zone >18 meters; human activities (i.e. parking lots, roadbeds, clear-cut, lawns or crops have not impacted zone. | Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. | Width of riparian zone 12- 18 meters; human activities have impacted zone a great deal. | Width of riparian zone <6 meters; little or no riparian vegetation due to human activities. |
| Left Bank 10 9 | **8 7 6** | **5 4 3** | **2 1 0** |
| Right Bank 10 9 | **8 7 6** | **5 4 3** | **2 1 0** |

**Optimal**



**Poor**

CALIFORNIA DEPARTMENT OF FISH AND GAME
AQUATIC BIOASSESSMENT LABORATORY

WATER POLLUTION CONTROL LABORATORY
REVISION DATE-- MAY 1999

# PHYSICAL HABITAT QUALITY
## (California Stream Bioassessment Procedure)

WATERSHED/ STREAM: _____ DATE/ TIME: _____

COMPANY/ AGENCY: _____ SAMPLE ID NUMBER: _____

SITE DESCRIPTION: _____

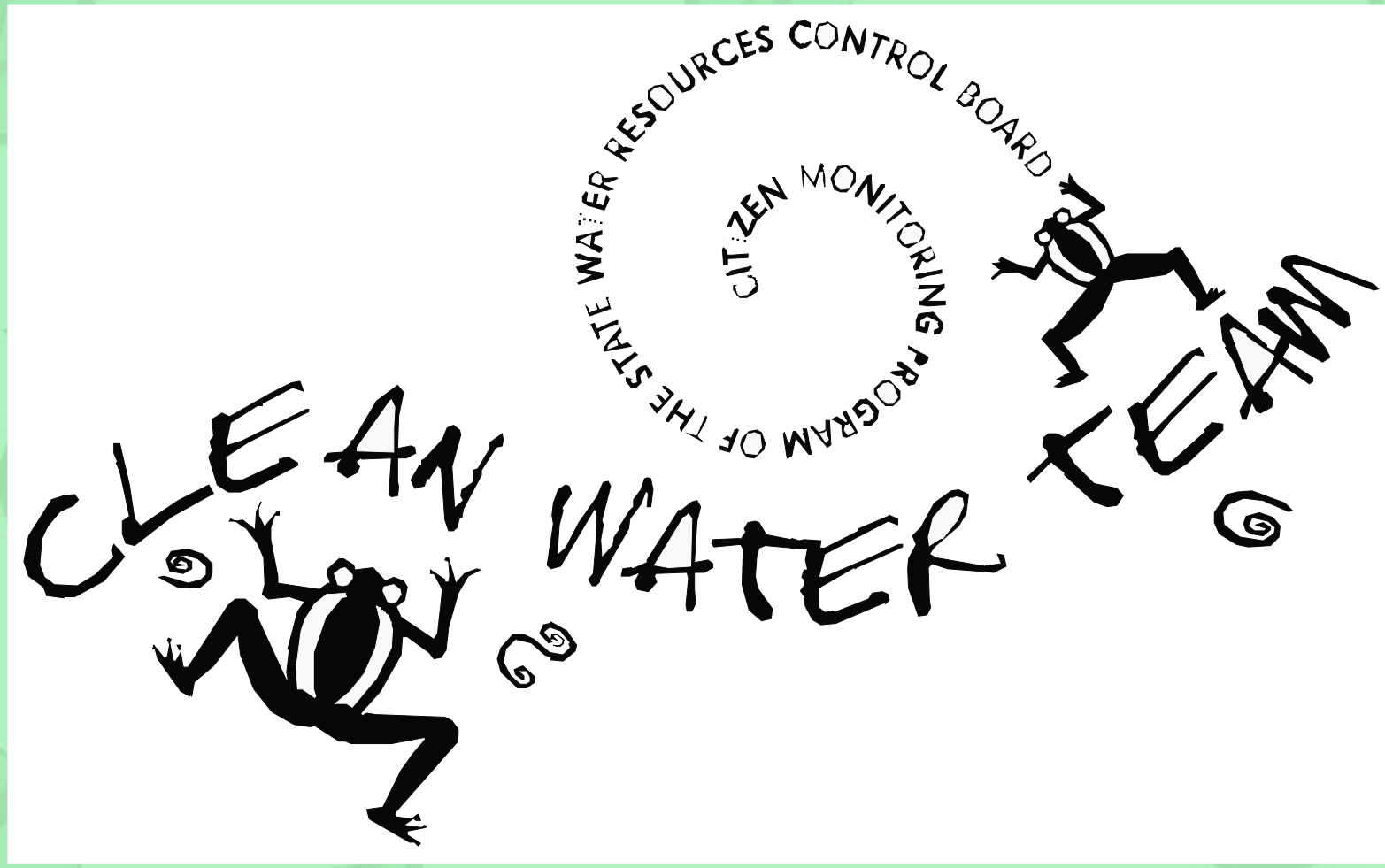
**Circle the appropriate score for all 20 habitat parameters. Record the total score on the front page of the CBW.**

Parameters to be evaluated within the sampling reach

| HABITAT PARAMETER | CONDITION CATEGORY | | | |
|---|---|---|---|---|
| | **OPTIMAL** | **SUBOPTIMAL** | **MARGINAL** | **POOR** |
| **1. Epifaunal Substrate/ Available Cover** | Greater than 70% (50% for low gradient streams) of substrate favorable for epifaunal colonization and fish cover; most favorable is a mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient). | 40-70% (30-50% for low gradient streams) mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale). | 20-40% (10-30% for low gradient streams) mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed. | Less than 20% (10% for low gradient streams) stable habitat; lack of habitat is obvious; substrate unstable or lacking. |
| | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| **2. Embeddedness** | Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. | Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. | Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment. | Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment. |
| | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| **3. Velocity/ Depth Regimes** *(deep<0.5 m, slow<0.3 m/s)* | All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). | Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes). | Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low). | Dominated by 1 velocity/ depth regime (usually slow-deep). |
| | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| **4. Sediment Deposition** | Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition. | Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools. | Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent. | Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition. |
| | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| **5. Channel Flow Status** | Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. | Water fills >75% of the available channel; or <25% of channel substrate is exposed. | Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. | Very little water in channel and mostly present as standing pools. |
| | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |

Parameters to be evaluated in an area longer than the sampling reach

| HABITAT PARAMETER | CONDITION CATEGORY | | | |
|---|---|---|---|---|
| | OPTIMAL | SUBOPTIMAL | MARGINAL | POOR |
| **6. Channel Alteration** | Channelization or dredging absent or minimal; stream with normal pattern. | Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. | Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted. | Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely. |
| | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| **7. Frequency of Riffles (or bends)** | Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important. | Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15. | Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25. | Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25. |
| | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| **8. Bank Stability** (score each bank) Note: determine left of right side by facing downstream | Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. | Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. | Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. | Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. |
| | Left Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| | Right Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| **9. Vegetative Protection** (score each bank) Note: determine left or right side by facing downstream. | More than 90% of the streambank surfaces and immediate riparian zones covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. | 70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. | 50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. | Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height. |
| | Left Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| | Right Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| **10. Riparian Vegetative Zone Width** (score each bank riparian zone) | Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. | Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. | Width of riparian zone 6-12 meters; human activities haveimpacted zone a great deal. | Width of riparian zone <6 meters: little or no riparian vegetation due to human activities. |
| | Left Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| | Right Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |




http://www.waterboards.ca.gov/nps/volunteer.html