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Texas Water Resources Institute
make every drop count

Aquatic Life and Habitat Inventory Assessment

Submitted to
Texas State Soil and Water Conservation Board (TSSWCB)
U.S. Environmental Protection Agency (EPA)

Prepared by

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Clean Rivers Program

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Watershed Protection Plan Development for the Pecos River

Task 1.3 Aquatic life and habitat inventory

Wayne Belzer

Introduction

Traditionally, water quality monitoring has been focused on chemical attributes such as mineral content, metals, and other contaminants. Biological monitoring is becoming more frequently utilized to assess overall ecological integrity of the water body. Biological monitoring is particularly useful in assessing the effects of nonpoint sources of pollution such as nutrient enrichment and sedimentation. Biological monitoring data collected during this project will provide baseline data that will allow comparisons to be made between sites on the Pecos River as well as comparisons to similar rivers in the state. Monitoring efforts will also provide a baseline for sites along the Pecos River. This data can be used to assess trends and future changes that may occur as conditions in the river change.

The development of a sustainable Pecos River Basin water management plan would be a giant first step forward and a great aid to maintaining or increasing populations of endangered species found in the Basin. A healthy, natural watershed and riparian zone is critical to life, especially in semi-arid and desert regions.

The U.S. Section International Boundary and Water Commission (USIBWC) Clean Rivers Program (CRP) coordinated a biological assessment with assistance from the Texas Commission on Environmental Quality (TCEQ) in the upper Pecos and with the United State Geological Survey (USGS) in the lower Pecos. Sites were selected along the Pecos River in Texas for assessment of biological condition. At those sites, data on benthic macroinvertebrate organisms, fish, and physical habitat characteristics of the river were collected and catalogued according to protocols previously published by the TCEQ.

Previous work

The Texas Parks and Wildlife Department (TPWD) collected fish and water quality samples at 16 locations along the Pecos River from Red Bluff Reservoir to Amistad Lake in October of 1987. The fish were collected using only seines. They collected 26 different fish species in the Pecos River. The middle reach of the Pecos River contained primarily salt tolerant species and the greatest abundance and diversity was found below the confluence with Independence Creek and the lowest occurring in the upper and middle reaches of the Pecos River especially around Orla and Girvin. Throughout the Pecos River, the survey found a variety of shiner species, several minnow species, mosquitofish, silversides, and pupfish.

From the 1994 Regional Assessment for the Rio Grande Basin, fish surveys performed in the Pecos River in 1989, 1991, and 1992 found the abundance and diversity of the upper Pecos and

at Langtry to be low. Primarily pollution tolerant species were collected and no intolerant species were collected. Fish collected included red shiners, gambusia, carp, shad, sheepshead minnows, plains killifish and some sunfish. Macroinvertebrate data collected in the Pecos River at the same time also showed low diversity and rated as low. The primary aquatic insects collected were riffle beetles and mayflies. The lack of intolerant species was considered likely to be caused by the extreme salinity concentrations in the river.

In 1996, a biological survey in the Upper Pecos River was done by the TCEQ. The study collected data in the Pecos River at Orla, Coyanosa, Girvin, Sheffiield, and just upstream of the Val Verde County line. In the report, it is noted that periodic flow variation due to irrigation releases from Red Bluff Reservoir creates a scoured streambed causing reduced habitat in the substrate. Species collected were salt tolerant species comprised mostly of shiners and silversides with some hybrid pupfish, killifish, and mosquitofish. Habitat, species diversity, and richness improved slightly at Sheffield and at the Val Verde County line where lower populations of tolerant fish were found but the index still rated limited/intermediate like the sites upstream. Benthic macroinvertebrate collections at the sites mimicked the results from the fish communities displaying limited to intermediate indices that showed a great improvement in habitat as the river flows downstream but only a slight improvement in species diversity and richness.

In October of 1999 and February of 2000 an aquatic life use study was performed by the TCEQ and the IBWC Clean Rivers Program on the Pecos River near Orla, TX. The assessment of the collection from the Orla site also exhibited a limited/intermediate index value. The fish study collected 8 species comprised mostly of red shiners, silversides and gulf killifish. Reasons cited for the low diversity and abundance was high salinity values and heavily fluctuating flows. Benthic data from these collections received the lowest score possible for the metric. The primary species present was midge flies and there was no intolerant species present, which correlates to poor quality habitat, possibly due to high salinity values.

Sampling

Sampling of the lower Pecos River was performed by the USGS on the Pecos River between Pandale, Texas and Amistad Lake in conjunction with a study they performed with The Nature Conservancy. For this project the USGS collected biological samples in the middle Pecos River at a site directly above the confluence with Independence Creek, directly below the confluence with Independence Creek and at Pandale, TX. This sampling occurred from June 21, 2006 through June 30, 2006. Data from the three sites collected by the USGS were submitted for inclusion in this report. Data collected by the USGS in the lower Pecos River is being submitted in a separate report by the USGS to The Nature Conservancy.
Sampling of the upper Pecos River was performed by the CRP and TCEQ at four sites in the Upper Pecos River from December 11, 2006 through December 15, 2006. The sites chosen by the TCEQ for collecting biological samples included a site on the Pecos River at Orla, TX, Coyanosa, TX, Girvin, TX, and at Sheffield, TX.

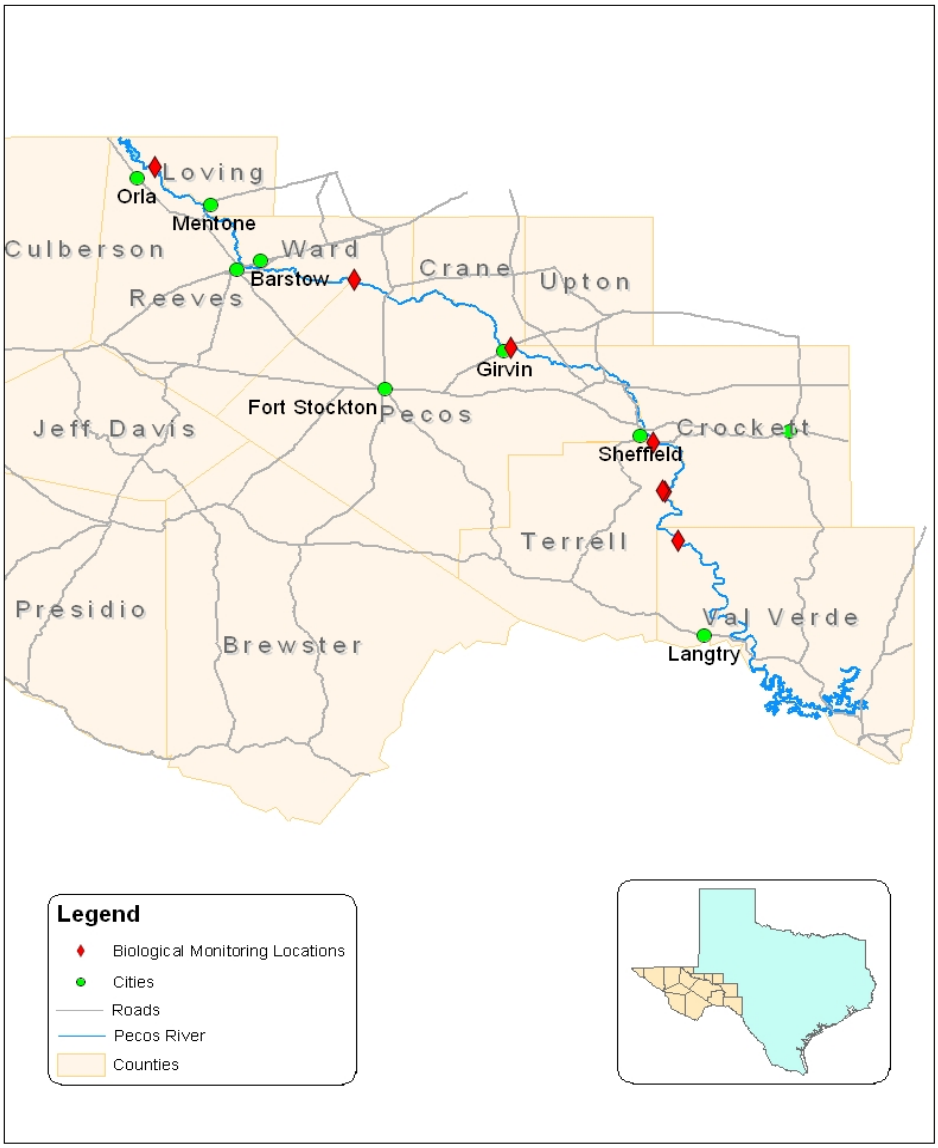

Figure 1. Biological Sampling Locations.

Sampling Methodology

Biological sampling methods for the sites collected by the TCEQ and by the USGS at the sites above and below Independence Creek were sampled using TCEQ established protocols as outlined in the TCEQ document RG-416, ***Surface Water Quality Monitoring Procedures, Volume 2:*** *Methods for Collecting and Analyzing Biological Community and Habitat Data*, dated April 2005. The online version of this document is located at www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/mtr/swqm_procedures.html
All sites were assessed for the quality of the habitat, the fish community, and benthic macroinvertebrates.

Sites collected by the USGS between Pandale and Amistad Lake were collected using USGS established protocols.

Sampling Results

The metrics denote the aquatic health of the site where the samples were collected. The data for habitat collection and assessment can be found in Appendix A. The data for the identification and assessment of the fish communities for each site can be found in Appendix B. The identification and assessment of the benthic macroinvertebrate samples for each site can be found in Appendix C. For the benthic samples, two different metrics were used. The first one is the statewide metric and the second is the Chihuahuan Desert Ecoregion metric developed by Bill Harrison of the TCEQ for comparison against the statewide metric using the scoring established below.

ALU CATEGORY STATEWIDE RBIBI	
Point Score Ranges	
Exceptional	>36
High	29 - 36
Intermediate	22 - 28
Limited	<22

ALU CATEGORY CHIHUAHUAN DESERTS ECOREGION RBIBI	
Point Score Ranges	
Exceptional	>26
High	21 - 26
Intermediate	18 - 20
Limited	<18

The sites collected by TCEQ and the USGS in the upper and middle reach of the Pecos River scored intermediate to high quality habitat, meaning the physical environment is generally conducive to sustaining a healthy community of aquatic life. This is determined by evaluating the quality of the meandering of the stream, availability of plant overhang, substrate quality, changes in the flow of the river, stability of the bank, and overall natural and unpolluted habitat. The chemical composition is not included in the score, however, and it the high salinity in certain areas of the river that have prevented intolerant and native species to populate the river.

The evaluation of the fish species collected at all of the sites exhibited limited biotic integrity and very low species diversity except for the site below the confluence with Independence creek where the diversity increased and the biotic integrity was close to high. No intolerant species were found with most of the fish comprising tolerant and non-native species.

Benthic Macroinvertebrate collections for the sites above the confluence with Independence Creek showed low to intermediate values for the metrics. The sites below Independence Creek rated high to exceptional. This is attributed directly to the salinity values in the river and the fluctuating flows. Salinity below Independence Creek is much lower than for above and flows fluctuate radically in the upper reaches of the Pecos River but are normalized from consistent spring flows and a lack of diversions in the lower reaches.

Summary of Results by Site

Pecos River at Orla

This site has the lowest ratings for all three parameters exhibiting very poor habitat, primarily tolerant species for fish, and the only site to receive a limited rating for the benthic macroinvertebrates in the Chihuahuan ecoregion IBI. Fish species diversity was limited to primarily silversides and killifish. Biological surveys done prior to this survey had similar results except red shiners are missing showing a reduction in species diversity. Sample collection for this portion of the study had to be delayed due to irregular flows and heavy scouring at this site. Previous surveys also had problems finding species richness and diversity due to scouring and irregular flows.

Pecos River at Coyanosa

Salinity values continue to increase in the Pecos River at this location. Fish species were similar to the Orla site with the inclusion of hybrid pupfish giving this site a higher index value but still rated as limited with only tolerant species and non natives. The benthic communities improved slightly over Orla with an intermediate rating and less visible scouring. This is similar to previous studies showing no change in the system.

Pecos River at Girvin

The Girvin site contains the highest conductivity values for all of the sites and has reduced species diversity for benthics and the same tolerant species of fish as found at the Orla site. Previous studies also show low fish and benthic diversity at this site and have noted the high conductivity values.

Pecos River at Sheffield

Water quality at this site improves significantly over the Girvin site and this site had the highest habitat rating; however the index for fish and benthics does not show improvement. Fish species increases in diversity but the species are still pollution tolerant, non-native species. Previous studies show improvements at this site, but still note that the index is only limited to intermediate comprised of tolerant species.

Pecos River at Chandler Ranch

This site also shows a high rating for habitat, but like Sheffield has a limited fish index and only a slightly improved benthic index over Sheffield. Salinity values are reduced from the upstream sites but not enough to improve water quality leaving only salt tolerant species of fish in the river.

Pecos River at Independence Creek

The introduction of high quality water at this point of the river has dramatic changes in the aquatic life in the Pecos River. The habitat index is actually lower at this point than at the previous two stations but the indices for fish and benthics is much higher. The index for fish is still only limited but the number of different species is greater with the inclusion of blacktail shiners and gar. The index is not higher due to the increased diversity because the species are all still pollution tolerant and non-native fish. The benthic community however improves greatly to the highest value in the river with an exceptional rating. Species diversity jumps from only 9 or 10 species at Orla to over 24 different species here. The reduced habitat did not affect benthic communities but the fresh water from the natural springs in the area allowed for a greater diversity of species.

Pecos River at Pandale

Habitat at Pandale is very similar to Independence creek but with higher water quality the fish index is much higher and rates intermediate to high. Many of the same fish species are found here as at the Independence Creek confluence as well as sunfish and bluegills. Benthic communities also rate high to exceptional here as well.

Conclusion

In the upper portions of the Pecos River, irregular flows and very high salinity values suppress the aquatic diversity and species richness. With the introduction of freshwater and regular flows, biological indicators improve even though the habitat does not improve. Appendix D shows a summary of the values and ratings as well as conductivity values for the 7 sites showing the improvements in the biological indices with improved water quality. Previous studies in the river show that little change has occurred over the past 20 years with some degradation in the biological diversity occurring in the upper portion of the Pecos River.

Acknowledgement

This project is sponsored by U.S. Environmental Protection Agency (EPA) and Texas State Soil and Water Conservation Board (TSSWCB).

References

Texas Commission on Environmental Quality manual RG-416, ***Surface Water Quality Monitoring Procedures, Volume 2:*** *Methods for Collecting and Analyzing Biological Community and Habitat Data*, April 2005.

Linam, Gordon W. and Kleinsasser, Leroy J., *Relationship Between Fishes and Water Quality in the Pecos River, Texas*, April 1996 River Studies Report No. 9, Resource Protection Division, Texas Parks and Wildlife Department, Austin, Texas.

Texas Natural Resource Conservation Commission, *1994 Regional Assessment of Water Quality in the Rio Grande Basin,* Publication AS-34, October 1994.

Texas Natural Resource Conservation Commission, *Fish Community Structure in Relation to Water Quality and Habitat in the Upper Pecos River, Texas,* Publication AS-095/SR, February 1996, prepared by Greg Larson.

Texas Natural Resource Conservation Commission, *Benthic Macroinvertebrate Community Structure in Relation to Water Quality and Habitat in the Upper Pecos River, Texas,* Publication AS-107/SR, July 1996, prepared by Greg Larson.

Appendix A – Habitat Assessments

Table 1. Habitat for Pecos River at Highway 652 near Orla collected on 12/12/06.

Habitat Parameter	**Scoring Category**			
Available Instream Cover	**Abundant** >50% of substrate favorable for colonization and fish cover; good mix of several stable (not new fall or transient) cover types such as snags, cobble, undercut banks, macrophytes	**Common** 30-50% of substrate supports stable habitat; adequate habitat for maintenance of populations; may be limited in the number of different habitat types	**Rare** 10-29.9% of substrate supports stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed	**Absent** <10% of substrate supports stable habitat; lack of habitat is obvious; substrate unstable or lacking
Score___2___	4	3	2	1
Bottom Substrate Stability	**Stable** >50% gravel or larger substrate; gravel, cobble, boulders; dominant substrate type is gravel or larger	**Moderately Stable** 30-50% gravel or larger substrate; dominant substrate type is mix of gravel with some finer sediments	**Moderately Unstable** 10-29.9% gravel or larger substrate; dominant substrate type is finer than gravel, but may still be a mix of sizes	**Unstable** <10% gravel or larger substrate; substrate is uniform sand, silt, clay, or bedrock
Score___1___	4	3	2	1
Number of Riffles To be counted, riffles must extend >50% the width of the channel and be at least as long as the channel width	**Abundant** ≥ 5 riffles	**Common** 2-4 riffles	**Rare** 1 riffle	**Absent** No riffles
Score___2___	4	3	2	1

Habitat Parameter	Scoring Category			
Dimensions of Largest Pool	**Large** Pool covers more than 50% of the channel width; maximum depth is >1 meter	**Moderate** Pool covers approximately 50% or slightly less of the channel width; maximum depth is 0.5-1 meter	**Small** Pool covers approximately 25% of the channel width; maximum depth is <0.5 meter	**Absent** No existing pools; only shallow auxiliary pockets
Score___3___	4	3	2	1
Channel Flow Status	**High** Water reaches the base of both lower banks; < 5% of channel substrate is exposed	**Moderate** Water fills >75% of the channel; or <25% of channel substrate is exposed	**Low** Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed	**No Flow** Very little water in the channel and mostly present in standing pools; or stream is dry
Score___1____	3	2	1	0
Bank Stability	**Stable** Little evidence (<10%) of erosion or bank failure; bank angles average <30°	**Moderately Stable** Some evidence (10-29.9%) of erosion or bank failure; small areas of erosion mostly healed over; bank angles average 30-39.9°	**Moderately Unstable** Evidence of erosion or bank failure is common (30-50%); high potential of erosion during flooding; bank angles average 40-60°	**Unstable** Large and frequent evidence (>50%) of erosion or bank failure; raw areas frequent along steep banks; bank angles average >60°
Score___1__	3	2	1	0
Channel Sinuosity	**High** ≥ 2 well-defined bends with deep outside areas (cut banks) and shallow inside areas (point bars) present	**Moderate** 1 well-defined bend or ≥ 3 moderately-defined bends present	**Low** <3 moderately-defined bends or only poorly-defined bends present	**None** Straight channel; may be channelized
Score___1___	3	2	1	0

Habitat Parameter	Scoring Category			
Riparian Buffer Vegetation	**Extensive** Width of natural buffer is >20 meters	**Wide** Width of natural buffer is 10.1-20 meters	**Moderate** Width of natural buffer is 5-10 meters	**Narrow** Width of natural buffer is <5 meters
Score___3_____	3	2	1	0
Aesthetics of Reach	**Wilderness** Outstanding natural beauty; usually wooded or unpastured area; water clarity is usually exceptional	**Natural Area** Trees and/or native vegetation are common; some development evident (from fields, pastures, dwellings); water clarity may be slightly turbid	**Common Setting** Not offensive; area is developed, but uncluttered such as in an urban park; water clarity may be turbid or discolored	**Offensive** Stream does not enhance the aesthetics of the area; cluttered; highly developed; may be a dumping area; water clarity is usually turbid or discolored
Score____1____	3	2	1	0
Total Score_____15_____				

HABITAT QUALITY INDEX

26 - 31 **Exceptional**
20 - 25 **High**
14 - 19 **Intermediate**
≤ 13 **Limited**

Part II - Summary of Physical Characteristics of Water Body Using information from all of the transects and measurements in Part I and other sources, report the following general characteristics or averages for the entire reach:	
Stream Name: Pecos River @ Hwy 652 near Orla	**Date:** 12/12/06
Physical Characteristics	**Value**
Stream bed slope over evaluated reach (from USGS map; elevation change in meters/reach length in kilometers)	
Approximate drainage area above the transect furthest downstream (from USGS or county highway map in km^2)	
Stream order	
Length of stream evaluated (meters or kilometers)	360
Number of lateral transects made	6
Average stream width (meters)	10.1
Average stream depth (meters)	0.21
Stream discharge (ft^3/sec)	
Flow measurement method	
Channel flow status (high, moderate, low, or no flow)	low
Maximum pool width (meters)	7.3
Maximum pool depth (meters)	
Total number of stream bends	4
Number of well defined bends	1
Number of moderately defined bends	1
Number of poorly defined bends	2
Total number of riffles	0
Dominant substrate type	silt
Average percent of substrate gravel sized or larger	1.7
Average percent instream cover	19.5
Number of stream cover types	5
Average percent stream bank erosion potential	25.8
Average stream bank slope (degrees)	6.1
Average width of natural buffer vegetation (meters)	10.8
Average riparian vegetation percent composition by: (total to equal 100%)	
Trees	25
Shrubs	25
Grasses and Forbs	50
Cultivated fields	0
Average percent tree canopy coverage	20.7
Overall aesthetic appraisal of the stream	natural-common

Table 2. Habitat for Pecos River at Highway 67 near Coyanos collectedled on 12/13/06.

Habitat Parameter	Scoring Category			
Available Instream Cover	**Abundant** >50% of substrate favorable for colonization and fish cover; good mix of several stable (not new fall or transient) cover types such as snags, cobble, undercut banks, macrophytes	**Common** 30-50% of substrate supports stable habitat; adequate habitat for maintenance of populations; may be limited in the number of different habitat types	**Rare** 10-29.9% of substrate supports stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed	**Absent** <10% of substrate supports stable habitat; lack of habitat is obvious; substrate unstable or lacking
Score___2_____	4	3	2	1
Bottom Substrate Stability	**Stable** >50% gravel or larger substrate; gravel, cobble, boulders; dominant substrate type is gravel or larger	**Moderately Stable** 30-50% gravel or larger substrate; dominant substrate type is mix of gravel with some finer sediments	**Moderately Unstable** 10-29.9% gravel or larger substrate; dominant substrate type is finer than gravel, but may still be a mix of sizes	**Unstable** <10% gravel or larger substrate; substrate is uniform sand, silt, clay, or bedrock
Score___1_____	4	3	2	1
Number of Riffles To be counted, riffles must extend >50% the width of the channel and be at least as long as the channel width	**Abundant** ≥ 5 riffles	**Common** 2-4 riffles	**Rare** 1 riffle	**Absent** No riffles
Score___1_____	4	3	2	1

Dimensions of Largest Pool	**Large** Pool covers more than 50% of the channel width; maximum depth is >1 meter	**Moderate** Pool covers approximately 50% or slightly less of the channel width; maximum depth is 0.5-1 meter	**Small** Pool covers approximately 25% of the channel width; maximum depth is <0.5 meter	**Absent** No existing pools; only shallow auxiliary pockets
Score____4_____	4	3	2	1
Channel Flow Status	**High** Water reaches the base of both lower banks; < 5% of channel substrate is exposed	**Moderate** Water fills >75% of the channel; or <25% of channel substrate is exposed	**Low** Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed	**No Flow** Very little water in the channel and mostly present in standing pools; or stream is dry
Score____2_____	3	2	1	0
Bank Stability	**Stable** Little evidence (<10%) of erosion or bank failure; bank angles average <30°	**Moderately Stable** Some evidence (10-29.9%) of erosion or bank failure; small areas of erosion mostly healed over; bank angles average 30-39.9°	**Moderately Unstable** Evidence of erosion or bank failure is common (30-50%); high potential of erosion during flooding; bank angles average 40-60°	**Unstable** Large and frequent evidence (>50%) of erosion or bank failure; raw areas frequent along steep banks; bank angles average >60°
Score____2.5____	3	2	1	0
Channel Sinuosity	**High** ≥ 2 well-defined bends with deep outside areas (cut banks) and shallow inside areas (point bars) present	**Moderate** 1 well-defined bend or ≥ 3 moderately-defined bends present	**Low** <3 moderately-defined bends or only poorly-defined bends present	**None** Straight channel; may be channelized
Score____2___	3	2	1	0

Habitat Parameter	Scoring Category			
Riparian Buffer Vegetation	**Extensive** Width of natural buffer is >20 meters	**Wide** Width of natural buffer is 10.1-20 meters	**Moderate** Width of natural buffer is 5-10 meters	**Narrow** Width of natural buffer is <5 meters
Score___2_____	3	2	1	0
Aesthetics of Reach	**Wilderness** Outstanding natural beauty; usually wooded or unpastured area; water clarity is usually exceptional	**Natural Area** Trees and/or native vegetation are common; some development evident (from fields, pastures, dwellings); water clarity may be slightly turbid	**Common Setting** Not offensive; area is developed, but uncluttered such as in an urban park; water clarity may be turbid or discolored	**Offensive** Stream does not enhance the aesthetics of the area; cluttered; highly developed; may be a dumping area; water clarity is usually turbid or discolored
Score____1.5___	3	2	1	0
Total Score_____18_____				

HABITAT QUALITY INDEX

26 - 31 **Exceptional**
20 - 25 **High**
14 - 19 **Intermediate**
≤ 13 **Limited**

Part II - Summary of Physical Characteristics of Water Body Using information from all of the transects and measurements in Part I and other sources, report the following general characteristics or averages for the entire reach:	
Stream Name: Pecos River @ FM 1776 near Cayanosa	**Date:** 12/13/06
Physical Characteristics	**Value**
Stream bed slope over evaluated reach (from USGS map; elevation change in meters/reach length in kilometers)	
Approximate drainage area above the transect furthest downstream (from USGS or county highway map in km^2)	
Stream order	
Length of stream evaluated (meters or kilometers)	400
Number of lateral transects made	6
Average stream width (meters)	10.9
Average stream depth (meters)	0.31
Stream discharge (ft^3/sec)	
Flow measurement method	
Channel flow status (high, moderate, low, or no flow)	moderate
Maximum pool width (meters)	7
Maximum pool depth (meters)	1.37
Total number of stream bends	4
Number of well defined bends	1
Number of moderately defined bends	1
Number of poorly defined bends	2
Total number of riffles	0
Dominant substrate type	silt
Average percent of substrate gravel sized or larger	1.7
Average percent instream cover	19.5
Number of stream cover types	5
Average percent stream bank erosion potential	25.8
Average stream bank slope (degrees)	6.1
Average width of natural buffer vegetation (meters)	10.8
Average riparian vegetation percent composition by: (total to equal 100%)	
Trees	25
Shrubs	25
Grasses and Forbs	50
Cultivated fields	0
Average percent tree canopy coverage	20.7
Overall aesthetic appraisal of the stream	natural-common

Table 3. Habitat for Pecos River at Highway 67 near Girvin collected on 12/14/06.

Habitat Parameter	Scoring Category			
Available Instream Cover	**Abundant** >50% of substrate favorable for colonization and fish cover; good mix of several stable (not new fall or transient) cover types such as snags, cobble, undercut banks, macrophytes	**Common** 30-50% of substrate supports stable habitat; adequate habitat for maintenance of populations; may be limited in the number of different habitat types	**Rare** 10-29.9% of substrate supports stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed	**Absent** <10% of substrate supports stable habitat; lack of habitat is obvious; substrate unstable or lacking
Score___2_____	4	3	2	1
Bottom Substrate Stability	**Stable** >50% gravel or larger substrate; gravel, cobble, boulders; dominant substrate type is gravel or larger	**Moderately Stable** 30-50% gravel or larger substrate; dominant substrate type is mix of gravel with some finer sediments	**Moderately Unstable** 10-29.9% gravel or larger substrate; dominant substrate type is finer than gravel, but may still be a mix of sizes	**Unstable** <10% gravel or larger substrate; substrate is uniform sand, silt, clay, or bedrock
Score____1_____	4	3	2	1
Number of Riffles To be counted, riffles must extend >50% the width of the channel and be at least as long as the channel width	**Abundant** ≥ 5 riffles	**Common** 2-4 riffles	**Rare** 1 riffle	**Absent** No riffles
Score____1_____	4	3	2	1

Dimensions of Largest Pool	**Large** Pool covers more than 50% of the channel width; maximum depth is >1 meter	**Moderate** Pool covers approximately 50% or slightly less of the channel width; maximum depth is 0.5-1 meter	**Small** Pool covers approximately 25% of the channel width; maximum depth is <0.5 meter	**Absent** No existing pools; only shallow auxiliary pockets
Score____4_____	4	3	2	1
Channel Flow Status	**High** Water reaches the base of both lower banks; < 5% of channel substrate is exposed	**Moderate** Water fills >75% of the channel; or <25% of channel substrate is exposed	**Low** Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed	**No Flow** Very little water in the channel and mostly present in standing pools; or stream is dry
Score____2_____	3	2	1	0
Bank Stability	**Stable** Little evidence (<10%) of erosion or bank failure; bank angles average <30°	**Moderately Stable** Some evidence (10-29.9%) of erosion or bank failure; small areas of erosion mostly healed over; bank angles average 30-39.9°	**Moderately Unstable** Evidence of erosion or bank failure is common (30-50%); high potential of erosion during flooding; bank angles average 40-60°	**Unstable** Large and frequent evidence (>50%) of erosion or bank failure; raw areas frequent along steep banks; bank angles average >60°
Score____2____	3	2	1	0
Channel Sinuosity	**High** ≥ 2 well-defined bends with deep outside areas (cut banks) and shallow inside areas (point bars) present	**Moderate** 1 well-defined bend or ≥ 3 moderately-defined bends present	**Low** <3 moderately-defined bends or only poorly-defined bends present	**None** Straight channel; may be channelized
Score____2___	3	2	1	0

Habitat Parameter	Scoring Category			
Riparian Buffer Vegetation	**Extensive** Width of natural buffer is >20 meters	**Wide** Width of natural buffer is 10.1-20 meters	**Moderate** Width of natural buffer is 5-10 meters	**Narrow** Width of natural buffer is <5 meters
Score___1_____	3	2	1	0
Aesthetics of Reach	**Wilderness** Outstanding natural beauty; usually wooded or unpastured area; water clarity is usually exceptional	**Natural Area** Trees and/or native vegetation are common; some development evident (from fields, pastures, dwellings); water clarity may be slightly turbid	**Common Setting** Not offensive; area is developed, but uncluttered such as in an urban park; water clarity may be turbid or discolored	**Offensive** Stream does not enhance the aesthetics of the area; cluttered; highly developed; may be a dumping area; water clarity is usually turbid or discolored
Score____1.5___	3	2	1	0
Total Score_____16.5_____				

HABITAT QUALITY INDEX

26 - 31 **Exceptional**
20 - 25 **High**
14 - 19 **Intermediate**
≤ 13 **Limited**

Part II - Summary of Physical Characteristics of Water Body Using information from all of the transects and measurements in Part I and other sources, report the following general characteristics or averages for the entire reach:	
Stream Name: Pecos River @ US Hwy 67 near Girvin	**Date:** 12/14/06
Physical Characteristics	**Value**
Stream bed slope over evaluated reach (from USGS map; elevation change in meters/reach length in kilometers)	
Approximate drainage area above the transect furthest downstream (from USGS or county highway map in km^2)	
Stream order	
Length of stream evaluated (meters or kilometers)	350
Number of lateral transects made	6
Average stream width (meters)	11.3
Average stream depth (meters)	0.49
Stream discharge (ft^3/sec)	
Flow measurement method	
Channel flow status (high, moderate, low, or no flow)	moderate
Maximum pool width (meters)	4.5
Maximum pool depth (meters)	>1.6
Total number of stream bends	3
Number of well defined bends	1
Number of moderately defined bends	1
Number of poorly defined bends	1
Total number of riffles	0
Dominant substrate type	silt
Average percent of substrate gravel sized or larger	0
Average percent instream cover	20.8
Number of stream cover types	4
Average percent stream bank erosion potential	39.6
Average stream bank slope (degrees)	13.4
Average width of natural buffer vegetation (meters)	6
Average riparian vegetation percent composition by: (total to equal 100%)	
Trees	55
Shrubs	20
Grasses and Forbs	25
Cultivated fields	0
Average percent tree canopy coverage	36.8
Overall aesthetic appraisal of the stream	natural-common

Table 4. Habitat for Pecos River at Crockett CR307 near Sheffield collected on 12/11/06.

Habitat Parameter	Scoring Category			
Available Instream Cover	**Abundant** >50% of substrate favorable for colonization and fish cover; good mix of several stable (not new fall or transient) cover types such as snags, cobble, undercut banks, macrophytes	**Common** 30-50% of substrate supports stable habitat; adequate habitat for maintenance of populations; may be limited in the number of different habitat types	**Rare** 10-29.9% of substrate supports stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed	**Absent** <10% of substrate supports stable habitat; lack of habitat is obvious; substrate unstable or lacking
Score____3_____	4	3	2	1
Bottom Substrate Stability	**Stable** >50% gravel or larger substrate; gravel, cobble, boulders; dominant substrate type is gravel or larger	**Moderately Stable** 30-50% gravel or larger substrate; dominant substrate type is mix of gravel with some finer sediments	**Moderately Unstable** 10-29.9% gravel or larger substrate; dominant substrate type is finer than gravel, but may still be a mix of sizes	**Unstable** <10% gravel or larger substrate; substrate is uniform sand, silt, clay, or bedrock
Score____4_____	4	3	2	1
Number of Riffles To be counted, riffles must extend >50% the width of the channel and be at least as long as the channel width	**Abundant** ≥ 5 riffles	**Common** 2-4 riffles	**Rare** 1 riffle	**Absent** No riffles
Score____2_____	4	3	2	1

Dimensions of Largest Pool	**Large** Pool covers more than 50% of the channel width; maximum depth is >1 meter	**Moderate** Pool covers approximately 50% or slightly less of the channel width; maximum depth is 0.5-1 meter	**Small** Pool covers approximately 25% of the channel width; maximum depth is <0.5 meter	**Absent** No existing pools; only shallow auxiliary pockets
Score____4_____	4	3	2	1
Channel Flow Status	**High** Water reaches the base of both lower banks; < 5% of channel substrate is exposed	**Moderate** Water fills >75% of the channel; or <25% of channel substrate is exposed	**Low** Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed	**No Flow** Very little water in the channel and mostly present in standing pools; or stream is dry
Score____2_____	3	2	1	0
Bank Stability	**Stable** Little evidence (<10%) of erosion or bank failure; bank angles average <30°	**Moderately Stable** Some evidence (10-29.9%) of erosion or bank failure; small areas of erosion mostly healed over; bank angles average 30-39.9°	**Moderately Unstable** Evidence of erosion or bank failure is common (30-50%); high potential of erosion during flooding; bank angles average 40-60°	**Unstable** Large and frequent evidence (>50%) of erosion or bank failure; raw areas frequent along steep banks; bank angles average >60°
Score____2____	3	2	1	0
Channel Sinuosity	**High** ≥ 2 well-defined bends with deep outside areas (cut banks) and shallow inside areas (point bars) present	**Moderate** 1 well-defined bend or ≥ 3 moderately-defined bends present	**Low** <3 moderately-defined bends or only poorly-defined bends present	**None** Straight channel; may be channelized
Score____1___	3	2	1	0

Habitat Parameter	Scoring Category			
Riparian Buffer Vegetation	**Extensive** Width of natural buffer is >20 meters	**Wide** Width of natural buffer is 10.1-20 meters	**Moderate** Width of natural buffer is 5-10 meters	**Narrow** Width of natural buffer is <5 meters
Score___2_____	3	2	1	0
Aesthetics of Reach	**Wilderness** Outstanding natural beauty; usually wooded or unpastured area; water clarity is usually exceptional	**Natural Area** Trees and/or native vegetation are common; some development evident (from fields, pastures, dwellings); water clarity may be slightly turbid	**Common Setting** Not offensive; area is developed, but uncluttered such as in an urban park; water clarity may be turbid or discolored	**Offensive** Stream does not enhance the aesthetics of the area; cluttered; highly developed; may be a dumping area; water clarity is usually turbid or discolored
Score____2____	3	2	1	0
Total Score_____22_____				

HABITAT QUALITY INDEX

26 - 31 **Exceptional**
20 - 25 **High**
14 - 19 **Intermediate**
≤ 13 **Limited**

Part II - Summary of Physical Characteristics of Water Body Using information from all of the transects and measurements in Part I and other sources, report the following general characteristics or averages for the entire reach:	
Stream Name: Pecos River at Crockett CR 307 near Sheffield	**Date:** 12/11/06
Physical Characteristics	**Value**
Stream bed slope over evaluated reach (from USGS map; elevation change in meters/reach length in kilometers)	
Approximate drainage area above the transect furthest downstream (from USGS or county highway map in km^2)	
Stream order	
Length of stream evaluated (meters or kilometers)	350 m
Number of lateral transects made	6
Average stream width (meters)	10.9
Average stream depth (meters)	0.34
Stream discharge (ft^3/sec)	
Flow measurement method	
Channel flow status (high, moderate, low, or no flow)	moderate
Maximum pool width (meters)	6.8
Maximum pool depth (meters)	1.6
Total number of stream bends	2
Number of well defined bends	0
Number of moderately defined bends	2
Number of poorly defined bends	0
Total number of riffles	2
Dominant substrate type	medium gravel
Average percent of substrate gravel sized or larger	82.5
Average percent instream cover	45
Number of stream cover types	6
Average percent stream bank erosion potential	33
Average stream bank slope (degrees)	32
Average width of natural buffer vegetation (meters)	19.2
Average riparian vegetation percent composition by: (total to equal 100%)	
Trees	35
Shrubs	25
Grasses and Forbs	35
Other	10
Average percent tree canopy coverage	39.7
Overall aesthetic appraisal of the stream	natural

Table 5. Habitat for Pecos River at Chandler Ranch collected on 6/22/06.

Habitat Parameter	**Scoring Category**			
Available Instream Cover	**Abundant** >50% of substrate favorable for colonization and fish cover; good mix of several stable (not new fall or transient) cover types such as snags, cobble, undercut banks, macrophytes	**Common** 30-50% of substrate supports stable habitat; adequate habitat for maintenance of populations; may be limited in the number of different habitat types	**Rare** 10-29.9% of substrate supports stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed	**Absent** <10% of substrate supports stable habitat; lack of habitat is obvious; substrate unstable or lacking
Score____2____	4	3	2	1
Bottom Substrate Stability	**Stable** >50% gravel or larger substrate; gravel, cobble, boulders; dominant substrate type is gravel or larger	**Moderately Stable** 30-50% gravel or larger substrate; dominant substrate type is mix of gravel with some finer sediments	**Moderately Unstable** 10-29.9% gravel or larger substrate; dominant substrate type is finer than gravel, but may still be a mix of sizes	**Unstable** <10% gravel or larger substrate; substrate is uniform sand, silt, clay, or bedrock
Score____4____	4	3	2	1
Number of Riffles To be counted, riffles must extend >50% the width of the channel and be at least as long as the channel width	**Abundant** ≥ 5 riffles	**Common** 2-4 riffles	**Rare** 1 riffle	**Absent** No riffles

Score____3___	4	3	2	1
Dimensions of Largest Pool	**Large** Pool covers more than 50% of the channel width; maximum depth is >1 meter	**Moderate** Pool covers approximately 50% or slightly less of the channel width; maximum depth is 0.5-1 meter	**Small** Pool covers approximately 25% of the channel width; maximum depth is <0.5 meter	**Absent** No existing pools; only shallow auxiliary pockets
Score____4___	4	3	2	1
Channel Flow Status	**High** Water reaches the base of both lower banks; < 5% of channel substrate is exposed	**Moderate** Water fills >75% of the channel; or <25% of channel substrate is exposed	**Low** Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed	**No Flow** Very little water in the channel and mostly present in standing pools; or stream is dry
Score____1___	3	2	1	0
Bank Stability	**Stable** Little evidence (<10%) of erosion or bank failure; bank angles average <30°	**Moderately Stable** Some evidence (10-29.9%) of erosion or bank failure; small areas of erosion mostly healed over; bank angles average 30-39.9°	**Moderately Unstable** Evidence of erosion or bank failure is common (30-50%); high potential of erosion during flooding; bank angles average 40-60°	**Unstable** Large and frequent evidence (>50%) of erosion or bank failure; raw areas frequent along steep banks; bank angles average >60°
Score____1____	3	2	1	0

Channel Sinuosity	**High** ≥ 2 well-defined bends with deep outside areas (cut banks) and shallow inside areas (point bars) present	**Moderate** 1 well-defined bend or ≥ 3 moderately-defined bends present	**Low** <3 moderately-defined bends or only poorly-defined bends present	**None** Straight channel; may be channelized
Score___1___	3	2	1	0
Riparian Buffer Vegetation	**Extensive** Width of natural buffer is >20 meters	**Wide** Width of natural buffer is 10.1-20 meters	**Moderate** Width of natural buffer is 5-10 meters	**Narrow** Width of natural buffer is <5 meters
Score___2____	3	2	1	0
Aesthetics of Reach	**Wilderness** Outstanding natural beauty; usually wooded or unpastured area; water clarity is usually exceptional	**Natural Area** Trees and/or native vegetation are common; some development evident (from fields, pastures, dwellings); water clarity may be slightly turbid	**Common Setting** Not offensive; area is developed, but uncluttered such as in an urban park; water clarity may be turbid or discolored	**Offensive** Stream does not enhance the aesthetics of the area; cluttered; highly developed; may be a dumping area; water clarity is usually turbid or discolored
Score____2__	3	2	1	0
Total Score_____20_____				

HABITAT QUALITY INDEX

26 - 31 **Exceptional**
20 - 25 **High**
14 - 19 **Intermediate**
≤ 13 **Limited**

Part II - Summary of Physical Characteristics of Water Body Using information from all of the transects and measurements in Part I and other sources, report the following general characteristics or averages for the entire reach:	
Stream Name: Pecos River @ Chandler Ranch	**Date:** 6/22/06
Physical Characteristics	**Value**
Stream bed slope over evaluated reach (from USGS map; elevation change in meters/reach length in kilometers)	
Approximate drainage area above the transect furthest downstream (from USGS or county highway map in km^2)	
Stream order	
Length of stream evaluated (meters or kilometers)	168
Number of lateral transects made	5
Average stream width (meters)	14.7
Average stream depth (meters)	0.91
Stream discharge (ft^3/sec)	
Flow measurement method	
Channel flow status (high, moderate, low, or no flow)	low
Maximum pool width (meters)	16.3
Maximum pool depth (meters)	1.37
Total number of stream bends	2
Number of well defined bends	0
Number of moderately defined bends	2
Number of poorly defined bends	0
Total number of riffles	2
Dominant substrate type	gravel
Average percent of substrate gravel sized or larger	72.0
Average percent instream cover	11.0
Number of stream cover types	2
Average percent stream bank erosion potential	44.0
Average stream bank slope (degrees)	71.0
Average width of natural buffer vegetation (meters)	20.0
Average riparian vegetation percent composition by: (total to equal 100%)	
Trees	90
Shrubs	10
Grasses and Forbs	0
Cultivated fields	0
Other	0
Average percent tree canopy coverage	53.0
Overall aesthetic appraisal of the stream	natural

Table 6. Habitat for Pecos River at Independence Creek collected on 6/21/06.

Habitat Parameter	Scoring Category			
Available Instream Cover	**Abundant** >50% of substrate favorable for colonization and fish cover; good mix of several stable (not new fall or transient) cover types such as snags, cobble, undercut banks, macrophytes	**Common** 30-50% of substrate supports stable habitat; adequate habitat for maintenance of populations; may be limited in the number of different habitat types	**Rare** 10-29.9% of substrate supports stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed	**Absent** <10% of substrate supports stable habitat; lack of habitat is obvious; substrate unstable or lacking
Score____1____	4	3	2	1
Bottom Substrate Stability	**Stable** >50% gravel or larger substrate; gravel, cobble, boulders; dominant substrate type is gravel or larger	**Moderately Stable** 30-50% gravel or larger substrate; dominant substrate type is mix of gravel with some finer sediments	**Moderately Unstable** 10-29.9% gravel or larger substrate; dominant substrate type is finer than gravel, but may still be a mix of sizes	**Unstable** <10% gravel or larger substrate; substrate is uniform sand, silt, clay, or bedrock
Score____4____	4	3	2	1
Number of Riffles To be counted, riffles must extend >50% the width of the channel and be at least as long as the channel width	**Abundant** ≥ 5 riffles	**Common** 2-4 riffles	**Rare** 1 riffle	**Absent** No riffles
Score____3___	4	3	2	1

Habitat Parameter	Scoring Category			
Dimensions of Largest Pool	**Large** Pool covers more than 50% of the channel width; maximum depth is >1 meter	**Moderate** Pool covers approximately 50% or slightly less of the channel width; maximum depth is 0.5-1 meter	**Small** Pool covers approximately 25% of the channel width; maximum depth is <0.5 meter	**Absent** No existing pools; only shallow auxiliary pockets
Score____1___	4	3	2	1
Channel Flow Status	**High** Water reaches the base of both lower banks; < 5% of channel substrate is exposed	**Moderate** Water fills >75% of the channel; or <25% of channel substrate is exposed	**Low** Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed	**No Flow** Very little water in the channel and mostly present in standing pools; or stream is dry
Score____1___	3	2	1	0
Bank Stability	**Stable** Little evidence (<10%) of erosion or bank failure; bank angles average <30°	**Moderately Stable** Some evidence (10-29.9%) of erosion or bank failure; small areas of erosion mostly healed over; bank angles average 30-39.9°	**Moderately Unstable** Evidence of erosion or bank failure is common (30-50%); high potential of erosion during flooding; bank angles average 40-60°	**Unstable** Large and frequent evidence (>50%) of erosion or bank failure; raw areas frequent along steep banks; bank angles average >60°
Score____1___	3	2	1	0
Channel Sinuosity	**High** ≥ 2 well-defined bends with deep outside areas (cut banks) and shallow inside areas (point bars) present	**Moderate** 1 well-defined bend or ≥ 3 moderately-defined bends present	**Low** <3 moderately-defined bends or only poorly-defined bends present	**None** Straight channel; may be channelized
Score____1___	3	2	1	0

Riparian Buffer Vegetation	**Extensive** Width of natural buffer is >20 meters	**Wide** Width of natural buffer is 10.1-20 meters	**Moderate** Width of natural buffer is 5-10 meters	**Narrow** Width of natural buffer is <5 meters
Score___2_____	3	2	1	0
Aesthetics of Reach	**Wilderness** Outstanding natural beauty; usually wooded or unpastured area; water clarity is usually exceptional	**Natural Area** Trees and/or native vegetation are common; some development evident (from fields, pastures, dwellings); water clarity may be slightly turbid	**Common Setting** Not offensive; area is developed, but uncluttered such as in an urban park; water clarity may be turbid or discolored	**Offensive** Stream does not enhance the aesthetics of the area; cluttered; highly developed; may be a dumping area; water clarity is usually turbid or discolored
Score____2____	3	2	1	0
Total Score_____16_____				

HABITAT QUALITY INDEX

26 - 31 **Exceptional**
20 - 25 **High**
14 - 19 **Intermediate**
≤ 13 **Limited**

Part II - Summary of Physical Characteristics of Water Body Using information from all of the transects and measurements in Part I and other sources, report the following general characteristics or averages for the entire reach:	
Stream Name: Pecos River @ Independence Creek	**Date:** 6/21/06
Physical Characteristics	**Value**
Stream bed slope over evaluated reach (from USGS map; elevation change in meters/reach length in kilometers)	
Approximate drainage area above the transect furthest downstream (from USGS or county highway map in km^2)	
Stream order	
Length of stream evaluated (meters or kilometers)	197
Number of lateral transects made	5
Average stream width (meters)	10.3
Average stream depth (meters)	0.55
Stream discharge (ft^3/sec)	
Flow measurement method	
Channel flow status (high, moderate, low, or no flow)	low
Maximum pool width (meters)	
Maximum pool depth (meters)	
Total number of stream bends	2
Number of well defined bends	0
Number of moderately defined bends	2
Number of poorly defined bends	0
Total number of riffles	3
Dominant substrate type	gravel
Average percent of substrate gravel sized or larger	100.0
Average percent instream cover	6.0
Number of stream cover types	2
Average percent stream bank erosion potential	40.0
Average stream bank slope (degrees)	30.0
Average width of natural buffer vegetation (meters)	12.4
Average riparian vegetation percent composition by: (total to equal 100%)	
Trees	70
Shrubs	30
Grasses and Forbs	0
Cultivated fields	0
Other	0
Average percent tree canopy coverage	32.7
Overall aesthetic appraisal of the stream	rare

Table 7. Habitat for Pecos River at Pandale collected on 6/20/06.

Habitat Parameter	**Scoring Category**			
Available Instream Cover	**Abundant** >50% of substrate favorable for colonization and fish cover; good mix of several stable (not new fall or transient) cover types such as snags, cobble, undercut banks, macrophytes	**Common** 30-50% of substrate supports stable habitat; adequate habitat for maintenance of populations; may be limited in the number of different habitat types	**Rare** 10-29.9% of substrate supports stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed	**Absent** <10% of substrate supports stable habitat; lack of habitat is obvious; substrate unstable or lacking
Score____3____	4	3	2	1
Bottom Substrate Stability	**Stable** >50% gravel or larger substrate; gravel, cobble, boulders; dominant substrate type is gravel or larger	**Moderately Stable** 30-50% gravel or larger substrate; dominant substrate type is mix of gravel with some finer sediments	**Moderately Unstable** 10-29.9% gravel or larger substrate; dominant substrate type is finer than gravel, but may still be a mix of sizes	**Unstable** <10% gravel or larger substrate; substrate is uniform sand, silt, clay, or bedrock
Score____4____	4	3	2	1
Number of Riffles To be counted, riffles must extend >50% the width of the channel and be at least as long as the channel width	**Abundant** ≥ 5 riffles	**Common** 2-4 riffles	**Rare** 1 riffle	**Absent** No riffles
Score____3___	4	3	2	1

Dimensions of Largest Pool	**Large** Pool covers more than 50% of the channel width; maximum depth is >1 meter	**Moderate** Pool covers approximately 50% or slightly less of the channel width; maximum depth is 0.5-1 meter	**Small** Pool covers approximately 25% of the channel width; maximum depth is <0.5 meter	**Absent** No existing pools; only shallow auxiliary pockets
Score____3___	4	3	2	1
Channel Flow Status	**High** Water reaches the base of both lower banks; < 5% of channel substrate is exposed	**Moderate** Water fills >75% of the channel; or <25% of channel substrate is exposed	**Low** Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed	**No Flow** Very little water in the channel and mostly present in standing pools; or stream is dry
Score____1___	3	2	1	0
Bank Stability	**Stable** Little evidence (<10%) of erosion or bank failure; bank angles average <30°	**Moderately Stable** Some evidence (10-29.9%) of erosion or bank failure; small areas of erosion mostly healed over; bank angles average 30-39.9°	**Moderately Unstable** Evidence of erosion or bank failure is common (30-50%); high potential of erosion during flooding; bank angles average 40-60°	**Unstable** Large and frequent evidence (>50%) of erosion or bank failure; raw areas frequent along steep banks; bank angles average >60°
Score____1___	3	2	1	0
Channel Sinuosity	**High** ≥ 2 well-defined bends with deep outside areas (cut banks) and shallow inside areas (point bars) present	**Moderate** 1 well-defined bend or ≥ 3 moderately-defined bends present	**Low** <3 moderately-defined bends or only poorly-defined bends present	**None** Straight channel; may be channelized
Score____1___	3	2	1	0

Riparian Buffer Vegetation	**Extensive** Width of natural buffer is >20 meters	**Wide** Width of natural buffer is 10.1-20 meters	**Moderate** Width of natural buffer is 5-10 meters	**Narrow** Width of natural buffer is <5 meters
Score__1_____	3	2	1	0
Aesthetics of Reach	**Wilderness** Outstanding natural beauty; usually wooded or unpastured area; water clarity is usually exceptional	**Natural Area** Trees and/or native vegetation are common; some development evident (from fields, pastures, dwellings); water clarity may be slightly turbid	**Common Setting** Not offensive; area is developed, but uncluttered such as in an urban park; water clarity may be turbid or discolored	**Offensive** Stream does not enhance the aesthetics of the area; cluttered; highly developed; may be a dumping area; water clarity is usually turbid or discolored
Score____1____	3	2	1	0
Total Score_____**18**_____				

HABITAT QUALITY INDEX

26 - 31 **Exceptional**
20 - 25 **High**
14 - 19 **Intermediate**
≤ 13 **Limited**

Part II - Summary of Physical Characteristics of Water Body Using information from all of the transects and measurements in Part I and other sources, report the following general characteristics or averages for the entire reach:	
Stream Name: Pecos River @ Pandale	**Date:** 6/20/06
Physical Characteristics	**Value**
Stream bed slope over evaluated reach (from USGS map; elevation change in meters/reach length in kilometers)	
Approximate drainage area above the transect furthest downstream (from USGS or county highway map in km^2)	
Stream order	
Length of stream evaluated (meters or kilometers)	240
Number of lateral transects made	5
Average stream width (meters)	27.6
Average stream depth (meters)	0.57
Stream discharge (ft^3/sec)	
Flow measurement method	
Channel flow status (high, moderate, low, or no flow)	low
Maximum pool width (meters)	33
Maximum pool depth (meters)	0.76
Total number of stream bends	2
Number of well defined bends	0
Number of moderately defined bends	0
Number of poorly defined bends	2
Total number of riffles	2
Dominant substrate type	silt/gravel
Average percent of substrate gravel sized or larger	52.0
Average percent instream cover	48.0
Number of stream cover types	1
Average percent stream bank erosion potential	2.0
Average stream bank slope (degrees)	34.0
Average width of natural buffer vegetation (meters)	9.0
Average riparian vegetation percent composition by: (total to equal 100%)	
Trees	5
Shrubs	30
Grasses and Forbs	20
Cultivated fields	0
Other	0
Average percent tree canopy coverage	37.6
Overall aesthetic appraisal of the stream	natural-common

Appendix B – Fish Collection Assessment

Table 8. Fish Assessment for Pecos at Orla.

Site	**Pecos River**
Location	**FM 652 near Orla**
Collector	**Pat Bohannon**
Date	**12/12/06**
County	**Loving/Reeves**
# Seine Hauls	**6**
Shocking Effort (min)	**20.4**

Scientific Name	Common Name	Trophic Feeding Group	Tolerance	Non-native	Number Collected Shock	Number Collected Seine	Number Collected Total
Cyprinus carpio	Common carp	O	T	Non-native	4		4
Fundulus grandis	Gulf killifish	O			71	4	75
Lucania parva	Rainwater killifish	IF			3	1	4
Menidia beryllina	Inland silverside	IF			10	198	208
Total Disease/Anomoly					4		4
							Total Individuals
					Individuals (Shock)	Individuals (Seine)	
					88	**203**	**291**

Total Species	Total Tolerant Individuals	Total Omnivore Individuals	Total Invertivore Individuals	Total Non-native Individuals
4	**4**	**79**	**212**	**4**

Pecos River @ FM 652 near Orla, Loving/Reeves Co.		Ecoregion 24
Pat Bohannon	**12/12/06**	
Metric Category	**Intermediate Totals for Metrics**	
	Drainage Basin Size	54933
Species Richness and Composition	Number of Fish Species	4
	Number of Native Cyprinid Species	0
	Number of Benthic Invertivore Species	0
	Number of Sunfish Species	0
	Number of Intolerant Species	0
	Number of Individuals as Tolerants	4
Trophic Composition	Number of Individuals as Omnivores	79
	Number of Individuals as Invertivores	212
	Number of Individuals (Seine)	203
Fish Abundance and Condition	Number of Individuals (Shock)	88
	Number of Individuals in Sample	291
	# of Individuals as Non-native species	4
	# of Individuals With Disease/Anomaly	4

Metric Name	**Raw Value**	**IBI Score**
Log Drainage Basin Size	4.74	NA
Total Number of Fish Species	4	
Number of Native Cyprinid Species	0	1
Number of Benthic Invertivore Species	0	1
Number of Sunfish Species	0	1
Number of Intolerant Species	0	1
% of Individuals as Tolerant Species	1.4	5
% of Individuals as Omnivores	27.1	1
% of Individuals as Invertivores	72.9	5
Number of Individuals in Sample		1
% of Individuals as Non-native species	1.4	3
% of Individuals With Disease/Anomaly	1.4	1
Number of Individuals/seine haul	33.8	1
Number of Individuals/min electrofishing	4.31	1
	Index of Biotic Integrity Numeric Score:	**20**
Index of Biotic Integrity Classification:		**Limited**

Table 9. Fish Assessment for Pecos at Coyanosa.

Site	**Pecos River**
Location	**FM 1776 near Coyanosa**
Collector	**Pat Bohannon**
Date	**12/13/06**
County	**Pecos/Ward**
# Seine Hauls	**0**
Shocking Effort (min)	**27**

Scientific Name	**Common Name**	**Trophic Feeding Group**	**Tolerance**	**Number Collected Shock**	**Number Collected Seine**	**Number Collected Total**
Cyprinodon pecosensis x variegatus	Pecos pupfish hybrid	O	T	52		52
Fundulus grandis	Gulf killifish	O		158		158
Gambusia affinis	Western mosquitofish	IF		3		3
Lucania parva	Rainwater killifish	IF		72		72
				Individuals (Shock)	Individuals (Seine)	**Total Individuals**
				285	**0**	**285**

Total Species	**Total Tolerant Individuals**	**Total Omnivore Individuals**	**Total Invertivore Individuals**
4	**52**	**210**	**75**

Pecos River @ FM 1776 near Coyanosa, Pecos/Ward Co.		Ecoregion 24
Pat Bohannon	**12/13/06**	
Metric Category	**Intermediate Totals for Metrics**	
	Drainage Basin Size	20132.54
Species Richness	Number of Fish Species	4
and Composition	Number of Native Cyprinid Species	0
	Number of Benthic Invertivore Species	0
	Number of Sunfish Species	0
	Number of Intolerant Species	0
	Number of Individuals as Tolerants	52
Trophic Composition	Number of Individuals as Omnivores	210
	Number of Individuals as Invertivores	75
	Number of Individuals (Seine)	0
Fish Abundance	Number of Individuals (Shock)	285
and Condition	Number of Individuals in Sample	285
	# of Individuals as Non-native species	0
	# of Individuals With Disease/Anomaly	0
Metric Name	**Raw Value**	**IBI Score**
Log Drainage Basin Size	4.30	NA
Total Number of Fish Species	4	
Number of Native Cyprinid Species	0	1
Number of Benthic Invertivore Species	0	1
Number of Sunfish Species	0	1
Number of Intolerant Species	0	1
% of Individuals as Tolerant Species	18.2	5
% of Individuals as Omnivores	73.7	1
% of Individuals as Invertivores	26.3	1
Number of Individuals in Sample		1
% of Individuals as Non-native species	0.0	5
% of Individuals With Disease/Anomaly	0.0	5
Number of Individuals/seine haul	0.0	1
Number of Individuals/min electrofishing	10.56	1
	Index of Biotic Integrity Numeric Score:	**22**
Index of Biotic Integrity Classification:		**Limited**

Table 10. Fish Assessment for Pecos at Girvin.

Site	**Pecos River**
Location	**US 67 near Girvin**
Collector	**Pat Bohannon**
Date	**12/14/06**
County	**Pecos/Crockett**
# Seine Hauls	**0**
Shocking Effort (min)	**22.9**

Scientific Name	**Common Name**	**Trophic Feeding Group**	**Tolerance**	**Number Collected Shock**	**Number Collected Seine**	**Number Collected Total**
Cyprinodon pecosensis x variegatus	Pecos pupfish hybrid	O	T	20		20
Fundulus grandis	Gulf killifish	O		17		17
Gambusia affinis	Western mosquitofish	IF		2		2
Lucania parva	Rainwater killifish	IF		6		6
Menidia beryllina	Inland silverside	IF		1		1
						Total Individuals
				Individuals (Shock)	Individuals (Seine)	
				46	**0**	**46**

Total Species	**Total Tolerant Individuals**	**Total Omnivore Individuals**	**Total Invertivore Individuals**
5	**20**	**37**	**9**

Pecos River @ US 67 near Girvin, Pecos/Crockett Co.		Ecoregion 24
Pat Bohannon	**12/14/06**	
Metric Category	**Intermediate Totals for Metrics**	
	Drainage Basin Size	76560
Species Richness and Composition	Number of Fish Species	5
	Number of Native Cyprinid Species	0
	Number of Benthic Invertivore Species	0
	Number of Sunfish Species	0
	Number of Intolerant Species	0
	Number of Individuals as Tolerants	20
Trophic Composition	Number of Individuals as Omnivores	37
	Number of Individuals as Invertivores	9
	Number of Individuals (Seine)	0
Fish Abundance and Condition	Number of Individuals (Shock)	46
	Number of Individuals in Sample	46
	# of Individuals as Non-native species	0
	# of Individuals With Disease/Anomaly	0

Metric Name	**Raw Value**	**IBI Score**
Log Drainage Basin Size	4.88	NA
Total Number of Fish Species	5	
Number of Native Cyprinid Species	0	1
Number of Benthic Invertivore Species	0	1
Number of Sunfish Species	0	1
Number of Intolerant Species	0	1
% of Individuals as Tolerant Species	43.5	3
% of Individuals as Omnivores	80.4	1
% of Individuals as Invertivores	19.6	1
Number of Individuals in Sample		1
% of Individuals as Non-native species	0.0	5
% of Individuals With Disease/Anomaly	0.0	5
Number of Individuals/seine haul	0.0	1
Number of Individuals/min electrofishing	2.01	1
	Index of Biotic Integrity Numeric Score:	**20**
Index of Biotic Integrity Classification:		**Limited**

Table 11. Fish Assessment for Pecos at Sheffield.

Site	**Pecos River**
Location	**River Road near Sheffield**
Collector	**Pat Bohannon**
Date	**12/11/06**
County	**Crockett/Pecos**
# Seine Hauls	**8**
Shocking Effort (min)	**20.1**

Scientific Name	Common Name	Trophic Feeding Group	Tolerance	Number Collected Shock	Number Collected Seine	Number Collected Total
Cyprinella lutrensis	Red shiner		T	2	11	13
yprinodon pecosensis x variegatus	Pecos pupfish hybrid		T	14	2	16
Cyprinus carpio	Common carp		T	7	0	7
Fundulus grandis	Gulf killifish			76	6	82
Gambusia affinis	Western mosquitofish			1	0	1
Lepomis cyanellus	Green sunfish		T	2	0	2
Menidia beryllina	Inland silverside			0	9	9
imephales promelas	Fathead minnow		T	23	0	23
						Total Individuals
				Individuals (Shock)	Individuals (Seine)	
				125	**28**	**153**

Total Species	Total Native Cyprinid Species	Total Sunfish Species	Total Tolerant Individuals	Total Omnivore Individuals	Total Invertivore Individuals	Total Piscivore Individuals	Total Non-native Individuals
8	**2**	**1**	**61**	**128**	**23**	**2**	**7**

Pecos River @ River Road near Sheffield, Crockett/Pecos Co.		
Pat Bohannon	**12/11/06**	**Ecoregion 24**

Metric Category	**Intermediate Totals for Metrics**	
	Drainage Basin Size	18669.08
Species Richness and Composition	Number of Fish Species	9
	Number of Native Cyprinid Species	2
	Number of Benthic Invertivore Species	0
	Number of Sunfish Species	1
	Number of Intolerant Species	0
	Number of Individuals as Tolerants	61
Trophic Composition	Number of Individuals as Omnivores	128
	Number of Individuals as Invertivores	29
	Number of Individuals (Seine)	28
Fish Abundance and Condition	Number of Individuals (Shock)	131
	Number of Individuals in Sample	159
	# of Individuals as Non-native species	7
	# of Individuals With Disease/Anomaly	0

Metric Name	**Raw Value**	**IBI Score**
Log Drainage Basin Size	4.27	NA
Total Number of Fish Species	9	
Number of Native Cyprinid Species	2	1
Number of Benthic Invertivore Species	0	1
Number of Sunfish Species	1	3
Number of Intolerant Species	0	1
% of Individuals as Tolerant Species	38.4	3
% of Individuals as Omnivores	80.5	1
% of Individuals as Invertivores	18.2	1
Number of Individuals in Sample		1
% of Individuals as Non-native species	4.4	1
% of Individuals With Disease/Anomaly	0.0	5
Number of Individuals/seine haul	3.5	1
Number of Individuals/min electrofishing	6.52	1
	Index of Biotic Integrity Numeric Score:	**18**
Index of Biotic Integrity Classification:		**Limited**

Table 12. Fish Assessment for Pecos at Chandler Ranch.

Site	**Pecos River**
Location	**Chandler Ranch**
Collector	**Bruce Moring**
County	**Loving/Reeves**
# Seine Hauls	**6**
Shocking Effort (min)	**25**
Date	**6/22/06**

Scientific Name	Common Name	Trophic Feeding Group	Tolerance	Non-native	Number Collected Shock	Number Collected Seine	Number Collected Total
Carpiodes carpio	River carpsucker	O	T		1		1
Cichlasoma cyanoguttatum	Rio Grande cichlid	IF			1		1
Cyprinella lutrensis	Red shiner	IF	T		12	9	21
Cyprinodon variegatus	Sheepshead minnow	O	T			1	1
Cyprinus carpio	Common carp	O	T	Non-native	5		5
Dorosoma cepedianum	Gizzard shad	O	T		9		9
Fundulus zebrinus	Plains killifish	IF	T		10	7	17
Ictalurus punctatus	Channel catfish	O	T		2	1	3
Lepisosteus osseus	Longnose gar	P	T		1		1
Menidia beryllina	Inland silverside	IF				1	1
Micropterus salmoides	Largemouth bass	P			1	1	2
					Individuals (Shock) **42**	Individuals (Seine) **20**	

Total Species	Total Cyprinid Species	Total Tolerant Individuals	Total Omnivore Individual	Total Invertivore Individuals	Total Piscivore Individual	Total Non-native Individuals
11	**1**	**58**	**19**	**40**	**3**	**5**

Pecos River @ Chandler, Crockett Co.		
Bruce Moring	**6/22/06**	**Ecoregion 24**

Metric Category	**Intermediate Totals for Metrics**	
	Drainage Basin Size	54933
Species Richness and Composition	Number of Fish Species	11
	Number of Native Cyprinid Species	1
	Number of Benthic Invertivore Species	0
	Number of Sunfish Species	0
	Number of Intolerant Species	0
	Number of Individuals as Tolerants	58
Trophic Composition	Number of Individuals as Omnivores	19
	Number of Individuals as Invertivores	40
Fish Abundance and Condition	Number of Individuals (Seine)	20
	Number of Individuals (Shock)	42
	Number of Individuals in Sample	62
	# of Individuals as Non-native species	5
	# of Individuals With Disease/Anomaly	0

Metric Name	**Raw Value**	**IBI Score**
Log Drainage Basin Size	4.74	NA
Total Number of Fish Species	11	
Number of Native Cyprinid Species	1	1
Number of Benthic Invertivore Species	0	1
Number of Sunfish Species	0	1
Number of Intolerant Species	0	1
% of Individuals as Tolerant Species	93.5	1
% of Individuals as Omnivores	30.6	1
% of Individuals as Invertivores	64.5	3
Number of Individuals in Sample		1
% of Individuals as Non-native species	8.1	1
% of Individuals With Disease/Anomaly	0.0	5
Number of Individuals/seine haul	3.3	1
Number of Individuals/min electrofishing	1.68	1
	Index of Biotic Integrity Numeric Score:	**16**
Index of Biotic Integrity Classification:		**Limited**

Table 13. Fish Assessment for Pecos at Independence Creek.

Site	**Pecos River**
Location	**Pecos River @ Independence Creek**
Collector	**Bruce Moring**
County	**Crockett/Terrell**
# Seine Hauls	**6**
Shocking Effort (min)	**20**
Date	**6/21/06**

Scientific Name	Common Name	Trophic Feeding Group	Tolerance	Non-native	Number Collected Shock	Number Collected Seine	Number Collected Total
Astyanax mexicanus	Mexican tetra	IF				2	2
Carpiodes carpio	River carpsucker	O	T		1		1
Cichlasoma cyanoguttatum	Rio Grande cichlid	IF			4		4
Cyprinella lutrensis	Red shiner	IF	T		24	1	25
Cyprinella venusta	Blacktail shiner	IF			2		2
Cyprinus carpio	Common carp	O	T	Non-native	6		6
Dorosoma cepedianum	Gizzard shad	O	T		14		14
Fundulus zebrinus	Plains killifish	IF	T		21		21
Ictalurus punctatus	Channel catfish	O	T		4		4
Lepisosteus osseus	Longnose gar	P	T		1		1
Micropterus salmoides	Largemouth bass	P			16	10	26
Moxostoma congestum	Gray redhorse	IF			3		3
Pimephales vigilax	Bullhead minnow	IF			2	2	4
					Individuals (Shock) **98**	Individuals (Seine) **15**	

Total Species	Total Tolerant Individuals	Total Omnivore Individuals	Total Invertivore Individuals	Total Piscivore Individuals	Total Non-native Individuals
13	**72**	**25**	**61**	**27**	**6**

Pecos River @ Independence Creek, Crockett/Terrell Co.		
Bruce Moring	**6/21/06**	**Ecoregion 24**

Metric Category	**Intermediate Totals for Metrics**	
	Drainage Basin Size	54933
Species Richness and Composition	Number of Fish Species	13
	Number of Native Cyprinid Species	3
	Number of Benthic Invertivore Species	1
	Number of Sunfish Species	0
	Number of Intolerant Species	0
	Number of Individuals as Tolerants	72
Trophic Composition	Number of Individuals as Omnivores	25
	Number of Individuals as Invertivores	61
	Number of Individuals (Seine)	15
Fish Abundance and Condition	Number of Individuals (Shock)	98
	Number of Individuals in Sample	113
	# of Individuals as Non-native species	6
	# of Individuals With Disease/Anomaly	0

Metric Name	**Raw Value**	**IBI Score**
Log Drainage Basin Size	4.74	NA
Total Number of Fish Species	13	
Number of Native Cyprinid Species	3	3
Number of Benthic Invertivore Species	1	3
Number of Sunfish Species	0	1
Number of Intolerant Species	0	1
% of Individuals as Tolerant Species	63.7	1
% of Individuals as Omnivores	22.1	1
% of Individuals as Invertivores	54.0	3
Number of Individuals in Sample		1
% of Individuals as Non-native species	5.3	1
% of Individuals With Disease/Anomaly	0.0	5
Number of Individuals/seine haul	2.5	1
Number of Individuals/min electrofishing	4.90	1
	Index of Biotic Integrity Numeric Score:	**20**
Index of Biotic Integrity Classification:		**Limited**

Table 14. Fish Assessment for Pecos at Pandale.

Site	**Pecos River**
Location	**Pandale**
Collector	**Bruce Moring**
County	**Val Verde**
# Seine Hauls	**6**
Shocking Effort (min)	**17.35**
Date	**6/20/06**

Scientific Name	Common Name	Trophic Feeding Group	Tolerance	Non-native	Number Collected Shock	Number Collected Seine	Number Collected Total
Astyanax mexicanus	Mexican tetra	IF				2	2
Cichlasoma cyanoguttatum	Rio Grande cichlid	IF			11	2	13
Cyprinella lutrensis	Red shiner	IF	T			1	1
Cyprinella venusta	Blacktail shiner	IF			9	1	10
Cyprinus carpio	Common carp	O	T	Non-native	1		1
Gambusia affinis	Western mosquitofish	IF			2	1	3
Ictalurus punctatus	Channel catfish	O	T		5		5
Lepomis auritus	Redbreast sunfish	IF		Non-native	18		18
Lepomis macrochirus	Bluegill	IF	T		1		1
Lepomis megalotis	Longear sunfish	IF			14		14
Menidia beryllina	Inland silverside	IF			1		1
Micropterus salmoides	Largemouth bass	P			1	1	2
Pylodictis olivaris	Flathead catfish	P			3	1	4
					Individuals (Shock) **66**	Individuals (Seine) **9**	

Total Species	Total Tolerant Individuals	Total Omnivore Individuals	Total Invertivore Individuals	Total Piscivore Individuals	Total Non-native Individuals
13	**8**	**6**	**63**	**6**	**19**

Pecos River @ Pandale, Val Verde Co.		
Bruce Moring	**6/20/06**	**Ecoregion 24**

Metric Category	**Intermediate Totals for Metrics**	
Species Richness and Composition	Number of Fish Species	13
	Number of Native Cyprinid Species	2
	Number of Benthic Invertivore Species	0
	Number of Sunfish Species	3
	Number of Intolerant Species	0
	Number of Individuals as Tolerants	8
Trophic Composition	Number of Individuals as Omnivores	6
	Number of Individuals as Invertivores	63
	Number of Individuals (Seine)	9
Fish Abundance and Condition	Number of Individuals (Shock)	66
	Number of Individuals in Sample	75
	# of Individuals as Non-native species	19
	# of Individuals With Disease/Anomaly	0

Metric Name	**Raw Value**	**IBI Score**
Total Number of Fish Species	13	
Number of Native Cyprinid Species	2	1
Number of Benthic Invertivore Species	0	1
Number of Sunfish Species	3	5
Number of Intolerant Species	0	1
% of Individuals as Tolerant Species	10.7	5
% of Individuals as Omnivores	8.0	5
% of Individuals as Invertivores	84.0	5
Number of Individuals in Sample		1
% of Individuals as Non-native species	25.3	1
% of Individuals With Disease/Anomaly	0.0	5
Number of Individuals/seine haul	1.5	1
Number of Individuals/min electrofishing	3.80	1
	Index of Biotic Integrity Numeric Score:	**30**
Index of Biotic Integrity Classification:		**Limited**

Appendix C – Benthic Macroinvertebrate Assessment

Table 15. Benthic Assessment at Orla.

Species Collected

Erpetogomphus sp.
Pseudochironomus sp.
Cheumatopsyche sp.
Polypedilum sp.
Dicrotendipes sp.
Cricotopus sp.
Goeldichironomus sp.
Hyallela azteca
Oligochaeta
Berosus sp.

Benthic macroinvertebrate taxa collected from Pecos River @ FM 652 near Orla, Loving Co., TX; 12/12/2006; 5-minute Kicknet in riffle	Value	Score
Taxa Richness	6	1
EPT	1	1
Biotic Index	6.53	1
% Chironomidae	55.09	1
% Dominant Taxon	55.09	1
% Dominant Functional Group	46.35	2
% Predators	35.33	2
Ratio Intolerant to Tolerant Taxa*	0.12	1
% of Total Trichoptera as Hydropsychidae	100	1
Number of Non-insect taxa	2	2
% Collector-Gatherers	46.35	1
% of n as Elmidae	0	1
Total Score STATEWIDE RBIBI		15

Taxa Richness	6	1
Number of Ephemeroptera Taxa	0	1
Percent of N as Trichoptera	21.13	1
% Chironomidae	55.09	1
% Diptera	55.09	1
% of Total Trichoptera as Hydropsychidae	100	1
Biotic Index	6.53	1
Number of Intolerant Taxa	1	1
% Collector-Gatherer	46.35	1
Total Score CHIHUAHUAN DESERTS ECOREGION RBIBI		9

Table 16. Benthic Assessment at Coyanosa.

Species Collected

Ithytrichia sp.
Oecetis sp.
Sphaeromias sp.
Argia sp.
Coenagrion/Enallagma sp.
Dicrotendipes sp.
Cricotopus sp.
Hyallela azteca
Oligochaeta
Berosus sp.
Physa sp.

Benthic macroinvertebrate taxa collected from Pecos River @ FM 1776 near Coyanosa, Pecos Co., TX; 12/13/2006; 5-minute Kicknet in riffle	Value	Score
Taxa Richness	10	2
EPT	2	1
Biotic Index	7.98	1
% Chironomidae	7.51	3
% Dominant Taxon	64.32	1
% Dominant Functional Group	38.73	3
% Predators	6.81	4
Ratio Intolerant to Tolerant Taxa*	0.01	1
% of Total Trichoptera as Hydropsychidae	0	4
Number of Non-insect taxa	3	2
% Collector-Gatherers	38.73	2
% of n as Elmidae	0	1
Total Score STATEWIDE RBIBI		25

	Value	Score
Taxa Richness	10	2
Number of Ephemeroptera Taxa	0	1
Percent of N as Trichoptera	0.94	2
% Chironomidae	7.51	4
% Diptera	7.98	3
% of Total Trichoptera as Hydropsychidae	0	4
Biotic Index	7.98	1
Number of Intolerant Taxa	1	1
% Collector-Gatherer	38.73	1
Total Score CHIHUAHUAN DESERTS ECOREGION RBIBI		19

Table 17. Benthic Assessment at Girvin.

Species Collected

Coenagrion/Enallagma sp.
Sympetrum sp.
Berosus sp.
Dicrotendipes sp.
Einfeldia sp.
Rheotanytarsus sp.
Sphaeromias sp.
Hyallela azteca

Benthic macroinvertebrate taxa collected from Pecos River @ HWY 67 near Girvin, Crockett Co., TX; 12/14/2006; 5-minute Kicknet	Value	Score
Taxa Richness	6	1
EPT	0	1
Biotic Index	7.28	1
% Chironomidae	31.46552	1
% Dominant Taxon	56.46552	1
% Dominant Functional Group	36.63793	3
% Predators	12.06897	4
Ratio Intolerant to Tolerant Taxa*	0.07907	1
% of Total Trichoptera as Hydropsychidae	nt	1
Number of Non-insect taxa	1	1
% Collector-Gatherers	36.63793	2
% of n as Elmidae	0	1
Total Score STATEWIDE RBIBI		18

	Value	Score
Taxa Richness	10	2
Number of Ephemeroptera Taxa	0	1
Percent of N as Trichoptera	0.94	2
% Chironomidae	7.51	4
% Diptera	7.98	3
% of Total Trichoptera as Hydropsychidae	0	4
Biotic Index	7.98	1
Number of Intolerant Taxa	1	1
% Collector-Gatherer	38.73	1
Total Score CHIHUAHUAN DESERTS ECOREGION RBIBI		19

Table 18. Benthic Assessment at Sheffield.

Species Collected

Neochoroterpes sp.
Cheumatopsyche sp.
Ithytrichia sp.
Argia sp.
Berosus sp.
Tabanus sp.
Sphaeromias sp.
Cricotopus sp.
Pseudochironomus sp.
Dicrotendipes sp.
Orthocladius sp.
Glyptotendipes sp.
Telopelopia sp.
Hyallela azteca
Physella sp.
Oligochaeta

Benthic macroinvertebrate taxa collected from Pecos River @ River Road; Sheffield, Co., TX; 12/11/2006; 5-minute Kicknet in riffle

	Value	Score
Taxa Richness	11	2
EPT	3	1
Biotic Index	6.81	1
% Chironomidae	13.62	2
% Dominant Taxon	45.96	1
% Dominant Functional Group	42.34	3
% Predators	11.49	4
Ratio Intolerant to Tolerant Taxa*	0.22	1
% of Total Trichoptera as Hydropsychidae	96.97	1
Number of Non-insect taxa	3	2
% Collector-Gatherers	42.34	1
% of n as Elmidae	0	1
Total Score STATEWIDE RBIBI		20

	Value	Score
Taxa Richness	11	2
Number of Ephemeroptera Taxa	1	1
Percent of N as Trichoptera	14.04	4
% Chironomidae	13.62	4
% Diptera	17.87	2
% of Total Trichoptera as Hydropsychidae	96.97	2
Biotic Index	6.81	1
Number of Intolerant Taxa	3	1
% Collector-Gatherer	42.34	1
Total Score CHIHUAHUAN DESERTS ECOREGION RBIBI		18

Table 19. Benthic Assessment at Chandler Ranch.

Species Collected

Tricorythodes sp.	*Stenelmis sp. (14 adult, 52 larvae)*
Neochoroterpes sp.	*Ambrysus sp.*
Baetis sp.	*Cryphocricos sp.*
Cheumatopsyche sp.	*Simulium sp.*
Hydropsyche sp.	*Tabanus sp.*
Ithytrichia sp.	*Bezzia/Palpomyia sp.*
Corydalus sp.	*Cricotopus sp.*
Argia sp.	*Hyallela azteca*
Hetaerina sp.	*Physa sp.*
Gyretes sp.	*Oligochaeta*
Lutrochus sp. (3 larvae)	*Postelichus sp.*
Hexacylloepus sp. (1 adult, 1 larva)	*Macrelmis sp.*

Benthic macroinvertebrate taxa collected from Pecos River above Independence Cr., Crockett Co., TX; USGS Sta. 003: USGS ID 302749101434901; 06/22/2006; 5-minute Kicknet in riffle	Value	Score
Taxa Richness	24	4
EPT	6	2
Biotic Index	5.72	1
% Chironomidae	0.43	1
% Dominant Taxon	28.70	3
% Dominant Functional Group	28.42	4
% Predators	28.20	2
Ratio Intolerant to Tolerant Taxa*	0.34	1
% of Total Trichoptera as Hydropsychidae	85.29	1
Number of Non-insect taxa	3	2
% Collector-Gatherers	28.20	3
% of n as Elmidae	31.30	1
Total Score STATEWIDE RBIBI		25

	Value	Score
Taxa Richness	24	4
Number of Ephemeroptera Taxa	3	2
Percent of N as Trichoptera	14.78	4
% Chironomidae	0.43	2
% Diptera	2.61	4
% of Total Trichoptera as Hydropsychidae	85.29	2
Biotic Index	5.72	1
Number of Intolerant Taxa	6	1
% Collector-Gatherer	28.20	2
Total Score CHIHUAHUAN DESERTS ECOREGION RBIBI		22

Table 20. Benthic Assessment at Independence Creek.

Species Collected

Tricorythodes sp.
Neochoroterpes sp.
Camelobaetidius sp.
Fallceon quilleri
Cheumatopsyche sp.
Hydropsyche sp.
Chimarra sp.
Polyplectropus sp.
Ithytrichia sp.
Nectopsyche sp.
Corydalus sp.
Physa sp.
Girardia sp.
Hydracarina
Erpetogomphus sp.
Argia sp.
Gyretes sp.
Hexacylloepus sp.
Macrelmis sp.
Microcylloepus sp.
Stenelmis sp.
Ambrysus sp.
Simulium sp.
Tabanus sp.
Polypedilum sp.
Cladotanytarsus sp.
Thienemanniella sp.

Benthic macroinvertebrate taxa collected from Pecos River downstream of Independence Cr., Crockett Co., TX; USGS Sta. 002: USGS ID 302628101431501; 06/21/2006; 5-minute Kicknet in riffle	Value	Score
Taxa Richness	25	4
EPT	10	4
Biotic Index	4.14	3
% Chironomidae	1.27	4
% Dominant Taxon	30.89	3
% Dominant Functional Group	44.94	3
% Predators	12.39	4
Ratio Intolerant to Tolerant Taxa*	2.16	2
% of Total Trichoptera as Hydropsychidae	58.62	2
Number of Non-insect taxa	3	2
% Collector-Gatherers	20.15	3
% of n as Elmidae	8.60	4
Total Score STATEWIDE RBIBI		38

	Value	Score
Taxa Richness	25	4
Number of Ephemeroptera Taxa	4	3
Percent of N as Trichoptera	18.47	4
% Chironomidae	1.27	3
% Diptera	32.80	1
% of Total Trichoptera as Hydropsychidae	58.62	3
Biotic Index	4.14	2
Number of Intolerant Taxa	9	3
% Collector-Gatherer	20.14	3
Total Score CHIHUAHUAN DESERTS ECOREGION RBIBI		26

Table 21. Benthic Assessment at Pandale.

Species Collected

Tricorythodes sp.
Neochoroterpes sp.
Thraulodes sp.
Camelobaetidius sp.
Fallceon quilleri
Cheumatopsyche sp.
Chimarra sp.
Hydroptila sp.
Corydalus sp.
Perithemis sp.
Psephenus sp.
Hexacylloepus sp.
Macrelmis sp.
Microcylloepus sp.
Girardia sp.
Neoelmis sp.
Stenelmis sp.
Ambrysus sp.
Cryphocricos sp.
Limnocoris sp.
Simulium sp.
Cricotopus sp.
Cryptochironomus sp.
Eukiefferiella sp.
Microtendipes sp.
Thienemannimyia sp.
Rheotanytarsus sp.
Hyallela azteca
Corbicula sp.

Benthic macroinvertebrate taxa collected from Pecos River immediately downstream of Co. Rd 1024 bridge near Pandale, Val Verde Co., TX; USGS Sta. 001: USGS ID 300737101342201; 06/20/2006; 5-minute Kicknet in riffle

	Value	Score
Taxa Richness	24	4
EPT	8	3
Biotic Index	3.81	3
% Chironomidae	2.67	4
% Dominant Taxon	26.47	3
% Dominant Functional Group	39.96	3
% Predators	1.70	1
Ratio Intolerant to Tolerant Taxa*	3.56	3
% of Total Trichoptera as Hydropsychidae	50.82	2
Number of Non-insect taxa	3	2
% Collector-Gatherers	38.6	2
% of n as Elmidae	30.75	1
Total Score STATEWIDE RBIBI		31

	Value	Score
Taxa Richness	24	4
Number of Ephemeroptera Taxa	5	3
Percent of N as Trichoptera	16.31	4
% Chironomidae	2.67	3
% Diptera	2.94	3
% of Total Trichoptera as Hydropsychidae	50.82	3
Biotic Index	3.81	3
Number of Intolerant Taxa	14	4
% Collector-Gatherer	38.60	1
Total Score CHIHUAHUAN DESERTS ECOREGION RBIBI		28

Appendix D – Biological Index Values by Site

Table 22. Summary of values by site

	Pecos River at Orla	Pecos River at Coyanosa	Pecos River at Girvin	Pecos River at Sheffield	Pecos River at Chandler Ranch	Pecos River at Independence Creek	Pecos River at Pandale
Habitat Index	15 – Intermediate	18 – Intermediate	16.5 – Intermediate	22 – High	20 – High	16 – Intermediate	18 - Intermediate
Fish Index	20 – limited	22 – Limited	20 – Limited	18 – Limited	16 – Limited	20 – Limited	30 – Limited to High
Benthic Index Statewide IBI	15 – Limited	25 – Limited	18 – Limited	20 – Limited	25 – Intermediate	38 – Exceptional	31 – High
Benthic Index Chihuahuan IBI	9 – Limited	19 – Limited	19 – Limited	18 – Limited	22 – High	26 – Exceptional	28 – Exceptional
Average Conductivity (mg/L)	11,400	12,230	21,219	12,166	5,096	3,201	2,388