# D'OLIVE WATERSHED MONITORING STUDY AND DEVELOPMENT OF A WATERSHED CONDITION FRAMEWORK



Prepared for

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TABLE OF CONTENTS 1.0 INTRODUCTION \_\_\_\_\_\_1 2.0 3.0 METHODS 5 Wetland and Stream Mapping......5 3.1 3.2 Field Assessment......5 4.0 4.1 Wetland Assessment 11 4.2 Stream Assessment 16 4.3 Trend Analysis 21 5.0 COST-EFFECTIVE AND EFFICIENT METHODS FOR EVALUATING TRENDS IN 6.0 7.0 8.0 **APPENDIX A -** Wetland Rapid Assessment Procedure (WRAP) Data Sheets APPENDIX B - Rapid Stream Assessment (RSA) and Habitat Assessment (HA) Data Sheets **APPENDIX C** - Photographs of Rapid Stream Assessment (RSA) Stations LIST OF FIGURES Figure 1-1. D'Olive Watershed restoration projects in Joe's Branch (J), D'Olive Creek (D), and Tiawasee Creek (TC) Sub-watersheds 3 Figure 3-1. A comparison of the RSA and ADEM HA scores generated during 2019 D'Olive stream surveys 9 Figure 3-2. Restoration maintenance problems at the TC2-Tributary restoration site, spring 2019.....10 Figure 4-1. Wetland quality and WRAP scores in the Joe's Branch Sub-watershed......12 Figure 4-6. Stream quality and RSA scores at sites in the Tiawasee Creek Sub-watersheds ......20 Figure 4-9. Stream condition at a sub-watershed scale, comparing 2019 scores and the proportion of forested land cover (NLCD, 2016) within a 200-ft riparian buffer ......25 LIST OF TABLES Table 3-1. Metrics included in the Rapid Stream Assessment method (RSA) and overlap with the Table 3-2. Rapid stream assessment (RSA) metric and scoring criteria for the D'Olive watershed 

# LIST OF TABLES (CONT'D)

Table 4-2. WRAP scores at sites in the D'Olive Creek Sub-watersheds	13
Table 4-3. WRAP scores at sites in the Tiawasee Creek Sub-watershed	14
Table 4-4. Stream RSA scores at sites in the Joe's Branch Sub-watershed	16
Table 4-5. Stream RSA scores at sites in the D'Olive Creek Sub-watersheds	18
Table 4-6. Stream RSA scores at sites in the Tiawasee Creek Sub-watershed	19
Table 4-7. Stream fauna collected or observed at RSA sampling locations	21
Table 4-8. WRAP scores generated since 2016 at the D'Olive restoration sites	21
Table 4-9. Wetland condition at a Sub-watershed scale, based on the acreage proportion of	of Good, Fair,
and Poor conditions	23
Table 4-10. Stream condition at a Sub-watershed scale, based on the proportion of Good,	Fair, and
Poor stream reach conditions	24

#### 1.0 INTRODUCTION

The Mobile Bay National Estuary Program (MBNEP) funded the project entitled, "D'Olive Watershed Monitoring Study and Development of a Watershed Condition Framework", though an Alabama Department of Environmental Management (ADEM) EPA Section 319 (non-point source) funding grant. This report presents an evaluation of trends in biological condition related to D'Olive Watershed restoration management activities and analyzes the cost-effectiveness and efficiency of the pre- and post-restoration monitoring performed to date. The goals of this project are:

- 1. To use a Biological Condition Gradient (BCG) framework to measure the ecological benefits of the D'Olive Watershed Restoration Program;
- 2. To develop a Watershed Condition Framework (WCF) to measure restoration success and management effectiveness; and
- 3. To determine the most cost-effective metrics and efficient methods for evaluating trends in habitat condition related to MBNEP watershed management efforts.

The D'Olive Bay Watershed has a drainage area of approximately 7,700 acres encompassing parts of the cities of Daphne and Spanish Fort as well as unincorporated Baldwin County, Alabama. Development in upland areas of the Watershed has resulted in an increased volume of stormwater runoff from impermeable surfaces; flashy hydrology; loss of natural wetlands and riparian areas; inadequate natural floodplains; and threats to aquatic and wildlife species survival and habitat. This change in land use has increased volume and velocity of urban stormwater flows which has resulted in severe downstream channel degradation in D'Olive Creek, Tiawasee Creek, Joe's Branch, and their tributaries. Due to a combination of steep slopes and highly erodible soils coupled with intensive residential and commercial development, the natural systems of creeks and streams used to convey stormwater runoff are severely degraded. The sediment generated during this process deposits in wetlands located in downstream floodplains, resulting in alterations to stream morphology and hydrologic function; destruction of native vegetation and wildlife habitat in the area; and the proliferation of invasive plant species. As a result, the three primary streams in the watershed are currently on the State of Alabama's Section 303(d) List of Impaired Waters, indicating they do not meet their designated use for propagation of fish and wildlife.

This report presents an evaluation of the success of the D'Olive Watershed Restoration Program, through an analysis of the quality of wetlands, streams, and riparian buffers at the restored sites and their adjacent areas. This effort is intended to serve as a template for using biological condition, measures of management effectiveness, and cost-effective monitoring to evaluate delivery of ecosystem services in coastal Alabama watersheds.

#### 2.0 BACKGROUND

# 2.1 D'Olive Watershed Restoration Projects

In 2010, the MBNEP and project partners developed a comprehensive watershed management plan (WMP) with the primary goals of: reducing sediment inputs into the Lake Forest Lake/D'Olive/Tiawasee system; reducing outgoing sediments loads into D'Olive Bay and the Mobile Bay estuary; remediating and restoring past effects of these sediment loads; and mitigating future impacts of development in the watershed (Thompson Engineering, 2010). Among the recommended management measures was implementation of a programmatic stream restoration approach for a sustained effort to halt the active head-cutting and channel erosion processes. The first funded project in Joe's Branch was approved in 2012 and completed in 2013. MBNEP began restoration activities

throughout the entire D'Olive Watershed with the planning and design of NFWF-funded projects in 2014, with construction beginning in 2015. The first of these was completed in late 2016 and the last in early 2019. Table 1-1 summarizes the project metrics. Project locations are presented in Figure 1-1.

The Program to date includes restoration/stabilization of 11,283 linear feet of streams with an associated 27.6 acres of riparian area. The projects have also restored 3.1 acres of wetlands (not including wetlands incidental to stream restoration). Additionally, stormwater facilities (SWMF) associated with the projects have increased retention/detention capacity of 123,900 cubic feet (not including the capacity added by stream restoration itself).

Table 1-1. Summary of D'Olive Watershed restoration projects and specifications.						
Project Name	Construction Start	Construction Substantial Completion	Stream Restoration Length (linear ft)	Floodplain Riparian Area (acres)	Wetlands Restored (acres)	SWMF Area (acres)/ Volume (ft³)
Joe's Branch Phase 1	Oct. 2012	Apr. 2013	1,000	2.2	0.5	
Joe's Branch Phase 2	Apr. 2015	Nov. 2016	3,300	7.0		
J-SWMF						0.4/35,000
JB-SWMF						0.5/53,400
D4-D6	May 2016	Sep. 2016	2,714	9.0		
DA3	Oct. 2016	Feb. 2017	1,100	2.2	1.6	
DAE	Apr. 2017	Sep. 2017	420	1.2		
DAF, DAF1	Jan. 2019	Mar. 2019	535	0.5		
DAF-1A (Melanie Loop)	Apr. 2018	May 2018	490	1.6		
TC1-TC2, TC2 Trib.	Jan. 2016	Sep. 2017	1,724	3.9	1.0	0.3/35,500
Restoration Projects Totals			11,283	27.6	3.1	1.2/123,900

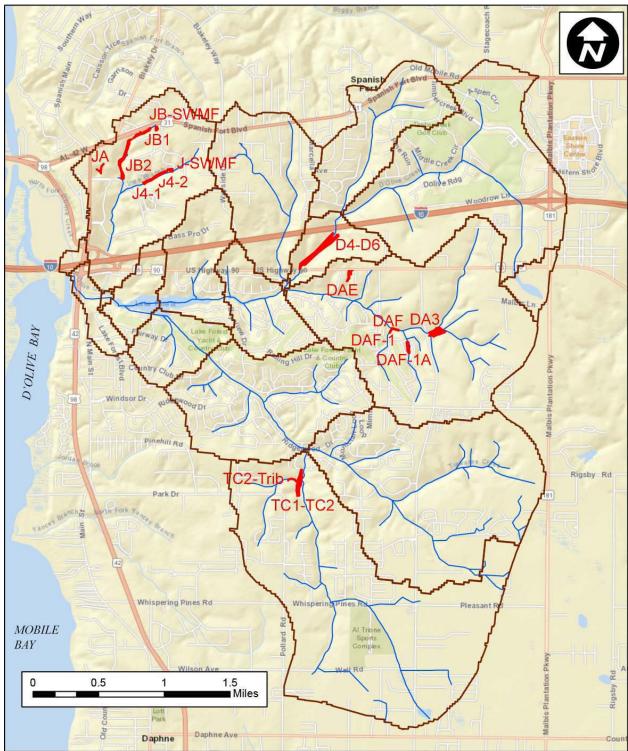


Figure 1-1. D'Olive Watershed restoration projects in Joe's Branch (J), D'Olive Creek (D), and Tiawasee Creek (TC) Sub-watersheds.

# 2.2 Developing a Watershed Condition Framework

A Watershed Condition Framework (WCF) can be used to track results and measure the success of management and restoration activities undertaken to improve the environmental condition of a priority watershed. The 2010 WMP classified the condition of the primary D'Olive stream systems as undergoing severe degradation due to development in upland areas of the watershed. A programmatic stream restoration approach first prioritized and then implemented integrated restoration projects in the Joe's Branch, D'Olive Creek, and Tiawasee Creek Sub-watersheds, for targeted improvement of stormwater management, water quality, and natural ecosystem function.

The United States Forest Service (USFS, 2011) developed a WCF approach describing three watershed condition classes that are directly related to the degree or level of watershed functionality or integrity, as follows:

Class 1 = Functioning Properly Class 2 = Functioning at Risk Class 3 = Impaired Function

A watershed in good condition is characterized as one that is functioning in a manner similar to natural conditions. The success of restoration on a whole-watershed scale can be assessed by a WCF, though demonstration of positive change in watershed classification moving from a degraded state to an improved condition, or higher quality watershed class (USFS, 2011). A watershed is considered to be functioning properly if its physical attributes are appropriate to maintain or improve biological integrity.

In order to remove the subjectivity inherent in assigning condition classes to watersheds, some method of measuring biological condition is required. The MBNEP underwent a multi-year process developing environmental indicators to track management effectiveness and gauge progress toward meeting objectives and goals in its Comprehensive Conservation and Management Plan. Toward that effort, the MBNEP Science Advisory Committee (SAC) developed a Biological Condition Gradient (BCG) framework of environmental assessment for evaluating and reporting on estuarine status and trends. The BCG framework describes the biological condition of priority coastal habitats along a continuum of stress, particularly impacts related to habitat destruction and alteration. The SAC ranked the impacts of environmental stressors on the capacity of priority habitats to provide ecosystem services, which are broadly defined as benefits people receive from the natural environment. The evaluation determined that stressors having the most impact on the Alabama estuarine condition are land use, habitat fragmentation, dredging and filling, and sedimentation. The most imperiled habitats, based on stressor impacts on habitat function and the delivery of ecosystem services, are freshwater wetlands; tidal marshes and flats; and streams, rivers, and their riparian buffers.

The conceptual framework for the BCG is based on the relative proportion of Good (Tier 1), Fair (Tier 2), and Poor (Tier 3) conditions for a watershed, sub-watershed, habitat type, or stream reach of interest. The framework is focused on the ecological quality of wetlands, streams, and riparian buffers, which affect the estuarine condition through hydrologic and structural connectivity with receiving bays and bayous. BCG tiers are classified as follows:

- Tier 1 Natural structure and function of biotic community maintained
- Tier 2 Moderate impairments in structure and function
- Tier 3 Major impairments in structure and function

Restoration of priority habitats requires monitoring the linkages between the restoration activities and the effect they have on aquatic habitat condition. The biological condition of wetlands, riparian buffers, and streams is typically measured using rapid assessment methods, which generate numeric expressions of habitat quality. Generating an overall wetland score makes it relatively simple to compare multiple sites.

Using habitat quality indicators, the BCG framework has potential to be applied as a consistent approach for classifying habitat condition and tracking the effectiveness of environmental management. Successful restoration can be considered to have occurred when a biological condition tier is improved or maintained. The BCG may be used in a WCF to determine if management activities in priority watersheds result in demonstrated improvement to stream and aquatic habitat conditions. Conceptually, a WCF may also be informed by measurable improvements in the physical aspects of restoration, such as more effective stormwater management or reductions in sediment loading. Use of physical attributes for condition assessment would require some measurable standard, such as a TMDL for subject streams.

### 3.0 METHODS

# 3.1 Wetland and Riparian Buffer Mapping

A tiered approach was used to assess the ecological condition of streams, wetlands, and riparian buffers in the watershed, using landscape-scale (Level 1) and ground-level (Level 2) assessments. Baldwin County produced a wetland map in 2005 called the Wetland Advanced Identification Map, or ADID (Baldwin County Planning and Zoning Department, 2005), a modified USFWS National Wetland Inventory (NWI) map. The ADID wetland map was used as a starting condition and updated using 2018-2019 aerial imagery, 2011 LiDAR contour data, and field assessment to delineate wetland-upland boundaries. National Hydrology Dataset (NHD) catchments (i.e., sub-watersheds) and flowlines (i.e., streams) were used for the mapping. For inaccessible locations and other areas not inspected in the field, assessment of stream and wetland conditions were made though evaluation of adjacent land cover, prior observations, and best professional judgment.

Level 1 assessment of habitat quality used the proportion of natural land cover (NLCD, 2016) within a 200-ft-wide (61-m) riparian corridor centered on watershed streams. Forested land (wetlands and uplands) is considered natural cover. Unnatural cover categories include pasture and cropland, barren land, and developed areas including roads, buildings, parks, and other areas where concentrations of human activity occur. The buffer condition corresponds to the score ranges for wetland quality used by the U.S. Army Corps of Engineers, Mobile District in the Wetland Rapid Assessment Procedure (WRAP). The WRAP protocol scores habitat condition in a range from 0.0 to 1.0, with a score of 0.50 or less considered to be low-quality (Poor), 0.51 to 0.74 as medium-quality (Fair), and 0.75 to 1.0 as high-quality (Good). Digital spatial data were analyzed in ArcGIS 10.3.7.

#### 3.2 Field Assessment

Field surveys assessed the condition of streams, riparian buffers, and wetlands using rapid assessment methods. The surveys were focused on the Joe's Branch, Tiawasee Creek, and D'Olive Creek Subwatersheds, principally at the restoration sites and along stream reaches upstream and downstream. Opportunistic observations and field assessments at accessible sites included reconnaissance of previously impacted wetland and riparian buffer habitats, including some locations that were evaluated during the 2010 WMP process.

#### Wetlands

Wetland Resources Environmental Consulting (2017) performed functional assessments of wetlands during the initial stages of D'Olive restoration monitoring (2015 to 2017). The assessments used the Wetland Rapid Assessment Procedure (WRAP) and a Floristic Quality Index (FQI) to measure wetland quality at key sites in the watershed. Most of these sites were re-visited in 2018 and 2019 to generate field data for this study.

Wetland Rapid Assessment Procedure (WRAP) is a Level 2 assessment method used by the Army Corps of Engineers, Mobile District, for wetland permitting and mitigation in the Alabama coastal area. WRAP assesses six functional wetland values, including wetland hydrology, water quality input and treatment, wetland vegetation ground cover, wetland overstory/shrub canopy, adjacent upland buffer, and wildlife utilization. Each function is scored based on the field assessment, and a cumulative value for the condition of each wetland assessment area is generated. A variable score of 3 is considered the best a system can function and a 0 is for a system that is severely impacted and is exhibiting negligible attributes. The overall score is expressed as a percentage, ranging from 0% - 100%. WRAP scores of 0-50% (0.0 to 0.50) are considered Poor (low quality) wetlands; 51-75% (0.51 to 0.75) are Fair (medium quality); and greater than 75% (0.76 to 1.0) are Good (high quality). WRAP data sheets for the 2018 and 2019 D'Olive field assessment sites are included in Appendix A.

The FQI employs a measure of conservatism (Coefficient of Conservatism) along with richness of a plant community to derive an estimate of habitat quality (Wilhelm & Ladd 1988, Lopez & Fennessy 2002). Coefficients of Conservatism (C values) for each plant species follow the wetland FQI for the Southeastern U.S. developed by the Southeast Wetlands Workgroup (Gianopulos 2014). A C value ranging from 0 to 10 is assigned *a priori* to individual wetland plant species by the Southeast Wetlands Workgroup to reflect tolerance to disturbance and fidelity to a particular habitat type or range of conditions. Native obligate wetland species are generally assigned higher C values, whereas plants with broad tolerances have lower values. Invasive species are assigned a C value of 0. FQI results for the field assessment sites are contained in Appendix A.

# Rapid Stream Assessment

Vittor & Associates was tasked with researching and developing an approach to stream assessment that would allow monitoring personnel to make sound but rapid judgments of general stream condition over time, specifically in relation to the restored areas of streams in the D'Olive Watershed. A Rapid Stream Assessment (RSA) method was developed to measure D'Olive stream condition, combining elements of established State-specific habitat assessments (HAS), the Riparian Habitat Health Level Evaluation (RipHLE), Wetland Rapid Assessment Procedure (WRAP), and field biological observations. The RSA used here is a combination of metrics taken directly from the other methods, primarily state-specifics HAS.

The Alabama Department of Environmental Management (ADEM), the Florida Department of Environmental Protection (FDEP), and the Mississippi Department of Environmental Quality (MDEQ) have established procedures for stream habitat assessment. Although specific methods differ, all generally score the same physical and biological aspects of a stream reach of interest. Measured components include available structure/habitat, characterizations of pools, sediments, stream channel, bank stability, and riparian buffer width and condition. The RSA developed for the D'Olive assessment focuses on stream condition as affected by channel alteration, sedimentation, habitat smothering, and stream flow velocity, since amelioration of these stressors is among the primary goals of D'Olive restoration management.

Most of the metrics included in the RSA are taken from typical stream assessment attributes and have some overlap with the RipHLE and WRAP parameters. The RipHLE is a multi-metric approach, designed specifically for use in riparian forests in urban watersheds using primarily vegetative indicators to establish riparian health. RipHLE results from D'Olive monitoring in 2016 and 2017 were somewhat inconclusive for the relatively short study period, and some of the metrics utilized were deemed redundant by the author. While not all of the land surrounding the D'Olive streams comprises wetlands, the WRAP contains parameters that are useful in the development of this method for assessing overall stream and riparian conditions.

Table 3-1 presents a list of the metrics included in the RSA, and how they overlap with other multimetric approaches to riparian zone and stream assessments. Table 3-2 presents the RSA attributes and their scoring criteria. The RSA is a combination of metrics taken directly from the other methods, primarily state-specific HAS.

Table 3-1. Metrics included in th	e Rapid Stream Assessm	ent method (RSA) a	nd overlap with the
RipHLE and WRAP methods.	•	, ,	•
Metric	RipHLE	HAS	WRAP
Riparian Buffer Width	*	*	
Riparian Vegetative Quality	* (Non-native Species)		*
Canopy Cover	*	*	
Local Watershed Erosion		*	
Sediment Deposition		*	
Habitat Availability		*	
Habitat Smothering		*	
Channel Alteration		*	
Channel Sinuosity		*	
Bank Stability	* (BEHI)	*	
Bank Vegetative Protection	* (BEHI)	*	
Macroinvertebrates	. ,		

In some cases multiple metrics from the other methods are combined into single metrics in the RSA. The RipHLE includes the metric "Bank Erosion Hazard Index" (BEHI), which is a composite of several measurements of bank stability. Two of the metrics included in the RSA (Bank Stability and Bank Vegetative Protection) are similar to measurements in the BEHI. In a natural system, bank vegetative protection is an integral part of bank stability, so the two attributes are in general positively associated. The restored stream reaches in the D'Olive Watershed have been artificially created and recent, without well-developed vegetative cover, and the RSA distinguishes between bank cover and stability.

Several vegetative metrics from the WRAP are combined into the single metric of "Riparian Vegetative Quality", with a single estimate of percent native species. Instead of a larger range of numbers (0-20) usually used in stream habitat assessment, RSA attributes are scored as Poor (+0), Moderate (+2), or Good (+4), and the points summed and reported as a proportion of a 50-point maximum.

Table 3-2. Rapid stream assessment (RSA) metric and scoring criteria for the D'Olive watershed sampling stations. Metric Score Criteria Poor (0-9 m) Moderate (9-18 m) Good (>18 m) Riparian Zone Width +2 +0+4 Riparian Vegetative Poor (0-25% Native) Moderate (25-75% Good (>75% Native) Quality +0Native) +4 Poor (<30%, 89-100%) Moderate (30-50%) Good (51-88%) Canopy Cover +0+2+4Local Watershed Heavy Moderate Light Erosion +0+2Poor (>75% of bottom Moderate (25-75% of Good (<25% of Sediment Deposition affected) bottom affected) bottom affected) +0+2+4 Moderate (10-50% Good (>50% stable Poor (<10% stable Habitat Availability stable habitat) habitat) habitat) +0+2+4Poor (>75% of habitat Moderate (25-75% of Good (<25% of **Habitat Smothering** affected) habitat affected) habitat affected) +0+2 +4 Good (No Poor (Extensive Moderate (Some channelization Channel Alteration channelization evident) channelization evident) evident) +() +2+4Moderate (Some bends Good (Extensive Poor (Straight channel) in channel) bends in channel) **Channel Sinuosity** +0+2+4Moderate (30-60% of Good (<30% of Poor (>60% of banks banks banks Bank Stability unstable/eroding) unstable/eroding) unstable/eroding) +0+4 +2Moderate (50-75% of Poor (<50% of Good (>75% of Bank Vegetative streambank with streambank with streambank with Protection vegetation) vegetation) vegetation) +0+2+4 No Yes Macroinvertebrates Yes Present +0+2+2Pollution-Tolerant Moderately Pollution-Pollution-Sensitive Identified Taxa\* Sensitive Taxa Taxa Taxa -2 +2+4 Midge Larvae Caddisfly Water Penny Midge Pupae Damselfly Stonefly \*Taxa Examples Black Fly Dragonfly Mayfly Rat-tailed Maggot **Amphipods** Riffle Beetle Dobson Fly

The RSA method includes qualitative, in-field assessment of stream biota. Stream macroinvertebrate communities can be extremely diverse with genera within the same family indicative of both healthy and degraded/polluted systems. There are certain families of macroinvertebrates that are generally all pollution-sensitive (or moderately so) or pollution-tolerant and easy to identify. At each assessed stream reach, standard rapid bioassessment (RBA) methods were used to collect macroinvertebrates (e.g., using D-frame net sweeps), and the following parameters were noted:

- Presence/absence of macroinvertebrates
- List of any pollution sensitive organisms
- List of any moderately pollution sensitive organisms
- List of pollution-tolerant organisms

Macroinvertebrate attributes were score based on presence (+2) or absence (+0), and if present scored as Poor (-2), Moderate (+2), or Good (+4) based on sensitivity to pollution (Table 3-2). Stream assessment reaches were 100 meters long, except in cases where streams were constrained by roads or other impediments. The RSA results were compared to the ADEM habitat assessment (HA) method, which was simultaneously performed at each stream assessment location. Figure 3-1 presents a comparison of the RSA and ADEM HA scoring, each scaled to their maximum achievable point total. The RSA and ADEM HA methods give similar results in terms of relative scores for different sites. Differences are due in part to a larger range of possible scores in the HA metric (up to 20) compared to the RSA (up to 4), because certain HA attributes were combined for the RSA methods, and due to inclusion of metrics found only in the RSA (e.g., macroinvertebrate criteria).

RSA and ADEM habitat assessment field data sheets are included in Appendix B. Photographs of the stream sampling sites are included in Appendix C.

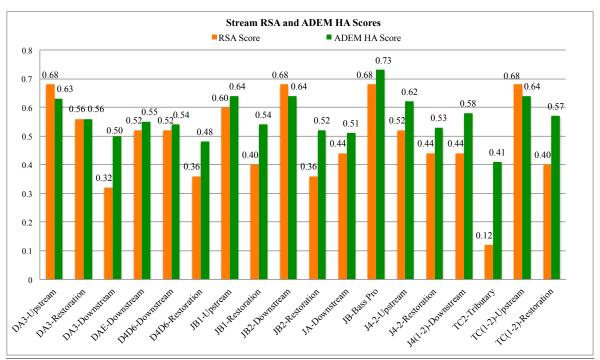


Figure 3-1. Comparison of RSA and ADEM HA scores reported as total points/maximum possible points.

# 3.3 Baseline Ecosystem Conditions

The 2010 D'Olive WMP (Thompson Engineering, 2010) presented information on the pre-restoration condition of streams, riparian areas, and wetlands at key locations in the watershed, including site photographs and observations, measurements, and narrative descriptions. The Tetra Tech stream analysis mapped locations with head-cutting, channel erosion, and sedimentation. Vittor & Associates generated a qualitative map of wetland condition based on site-specific information. The WMP information was used to establish theoretical baseline scores to facilitate a condition trend analysis for this study.

Baseline scores for stream restoration reaches were estimated using the TC2-Tributary restoration site as a model. This site scored lowest of all stream locations in 2019, due to poor conditions for bank stability, bank vegetative protection, habitat availability, sediment deposition, and habitat smothering (Figure 3-2). Prior to restoration the D'Olive stream sites exhibited similar impairments. The TC2-Tributary site therefore provides a good representation of baseline conditions.



Figure 3-2. Restoration maintenance problems at the TC2-Tributary restoration site, spring 2019.

Pre-restoration conditions downstream included severe smothering of wetland and riparian plant communities. Baseline scores for areas downstream of restoration are presumed lower for riparian buffer zone width, riparian vegetative quality, and canopy cover. Baseline scores for downstream sites were also given low ("poor") scores for local watershed erosion, sediment deposition, habitat availability, and habitat smothering. Downstream scores for bank stability, bank vegetative protection, and channel sinuosity were kept constant for baseline and 2019 condition. Pre-restoration conditions

upstream of the restoration projects were presumed to be equivalent to the 2019 scores. No specific taxa (good or bad) were designated for the baseline scoring.

Developing a baseline condition for wetlands is problematic because pre-restoration data is largely qualitative. Site-specific WRAP and FQI assessments conducted as part of the D'Olive Program are relatively small-scale and not usable for developing condition baselines across broader areas, including at a sub-watershed level.

# 4.0 RESULTS

#### 4.1 Wetland Assessment

Tables 4-1 though 4-3 presents WRAP scores by restoration sub-watershed. Figures 4-1 through 4-3 present wetland distributions and the locations of the field sites assessed for wetland quality. The highest quality wetlands in the watershed generally are associated with headwater areas on Malbis Plantation properties above DA3 and on the main tributary to Tiawasee Creek, and the area upstream of the TC restoration site.

In the Joe's Branch Sub-watershed (Table 4.1 and Figure 4.2), highest quality wetlands are associated with Site J4, areas upstream and downstream of JB, and along the main stem of Joe's Branch to the west of the Spanish Fort Town Center development. At J4, wetlands scored high for water quality input and treatment and upland buffers at the downstream end (J4), and for all six functional wetland values at the upstream end (J4-2). Upstream of JB, the headwater slope wetland scored highest for high quality ground cover, had a healthy overstory, and high quality wildlife habitat. Downstream of JB, the wetland scored highest for water quality input and treatment and relatively low for upland buffer condition.

Low WRAP scores in the Joe's Branch Sub-watershed are associated with restoration sites JA and JB. At JA, non-native exotics, including Chinese tallowtree, are present in both the canopy and subcanopy, and hydrology has been altered by commercial development and road construction. At JB, approximately 70% of the groundcover consists of exotics and transitional upland species. The canopy is immature, but has potential for good development, and several species of planted trees are still alive. Both JA and JB are just below the threshold for a condition class of Fair.

Table 4-1. WRAP scores at sites in the Joe's Branch Sub-watershed.			
Sampling Station	mpling Station 2019 WRAP Score Condition		
JA-Restoration	$0.49^{1}$	Poor	
JB-Upstream	0.83	Good	
JB-Restoration	0.48	Poor	
JB-Downstream	0.64	Fair	
J4-Upstream	0.83	Good	
J4-Downstream	0.71	Fair	
JB-Bass Pro Shop	0.68	Fair	

<sup>1</sup>0.0 to 0.50=Poor quality; 0.51 to 0.75=Fair quality; 0.76 to 1.0=Good quality

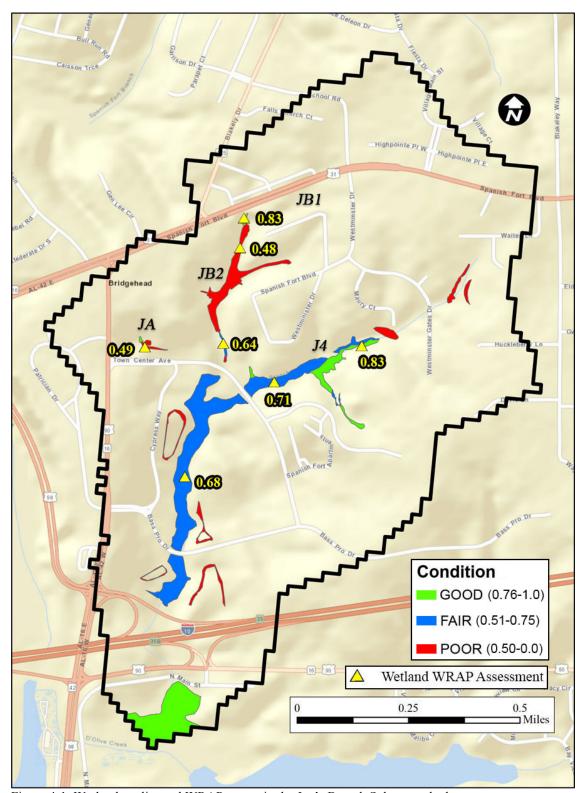


Figure 4-1. Wetland quality and WRAP scores in the Joe's Branch Sub-watershed.

In the two D'Olive Creek Sub-watersheds (Table 4.2 and Figure 4.2), the highest quality wetlands are associated with Malbis Plantation (MP) property upstream from restoration site DA3. These

wetlands scored high for vegetation quality and wildlife habitat, and have forested upland buffers providing good pre-treatment of water entering the system.

Site DA3 wetlands are classified as Fair (0.54), and scored highest for water quality input and treatment, and field hydrology. Because this site is recently restored, wildlife habitat is marginal due to limited canopy cover, and wetland ground cover is sparse compared to high quality wetlands.

Downstream at Acorn Knoll and Deciduous Court, fair quality wetlands occur at a drainageway leading to the DA tributary of D'Olive Creek. These wetlands scored high for wetland canopy and ground cover, and field hydrology. Human disturbance, vehicle traffic and barriers such as silt fence negatively affect wildlife utilization. A large portion of its drainage area has been removed by residential development, and has a low score for water quality input and treatment.

Restoration sites DAE and D4D6 have poor quality wetlands, though only marginally, with WRAP scores of 0.48 and 0.45, respectively. While both sites have little to no canopy cover, the planted trees at D4D6 have good potential for future condition improvement. D4D6 has a low functional value for ground cover, whereas DAE has a moderate ground cover score. With continued maturation, ground cover values at D4D6 are expected to improve. Both DAE and D4D6 have moderate scores for field hydrology and water quality input and treatment. The highest functional value at D4D6 is provided by its adjacent upland buffer, which is forested. The recently restored sites DAF, DAF1, DAF-1A were not inspected for this study. Predicted wetland conditions are Fair to Good for DAF and DAF1. The DAF-1A (Melanie Loop) site has wetlands predicted to be in Fair condition (Figure 4-2).

Table 4-2. WRAP scores at sites in the D'Olive Creek Sub-watersheds.			
Sampling Station	2019 WRAP Score	Condition	
D4D6-Restoration	$0.45^{1}$	Poor	
DAE-Restoration	0.48	Poor	
DA3-Restoration	0.54	Fair	
Acorn Knoll at Deciduous Ct	0.67	Fair	
MP-WRAP 6	0.88	Good	
MP-WRAP 4	0.82	Good	
MP-WRAP 3	0.63	Fair	
MP-WRAP 1	0.96	Good	
MP-WRAP 2	0.38	Poor	

<sup>1</sup>0.0 to 0.50=Poor quality; 0.51 to 0.75=Fair quality; 0.76 to 1.0=Good quality

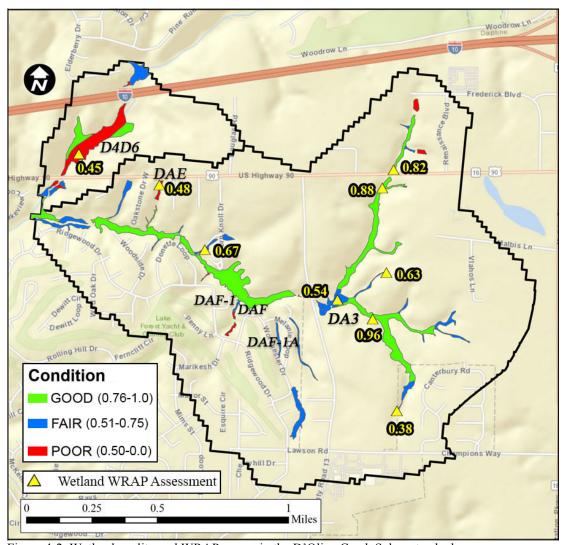


Figure 4-2. Wetland quality and WRAP scores in the D'Olive Creek Sub-watersheds.

Wetlands in the TC1-TC2 restoration site (Table 4-3 and Figure 4.3) are classified as Fair (0.61), and scored highest for upland buffer quality and water quality input and treatment. Wildlife habitat is marginal due to limited canopy cover, and wetland ground cover is sparse compared to high quality wetlands. With continued maturation, canopy and ground cover values at TC1-TC2 are expected to improve. The wetlands immediately upstream of TC1-TC2 are high quality, scoring high in all six WRAP functional values. The TC2-Tributary restoration site was inspected and its associated wetlands determined to have Poor condition.

Table 4-3. WRAP scores at sites in the Tiawasee Creek Sub-watershed.				
Sampling Station 2019 WRAP Score Condition				
TC1-TC2-Restoration	$0.61^{1}$	Fair		
TC1-TC2-Upstream	0.92	Good		
TC2 Tributary-Restoration	N/A	Poor		

<sup>1</sup>0.51 to 0.75=Fair quality; 0.76 to 1.0=Good quality

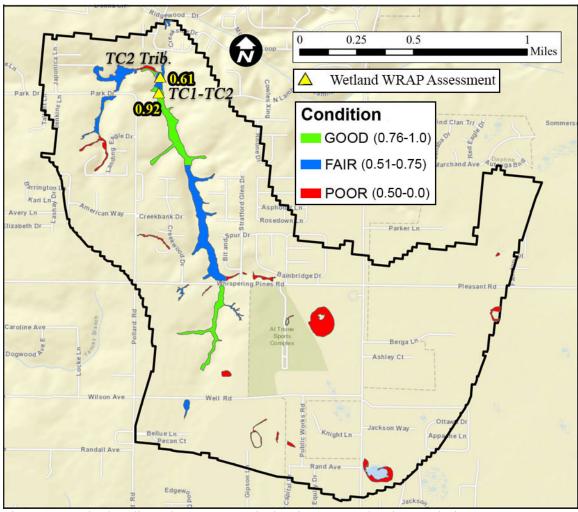


Figure 4-3. Wetland quality and WRAP scores in the Tiawasee Creek Sub-watershed.

#### 4.2 Stream Assessment

Tables 4-4 though 4-6 presents RSA scores by sub-watershed. Summary tables for the RSA results are provided in Appendix B. Figures 4-4 through 4-6 shows the locations of the field sites assessed for stream quality. In the Joe's Branch Sub-watershed (Table 4-4 and Figure 4-4), highest quality streams are associated with downstream areas of JB2 and along the main stem of Joe's Branch to the west of the Town Center development (Table 4-4). These stream reaches scored "good" for riparian zone width, canopy cover, and channel alteration. The Bass Pro Shop reach also scored "good" for channel sinuosity and habitat smothering.

Table 4-4. Stream RSA scores at sites in the Joe's Branch Sub-watershed.			
Sampling Station	2019 RSA Score	Condition	
JB1-Upstream	$0.60^{1}$	Fair	
JB1-Restoration	0.40	Poor	
JB2-Downstream	0.68	Fair	
JB2-Restoration	0.36	Poor	
JA-Downstream	0.44	Poor	
JB-Bass Pro Shop	0.68	Fair	
J4-Upstream	0.52	Fair	
J4-Restoration	0.44	Poor	
J4-Downstream	0.44	Poor	

<sup>1</sup>0.0 to 0.50=Poor quality; 0.51 to 0.75=Fair quality

The restoration sites in the Joe's Branch Sub-watershed had Poor stream conditions, including at JB1 (RSA=0.40), JB2 (0.36), and J4 (0.44). All three sites had "poor" scores for canopy cover and riparian zone width. The JB2 site had "poor" scores for channel alteration and sinuosity, whereas JB1 and JB4 had "moderate" scores for these two metrics. All three sites had "moderate" scores for sediment deposition and habitat smothering. The JA Downstream site is essentially a drainage ditch with good riparian buffer width and canopy cover, but received "poor" scores for channel sinuosity, habitat availability and smothering, and sediment deposition. Two upstream sites in Joe's Branch, at JB1 and J4, are in Fair condition, with RSA scores of 0.60 and 0.52, respectively.

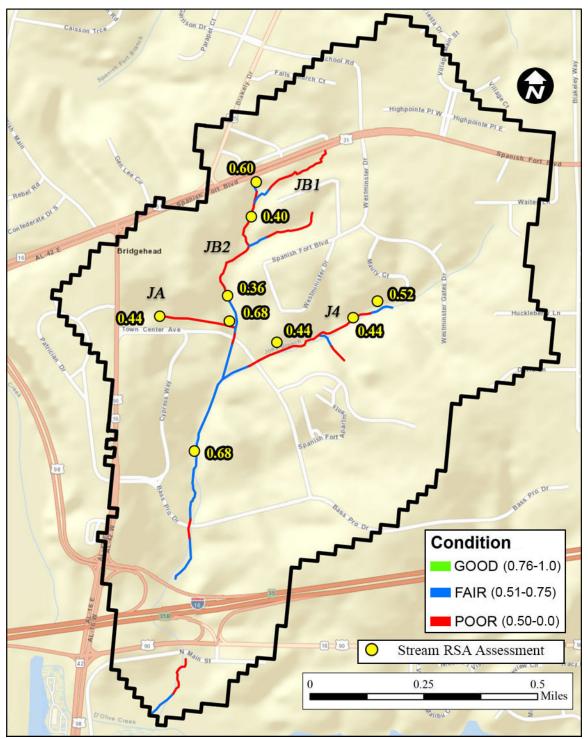


Figure 4-4. Stream quality and RSA scores at sites in the Joe's Branch Sub-watershed.

In the D'Olive Creek DA Tributary Sub-watershed, highest quality streams are associated with Malbis Plantation (MP) property upstream from restoration site DA3 (Table 4-5 and Figure 4-5). The DA3 Upstream location scored "good" for riparian zone width, vegetative quality, canopy cover, channel alteration, and habitat smothering.

The condition of Site DA3 is classified as Fair (0.54) and scored "good" for sediment deposition and habitat smothering. DA3 scores poorly for canopy cover and riparian zone width, reflecting its recent construction and initial stage of development. Stonefly and caddisfly larvae, insects with high and moderate pollution sensitivity, respectively, were collected at DA3, improving its condition score.

West of CR13, the DA3 downstream site scored poorly in several categories, including for channel sinuosity, bank stability, bank vegetative protection, sediment deposition, and habitat smothering. A 250-ft (76-m) reach of this portion of the DA Tributary does not have associated wetlands.

Table 4-5. Stream RSA scores at sites in the D'Olive Creek Sub-watersheds.			
Sampling Station 2019 RSA Score Condition			
DA3-Upstream	$0.68^{1}$	Fair	
DA3-Restoration	0.56	Fair	
DA3-Downstream	0.32	Poor	
DAE-Downstream	0.52	Fair	
D4D6-Restoration	0.36	Poor	
D4D6-Downstream	0.52	Fair	

<sup>1</sup>0.0 to 0.50=Poor quality; 0.51 to 0.75=Fair quality

Downstream of restoration site DAE has a Fair condition (0.52), with "good" scoring for riparian zone width, vegetative quality, and canopy cover. The site scored poorly for habitat availability and sediment deposition and "moderate" for bank vegetative protection and habitat smothering. The D4D6 downstream site also scored Fair (0.52) and was similar to DAE downstream with respect to sediment deposition ("poor"), but has better stream habitat availability and yielded two macroinvertebrate taxa (damselfly and dragonfly) with moderate pollution sensitivity, increasing its overall condition score.

The D4D6 restoration site has poor stream quality, with "poor" conditions for bank vegetative protection, canopy cover, and riparian zone width, reflecting the recent construction of the site. D4D6 is rated "good" for stream bank stability, and receives "moderate" scores for channel sinuosity, channel alteration, bank vegetative protection, habitat availability, and habitat smothering.

Restoration Sites DAF, DAF-1, AND DAF-1A were not field-inspected. Based on surrounding land cover, stream condition is predicted to be Fair at DAF and DAF-1A (Melanie Loop). DAF-1 is assigned a condition of Poor.

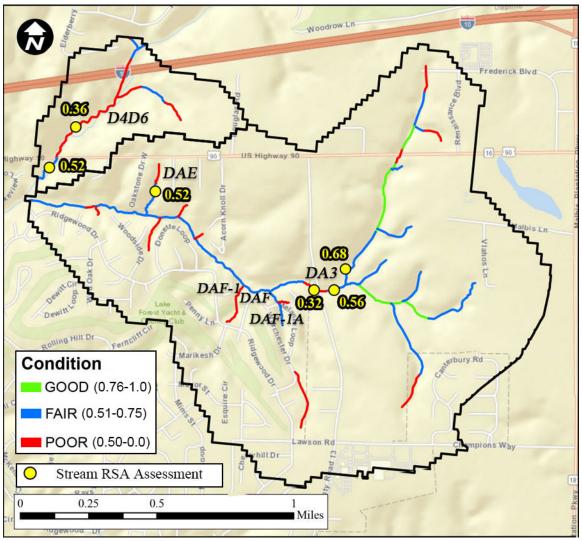


Figure 4-5. Stream quality and RSA scores at sites in the D'Olive Creek Sub-watersheds.

The TC1-TC2 restoration site is classified as Poor (0.40) (Table 4-6 and Figure 4-6), primarily due to "poor" scores for riparian zone width, canopy cover, and channel alteration. The site receives a "good" score for bank stability, and "moderate" scores for sediment deposition, habitat smothering, habitat availability, channel sinuosity, and bank vegetative protection. The reach upstream of TC1-TC2 is classified as Fair quality (0.68), scoring high for riparian zone width, canopy cover, and macroinvertebrate taxa.

Table 4-6. Stream RSA scores at sites in the Tiawasee Creek Sub-watershed.			
Sampling Station 2019 RSA Score Condition			
TC1-TC2 -Upstream	$0.68^{1}$	Fair	
TC1-TC2 -Restoration	0.40	Poor	
TC2-Tributary Restoration	0.12	Poor	

10.0 to 0.50=Poor quality; 0.51 to 0.75=Fair quality

The TC2-Tributary restoration site scored lowest of all stream assessment locations in 2019, largely due to poor bank stability, bank vegetative protection, habitat availability, sediment deposition, and habitat smothering.

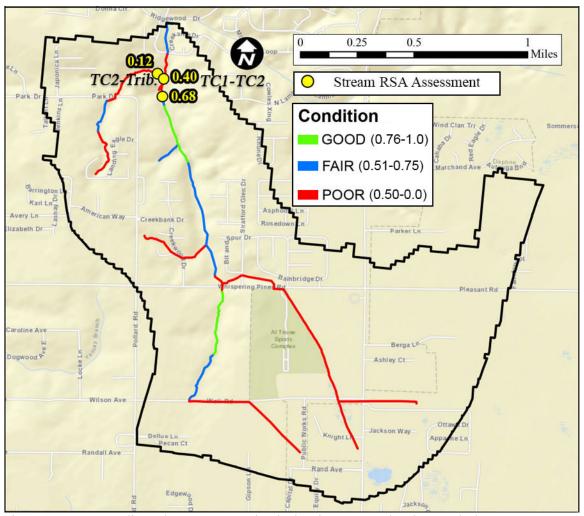


Figure 4-6. Stream quality and RSA scores at sites in the Tiawasee Creek Sub-watershed.

Table 4-7 summarizes stream fauna sampling results for all RSA stations. Moderately pollution-sensitive macroinvertebrates were collected at restoration sites JB2, J4, DA3, and TC1-TC2, indicating good benthic community development since completion of the restorations. Macroinvertebrate community observations were variable at downstream sampling sites, with some sites having very few, stress-tolerant invertebrates collected, and others having a more diverse invertebrate community that included more sensitive species.

Table 4-7. Stream fauna at RSA sampling locations.				
	Macroinvertebrates			
Site	Pollution- Tolerant	Moderate Pollution- Sensitive	Pollution- Sensitive	Crayfish, Vertebrates
JB1-Upstream				
JB1-Restoration				
JB2-Downstream		√		V
JB2-Restoration		$\sqrt{}$		
JA-Downstream		√		
J4-Upstream	√	√		
J4-Restoration	√	√		
J4-Downstream		V		
JB-Bass Pro Shop				
DA3-Upstream				
DA3-Restoration		$\sqrt{}$		
DA3-Downstream				
DAE-Downstream				
D4D6-Restoration				
D4D6-Downstream		√		
TC-Trib. Restoration	V			
TC-Upstream		V		V
TC1-TC2- Restoration				

# 4.3 Trend Analysis

# Wetlands

Table 4-8 presents the WRAP scores generated since 2016 at and near the D'Olive restoration sites. The measured wetland qualities are relatively stable throughout the assessment period. Scores at Site J4 in Joe's Branch, downstream from the J4-1 and J4-2 restorations, show consistently fair quality. These wetlands were identified in the 2010 WMP as being associated with a stream segment with high potential for future degradation. The J4-1 and J4-2 restorations appear to have stabilized this location.

Table 4-8. WRAP scores generated since 2016 at the D'Olive restoration sites.					
Assessment Location	2016 WRAP	2017 WRAP	2019 WRAP	% Change	
J4-1-2	$0.72^{1}$	0.72	0.71	-1.4 %	
JA	0.44	0.44	0.49	+11.4 %	
JB	0.39	0.42	0.48	+23.1 %	
DA3	0.66	0.60	0.54	-18.2 %	
D4-D6	0.42	0.53	0.45	+7.1 %	
TC1-TC2	0.61	0.64	0.61	-	

0.0 to 0.50=Poor quality; 0.51 to 0.75=Fair quality; 0.76 to 1.0=Good quality

Restoration Sites JA and JB, also in Joe's Branch, still have poor quality, but both show an upward trend in WRAP scoring. Both JA and JB are just below the threshold for a condition class of Fair.

Much of the groundcover at JB consists of invasive exotic species, and the canopy is immature, but with additional management and maturation the site has good potential for improved condition.

Site DA3 has shown a consistently fair condition, with some measured deterioration since 2016 (Table 4-8). With further maturation this site should improve in the quality of its canopy, ground cover, and wildlife habitat.

Site D4D6 has poor quality wetlands, though only marginally, with a current WRAP score of 0.45. This site presently has little to no canopy cover, but its planted trees and expected natural recruitment, including for ground cover, should result in future condition improvement.

The FQI was performed at two locations in 2019, with both locations showing an increase in condition since 2016. The FQI assessment scores are presented in the following table.

Site	2016 FQI	2017 FQI	2019 FQI
JA	17.92	17.32	29.23
DA3	23.95	29.80	32.52

In the assessment for the 2010 WMP, the Joe's Branch wetland adjacent to the Bass Pro Shop at Spanish Fort Town Center was among the most degraded areas in the entire D'Olive Watershed. This section of Joe's Branch was severely impacted by sedimentation, with approximately 50% of the mature, native canopy trees dead or dying, and an understory dominated by exotic species. The habitat provided very little cover for any endemic species, due to the extreme amount of silt accumulation and denuding of the lower vegetative strata. Review of available aerial imagery shows large areas of bare sediment and mostly dead canopy trees as recently as 2013.

Based on the 2009-2010 field surveys, and subsequent reconnaissance of the site, a baseline WRAP score of 0.32 (Poor) was developed for the Bass Pro Shop wetlands. In comparison, the 2019 field assessment generated a WRAP score of 0.68 (Fair) (Table 4-1). Functional values have increased for this wetland area since completion of restoration. While there remains a high prevalence of exotics like Chinese tallowtree and privet seedlings, approximately 65% of the current groundcover comprises native wetland species. The native canopy trees still show signs of past siltation, but around 75% of canopy cover is made up of native, although not fully mature, wetland species. Some competition from exotics such as Chinese tallow tree continues at the site.

TC1-TC2 and the TC2 Tributary restorations included 1.0 acre of wetland restoration. The TC1-TC2 site has shown a consistent fair condition. With further maturation wetland conditions should improve in the quality of its canopy, ground cover, and wildlife habitat.

At a sub-watershed scale, the proportion of good, fair, and poor wetland conditions was calculated based on the total acreage for each 2019 condition class (Table 4-9). D'Olive Creek (DA Tributary) has the best overall wetland conditions at 0.88 (Good). D'Olive Creek (D4D6) has the lowest overall quality, at 0.57 (Fair).

Table 4-9. Wetland condition at a sub-watershed scale, based on the acreage proportion of Good, Fair, and Poor conditions.					
Sub-Watershed	2019 Condition				
Joe's Branch	$0.70^{1}$				
D'Olive Creek (D4D6)	0.57				
D'Olive Creek (DA)	0.88				
Tiawasee Creek	0.66				

<sup>1</sup>0.51 to 0.75=Fair quality; 0.76 to 1.0=Good quality

#### Streams

Figure 4-7 presents the baseline RSA and 2019 RSA scores for the assessed stream reaches. Appendix B includes the complete per-category breakdown for the RSA scores. Compared to the 2019 RSA, baseline conditions for the restoration sites were generally given higher scores for riparian buffer zone width and canopy cover, but low for local watershed erosion, sediment deposition, habitat availability, habitat smothering, bank stability and bank vegetative protection. Baseline scores for the restoration sites averaged 12 points (ranging from 8 to 20 points) below the 2019 site scores.

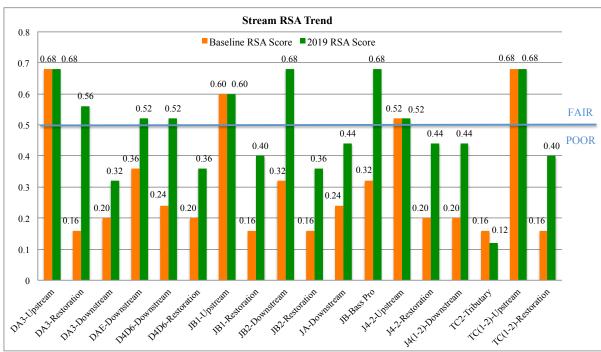


Figure 4-7. Comparison of baseline and 2019 RSA scores.

One restoration site (DA3), two downstream reaches in Joe's Branch (JB2, Bass Pro) and two downstream reaches in the D'Olive Subwatersheds (DAE, D4D6), are improved from a baseline Poor to restored Fair classification. Site DA3 had the greatest overall improvement in condition. The increase in stream reach quality at these sites suggests that restoration activities have resulted in measurable decreases in sediment loads being transported downstream, with corresponding improvements in habitat condition.

The JB Bass Pro Shop site scored well in terms of current stream condition and improvement relative to the other sampling sites. The large decrease in sediment loading originating upstream of this reach

(Cook, 2019) has resulted in large improvements to stream habitat (Figure 4-8). The site scored well ("moderate" to "good") in the categories of habitat availability, sediment deposition, habitat smothering, and bank stability. The favorable scores for these categories, compared to baseline, show a clear link between restoration efforts upstream, and improved downstream condition.



Figure 4-8. Joe's Branch stream and wetland habitat at Bass Pro Shop.

At a sub-watershed scale, the proportion of good, fair, and poor stream conditions was calculated based on the total stream feet for each condition class (Table 4-10). Overall, stream condition improved on a sub-watershed scale only in the Joe's Branch catchment, largely due to the improvement in the Bass Pro Shop reach. The other restoration sub-watersheds have yet to show a condition class increase. D'Olive Tributary DA, which includes multiple restoration sites, is in Fair condition.

Table 4-10. Stream condition at a sub-watershed scale, based on the proportion of Good, Fair, and Poor stream reach conditions.								
Sub-Watershed Baseline Score 2019 Score Change Condition Class Increase								
Joe's Branch	$0.38^{1}$	0.51	+0.13	√				
D'Olive Creek (D4D6)	0.41	0.44	+0.03					
D'Olive Creek (DA)	0.59	0.63	+0.04					
Tiawasee Creek	0.49	0.49	-					

<sup>1</sup>0.0 to 0.50=Poor quality; 0.51 to 0.75=Fair quality

Much of the upper portions of the Tiawasee Creek Sub-watershed include poor quality stream reaches that traverse developed areas and farm fields. If these areas were removed from consideration of overall stream quality, the overall Tiawasee Sub-watershed condition score would be improved.

Comparing the 2019 scores with the Level 1 riparian buffer assessment shows relative similarity in the assessed sub-watershed stream conditions (Figure 4-9). Differences between the two methods are likely related to the inclusion of quantitative and qualitative field information in the Level 2 assessments.

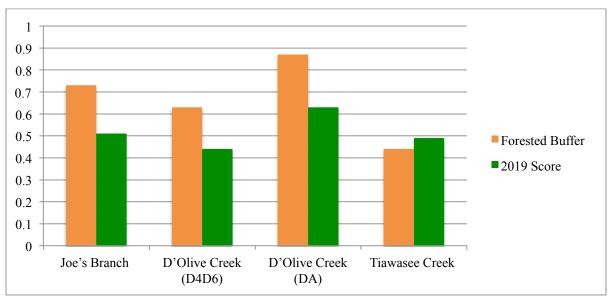


Figure 4-9. Stream condition at a sub-watershed scale, comparing 2019 condition scores and the proportion of forested land cover (NLCD, 2016) within a 200-ft riparian buffer.

# 5.0 MEASURING RESTORATION SUCCESS

A primary objective of the D'Olive Restoration Program is to improve watershed habitats that had been adversely impacted or were threatened by future stream erosion and altered hydrology. The Program was implemented to halt the impairment and destruction of these natural areas, to maintain their provision of environmental services and benefits.

On a reach scale, direct restoration has improved the ecological condition of 9,838 linear feet of streams and their associated riparian areas. Downstream areas are also improving in condition.

Streams in the Joe's Branch Sub-watershed overall have improved to a BCG Tier 2 (Fair) condition from a pre-restoration Tier 3 (Poor) condition. The large reductions in sediment loading provided by the Joe's Branch restoration projects, and documented by Cook (2019), have led to improvements in downstream habitat quality. Wetland quality has been improved in some areas (e.g., Bass Pro Shop) and maintained in others (e.g., J4). A Watershed Condition Framework (WCF) classification for Joe's Branch has improved from Class 3 (Impaired Function) to Class 2 (Functioning at Risk), based on the BCG tier improvement resulting from amelioration of erosion and sedimentation and improved stormwater management. Continued risk is due to anticipated future development in the Joe's Branch Sub-watershed.

Wetlands in the D'Olive Tributary DA are in good condition overall (0.88). Stream condition is Fair (0.63). Of the restoration sites, DA3 is in Fair biological condition. The site is expected to improve in quality as it matures. DA3 has also halted two active head-cuts, maintaining and protecting higher quality habitat upstream. Stream conditions below DAE are classified as Fair. While some of the DA Tributary projects are in an early restoration maintenance phase, all projects are complete and the overall habitat trajectory is positive. A WCF classification in this sub-watershed is maintained at Class 2.

Site D4D6 has poor quality wetlands, though only marginally. The D4D6 stream condition is classified as Poor (0.44). Both wetland and stream conditions at D4D6 are expected to improve as the site matures. With the continued condition improvement anticipated for Site D4D6, the WCF classification for the D'Olive Creek Sub-watershed has been maintained at a WCF Class 2 as a result of the restoration.

The T1-T2 restoration stream reach currently has Poor quality (0.40) and its associated wetland area is classified as Fair (0.61). The stream condition is improved compared to the pre-restoration condition. Stream and wetland conditions at T1-T2 are expected to continue to improve through time. Due to the T1-T2 restoration, the upstream reach of Tiawasee Creek and its associated good quality wetlands are being protected and maintained. The TC Tributary restoration site has some maintenance issues that need to be addressed, but the size of the deteriorated area is relatively small. On a watershed scale, the WCF classification for the Tiawasee Creek Sub-watershed has been maintained at Class 2.

# 6.0 COST-EFFECTIVE AND EFFICIENT METHODS FOR EVALUATING TRENDS IN HABITAT CONDITION

WRAP evaluates the extent to which wetland functions are performed. The WRAP procedure is widely used for wetland assessment, including by state and federal regulatory agencies for wetland mitigation in Alabama coastal counties. WRAP is not as sensitive to ecological condition changes as other assessment methods such as FQI and Hydrogeomorphic (HGM) models. But while the WRAP is relatively imprecise in reflecting changes in habitat function along a disturbance gradient, it minimizes variability between different evaluators to provide a consistent method across assessment sites and though time.

Compared to WRAP, the FQI is a time-consuming method prone to generating inconsistent results, due in part to variable taxonomic expertise among field personnel. For the D'Olive study the FQI was performed at two locations, with search times recorded to measure the level of effort. It quickly became apparent the FQI approach requires a standardized level of effort. Species diversity was extremely high with numerous weedy (often non-native) early colonizing winter annuals characteristic of disturbed sites. Many of the restoration sites are heavily overgrown with blackberries, greenbriers, and other shrubs that make detection of herbaceous groundcover difficult. The large number of species (several sites recorded over 100 species) makes the recording of all species present difficult for such a large area. Future use of FQI for monitoring should identify permanent sampling plots or a standardized random sampling design to be performed within marked boundaries of the assessment areas.

Most states have calibrated indexes of biological integrity (IBI) for assessing stream biological communities and habitat condition. The use of IBIs involves intensive macroinvertebrate sampling and time-consuming laboratory and data analysis. While complete bioassessment is probably the most effective method for assessing stream health in most situations, it can be cost-prohibitive. The Rapid

Stream Assessment method developed for D'Olive monitoring was designed to provide a measure of relative condition among restoration sites and their upstream and downstream areas. Unlike an IBI, the RSA used for the D'Olive stream assessment does not determine a specific value by which stream health is compared to a pristine system. Rather, it is designed to relate conditions of specific stream reaches to other reaches in the same system, such as a restored stream reach and areas above and below the restoration.

The study results suggest the RSA provides a sound method of estimating and comparing stream conditions without the use of time-consuming, costly assessment techniques. The RSA can be tailored to specific watersheds based on restoration goals, and allows total scores for sampling sites to be easily calculated and compared. RSA metrics were chosen for D'Olive based on the goals of restoration, focusing primarily on erosion, sediment deposition, and habitat smothering. Applied consistently, it can be used to measure the relative condition of stream reaches through time. Future assessments at the D'Olive restoration sites have potential to better determine the efficacy of the RSA method in detecting temporal changes in stream condition. The ultimate goal is a reliable rapid assessment method that can be used across Alabama coastal watersheds.

The D'Olive Program implemented a series of integrated restoration projects after completion of a watershed management plan, field inspections, and identification of degraded stream locations. For target watersheds in early stages of management planning, landscape-scale (Level 1) assessment of riparian buffer integrity provides a simple method to screen for areas of potential habitat degradation, followed by field inspections to assess conditions at the ground level.

#### 7.0 CONCLUSIONS AND RECOMMENDATIONS

The BCG framework describes the biological condition of priority coastal habitats along a continuum of stress, particularly impacts related to habitat destruction and alteration. A Watershed Condition Framework based on the ecological condition of its priority habitats provides an objective method for measuring the management effectiveness of restoration activities undertaken to improve environmental condition on a watershed scale.

In general, stream reaches above the restoration sites scored higher than the restoration sites themselves or their immediate downstream reaches. Upstream areas generally had "moderate" to "good" riparian buffer zone widths, riparian vegetative quality, channel sinuosity, bank stability, and bank vegetative protection. Restored stream reaches overall had relatively poor scores for riparian buffer zone width and canopy cover, and in some for instances for channel alteration and bank vegetative protection. Plant community attributes in restored areas are expected to improve as the sites develop and mature.

Results for downstream reaches were variable, but their overall RSA scores were similar to or higher than the restoration areas. This was generally due to greater riparian buffer zone width and canopy cover downstream. Scores for sediment deposition were generally poor at downstream sites, but most received moderate scores for habitat smothering, suggesting that the active sedimentation occurring pre-restoration has decreased and new habitat is developing.

Macroinvertebrates in restored reaches reflected generally good water quality and habitat availability. The placement of logs, rocks, and step pools appears to have enhanced bank stability to provide habitat for a range of species. The presence of moderately pollution-tolerant macroinvertebrates at restoration sites suggests habitat improvement compared to pre-restoration conditions.

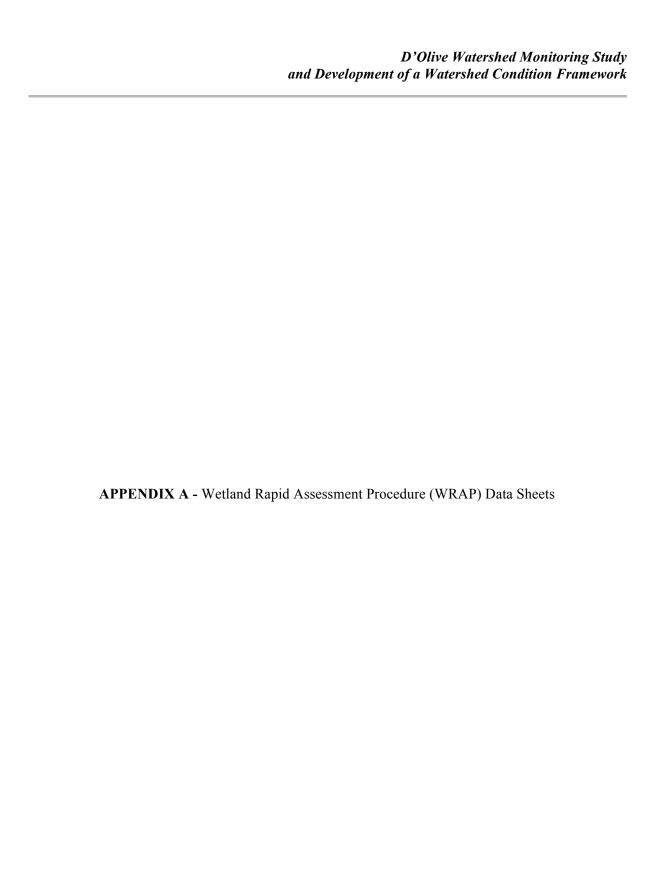
The D'Olive Program was designed primarily to accommodate increased stormwater volume and slow runoff velocity, and halt head-cutting and erosional process, and not to necessarily return streams to a natural state. Multiple locations show apparent improvement in downstream conditions, especially in the Joe's Branch Sub-watershed, where highly degraded conditions that occurred pre-restoration are beginning to improve naturally.

In the D'Olive Creek Sub-watershed, which encompasses Site D4D6, broad-scale improvement to watershed wetland and stream condition is likely to lag the completion of the restoration by several years. More recent restoration projects at DAF, DAF1, and DAF-1A are still in an early post-construction maintenance period. These sites were not inspected as part of this study, and maintenance period inspections should include at least qualitative assessment of habitat condition, if not RSA and WRAP/FQI assessments.

The removal of vegetation and the resulting bare ground at the restoration sites has promoted rapid colonization by invasive exotic species. Invasive plants are spreading into adjacent natural areas both upstream and downstream of the projects. Several areas bordering the restoration sites are forested seepage slope wetlands with very good groundcover and a healthy canopy of healthy large trees, including locally uncommon species such as American Beech at JB1 and JB2. An invasive plant management program should be considered for implementation in the D'Olive Watershed.

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JA - W	RAP 15		√ Cı	√ Check One urrent Conditions posed Conditions				
Applicati	on Number		t Name Dlive Creek	Date April, 2019	Evaluator David Knowles	1	Wetlan-	
				r 7				·····
	d Use ed Land	1		Description/Notes		1	Wetland	Acreage
Folest	eu Lanu					J		
Wildlife Utilizat	ion (WU)	]		Wetland Canopy (O/S) 0.5	7		Wetland Gro	
	Habitat Su	oport Buffer		Field Hydrology (HYD)	<u> </u>		WQ Input &	Treatment *
Buffer Type	(Score) X	area(0-1.0)	Sub Totals	2	ĺ /—	<b>&gt;</b>	1.	
~300ft	2	0.75	1.5		_ /			
>30<300	1.5	0.25	0.375	Total 1.875		TOTA	ue of WQ is obtain L scores of Land watment category th	use Category and
	Land usa Co	ntagory (LLD			/	Dratraatma	nt Category (PT)	
LU Category	(Score) X	ategory (LU) area(0-1.0)	Sub Totals		/ PT Category		area $(0-1.0)$	Sub Totals
Forested Land	2	0.5	1		Forested land	2	0.5	1
Commercial	1	0.5	0.5		Runoff from			0
Development			0		Commercial			0
			0		Development	1	0.5	0.5
		LU Total	1.50				PT Total	1.5
	P Score	1						
	.49							
Field Notes:	. OTAL	Τ						
	s limited cover for es and birds that p			is medium quality at best. We n disturbance in the form of c				
Wetland Canopy								
				native treesthat are present are sed by presence of aggresive of				
Wetland Ground	Cover							
Native ferns are	present, however,	they are beginnin	g to experience sign	nificant competion from exoti	ic invasives.			
Habitat Support/	Buffer							
				s. Provides somewhat limited t to downstream habitat (road				
Field Hydrology	(HYD)							
Hydrology is ad			ation; however, the	drainage area and surface wa	ter budget has bee	n diminished	I in size due to con	nmercial
WQ Input & Tre	atment							
A portion of the	Surrounding land			re-treatment of water entering	the wetland system	m (forested,	sandy hillslopes),	and the
remainder come	s from runoff from	n a commercial de	velopment.					

Wetland Rapid Assessment Procedure (WRAP)

WRAP Location

WRAP ID

JB 1 - V	Upstream		√ Cu	√ Check One urrent Conditions cosed Conditions				
Applicati	on Number		t Name Dlive Creek	Date 5/8/19	Evaluator David Knowles	1	Wetland	
		I NEI B	SHYC CICCK	3/0/19			TTO TICUL	water brope
	nd Use oed Forested	1	_	Description/Notes		<u>.</u> 1	Wetland	Acreage
Ondevelop	bed Polested	I				J		
Wildlife Utilizat	tion (WU)	1		Wetland Canopy (O/S) 2.5			Wetland Gro	
	2.3	l		2.3				'
	Habitat Sur	port Buffer		Field Hydrology (HYI	<b>)</b> )		WQ Input &	Treatment *
Buffer Type	_	area(0-1.0)	Sub Totals	2.5		<b>&gt;</b>	1.8	75
ave 250ft	2.5	1	2.5		_ /			
			0	Total			ue of WQ is obtain	
			0	2.5			L scores of Land usatment category th	
	•	•	<u>'</u>				2 3	2 ,
	Land use Ca	ategory (LU)			/	Pretreatme	ent Category (PT)	
LU Category	(Score) X	area(0-1.0)	Sub Totals		PT Category	(Score) X	area(0-1.0)	Sub Totals
Silviculture	2.5	1	2.5		Forested	2.5	0.5	1.25
			0		Slopes			0
			0					0
			0		No Detention	0	0.0	0
WD A	P Score	LU Total	2.50				PT Total	1.25
	.83	1						
	.03	ı						
Field Notes: Wildlife Utilizat	ion (WII)							
		ny different Phylı	ım and Class. The w	vetland provides high quality	y habitat, while the	adjacent upla	and buffers are a m	nix of
anthropogenic u	ses and natural for	rested areas.						
Wetland Canopy	/ (O/S)							
The wetland car	opy provides cove			signs of natural regen., and	is free of exotics. Th	ne shrub laye	er, however, contai	ns moderate
levels of exotic	species such as Ch	inese privet and c	amphor tree.					
Wetland Ground	l Cover							
		e system being ev	aluated (several spe	cies of OBL ferns), especial	ly given the amoun	t of shade pr	esent, due to a hear	lthy overstory.
Habitat Support		11.11.1	. 1 14 '111'C	24.1 1 1	1, 65 11	11 4 1		
The upland buff	ers provide some s	support to the wet	iand and the wildlife	e within, however, heavy roa	ad traffic and numar	i disturbance	e are a concern.	
Field Hydrology								
It is a groundwa	ter driven system,	, however, much o	of it's natural catchm	ent has been developed or h	nad roads built on it.			
I								
WQ Input & Tre								
Surrounding for	ested areas provide		ent of water entering	g the wetland system (forest	ed, sandy hillslopes	), but a porti	on of the water en	tering (via the

Wetland Rapid Assessment Procedure (WRAP)

WRAP Location

WRAP ID

$\underline{WR}$	AP ID	Wet	tland Rapid As	ssessment Procedure	e (WRAP)	]	WRAPI	Location
JB - WRAP 13								
√ Current Conditions								
			Pro	oposed Conditions		]		
Annlicati	on Number	Project	t Name	Date	Evaluator		Wetlan	d Type
Турпсин	on rumber	NEP - D'O		April, 2019	David Knowles	]	PSS - Head	
Lan	d Use			Description/Notes		-	Wetland	Acreage
Stream Res	storation Site		Phas	se I of Upper Joe's Branch	Tributary			
				***	. (0)			
Wildlife Utilizat	ion (WU)	I		Wetland Canopy (C	<u>D/S)</u>		Wetland Gro	
	1.3			1.3			0.	<u></u>
	Habitat Sur	port Buffer		Field Hydrology (H	IYD)		WQ Input &	Treatment *
Buffer Type	_	area(0-1.0)	Sub Totals	1.5		<b>&gt;</b>	2.1	
>30<300ft	1.5	1	1.5		<del></del>			
			0		/	* The valu	ue of WQ is obtair	ned by adding the
			0	Total		TOTA	L scores of Land	use Category and
			0	1.5	/	Pretre	eatment category tl	nen dividing by 2
	I I C-	otana (III)				D.,	ort Cotton of (DT)	
LU Category		ategory (LU)	Sub Totals		/ PT Category		nt Category (PT)	Sub Totals
Forested Land	2.5	area(0-1.0) 0.75	1.875		Forested land	2.5	area(0-1.0) 0.75	1.875
Residential	1	0.25	0.25		Residential	1	0.25	0.25
			0		Runoff		0,00	0
			0					0
		LU Total	2.13	/			PT Total	2.125
	P Score	1						
	.48	l						
Field Notes:	. WHID							
Wildlife Utilizat Wetland provide		wildlife, and adj	acent upland buffe	r is medium quality at bes	st. Wetland habitat is av	ailable to ag	uatic species, med	-small
mammals, reptil	es and birds that p			There is minimal human of				
terrestrial specie	es.							
Wetland Canopy								
				are still alive. Hydrology er, the species that are pres				
currently less the	an 25/0 exoties wi	unii the earlopy/si	nuo layer, noweve	i, the species that are pres	sent will likely start to t	out-compete	the natives in the	icai iutuic.
Wetland Ground	Cover							
		cover at the locati	on the WRAP was	s performed is inappropria	te (exotics / transitiona	l upland spec	cies). Imperata cyl	indrica and
Bidens alba wer	e co-dominants.							
Habitat Support		. 1 6 1	C.C 1	1 1 0 1	.1: :.10 1	, 1	C 1111.C X	4 4:1
				olands. Provides somewhat deterrent to downstream				
roadway.		( <u>.</u>			(		P	
Field Hydrology	(HYD)							
Succession of w	etland plants to tra			construct the step pool se				
				s and pools. This has led t g floodplain hydrology noi	_	away from h	ydrophytic specie	s. It is feasible
		ae to me pomit at	winen the abuttill8	, mooupiam nyurology noi	manzes.			
WQ Input & Tre		good pro treatmen	nt of water entering	g the wetland system (fore	setad candy hillalance)			
Surrounding lan	uuse provides for §	goou pre-treatmen	n or water entering	3 me wenana system (10re	sicu, sanuy miisiopes).			

WR	AP ID	Wet	tland Rapid Ass	sessment Procedure (W	RAP)		WRAPI	Location
JB Downstre	am - WRAP 14			√ Check One				
				urrent Conditions				
			Prop	posed Conditions				
					-			
Application	on Number	Project NEP - D'C	t Name	Date April, 2019	Evaluator David Knowles	1	Wetlan PFO - Head	
		NEF-DC	onve creek	Aprii, 2019	David Knowies		FFO - Head	water Stope
Lan	d Use			Description/Notes		]	Wetland	Agranga
Lan	u Ose	]	Downstream	n of Upper Joe's Branch Resto	oration Site	1	wettanu	Acreage
		1	<u> </u>	11		J	<u> </u>	
Wildlife Utilizat	ion (WU)			Wetland Canopy (O/S)			Wetland Gro	ound Cover
	2			2			2	
					_			
	Habitat Sup	port Buffer		Field Hydrology (HYD)	7		WQ Input &	Treatment *
Buffer Type	(Score) X	area(0-1.0)	Sub Totals	1.5		<b>→</b>	2.3	125
~250ft	1.5	0.5	0.75		/			
>300ft	2	0.5	1		/	* The valu	ue of WQ is obtain	ned by adding the
			0	Total			L scores of Land	
			0	1.75	/	Pretre	atment category th	nen dividing by 2
	Land was Ca	otacami (LLD)				Duatuaatus	mt Catagomy (DT)	
LU Category	(Score) X	ategory (LU) area(0-1.0)	Sub Totals		/ PT Category	(Score) X	nt Category (PT)	Sub Totals
Forested Land	2.5	0.75	1.875		Forested land	2.5	1	2.5
High Volume	1	0.25	0.25		1 orested fand	2.3	1	0
Roadway		0.23	0.25					0
			0					0
	•	LU Total	2.13	,		•	PT Total	2.5
WRA	P Score	•	_					
0	.64							
Field Notes:								
Wildlife Utilizat								
				is medium quality at best. We n disturbance associated with				
				pecies. We considered the busy				
and other species	s like turtles and s	nakes.						
Wetland Canopy	(O/S)							
				omised of aggresive exotic spe		privet, Jap. C	Climbing Fern, Car	mphor Tree.
There is some tra	ansition towards u	pland species in the	ne lower strata, like	ly due to past stream incision.				
Wetland Ground	Cover							
		they are beginnin	g to experience con	npetion from exotic invasives	like Jap. False-Sp	leenwort, an	d privet and camp	hor seedlings.
Habitat Support/		1 - 6 1		- D	£1 1t		:141:6- N 4	
				s. Provides somewhat limited to downstream habitat (road				
					<i>y</i>			,
Field Hydrology	(HVD)							
		nd species, especia	ally in the lower stra	ata, likely due to past stream is	ncision. Stream ha	as become so	mewhat detached	from a wetland
floodplain.	-	-		-				
WQ Input & Tre			and mun tur-tur	freeton ontonin - 4141 1	viatora (fr t - 1	om der h :11-1	and the	n dan aan f-
	Surrounding landi mmercial develop		ood pre-treatment 0	of water entering the wetland s	ystem (mested, s	anuy mnsiop	ics), and the remai	nuer comes from
I								

<u>WI</u>	RAP ID	We	tland Rapid As	ssessment Procedure (	WRAP)		WRAPI	Location
J4 Downstr	eam - WRAP 17			√ Check One				
0.120,,,130,	VIII 17			Current Conditions				
			Pro	oposed Conditions				
Applica	ation Number		t Name	Date	Evaluator  David Knowles	1	Wetlan	
		NEP - D'C	Olive Creek	April, 2019	David Knowles		PFO - Head	water Slope
						_		
	and Use orestry	1		Description/Notes  Contains Perennial Stream	,	1	Wetland	Acreage
1	orestry	l		Contains i cicinnai Sucan	1	J		
Wildlife Utiliz	ation (WII)			Wetland Canopy (O/S	)		Wetland Gro	ound Cover
Whame offinz	2	1		2	<u></u>		2	
		1						
	Habitat Su	oport Buffer		Field Hydrology (HY	D)		WQ Input &	Treatment *
Buffer Type	(Score) X	area(0-1.0)	Sub Totals	2		<b>→</b>	2.	
>300ft of	2.5	0.75	1.875		_ /			
forested uplane	d buffer		0		/	* The val	ue of WQ is obtain	and by adding the
			0	Total	/		L scores of Land	
Residential	1.5	0.25	0.375	2.25	<i>'</i>		atment category th	
					/			
	Land use Ca	ategory (LU)			/	Pretreatme	nt Category (PT)	
LU Category	(Score) X	area(0-1.0)	Sub Totals		PT Category	(Score) X	area(0-1.0)	Sub Totals
Silviculture	2.5	0.5	1.25		Nat Undev.	3	0.5	1.5
			0		Wet Detention	2.5	0.5	1.25
Detention	2	0.5	1					0
Pond			0					0
WD	A.D.C	LU Total	2.25				PT Total	2.75
	AP Score 0.71	1						
	0.71	I						
Field Notes: Wildlife Utiliz	ation (WIII)	Ī						
		<u>l</u> eral different Phy	lum and Class. Th	e wetland and buffers to Nor	th, west and south p	rovide high o	quality habitat. The	e stream running
thru the wetlan	nd offers habitat for	aquatic species. T		on located east of the wetlan				
cut off by the b	ousy roadway to the	SE.						
Wetland Canop	by (O/S)							
The wetland ca	anopy/shrub strata p	rovides cover for	wildlife, is healthy	y, but is somewhat immature	and contains Chines	e tallowtree.		
Wetland Groun		C 41 4 1	. 1 . 1 .	1 : CODI C	1 41	C:1 : :(	· 1 C	
	is mostly appropriating ging on the forest fl			veral species of OBL ferns);	nowever, there were	e tairty signit	icant numbers of e	exotic species
securings emer	igning on the forest in	ioor, una omer no	ir native ferns are p	stebent as wen.				
II-1:4-4 C		Γ						
Habitat Support		I on three sides) pro	ovide good support	to wildlife and act as a dece	ent buffer to the wetl	ands (slowin	g runoff).	
up			See a suffer			(	B - •	
Field Hydrolog	gy (HYD)							
		and there is hydro	ology to support so	ome wetland vegetation. Hyd	rology has been alte	red by chang	es in the drainage	area.
WQ Input & T								
Surrounding la	induse provides for	decent pre-treatm	ent of water entering	ng the wetland system (fores	ted, sandy hillslopes	and wet dete	ention up-stream).	

$\underline{WR}$	<u>AP ID</u>	Wetland Rapid Assessment Procedure (WRAP)					WRAP Location		
J4 Upstream - WRAP 16				√ Check One					
				Current Conditions					
			Pr	roposed Conditions					
Applicat	tion Number	Project	Name	Date	Evaluator		Wetlan	d Type	
Търрпош		NEP - D'O		April, 2019	David Knowles		PFO - Head		
	nd Use	1 1		Description/Notes		İ	Wetland	Acreage	
Fo	restry			Contains Perennial Stream					
Wildlife Utiliza	tion (WII)			Wetland Canopy (O/S)			Wetland Gro	ound Cover	
	2.5			2.5	1		2		
		•			_				
	Habitat Sup	port Buffer		Field Hydrology (HYD)	7		WQ Input &		
Buffer Type	(Score) X	area(0-1.0)	Sub Totals	2.5		<b>→</b>	2.6	525	
>300ft of	2.5	0.75	1.875		/				
forested upland	Duffer		0	Total /	/		ue of WQ is obtain		
Residential	1.5	0.25	0.375	2.25	/		L scores of Land atment category the		
			•		/			0 ,	
		ategory (LU)			/		nt Category (PT)		
LU Category	(Score) X	area(0-1.0)	Sub Totals		PT Category	(Score) X		Sub Totals	
Silviculture	2.5	1	2.5		Nat Undev.	2.5	0.5	1.5	
			0		Wet Detention	2.3	0.3	1.25	
			0					0	
	•	LU Total	2.50	/			PT Total	2.75	
r	AP Score	1							
(	0.83								
Field Notes:	T. CAMED	I							
Wildlife Utiliza Wetland is utiliza		<u>l</u> ny different Phylu	m and Class. The	wetland and buffers to North, v	west and south pro	vide high qu	ality habitat. The	stream running	
				division located east of the wet					
Wetland Canop	y (O/S)								
		rovides cover for	wildlife, is healthy	y, shows signs of natural re-gen	•				
Wetland Groun	1.0	Γ							
		e for the system b	eing evaluated (se	everal species of OBL ferns).					
Habitat Support		on three sides) pro	vida good sunnor	t to wildlife and act as a decent	buffer to the wetle	nde (elowin	a runoff)		
The upland bull	ieis (300+ it wide (	on three sides) pro	vide good suppor	t to whathe and act as a decent	buller to the wetla	mas (slowing	g runon).		
Field Hydrolog									
It is a groundwa	ater driven system,	and there is adeq	uate hydrology to	support wetland vegetation.					
WQ Input & Tr	eatment								
		decent pre-treatme	ent of water enteri	ng the wetland system (forested	l, sandy hillslopes	and wet dete	ention up-stream).		
I									

#### WRAP ID Wetland Rapid Assessment Procedure (WRAP) WRAP Location West of Cypress Way and √ Check One JB Bass Pro - WRAP 20 Adjacent to Bass Pro Shop √ Current Conditions Development. Proposed Conditions Application Number Project Name Date Evaluator Wetland Type David Knowles NEP - D'Olive Creek 6/19/19 PFO - Headwater Slope Land Use Wetland Acreage Description/Notes Natural Forested Wildlife Utilization (WU) Wetland Ground Cover Wetland Canopy (O/S) WQ Input & Treatment \* Habitat Support Buffer Field Hydrology (HYD) 2.5 1.775 Buffer Type (Score) X area(0-1.0) Sub Totals >30<300ft of forested upland buffer 0 \* The value of WQ is obtained by adding the 0 Total TOTAL scores of Land use Category and 2 Pretreatment category then dividing by 2 Land use Category (LU) Pretreatment Category (PT)

WRAP Score

0.68

(Score) X

area(0-1.0)

LU Total

2.5

Sub Totals

0.8

0

0.5

1.30

0.8

0.2

#### Field Notes:

LU Category

Commercial&

Forested Land

Residential

Wildlife Utilization (WU)

Habitat provides cover for any endemic species, however the upland food sources are limited and there is frequent human disturbance associated with Bass Pro Shop development and traffic. Some species are afforded access to off-site wetlands via a network of pipes, but there are serious challenges for other species in order to safely travel from site to site.

PT Category

Wet Detention

Vegetated, but

Steep-Sloped

(Score) X = area(0-1.0)

PT Total

2.5

Sub Totals

1.25

2.25

0.5

0.5

#### Wetland Canopy (O/S)

Some of the native wetland canopy trees appear to have been damaged by past siltation. Approximately 75% of canopy cover is appropriate, although not fully mature and there is some competition from exotics such as Chinese tallowtree.

#### Wetland Ground Cover

Approximately 65% of the groundcover is appropriate, but there is a high prevalence of exotics like Chinese tallowtree and privet seedlings, and several non-native ferns.

#### Habitat Support/Buffer

There are on average appropriate buffers of 50-100ft in width (forested, somwhat natural mix of species) which then give way to pine monoculture that holds nearly zero value for wildlife

#### Field Hydrology (HYD)

It was hard to assertain all of the input sources for this wetland due to the size of the commercial development nearby, but to the best of our knowledge It is mixture of a groundwater driven system and one supported by discharge from wet detention; there is adequate hydrology to support wetland vegetation.

#### WQ Input & Treatment

Surrounding landuse is primarily comprised of Commercial Development and Roadways and a small forested upland area which encircles it. Pretreatment comes from a mix of wet detention, and the forested buffer. It should be noted that the enbankments (upland slopes) are extremely steep and have very little herbaceous cover, so there likely isn't much pretreatment coming from rainwater percolating thru the upland soils.

DA-3 WRAP		√ Cur	Check One rrent Conditions osed Conditions				
Application Number	Project N		Date	Evaluator  David Knowles	1	Wetlan	
	NEP - D'Oli	ve Creek	4/17/19	David Knowles		PSS - Head	water Slope
Land Use	, –		Description/Notes		]	Wetland	Acreage
Stream Restoration Site	J L						
Wildlife Utilization (WU)	1		Wetland Canopy (O/S)	7		Wetland Gro	
1.5	]		0.5			1.	.5
Habitat Suj	pport Buffer		Field Hydrology (HYD)	)_		WQ Input &	
Buffer Type (Score) X	area(0-1.0)	Sub Totals	2	J /	<b>→</b>	2.3	25
>300ft but 2	1	2		/			
comprised		0			* The valu	ue of WQ is obtain	ned by adding the
of managed forestry land		0	<u>Total</u>	/ /		L scores of Land	
		0		/	Pretre	eatment category tl	hen dividing by 2
	a a a a a a a a a a a a a a a a a a a			/			
	ategory (LU)			/ DT G		nt Category (PT)	Q 1 m . 1
LU Category (Score) X	T	Sub Totals		PT Category	(Score) X	area(0-1.0)	Sub Totals
Silviculture 2.5	1	2.5		Silviculture	2	1	2
		0					0
		0					0
	X X X 77 1	0			ļ	DT T 1	0
WRAP Score	LU Total	2.50				PT Total	2
0.54	1						
	ı						
Field Notes:	1						
Wildlife Utilization (WU) Wetland provides limited protective	le cover for larger w	zildlife species. The	ere is cover for small mamm	als and the stream	offers some	habitat for aquati	c species and
amphibians and reptiles. Adjacent although there are frequent human	upland buffer offers	s some cover, and o	only moderate food source.	To some extent the			
Wetland Canopy (O/S)							
Site was re-planted after construct	ion of step pool con	nplex. There are so	me appropriate living saplin	gs which offer som	ne potential f	for future forestation	on.
Wetland Ground Cover							
There are plenty non-natives and i	nvasive exotics in the	he herbaceous layer	r. There were also several tra	ansitional/upland s	pecies noted	amongst the nativ	e hydrophytic
vegetation.		·				Ü	
Habitat Support/Buffer							
Buffers are greater than 300ft on a					n some exoti	c species and will	likely contain
larger numbers of them in the near	r future when surrou	inding uplands are	again harvested of the plante	ed pine.			
Field Hydrology (HYD)							
Between the stream restoration wo	ork and the past hear	vy siltation there ar	re definitely issues as far as l	hydrology to suppo	ort hydrophy	tic plant species.	
WQ Input & Treatment	<u> </u>						

Wetland Rapid Assessment Procedure (WRAP)

WRAP Location

WRAP ID

WR	WRAP ID Wetland Rapid Assessment Procedure (WRAP)					]	WRAP I	Location
DAE - V	WRAP ID  Wetland Rapid Assessment Procedure (WRAP)  √ Check One √ Current Conditions							
			Pr	roposed Conditions		]		
A1:	ou Niverbon	Duning	t Name	Dete	Freelington		Watlan	d Toma
Applicati	on Number		t Name Dlive Creek	Date April, 2019	Evaluator David Knowles	1	Wetlan Detention	• •
		1,27 2 0	, • • • • • • •	1.19111, 2017				
Lan	d Use			Description/Notes	<b>.</b>	1	Wetland	Acreage
	ed Land	]		Ţ		]		
		_				_		
Wildlife Utilizat	ion (WU)	_		Wetland Canopy (O/S	S)		Wetland Gro	ound Cover
1	1.5	]		0.5			1.	5
	Habitat Su	pport Buffer		Field Hydrology (HY	D)		WQ Input &	Treatment *
Buffer Type	(Score) X	area(0-1.0)	Sub Totals	1.5		<b>→</b>	1.56	525
	_		0		/			
>30<300	2	1	2	m . 1		* The valu	e of WQ is obtain	ned by adding the
			0	Total	/		L scores of Land	
		1	0	2		Pretre	atment category th	nen dividing by 2
	Landuse C	ategory (LU)				Dratraatma	nt Category (PT)	
LU Category	(Score) X	area(0-1.0)	Sub Totals		/ PT Category	(Score) X		Sub Totals
Forested Land	2	T ` ′	1		Forested land	2.	0.5	1
Roadways	1	0.25	0.25		Runoff from		0.3	0
Residential	1.5		0.375		Stormwatr			0
residential		0.20	0		Runoff	1	0.5	0.5
		LU Total	1.63				PT Total	1.5
WRA	P Score	_					_	
0	.48	]						
Field Notes:								
Wildlife Utilizat								
				acts more as a detention area constant traffic; connected to		by species lik	e frogs, turtles, re	ptiles, med-
Siliali ilialililiais,	and birds. There	is numan disturba	ice in the form of	constant traffic, connected to	o corridor to south.			
Wetland Canopy	, (O/S)	Г						
		r, planted trees ha	ve some potential	for future support. <10 cove	er by exotics at the tir	ne of survey.		
	,	,,	r	r	.,			
Wetland Ground	Cover							
Newly planted n	nitigation site, cov	ver impacted by str	eam restoration p	roject.				
Habitat Support		1906 (+ - 661	: 14:-14:	() 1				1:-14-41
north as breaks i		18011 (cut off by f	esidentiai properti	ies) and consist of forested la	ind. We considered tr	ie residentiai	properties and the	e nighway to the
Field Hydrology	(HVD)	1						
		some hydrophytic	vegetation; howe	ver, the water budget comes	from north of the hig	hway and is	sporadic. Transitio	on to upland
species was also		2 1 2	- 1	C		-		•
WQ Input & Tre								
				pre-treatment of water enteri	ng the wetland system	m (forested,	sandy hillslopes),	and the
nemainaer come	s 110111 FUNOIT GUFI	ing rainfall events.						

#### WRAP ID

WRAP 12- Acorn Knoll Drive & Deciduous Ct

#### Wetland Rapid Assessment Procedure (WRAP)

√ Check One
√ Current Conditions
Proposed Conditions

WRAP Location 30.651996 / -87.874023

			110pc	oca conantons		l		
			. 37	<b>D</b> .	<b>7</b> . 1		W. J. J.	
Applicat	ion Number		ot Name Olive Creek	Date 6/3/19	Evaluator David Knowles	1 —	Wetland Typ PFO - Headwater	
		TIEL BO	onve creek	0/3/17			110-Headwater	Бюре
Ia	nd Use			Description/Notes	L	ı	Wetland Acrea	200
	restry			Description/Tvotes		]	wettand / teres	иде
	J	1						
Wildlife Utiliza	tion (WU)			Wetland Canopy (O/S)		,	Wetland Ground	Cover
	1.5			2.5			2.5	
•		•			<del>_</del>	<u></u>		
	Habitat Sup	pport Buffer		Field Hydrology (HYD	<u>)</u>		WQ Input & Trea	atment *
Buffer Type	(Score) X	area(0-1.0)	Sub Totals	2.5		<b>→</b>	1.625	
~25-50ft ave.	1.5	1	1.5		/			
			0		/	* The value of V	VO is obtained h	ov adding the
			0	Total	/		res of Land use C	
			0	1.5	/	Pretreatmen	t category then d	lividing by 2
					/			
	Land use Ca	ategory (LU)			/	Pretreatment Cat	egory (PT)	
LU Category	(Score) X	area(0-1.0)	Sub Totals		PT Category	(Score) X area(	0-1.0) Sub	Totals
Silviculture	2.5	0.5	1.25		No Treatment	0	0.5	0
			0					0
Single Fam			0		Forested Land	2.5	0.5	1.25
Residential	1.5	0.5	0.75					0
		LU Total	2.00			PT To	otal	1.25
WRA	AP Score	•						
(	0.67							
Field Notes:								
Wildlife Utiliza								
				upied residences beside the				
aquatic fauna.	ince, vehicle traffic	and barriers such	as silt tence negative	ely effect wildlife utilization	n. The small stream	located within its	boundaries does	support
aquatic fauna.								
Wetland Canop							1:00	
				ontains small numbers of exnese privet has begun to end			different species	, and several
that we general	iy iinu iii iiigii quai	ity wettailus of th	ns type, nowever, chin	nese privet has begun to end	croach on the wetta	nus mu-story.		
		•						
Wetland Ground		a gygtam haing ay	volunted (several spee	ies of OBL ferns), especiall	ly given the emoun	t of shade due to a	haalthy, ayarstar	
Ground cover is	appropriate for the	e system being ev	aiuateu (severai spec	ies of OBL ferris), especian	ly given the amount	t of shade due to a	nearing oversion	у.
II 1 i a C	/D . CC	<u> </u>						
Habitat Support		l inished in size an	d quality due to adiac	ent construction of single fa	amily homes			
The uplana ban	iers nave been ann	mished in size an	a quanty due to adjac	ent construction of single it	uning nomes.			
Field Hydrolog	y (HVD)							
		l however, a large	portion of it's drainas	ge area has been removed b	v residential develo	opment.		
			1		J			
WQ Input & Tr	eatment							
		good pre-treatme	nt of water entering th	ne wetland system (forested	, sandy hillslopes).			
I	- '	-	Č	- *	/			

#### **WRAP ID** Wetland Rapid Assessment Procedure (WRAP) **WRAP** Location South of, and Abutting √ Check One D 4-D6 - WRAP 22 Interstate 10 √ Current Conditions Proposed Conditions Wetland Type Application Number Project Name Date Evaluator Howard Horne NEP - D'Olive Creek April, 2019 Riparian Restoration Site Land Use Description/Notes Wetland Acreage Forested Land Wildlife Utilization (WU) Wetland Canopy (O/S) Wetland Ground Cover 0.5 0.5 Habitat Support Buffer Field Hydrology (HYD) WQ Input & Treatment \* 2 1.5625 Buffer Type area(0-1.0) Sub Totals >300 2.5 2.5 \* The value of WQ is obtained by adding the 0 Total TOTAL scores of Land use Category and 2.5 Pretreatment category then dividing by 2 Land use Category (LU) Pretreatment Category (PT) (Score) X LU Category area(0-1.0) Sub Totals PT Category (Score) X = area(0-1.0)Sub Totals Forested Land 0.5 Forested land 0.5 Roadways 0.25 0.25 Runoff from 0 Residential 1.5 0.25 0.375 Stormwatr 0 Runoff 0.5 LU Total 1.63 PT Total WRAP Score 0.45 Field Notes: Wildlife Utilization (WU) Wetland provides very limited cover and food source for wildlife. The upland buffers adjacent to the restoration site do provide some support to wildlife. Wetland Canopy (O/S) Wetland canopy is absent, however, planted trees have some potential for future support. Wetland Ground Cover Newly planted mitigation site, cover impacted by stream restoration project. 2-3% cover by exotic species. Habitat Support/Buffer Buffers average >300ft of forested land. Connected to other wildlife corridors. Field Hydrology (HYD) Post-constuction hydrology has led to an overall reduction in wetlands, due to the necessary re-contouring of land around the constructed channel. There is hydrology

A portion of the Surrounding landuse provides for moderate levels of pre-treatment of water entering the wetland system (forested, sandy hillslopes), and the remainder comes from storm water (upstream of Interstate) during rainfall events.

for hydrophytic species within portions of the evaluation area.

WQ Input & Treatment

WRA	AP ID	Wet	land Rapid Ass	WRAP Location				
MP - WRAP	1 (above DA3)			√ Check One				
1/11 V/ 14/11	( ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( (			urrent Conditions				
	l		Proj	posed Conditions				
							*** •	
Application	on Number	Project NEP - D'O		Date 5/8/19	Evaluator David Knowles	Г		nd Type dwater Slope
		NLI - DO	iive creek	3/0/17	Buvia izno wies	L	110-1104	dwater Stope
Land	d Use			Description/Notes			Wetland	d Acreage
	estry					ſ		
		•				•		
Wildlife Utilizati	ion (WU)			Wetland Canopy (O/S)	_	_	Wetland G	round Cover
	3			3				3
	Habitat Sup	_		Field Hydrology (HYD	<u>)</u>	<b>.</b> [		& Treatment *
Buffer Type	1` 1	area(0-1.0)	Sub Totals	3		<b>→</b> [	2	.75
>300ft of HQ	2.5	1	2.5		/			
			0	Total	/			ined by adding the
			0	2.5	<i>'</i>			use Category and then dividing by 2
		I				1100100	unioni curegory	men unviaming by 2
	Land use Ca	tegory (LU)			/	Pretreatmen	nt Category (PT)	
LU Category	(Score) X	area(0-1.0)	Sub Totals		PT Category	(Score) X	area(0-1.0)	Sub Totals
Silviculture	2.5	1	2.5		Nat Undev.	3	1	3
			0					0
			0					0
			0					0
XV/D A		LU Total	2.50				PT Total	3
	P Score							
	.90							
Field Notes: Wildlife Utilizati	ion (WII)							
		ny different Phylu	m and Class. The v	vetland and surrounding buff	ers offer high qualit	y habitat. Th	e stream running	g thru the wetland
is relatively undi	sturbed and offers	great habitat for a	iquatic species.					
Wetland Canopy							_	
			ery healthy, shows tlands of this type.	signs of natural regen., and i	s free of exotics. Th	e shrub later	contains many o	different species,
and several that	we generally find i	in ingli quality we	tiands of this type.					
Wetland Ground	Carran							
		system being eva	aluated (several spe	ecies of OBL ferns), especial	ly given the amount	of shade due	e to a healthy ove	erstory.
							-	-
Habitat Support/								
While the upland to the wetlands (		n cut over in recen	it years, they were i	not clear-cut (selective cut) a	and still provide good	d support to	wildlife and act	as a decent buffer
to the wettands (	siowing funoit).							
Eigld Hadaala	(HVD) I							
Field Hydrology It is a groundwat		and there are no kr	nown impediments	to hydrology.				
			r	y <b></b>				
WQ Input & Tre								
		good pre-treatmen	t of water entering	the wetland system (forested	l, sandy hillslopes).		<u> </u>	

$\underline{WR}$	<u>AP ID</u>	Wetland Rapid Assessment Procedure (WRAP)					WRAP Location		
MP - WRAP	2 (above DA3)								
MP - WRAP 2 (above DA3				Current Conditions					
			Pro	posed Conditions					
Applicat	ion Number		t Name Olive Creek	Date 5/8/19	Evaluator David Knowles	]		nd Type dwater Slope	
		NEF-DC	nive Cleek	3/8/17	David Knowies		FSS - Fleat	dwater Stope	
Lar	nd Use			Description/Notes			Watland	d Acreage	
	restry			Description/1votes			Wettan	Artereage	
			J.			ı			
Wildlife Utiliza	tion (WU)			Wetland Canopy (O/S)	_		Wetland G	round Cover	
	1			0				1	
	Habitat Sup	-		Field Hydrology (HYD)	)	_		& Treatment *	
Buffer Type	(Score) X	area(0-1.0)	Sub Totals	1.5		<b>→</b>	2	.25	
>300ft but	1	1	1		/				
recently			0	Total	/			ned by adding the	
cut-over			0	10121				use Category and then dividing by 2	
					/	Tiene	atment category	unen dividing by 2	
	Land use Ca	ategory (LU)				Pretreatme	nt Category (PT)		
LU Category		area(0-1.0)	Sub Totals		PT Category		area(0-1.0)	Sub Totals	
Silviculture	2.5	1	2.5		Silviculture	2	1	2	
			0		lands, recently			0	
			0		cut-over and			0	
			0		lacking in cover			0	
****		LU Total	2.50				PT Total	2	
li e	P Score	1							
	.36								
Field Notes: Wildlife Utilizat	tion (WIII)								
		for wildlife, and a	adjacent upland buf	fer was recently cut-over, offer	ering only moderate	e food sourc	e and cover. The	wetland habitat is	
likely only utiliz	zed by small to med	dium sized mamn	nals and a few Avia	n species; no aquatic habitat a	and little cover for a	amphibians (	or reptiles.		
Wetland Canopy									
The wetland car	nopy is almosts nor	n-existent due to r	ecent cutting.						
Wetland Ground	1.0								
		Indcover is inapp	ropriate (exotics an	d transitional upland species)	. Site is essentially	newly mulc	hed and sediment	ation is an issue.	
	C		•	1 1 ,	,	,			
Habitat Support									
				ttle habitat support. Upland bu	ıffer does contain s	ome exotic s	species and will li	ikely contain	
larger numbers	of them in the near	ruture due to gro	und disturbance and	d opening of the canopy.					
P: 1177 1 1	(IN/D)								
Field Hydrology	(HYD) retland plants to tra	nsitional unlands	species Erosion car	used by large machinery has le	ed to a shift in vege	etation away	from hydronhyt	ic species. The	
				still able to access the water			, mom ny dropny t	ic species. The	
WQ Input & Tre	eatment								
		good pre-treatmer	nt of water entering	the wetland system (forested	, sandy hillslopes).				
1									

WRAP ID	Wetland Rapid Assessment Procedure (WRAP)					WRAP Location		
MP - WRAP 3 (above DA3)								
viii - vvikai 3 (above DA3)		√ Ci	urrent Conditions					
		Pro	posed Conditions					
Application Number		t Name	Date	Evaluator			nd Type	
	NEP - D'C	Olive Creek	5/8/19	David Knowles		PFO - Head	lwater Slope	
Y 177			D. C. A.			W d 1		
Land Use Forestry	1		Description/Notes			Wetland	Acreage	
Torestry	1							
Wildlife Utilization (WU)			Wetland Canopy (O/S)			Wetland Gr	ound Cover	
1.5	1		1.5	7			.5	
	4			_				
Habitat Su	pport Buffer		Field Hydrology (HYD)	)		WQ Input &	Treatment *	
Buffer Type (Score) X	area(0-1.0)	Sub Totals	2.5		$\longrightarrow$	2.	25	
>300ft but 2	1	2		_ /			-	
comprised		0			* The valu	ue of WQ is obtain	ned by adding the	
of heavily		0	Total	/		•	use Category and	
managed forestry land		0	2		Pretre	atment category t	hen dividing by 2	
	ategory (LU)			1		nt Category (PT)		
LU Category (Score) X	area(0-1.0)	Sub Totals		PT Category	(Score) X	area(0-1.0)	Sub Totals	
Silviculture 2.5	1	2.5		Silviculture	2	1	2	
		0		lands			0	
		0					0	
		2.50				DT T 4 1	0	
WRAP Score	LU Total	2.50				PT Total	2	
0.63	1							
	ı							
Field Notes: Wildlife Utilization (WU)	1							
Wetland provides adequate protec	tive cover for wild	llife; adjacent uplar	nd buffer is mostly scrub shru	b and planted pine	habitat, offe	ring only modera	te food sources	
and cover; no aquatic habitat for a	mphibians or rept	iles. Hog rutting wa	as observed, and they compete	e directly for resour	ces with the	native wildlife sp	pecies.	
Wetland Canopy (O/S)								
The wetland canopy is providing l		hough it is not fully	matured. Exotic species arer	n't yet competing w	ith native tre	ees or shrubs, but	they are present	
and will likely compete for resour	ces in the future.							
Wetland Ground Cover	-41	The	:		:	: : (t	-111:> 64	
Groundcover has been effected by few ferns that were present.	athropogenic ian	duse practices. Their	e is competition from exotic	vine species and ch	inese privet	is an issue (extra	snadding) for the	
Habitat Support/Buffer	1							
Buffers are greater than 300ft on a	lverage, although	the quality of the ve	egetation is not great. Upland	buffer does contain	some exoti	c species and will	likely contain	
larger numbers of them in the nea						1	, l	
Field Hydrology (HYD)								
Water budget is adequate for supp	orting wetland ve	getation; however, s	some siltation from the adjace	nt steep hillslopes	and forestry	operations was ev	ident.	
WQ Input & Treatment				(6)	1 1 1 22 2			
Surrounding upland forestry land	is providing good	pre-treatment of wa	ater entering the wetland syste	em (forested/scrub)	snrub hillslo	pes).		

WRAP ID  WRAP 4 (shows DA)		Wetland Rapid Assessment Procedure (WRAP)					WRAP Location		
MP - WRAP 4 (above DA3)				√ Check One					
,				Current Conditions					
			Pro	posed Conditions					
Annlicati	on Number	Project	Name	Date	Evaluator		Watlan	d Type	
Аррисан	on rumber	NEP - D'O		5/8/19	David Knowles			water Slope	
								^	
Lan	d Use			Description/Notes			Wetland	Acreage	
For	restry			Contains Perennial Stream					
Wildlife Utilizat	10n (WU) 2	I		Wetland Canopy (O/S) 2.5	٦		Wetland Gro	ound Cover .5	
	2	l		2.3	_			.5	
	Habitat Sup	pport Buffer		Field Hydrology (HYD)	)		WQ Input &	Treatment *	
Buffer Type		area(0-1.0)	Sub Totals	2.5		<b>&gt;</b>		75	
>300ft of	2.5	1	2.5		_ /				
forested upland	buffer		0			* The valu	ue of WQ is obtain	ned by adding the	
			0	Total	/	TOTA	L scores of Land	use Category and	
			0	2.5	/	Pretre	atment category t	hen dividing by 2	
	Land use Ca	ategory (LLI)				Pretreatme	nt Category (PT)		
LU Category		area(0-1.0)	Sub Totals		PT Category	(Score) X		Sub Totals	
Silviculture	2.5	1	2.5		Nat Undev.	3	1	3	
			0					0	
			0					0	
			0					0	
W/D A	P Score	LU Total	2.50				PT Total	3	
	.82								
Field Notes:	.02								
Wildlife Utilizat	ion (WU)							1	
Wetland is utiliz	ed by fauna of mai			wetland and buffers to east and					
wetland offers g wildlife.	ood habitat for aqu	atic species. Hwy	90 lies directly to	the south of the point of evalu	uation; however, an	id is a consta	int nuisance and d	anger to all	
Wetland Canopy The wetland can		rovides cover for	wildlife is healthy	, shows signs of natural regen.	but it does contai	n exotics wh	ich count for abou	ut 5% of total	
cover.	opy, sin ue su uu p	10 (140) 00 (01 101	, 10 11001117	, one we orgine or natural regen.	., 040 10 40 00 00 11441	ir enouge wi			
Wetland Ground									
	mostly appropriate timated cover is like			veral species of OBL ferns); he	owever several inv	asive vine sp	ecies inhabit the	wetland (~5% of	
GC), and that es	tilliated cover is in	kery to increase in	coming years.						
Habitat Support	/Puffar								
		on average) provic	le good support to	wildlife and act as a decent bu	iffer to the wetland	s (slowing r	unoff).		
Field Hydrology									
	ter driven system, rts and to the other		adequate hydrolog	gy to support wetland vegetation	on, there are poorly	placed culv	erts ajacent to it v	where the stream	
	to the onler	3111.1 y 70.							
WQ Input & Tre	eatment								
		decent pre-treatme	ent of water enterin	ng the wetland system (foreste	d, sandy hillslopes)	).			

WRAP ID	Wetland	Rapid Assessment Procedure	WRAP Location		
MP - WRAP 5 (above DA3	)	√ Check One			
	,	√ Current Conditions			
		Proposed Conditions		]	
Application Number	Project Name	Date	Evaluator	Wet'	land Type
T Application 1 value	NEP - D'Olive Cr		David Knowles		eadwater Slope
Land Use	_	Description/Notes		Wetla	nd Acreage
Forestry		Contains Perennial Stre	eam		
Wildlig-Thill4: (WII)		W-41 1 C ((	2/6)	W-41 4 (	C1 C
Wildlife Utilization (WU)	$\neg$	Wetland Canopy (C	0/8)		Ground Cover 2.5
		2.3			2.0
Habitat	Support Buffer	Field Hydrology (F	HYD)	WQ Input	& Treatment *
Buffer Type (Score) X	area(0-1.0) Sub T	otals 2.5		$\longrightarrow$	2.75
•	2.5 1	2.5	/		
forested upland buffer		0	/	* The value of WQ is obta	ained by adding the
		0 Total 0 2.5		TOTAL scores of Lan	
		0 2.5	/	Pretreatment category	y then dividing by 2
Land use	Category (LU)			Pretreatment Category (PT	3)
LU Category (Score) X	area(0-1.0) Sub To	otals	PT Category	(Score) X area(0-1.0)	Sub Totals
Silviculture	2.5 1	2.5	Nat Undev.	3	1 3
		0			0
		0			0
	T T T T T	0		DT T + 1	0
WRAP Score	LU Total	2.50		PT Total	3
0.82	$\neg$				
Field Notes:					
Wildlife Utilization (WU)					
		Class. The wetland and buffers to ea			
wildlife.	aquatic species. Hwy 90 nes	s directly to the north of the point of	evaluation, nowever, ar	id is a constant nuisance and	i danger to an
W-411 C (O/O)	1				
Wetland Canopy (O/S) The wetland canopy/shrub strat	a provides cover for wildlife	e, is healthy, and shows signs of natu	ral regen.		
		, ,,	C		
Wetland Ground Cover					
Ground cover is appropriate for	the system being evaluated	(several species of OBL ferns) and o	contains less than 10% of	cover by exotic species.	
Habitat Support/Buffer					
Aside from the north buffer (H	wy 90) the upland buffers (3	00+ ft wide on average) provide goo	d support to wildlife an	d act as a decent buffer to th	e wetlands
(slowing runoff).					
	-				
Field Hydrology (HYD)	m and while there is adequa	ate hydrology to support wetland veg	votation there are nearly	v placed culverts unstream fr	com the wetland
which likely takes some water			getation there are poorty	piaced curverts upstream in	om me wenand
WQ Input & Treatment					
	landuse provides for good pr	re-treatment of water entering the we	tland system (forested,	sandy hillslopes).	
1					

<u>WRAP ID</u>	Wetland Rapid A	apid Assessment Procedure (WRAP)			WRAP Location		
MP - WRAP 6 (above DA3)		√ Check One					
(4,000,000,000,000,000,000,000,000,000,0		Current Conditions					
	Pi	roposed Conditions					
A. P. C. N. I	D : (3)	ъ.	F 1 .		W. d	1.00	
Application Number	Project Name NEP - D'Olive Creek	Date 5/8/19	Evaluator David Knowles			ld Type lwater Slope	
	THE BOILT CITCH	3/6/17				water stope	
Land Use		Description/Notes			Wetland	Acreage	
Forestry		Contains Perennial Stream					
Wildlife Utilization (WU)	7	Wetland Canopy (O/S)	7		Wetland Gro		
2.5	]	2.5	J		2.	.5	
Habitat Cu	nnort Duffor	Field Hydrology (HVD)			WQ Input &	Traatmant *	
Buffer Type (Score) X	pport Buffer area(0-1.0) Sub Totals	Field Hydrology (HYD) 3	1 /	<b>&gt;</b>	2.**		
>300ft of 2.5	T ' T		]			70	
forested upland buffer	0		/	* The real	ue of WQ is obtain	and by adding the	
	0	Total /	/			use Category and	
	0	2.5		Pretre	atment category the	hen dividing by 2	
				_			
	ategory (LU)		   DT C +		nt Category (PT)	0.1.77.4.1	
LU Category (Score) X Silviculture 2.5	area(0-1.0) Sub Totals  1 2.5	1 /	PT Category Nat Undev.	(Score) X	area(0-1.0)	Sub Totals 3	
Silviculture 2.3	0		ivat Olidev.		1	0	
	0					0	
	0					0	
	LU Total 2.50	]′			PT Total	3	
WRAP Score	1						
0.88	]						
Field Notes:	<del></del>						
Wildlife Utilization (WU) Wetland is utilized by fauna of ma	lany different Phylum and Class. The	e wetland and buffers to east and	west provide high	quality hab	itat The stream ri	unning thru the	
wetland offers good habitat for aq	uatic species. Hwy 90 lies to the nor	rth of the point of evaluation, an					
travel northward, there is alternati	ve acces to a larger tract of undevelopment	oped lands.					
Wetland Canopy (O/S)							
The wetland canopy/shrub strata p	provides cover for wildlife, contains	relatively few exotics, is health	y, and shows signs	of natural r	egen.		
Wotland Crownd Cover	1						
Wetland Ground Cover Ground cover is appropriate for the	le system being evaluated (several s	pecies of OBL ferns) and contai	ns less than 10% c	over by exo	tic species.		
Habitat Support/Buffer							
The upland buffers (300+ ft wide	on average) provide good support to	o wildlife and act as a decent but	ffer to the wetland	s (slowing ru	anoff).		
Field Hydrology (HYD)	<del>                                     </del>						
This evaluation point is further re-	moved from the culverts at Hwy 90,	, and the hillslopes are providing	g plenty of ground	water (satura	ited soils through	out) and there is	
adequate hydrology to support we	tland vegetation.						
WQ Input & Treatment	duga massidas for a sala	at of water out-vive d d d	avatam (f 1	on dv. 1.:11. 1			
A majority of the surrounding land	duse provides for good pre-treatmen	nt or water entering the wetland	system (forested, s	andy nilisloj	pes).		

# WRAP ID TC1-TC2 WRAP

# Wetland Rapid Assessment Procedure (WRAP)

WRAP Location

 $\frac{\sqrt{\text{Check One}}}{\sqrt{\text{Current Conditions}}}$ 

Proposed Conditions

	Į		Тторо	sed Conditions				
Annlicati	on Number	Projec	et Name	Date	Evaluator		Watle	and Type
Application	on Number		Olive Creek	4/17/19	Matt Stowe and	1		dwater Slope
<u> </u>		<u> </u>			Howard Horne			
Lan	d Use			Description/Notes	L	ı	Wetlan	d Acreage
	toration Site			<b>F</b>		]		
		•						
Wildlife Utilizat	ion (WU)			Wetland Canopy (O/S)	_		Wetland G	round Cover
	2			0.5				1.5
	Habitat Sup	port Buffer		Field Hydrology (HYD)	)		WQ Input &	& Treatment *
Buffer Type	(Score) X	area(0-1.0)	Sub Totals	2	J /	<b>→</b>		2.5
>300ft and	2.5	1	2.5		/			
comprised			0			* The val	ue of WQ is obta	ined by adding the
of mixed hardwo	ood		0	Total	/	TOTA	L scores of Land	l use Category and
& pine forest			0	2.5	1	Pretre	eatment category	then dividing by 2
					1			
	Land use Ca				1		nt Category (PT)	
LU Category	1 /	area(0-1.0)	Sub Totals		PT Category	T .	area(0-1.0)	Sub Totals
Secondary	2.5	1	2.5		Mixed Pine &	2.5	1	1 2.5
Forest, likely			0		Hardwoods			0
Silviculture Land	ds		0					0
			0/	,				0
		LU Total	2.50				PT Total	2.5
	P Score	I						
0.	61							
Field Notes:								
Wildlife Utilizat								
Wetland provide	s limited protective	e cover for large	wildlife species. The	re is cover for small mamm nly moderate food source.	nals, and the stream	offers some	habitat for aqua	tic species and
				ourse thru residential areas.	to some extent the	wettand is c	officeted to off-s	ne comidors, but
Wetland Canopy		on of stan mool o	amenday. Thousans are	ne appropriate living saplin	as which offer son	a a matamatical i	Fam fastama famaatat	tion.
Site was re-plant	ed after constructi	on of step poof c	ompiex. There are sor	ne appropriate living sapiin	igs which offer son	ie potentiai	for future foresta	iion.
	~ 1							
Wetland Ground		avacive evotice it	the herbaceous layer	. There were also several tra	ancitional/unland c	nacies noted	amonast the nati	ive hydronhytic
				higher percentages of desira			amongst the nati	ive nydropnytic
				8 · F · · · · · · · · · · · · · · · · ·				
Habitat Cymnaut	Duffer							
Habitat Support/		verage although	the quality of the yege	etation is not great. Upland	buffer does contain	ı some exoti	c species and wil	1 likely contain
				gain harvested of the plant			e species and with	
Field Hydrology	(HVD)							
		rk and the past h	eavy siltation there are	e definitely issues related to	hydrology to supp	ort hydroph	vtic plant species	<u> </u>
		r	,	,	, 0, Fr	J - F	. 1 F	
WQ Input & Tre	atment							
		s providing decei	nt pre-treatment of wa	ter entering the wetland sys	stem (forested/scru	b shrub hills	lopes).	
I								

WR	AP ID	Wet	tland Rapid As	sessment Procedure (V	VRAP)			Location
TC1-TC2 Unst	ream - WRAP 19			√ Check One				we and Pollard
1C1-1C2 Opsi	ream - WKAI 19		√ C	urrent Conditions				of Restoration ite
			Pro	posed Conditions			51	
Annlicati	on Number	Droinat	: Nama	Data	Evaluator		Watlar	nd Trans
Аррисан	on Number	NEP - D'O	Name live Creek	Date April, 2019	David Knowles			water Slope
	,							
Lan	d Use	,		Description/Notes		1	Wetland	Acreage
For	restry			Contains Perennial Stream				
Wildlife Utilizat	ion (WII)			Wetland Canopy (O/S)			Wetland Gr	ound Cover
	2.5			3	7			3
					_			
	Habitat Sup	port Buffer		Field Hydrology (HYD	)			Treatment *
Buffer Type	T T	area(0-1.0)	Sub Totals	3	J /	$\longrightarrow$	2.6	525
>300ft of	2.5	1	2.5		/			
forested upland	buffer		0	Total	/		ue of WQ is obtain	
			0	2.5			L scores of Land eatment category t	
			<u> </u>			11001	aument eutegery t	u. (
	Land use Car	tegory (LU)				Pretreatme	ent Category (PT)	
LU Category	(Score) X	area(0-1.0)	Sub Totals		PT Category	(Score) X	area(0-1.0)	Sub Totals
Silviculture	2.5	1	2.5		Nat Undev.	3	0.5	1.5
			0		Wet Detention	2.5	0.5	1.25
			0					0
			0					0
W/D A		LU Total	2.50				PT Total	2.75
	P Score							
	.92							
Field Notes: Wildlife Utilizat	ion (WII)							
		y endemic specie	s. Corridors are so	mewhat fragmented due to the	ne way the wetland	is surrounde	d by residences ar	nd road crossings.
		-		_	-		-	
Wetland Canopy		ant vom little on		ntivon.				
Large, mature ca	anopy trees are pres	sent, very nute pr	essure from non-na	ilives.				
Wetland Ground	Cover							
While there were	e a few occurences			nost part the ground cover is	n excellent shape, o	comprised of	f a large number o	f species that we
typically associa	te with high quality	y headwater wetla	ands.					
Habitat Support				71.11.0	20 0 1 1	1 ( 1 :		
The upland buff	ers (300+ ft wide o	n all sides) provid	de good support to	wildlife and act as a decent b	ouffer for the wetlan	ds (slowing	runoff).	
Field Hydrology	(HYD) I							
		and there is adeq	uate hydrology to s	support wetland vegetation.				
	- 1	•		-				
WQ Input & Tre								
Surrounding lan	duse provides for g	good pre-treatmen	t of water entering	the wetland system (forested	i, sandy hillslopes a	nd wet deter	ntion up-stream).	
I								



Table B. RSA scores	for the D'Ol	ive watershed	sampling sites	, Spring 2019.		
Metric	<b>DA3 - U</b>	DA3 - R	DA3 - D	DAE - D	D4-D6 - D	D4-D6 - R
Riparian Zone Width	4	0	4	4	2	0
Riparian Vegetative Quality	4	2	4	4	2	2
Canopy Cover	4	0	4	4	4	0
Local Watershed Erosion	2	2	0	2	2	2
Sediment Deposition	2	4	0	0	0	2
Habitat Availability	2	2	0	0	2	2
Habitat Smothering	4	4	2	2	2	2
Channel Alteration	4	2	2	4	2	2
Channel Sinuosity	2	2	0	2	2	2
Bank Stability	2	2	0	2	2	4
Bank Vegetative Protection	2	2	0	2	0	0
Macroinvertebrates Present	2	2	2	2	2	2
Identified Taxa*	0	4	-2	-2	4	-2
*Specific Taxa		Stonefly (+4) Caddisfly (+2) Midge (-2)	Midge (-2)	Midge (-2)	Damselfly (+2) Dragonfly (+2)	Midge (-2)
Total:	34	28	16	26	26	18

Table B-2. RSA scores for the D'Olive watershed sampling sites, Spring 2019, continued.

continued.						ID D
Metric	<b>JB1 - U</b>	JB1 - R	JB2 - D	JB2 - R	JA-D	JB Bass Pro
Riparian Zone Width	4	0	4	0	4	4
Riparian Vegetative Quality	2	2	2	2	2	2
Canopy Cover	4	0	4	0	4	4
Local Watershed Erosion	2	2	2	2	2	2
Sediment Deposition	2	2	2	2	0	2
Habitat Availability	4	4	2	2	0	4
Habitat Smothering	2	2	2	2	0	4
Channel Alteration	4	2	4	0	2	4
Channel Sinuosity	2	2	2	0	0	4
Bank Stability	2	2	2	4	2	2
Bank Vegetative Protection	2	2	2	2	2	2
Macroinvertebrates Present	0	2	2	2	2	2
Identified Taxa*	0	-2	4	0	2	-2
			Caddisfly	Caddisfly	Damselfly	
*Specific Taxa		Midge (-2)	(+2) Damselfly (+2)	(+2) Midge (-2)	(+2) Dragonfly (+2)	Midge (-2)
Total:	30	20	34	18	22	34

Table B-3. RSA scores for the D'Olive watershed sampling sites, Spring 2019, continued.

continued.					TI C(4. A)	TF C7 (1 A)
Metric	<b>J42 - U</b>	J42 - R	J4(1-2) - D	TC2 Trib.	TC(1-2) - U	TC(1-2) - R
Riparian Zone Width	4	0	4	0	4	0
Riparian Vegetative Quality	2	2	2	2	2	2
Canopy Cover	4	0	4	0	4	0
Local Watershed Erosion	2	2	2	0	2	2
Sediment Deposition	0	2	0	0	2	2
Habitat Availability	2	2	2	0	2	2
Habitat Smothering	0	2	2	0	2	2
Channel Alteration	4	2	2	2	4	0
Channel Sinuosity	2	2	2	2	2	2
Bank Stability	2	2	0	0	2	4
Bank Vegetative Protection	2	2	0	0	2	2
Macroinvertebrates Present	2	2	2	2	2	2
Identified Taxa*	0	2	0	-2	4	0
*Specific Taxa	Midge (-2) Damselfly (+2)	Midge (-2) Caddisfly (+2) Damselfly (+2)	Midge (-2) Damselfly (+2)	Midge (-2)	Caddisfly (+2) Damselfly (+2)	Midge (-2) Damselfly (+2)
Total:	26	22	22	6	34	20

Station Name/Number DA3 - upstre	Date 4/17/19	- 0930 - 1000
Field Personnel J. o Weal	Weather _ ১ مرمر	
Riparian Zone Width: Poor (0-9m)		
Riparian Veg. Quality: Poor (0-25% Nati		
Water Quality: Water Temp (°C)	Cond. (μmohs/cm)S	al. (ppt) pH
DO (mg/L) DO (%)_	Turbidity (NTU)_	
Dominant Watershed Land Use: Forest_	メ Field/Pasture Agri	culture Residential
Commerci	al Industrial Other	· ·
Canopy Cover: Poor (<30%,89-100%)	Moderate (30-50%)	Good (51-88%)X
Local Watershed Erosion: None	Light ModerateX	Heavy
Sediment Deposition: Poor	Moderate× Good	l
Habitat Availability: Poor	ModerateX Good	
Habitat Smothering: Poor	Moderate Good	<u> </u>
Channel Alteration (Artificial Channelizati	on): Poor Moderate	Good X
Channel Sinuosity: Poor M	loderateXGood	
Bank Stability: Poor M	loderate× Good	
Bank Veg. Protection: Poor	Moderate × Good Good	1
Macroinvertebrates Present: Yes	No	
Circle Identified Taxa (refer to attached ID	guide)	
Pollution Sensitive	Mod. Pollution Sensitive	Pollution Tolerant
Water Penny	Caddisfly	Midge Larvae
Stonefly	Damselfly	Midge Pupae
Mayfly	Dragonfly	Black Fly
Riffle Beetle	Amphipods	Rat-tailed Maggot
Dobson fly	*	
Notes: Velout Crawtish so	Jamanders, Fish observe	D
- Stream type lepte	need, perennel et)	

Station Name/Number DA3	- Restantro	<u>n</u>	Date_ 4	17/19	10:00	) <del>-</del>		
Field Personnel J. D'N								
Riparian Zone Width: Poor (0								
Riparian Veg. Quality: Poor (								
Water Quality: Water Temp								
DO (mg/L)							F	
Dominant Watershed Land Use						<del>-</del>	ential	
		Indust				520		
Canopy Cover: Poor (<30%,89								è
Local Watershed Erosion: Non								
~		Moderate_						
		Moderate_						
TT 3.4:		Moderate_						
Channel Alteration (Artificial C			8			Good		
Channel Sinuosity: Poor								
		erate <u> </u>						
Bank Veg. Protection: Poor_								
T	Yes <del>/</del>	No			<del></del> >			
Circle Identified Taxa (refer to a	ttached ID gui	ide)	3					
Pollution Sensitive		Mod. Pollutio	on Sensitive	7	Г	Polluti	on Tolerant	
Water Penny		Caddi	isfly			_	ge Larvae	
Stonefly		Damse	elfly				-	
Mayfly		Drago	•		ļ.		ge Pupae	
Riffle Beetle		_	·				ick Fly	
Dobson fly	1	Amphi	μο <b>α</b> s			Rat-tai	led Maggot	
~ 0000a ny								
Notes: Rucky stepdowns	· All surf	uces covered	with p	eri phyt	00			<b>=</b> ?

Station Name/Number DA3 - Daw	Date 4/17/19	1130
Field Personnel J. o Well	Weather	- 75°F
	Moderate (9-18m)	
	Native) Moderate (25-75% Native)	
Water Quality: Water Temp (°C)	Cond. (μmohs/cm) Sal. (p	pt) pH
	Turbidity (NTU)	
Dominant Watershed Land Use: For	rest Field/Pasture Agricultur	re Residential
	ercial Industrial Other	
	) Moderate (30-50%)	
Local Watershed Erosion: None	Light Moderate	HeavyX
Sediment Deposition: Poor_	X Moderate Good	<u>^</u>
Habitat Availability: Poor	X Moderate Good	· ·
Habitat Smothering: Poor_	Moderate × Good	<u> </u>
Channel Alteration (Artificial Channeli	zation): Poor ModerateX	Good
Channel Sinuosity: Poor X	Moderate Good	
	Moderate Good	
Bank Veg. Protection: PoorX	Moderate Good	
Macroinvertebrates Present: Yes	No	
Circle Identified Taxa (refer to attached	ID guide)	
Pollution Sensitive	Mod. Pollution Sensitive	Pollution Tolerant
Water Penny	Caddisfly	Midge Larvae
Stonefly	Damselfly	Midge Pupae
Mayfly	Dragonfly	Black Fly
Riffle Beetle	Amphipods	Rat-tailed Maggot
Dobson fly	3 2	union viaggot
N-A		
Notes:		

DO (mg/L) DO (%) Turbidity (NTU)  Dominant Watershed Land Use: Forest Field/Pasture Agriculture Residential  Commercial Industrial Other  Canopy Cover: Poor (<30%,89-100%) Moderate (30-50%) Good (51-88%)  Local Watershed Erosion: None Light Moderate Good  Habitat Peposition: Poor Moderate Good  Habitat Availability: Poor Moderate Good  Channel Alteration (Artificial Channelization): Poor Moderate Good  Bank Stability: Poor Moderate Good  Bank Veg. Protection: Poor Moderate Good  Macroinvertebrates Present: Yes No  Circle Identified Taxa (refer to attached ID guide)  Pollution Sensitive Moderative Pollution Toler.	
Riparian Zone Width: Poor (0-9m)	
Riparian Veg. Quality: Poor (0-25% Native) Moderate (25-75% Native) Good (>75% Native) PH DO (mg/L) DO (%) Turbidity (NTU) DO (mg/L) DO (%) Turbidity (NTU) DO (mg/L) Good (51-88%) Agriculture Residential Commercial Industrial Other Good (51-88%) Good (51-88%) Good (51-88%) Good (51-88%) Good Hoderate Good Heavy Sediment Deposition: Poor Moderate Good Habitat Availability: Poor Moderate Good Good Good Channel Alteration (Artificial Channelization): Poor Moderate Good Good Habitat Sinuosity: Poor Moderate Good Bank Stability: Poor Moderate Good Hoderate Good Good Good Good Good Good Good Good Good Habitat Sinuosity: Poor Moderate Good Hoderate Good Good Good Good	
Water Quality: Water Temp (°C) Cond. (µmohs/cm) Sal. (ppt) pH_  DO (mg/L) DO (%) Turbidity (NTU)  Dominant Watershed Land Use: Forest X	
DO (mg/L) DO (%) Turbidity (NTU) Dominant Watershed Land Use: Forest X Field/Pasture Agriculture Residential Commercial Industrial Other Canopy Cover: Poor (<30%,89-100%) Moderate (30-50%) Good (51-88%) X Local Watershed Erosion: None Light Moderate X Heavy Sediment Deposition: Poor X Moderate Good Habitat Availability: Poor X Moderate X Good Channel Alteration (Artificial Channelization): Poor Moderate X Good Channel Sinuosity: Poor Moderate X Good Bank Stability: Poor Moderate X Good Bank Veg. Protection: Poor Moderate X Bood Bank Veg. Protection: Poor Bank Veg. P	
Dominant Watershed Land Use: Forest × Field/Pasture Agriculture Residential  Commercial Industrial Other  Canopy Cover: Poor (<30%,89-100%) Moderate (30-50%) Good (51-88%) ×  Local Watershed Erosion: None Light Moderate X Heavy  Sediment Deposition: Poor X Moderate Good Habitat Availability: Poor X Moderate Good Habitat Smothering: Poor Moderate X Good Channel Alteration (Artificial Channelization): Poor Moderate Good Hoderate Good Moderate Moderate Good Moderate Moderate Moderate Moderate Poor Moderate Poor Moderate Moderate Poor Moderate Poor Moderate Poor Moderate Poor Moderate Pool Moderate Pool Moderate Pollution Sensitive Pollution Tolerate Pollution Sensitive Pollution Tolerate Pool Moderate Pollution Tolerate Pool Moderate Pollution Tolerate Pool Moderate Pollution Tolerate Pollution Tolerate Pool Moderate Pollution Tolerate Pollution Tolerate Pool Moderate Pollution Tolerate Pollution Tolerate Pollution Tolerate Pollution Tolerate Pollution Tolerate Pollution Tolerate Pool Moderate Pollution Tolerate Pollut	
Commercial Industrial Other Canopy Cover: Poor (<30%,89-100%) Moderate (30-50%) Good (51-88%) Local Watershed Erosion: None Light Moderate	<
Canopy Cover: Poor (<30%,89-100%)	
Local Watershed Erosion: None Light Moderate X Heavy  Sediment Deposition: Poor Moderate Good  Habitat Availability: Poor Moderate Good  Habitat Smothering: Poor Moderate X Good  Channel Alteration (Artificial Channelization): Poor Moderate X Good  Channel Sinuosity: Poor Moderate X Good  Bank Stability: Poor Moderate X Good  Bank Veg. Protection: Poor Moderate X Good  Macroinvertebrates Present: Yes X No  Circle Identified Taxa (refer to attached ID guide)  Pollution Sensitive	
Sediment Deposition: Poor X Moderate Good  Habitat Availability: Poor Moderate Good  Habitat Smothering: Poor Moderate X Good  Channel Alteration (Artificial Channelization): Poor Moderate Good X  Channel Sinuosity: Poor Moderate X Good  Bank Stability: Poor Moderate X Good  Bank Veg. Protection: Poor Moderate X Good  Macroinvertebrates Present: Yes X No  Circle Identified Taxa (refer to attached ID guide)  Pollution Sensitive Mod. Pollution Sensitive Pollution Tolerate States And Application Tolerate Sta	
Habitat Availability: Poor X Moderate Good  Habitat Smothering: Poor Moderate X Good  Channel Alteration (Artificial Channelization): Poor Moderate Good X  Channel Sinuosity: Poor Moderate X Good  Bank Stability: Poor Moderate X Good  Bank Veg. Protection: Poor Moderate X Good  Macroinvertebrates Present: Yes X No  Circle Identified Taxa (refer to attached ID guide)  Pollution Sensitive Mod. Pollution Sensitive Pollution Tolerate State Penny	
Habitat Smothering: Poor Moderate X Good  Channel Alteration (Artificial Channelization): Poor Moderate Good  Channel Sinuosity: Poor Moderate X Good  Bank Stability: Poor Moderate X Good  Bank Veg. Protection: Poor Moderate X Good  Macroinvertebrates Present: Yes X No  Circle Identified Taxa (refer to attached ID guide)  Pollution Sensitive Mod. Pollution Sensitive Pollution Tolerate X Could be a feature of the pollution Tolerate X No	
Channel Alteration (Artificial Channelization): Poor Moderate Good  Channel Sinuosity: Poor Moderate X Good  Bank Stability: Poor Moderate_ X Good  Bank Veg. Protection: Poor Moderate_ X Good  Macroinvertebrates Present: Yes X No  Circle Identified Taxa (refer to attached ID guide)  Pollution Sensitive Mod. Pollution Sensitive Pollution Tolerate Autority Columnia (Columnia Sensitive)	
Channel Sinuosity: Poor Moderate X Good  Bank Stability: Poor Moderate X Good  Bank Veg. Protection: Poor Moderate X Good  Macroinvertebrates Present: Yes X No  Circle Identified Taxa (refer to attached ID guide)  Pollution Sensitive Mod. Pollution Sensitive Pollution Tolera	
Bank Veg. Protection: Poor ModerateX Good  Macroinvertebrates Present: YesX No  Circle Identified Taxa (refer to attached ID guide)  Pollution Sensitive	
Macroinvertebrates Present: Yes X No  Circle Identified Taxa (refer to attached ID guide)  Pollution Sensitive Mod. Pollution Sensitive Pollution Tolera	
Pollution Sensitive  Mod. Pollution Sensitive  Pollution Tolera	
Pollution Sensitive Mod. Pollution Sensitive Pollution Tolera	
Water Penny Co. 13 G. 13	8
Water Penny Codding.	ant
Water Penny Caddisfly Midge Larva	
Stonefly Damselfly Midge Pupae	
Mayfly Dragonfly Black Fly	
Riffle Beetle	
Dobson fly Rat-tailed Magg	,ot 

Station Name/Number D4-16 Designation Date # 4/17/19 1310-
*Field Personnel J. O'Newl Weather \$ P. Cloudy 800F
Riparian Zone Width: Poor (0-9m) Moderate (9-18m) × Good (>18m)
Riparian Veg. Quality: Poor (0-25% Native) Moderate (25-75% Native) Good (>75% Native)
*Water Quality: Water Temp (°C) Cond. (µmohs/cm) Sal. (ppt) pH
DO (mg/L) DO (%) Turbidity (NTU)
Dominant Watershed Land Use: Forest X Field/Pasture Agriculture Residential
Commercial Industrial Other Power time Comidar
Canopy Cover: Poor (<30%,89-100%) Moderate (30-50%) Good (51-88%)
Local Watershed Erosion: None Light Moderate X Heavy
Sediment Deposition: Poor X Moderate Good Good
Habitat Availability: Poor Moderate \(  \) Good
Habitat Smothering: Poor ModerateX Good
Channel Alteration (Artificial Channelization): Poor ModerateX Good
Channel Sinuosity: Poor ModerateX Good
Bank Stability: Poor Moderate_ X Good
Bank Veg. Protection: Poor Moderate Good
Macroinvertebrates Present: Yes No
Circle Identified Taxa (refer to attached ID guide)
Pollution Sensitive Mod. Pollution Sensitive Pollution Tolerant
Water Penny Caddisfly Midge Larvae
Stonefly Damselfly Midge Pupae
Mayfly Dragonfly Black Fly
Riffle Beetle Amphipods Rat-tailed Maggot
Dobson fly
Notes:

Station Name/Number Dy Dy	6-Restoration Date	4/17/19 1340	- 1400
	Weath		
Riparian Zone Width: Poor (0-9m	n)X Moderate (9-18	8m) Go	ood (>18m)
	5% Native) Moderate (25		
	) Cond. (µmohs/cm)		
	O (%) Turbid		
	Forest Field/Pasture		
	ommercialIndustrial		
	00%) X Moderate (30-50		
Local Watershed Erosion: None_			
	or ModerateX		
	or Moderate×		
Habitat Smothering: Poo	or Moderate	Good<	_
Channel Alteration (Artificial Chan	nnelization): PoorN	Toderatex	Good
Channel Sinuosity: Poor			——————————————————————————————————————
Bank Stability: Poor	Moderate Good	d X - Riprof	
Bank Veg. Protection: Poor	Moderate G	Good	
Macroinvertebrates Present: Yes	XNo		
Circle Identified Taxa (refer to attac	ched ID guide)		
Pollution Sensitive	Mod. Pollution Sensi	tive	Pollution Tolerant
Water Penny	Caddisfly		Midge Larvae
Stonefly	Damselfly		Midge Pupae
Mayfly	Dragonfly		Black Fly
Riffle Beetle	Amphipods		·
Dobson fly	- Implipous		Rat-tailed Maggot
٠			
otes:			

Station Name/Number JBI - Ups	trem Date 4/2:	3/19 0940-	
Field Personnel J. D'Neal	. Weather ع	unny - 68°F	
Riparian Zone Width: Poor (0-9m)	Moderate (9-18m)	Good (>18m) X	
Riparian Veg. Quality: Poor (0-25%)	Native) Moderate (25-75%	Native) × Good (>75% Native)	
Water Quality: Water Temp (°C)			
DO (mg/L) DO (%			
Dominant Watershed Land Use: For	rest_X Field/Pasture	Agriculture Residential	
		Other	
Canopy Cover: Poor (<30%,89-100%	) Moderate (30-50%)_	Good (51-88%) ×	
Local Watershed Erosion: None			
	ModerateX		
Habitat Availability: Poor_	Moderate	Good	
Habitat Smothering: Poor_	Moderate X	Good	
Channel Alteration (Artificial Channeli	ization): Poor Modera	ate Good_X	
Channel Sinuosity: Poor	Moderate K Good		
Bank Stability: Poor	Moderate X Good		
Bank Veg. Protection: Poor	ModerateXGood		
Macroinvertebrates Present: Yes	No		
Circle Identified Taxa (refer to attached	ID guide)		
Pollution Sensitive	Mod. Pollution Sensitive	Pollution Tolera	ınt
Water Penny	Caddisfly	Midge Larvae	
Stonefly	Damselfly	Midge Pupae	
Mayfly	Dragonfly	Black Fly	
Riffle Beetle	Amphipods	Rat-tailed Magg	ot
Dobson fly		The tailed Magg	oi.
otes:			
oues			

Station Name/Number JBI - Restoration Date 4/23/19 10/0-	
Field Personnel 5.5 Wel Weather	
Riparian Zone Width: Poor (0-9m) X Moderate (9-18m) Good (>18m)	
Riparian Veg. Quality: Poor (0-25% Native) Moderate (25-75% Native) Good (>75% Native)	)
Water Quality: Water Temp (°C) Cond. (μmohs/cm) Sal. (ppt) pH_	
DO (mg/L) DO (%) Turbidity (NTU)	
Dominant Watershed Land Use: Forest	
Commercial Industrial Other	
Canopy Cover: Poor (<30%,89-100%) \( \sqrt{\text{Moderate (30-50%)}} \) Good (51-88%)	
Local Watershed Erosion: None Light Moderate_X Heavy	_
Sediment Deposition: Poor Moderate X Good	
Habitat Availability: Poor Moderate Good X	
Habitat Smothering: Poor ModerateX Good	
Channel Alteration (Artificial Channelization): Poor Moderate_	
Channel Sinuosity: Poor ModerateX Good	
Bank Stability: Poor Moderate 😕 Good	
Bank Veg. Protection: Poor Moderate_X Good	
Macroinvertebrates Present: Yes Y No	
Circle Identified Taxa (refer to attached ID guide)	
Pollution Sensitive Mod. Pollution Sensitive Pollution Tolera	ant
Water Penny Caddisfly Midge Larva	e
Stonefly Damselfly Midge Pupae	
Mayfly Dragonfly Black Fly	
Riffle Beetle	
Dobson fly Rat-tailed Magg	ţot
Notes:	

Station Name/Number_JB2-	Date 4/21/19 1125
Field Personnel J. D'Weal	Weather Sunny - 750F
Riparian Zone Width: Poor (0-9	m) Moderate (9-18m) Good (>18m)
Riparian Veg. Quality: Poor (0-2	5% Native) Moderate (25-75% Native) X Good (>75% Native)
Water Quality: Water Temp (°C	Cond (umoha/am)
	O (%) Turbidity (NTU)
	Forest X Field/Pasture Agriculture Residential
Canopy Cover: Poor (<30%,89-1	ommercial         Industrial         Other           00%         Good (51-88%)         ×
Local Watershed Erosion: None	Good (51-88%) ×
	Light Moderatex Heavy
-	or ModerateX Good
	or Moderate X Good
<u> </u>	or Moderate× Good
	nnelization): Poor Moderate Good_ ~
Channel Sinuosity: Poor	
	ModerateX Good
Bank Veg. Protection: Poor	Moderate X Good
Macroinvertebrates Present: Yes	X No
Circle Identified Taxa (refer to atta	ched ID guide)
Pollution Sensitive	Mod. Pollution Sensitive Pollution Tolerant
Water Penny	Coddistry
Stonefly	Damsalfly
Mayfly	Whuge Pupae
Riffle Beetle	Dragonfly Black Fly
	Amphipods Rat-tailed Maggot
Dobson fly	

Station Name/Number JB 2 - Restoration Date 4/23/19 1205	
Field Personnel 5. O'NCLL Weather Sanny 780F	
Riparian Zone Width: Poor (0-9m) × Moderate (9-18m) Good (>18m)	
Riparian Veg. Quality: Poor (0-25% Native) Moderate (25-75% Native) Good (>75% Native)	
Water Quality: Water Temp (°C) Cond (umobs/om)	
DO (mg/L) DO (%) Turbidity (NTU)	
Dominant Watershed Land Use: Forest X Field/Pasture Agriculture Residential	
Commercial Industrial Other	
Canopy Cover: Poor (<30%,89-100%) X Moderate (30-50%) Good (51-88%)	
Local Watershed Erosion: NoneLightModerate Heavy	_
Sediment Deposition: Poor ModerateX Good	
Habitat Availability: Poor Moderate_ × Good	
Habitat Smothering: Poor ModerateX Good	
Channel Alteration (Artificial Channelization): Poor X Moderate Good	
Channel Sinuosity: Poor X Moderate Good Good	
Bank Stability: Poor Moderate GoodX	
Bank Veg. Protection: Poor Moderate_ X Good	
Macroinvertebrates Present: YesX No	
Circle Identified Taxa (refer to attached ID guide)	
Pollution Sensitive Mod. Pollution Sensitive Pollution Toler	ant
Water Penny  Caddisfly  Midge Larva	
Stonefly	
Mayfly Dragonfly	,
Riffle Beetle Amphipods	
Dobson fly Rat-tailed Mag	got
Dtes:	

Station Name/Number JA - Second State 4/23/19 1345	
Field Personnel J. O'Neel Weather Sunny 8000	
Riparian Zone Width: Poor (0-9m) Moderate (9-18m) Good (>18m)	
Riparian Veg. Quality: Poor (0-25% Native) Moderate (25-75% Native) Cood (>75% Native)	`
Water Quality: Water Temp (°C) Cond. (µmohs/cm) Sal. (ppt) pH_	<u>'</u>
DO (mg/L) DO (%) Turbidity (NTU)	
Dominant Watershed Land Use: Forest X Field/Pasture Agriculture Residential	
Commercial Industrial Other	
Canopy Cover: Poor (<30%,89-100%) Moderate (30-50%) Good (51-88%)_ ×	
Local Watershed Erosion: None Light Moderate X Heavy	
Sediment Deposition: Poor X Moderate Good Good	
Habitat Availability: Poor X Moderate Good Good	
Habitat Smothering: Poor X Moderate Smood Good	
Channel Alteration (Artificial Channelization): Poor ModerateX Good	
Channel Sinuosity: Poor X Moderate Good Book	
Bank Stability: Poor ModerateX Good	
Bank Veg. Protection: Poor Moderate X Good	
Macroinvertebrates Present: Yes No	
Circle Identified Taxa (refer to attached ID guide)	
Pollution Sensitive Mod. Pollution Sensitive Pollution Tolera	int
Water Penny Caddisfly Midge Larvae	
Stonefly Damselfly Midge Pupae	
Mayfly  Dragonfly  Black Fly	
Riffle Beetle Amphipode	
Dobson fly Rat-tailed Magg	ot
otes:	

Station Name/Number	1-2- upstream Date 4/24/19 1050-1105
Field Personnel J. D.N	Weather overcast 700 F
Riparian Zone Width: Poor	(0-9m) Moderate (9-18m) Good (>18m) X
	r (0-25% Native) Moderate (25-75% Native) X Good (>75% Native)
Water Quality: Water Tem	np (°C) Cond. (μmohs/cm) Sal. (ppt) pH
	DO (%) Turbidity (NTU)
	Use: Forest Field/Pasture Agriculture Residential
	Commercial Industrial Other
Canopy Cover: Poor (<30%)	6,89-100%) Moderate (30-50%) Good (51-88%)×
	one Light Moderate
Sediment Deposition:	Poor X Moderate Good
Habitat Availability:	Poor Moderate Good
Habitat Smothering:	PoorX Moderate Good
Channel Alteration (Artificial	l Channelization): Poor Moderate_ 🕳 Good 🔀
	Moderate X Good
	Moderate X Good
Bank Veg. Protection: Poor	Moderate X Good
Aacroinvertebrates Present:	YesNo
Circle Identified Taxa (refer to	o attached ID guide)
Pollution Sensitive	Mod. Pollution Sensitive Pollution Tolerant
Water Penny	Caddisfly Midge Larvae
Stonefly	Damselfly Midge Pupae
Mayfly	Dragonfly Black Fly
Riffle Beetle	Amphipods Rat-tailed Maggot
	1

Station Name/Number 54-2- Responden Date 4/24/19 1115-
Field Personnel J.o. Weather Overast 700F
Riparian Zone Width: Poor (0-9m) X Moderate (9-18m) Good (>18m)
Riparian Veg. Quality: Poor (0-25% Native) Moderate (25-75% Native) Good (>75% Native)
Water Quality: Water Temp (°C) Cond. (μmohs/cm) Sal. (ppt) pH
DO (mg/L) DO (%) Turbidity (NTU)
Dominant Watershed Land Use: Forest Field/Pasture Agriculture Residential
Commercial Industrial X Other Powerline Complex
Canopy Cover: Poor (<30%,89-100%) X Moderate (30-50%) Good (51-88%)
Local Watershed Erosion: None Light Moderate  Heavy
Sediment Deposition: Poor Moderate Good
Habitat Availability: Poor ModerateX Good
Habitat Smothering: Poor ModerateX Good
Channel Alteration (Artificial Channelization): Poor Moderate Good
Channel Sinuosity: Poor Moderate_X Good
Bank Stability: Poor ModerateX Good
Bank Veg. Protection: Poor ModerateX Good
Macroinvertebrates Present: Yes No
Circle Identified Taxa (refer to attached ID guide)
Pollution Sensitive Mod. Pollution Sensitive Pollution Tolerant
Water Penny Caddisfly Midge Larvae
Stonefly Damselfly Midge Pupae
Mayfly Dragonfly Black Fly
Riffle Beetle
Dobson fly Rat-tailed Maggot
intes:

Station Name/Number Jy-Downstean Date 4/24/19 1250	
Field Personnel Jo / HH / BK Weather Overcast 75	
Riparian Zone Width: Poor (0-9m) Moderate (9-18m) Goo	
Riparian Veg. Quality: Poor (0-25% Native) Moderate (25-75% Native) C	Good (>75% Native)
Water Quality: Water Temp (°C) Cond. (μmohs/cm) Sal. (ppt)	pH
DO (mg/L) DO (%) Turbidity (NTU)	
Dominant Watershed Land Use: Forest X Field/Pasture Agriculture	
Commercial Industrial Other	
Canopy Cover: Poor (<30%,89-100%) Moderate (30-50%) Good	(F1 000())
Local Watershed Erosion: None Light Moderate Heav	vy
Sediment Deposition: Poor X Moderate Good Good	
Habitat Availability: Poor Moderate Good	OF - 30
Habitat Smothering: Poor Moderate Good	
Channel Alteration (Artificial Channelization).	ood
Channel Sinuosity: Poor Moderate X Good	
Bank Stability: Poor X Moderate Good Good	
Bank Veg. Protection: Poor X Moderate Good Good	
Macroinvertebrates Present: Yes No	
Circle Identified Taxa (refer to attached ID guide)	
Pollution Sensitive Mod. Pollution Sensitive	Dollard's T. I.
Water Penny Caddisfly	Pollution Tolerant
Stonester	Midge Larvae
Stonefly  Damselfly	Midge Pupae
Mayfly Dragonfly	Black Fly
Riffle Beetle Amphipods	Rat-tailed Maggot
Dobson fly	00-
and the state of t	

Station Name/Number 10	2-Tab	Date_ 4.	124/19 140	0
Field Personnel 50/HH	1 AK	Weather	overest:	784
Riparian Zone Width: Poor (				Good (>18m)
Riparian Veg. Quality: Poor	(0-25% Native)			
				pH
DO (mg/L)	DO (%)	Turbidity	(NTU)	
Dominant Watershed Land Us				
Canopy Cover: Poor (<30%,8	9-100%)	<b>∠ Moderate (30-50%</b>	) Go	od (51-88%)
Local Watershed Erosion: No				
Sediment Deposition:		Moderate		
Habitat Availability:		Moderate		
Habitat Smothering:		Moderate		
Channel Alteration (Artificial (	Channelization)	): Poor Mod		
Channel Sinuosity: Poor				£
Bank Stability: Poor	✓ Mod			
Bank Veg. Protection: Poor_		oderate Good	ii	
Macroinvertebrates Present:	YesX	No		
Circle Identified Taxa (refer to a	ittached ID gui	(de)		
Pollution Sensitive		Mod. Pollution Sensitive		Pollution Tolerant
Water Penny		Caddisfly		Midge Larvae
Stonefly		Damselfly		Midge Pupae
Mayfly		Dragonfly		1999 - A. N. 1995
Riffle Beetle		Amphipods		Black Fly
Dobson fly	L	Kurhado		Rat-tailed Maggot
-		8		
lotes:				

Station Name/Number TCF2 Up Date 4/24/19 1425	
Field Personnel JO/HH/DK Weather Surveyed 785	
Riparian Zone Width: Poor (0-9m) Moderate (9-18m) Good (>18m)	
Riparian Veg. Quality: Poor (0-25% Native) Moderate (25-75% Native) Good (>75% Native)_	
Water Quality: Water Temp (°C) Cond. (μmohs/cm) Sal. (ppt) pH	
DO (mg/L) DO (%) Turbidity (NTU)	
Dominant Watershed Land Use: Forest X Field/Pasture Agriculture Residential	
Commercial Industrial Other	- 1
Canopy Cover: Poor (<30%,89-100%) Moderate (30-50%) Good (51-88%) &	
Local Watershed Erosion: None Light Moderate_ X Heavy	
Sediment Deposition: Poor Moderate_X Good	
Habitat Availability: Poor Moderate_X Good	
Habitat Smothering: Poor Moderate_ X Good	
Channel Alteration (Artificial Channelization): Poor Moderate Good	
Channel Sinuosity: Poor Moderate X Good	
Bank Stability: Poor ModerateX Good	
Bank Veg. Protection: Poor ModerateX Good	
Macroinvertebrates Present: Yes No No (common)	
Circle Identified Taxa (refer to attached ID guide)	
Pollution Sensitive Mod. Pollution Sensitive Pollution Toleran	
Water Penny  Caddisfly  Midge Larvae	
Stonefly	
Mayfly Drogonfly	
Riffle Rootle	
Dobson fly  Amphipods  Rat-tailed Maggot	
The same of the sa	
otes: Interestry full - out R	

# D'Olive Creek Watershed Data Sheet

Station Name/Number TCI The	Storostron Date 1/21	19 1950
Field Personnel Jo/HH / D &	Weather Sw	my 800F
	X Moderate (9-18m)	
Riparian Veg. Quality: Poor (0-25%	% Native) Moderate (25-75% Na	ntive) Good (>75% Native)
Water Quality: Water Temp (°C)_	Cond. (µmohs/cm)	Sal. (ppt) pH
DO (mg/L) DO	(%)Turbidity (NTU	J)
Dominant Watershed Land Use: 1	Forest_X Field/Pasture Ag	griculture Residential
Com	nmercialOt	her
	%)X	
Local Watershed Erosion: None	Light Moderate	上 Heavy
Sediment Deposition: Poor	Moderate_X G	pod
Habitat Availability: Poor	Moderate X G	ood
Habitat Smothering: Poor	Moderate X Go	ood
Channel Alteration (Artificial Chann	nelization): Poor Moderate	Good
	ModerateXGood	
Bank Stability: Poor	Moderate GoodX	
Bank Veg. Protection: Poor	ModerateX Good	<del></del>
Macroinvertebrates Present: Yes_	X No (com	nen
Circle Identified Taxa (refer to attach	ed ID guide)	
Pollution Sensitive	Mod. Pollution Sensitive	Pollution Tolerant
Water Penny	Caddisfly	Midge Larvae
Stonefly	Damselfly	Midge Pupae
Mayfly	Dragonfly	Black Fly
Riffle Beetle	Amphipods	
Dobson fly	Purpout	Rat-tailed Maggot
,	ő.	
Notes: Crawfish, Sam	e fish present	

# ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION

Name of Waterbody Station Number

DA3-UD

GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET

I owner 117/9 0930

		Investigators	IONUL	
Habitat		THE RESERVE TO BE	stagory	
Parameter	Optimal	Suboptimal	Marginal	Poor
1 Instream Cover	> 50% mix of snags, submerged logs, undercut banks, or other stable habitat, rubble, gravel may be present.		30-10% mix of stable habitat; habitat availability less than desirable.	<10% stable habitat; lack of habitat is obvious.
core T	20 18 18 17 16	15 14 13 412 11		- 50 A4 - 5 - 10 - 10 - 1
Pool Substrate Characterization	submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or day or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
3 Pool Variability	Even mix of large-shallow, large- deep, small-shallow, small-deep	Majority of pools large-deep; very few shallow.		Majority of pools small-shallow pools absent
onna 16	pools present.			
core 10	14201 THE 98 1 17 16 2	15 14 18 12 10	20 9 8 7 6	6 4 3 9 4
4 Channel Alteration	No Channelization or dradging present	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 years) may be present, but not recent.	New embankments present on both banks; channelization may be extensive, usually in urban or agriculture lands; and > 80% of stream reach is channelized and disrupted.	Extensive channelization; banks shored with gabion or cement; heavily urbanized areas; instream habitat greatly altered or removed entirely.
core 17	20 19 18 17 16	15 14 13 12 111		
5 Sediment Deposition	<20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of islands or point bars.	20-50% affected; moderate accumulation; substantial	50-80% affected; major deposition; pools shallow, heavily sited; embankments may be present on both banks; frequent and substantial sediment movement during storm events.	Channelized; mud, sill, and/or sand in braided or non-braided channels; pools almost absent due to deposition.
core 11	20 19 18 17 16			
wie -	Bends in stream increase stream	Bends in stream increase stream	6 - 10 - 9 - 8 - 7 - 6 - 1	5 4 3 2 1
6 Channel Sinuosity	length 3 to 4 times longer than if it was in a straight line.	length 2 to 3 times longer than if it was in a straight line.	Bends in stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight, waterway has been channelized for a long distance.
core 13	120 18 18 17 16 1	15-17-13-12-17	30 - 3 - 8 - 7 - 6 -	1 5-1 AT 3 2 11 AT 1
7 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.	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
ore o	20 19 18 17 16	15 14 13 12 11	10 1 8 18 16 7 16	5 4 3 2 150
S Condition of Banks	Banks stable; no evidence of erosion or bank failure; <5% affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% affected.	Moderately unstable; 30-60% of banks in reach have areas of erosion.	Unstable; many eroded areas; "raw" areas frequent along straight section and bends; on side slopes, 60-100% of bank has erosional scars.
	20 1 19 18 17 18	15 4 13 12 11	10 9 8 77 6	15 M NG 12 17 17 16
Bank Vegetative Protection (each bank)	> 90% of the stream bank surfaces covered by vegetation.	90-70% of the streambank surfaces covered by vegetation.	70-50% of the stream bank surfaces covered by vegetation.	<50% of the streambank surfaces covered by vegetation.
ore (LB)	10 - 2 9 - 0 - 8 3 - 1	· · · · · · · · · · · · · · · · · · ·	TO MILE STATE	and the property of the second
	Vocatative design	in the second se	5 5 5 5	中のようなはる。 1000年
Grazing or other disruptive pressure (each bank)	grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.	Disruption obvious; petches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.	Disruption of stream bank vegetation is very high; vegetation has been removed to ≤ 2 inches average stubble height.
199			194	
ine (LB)	10 19 8	5.0	5 4 5 3	
Riparian vegetative zone Width (each bank)	numan activities (i.e., parking	Width of riparian zone 60 - 40 feet, human activities have impacted zone only minimally.	Width of riparian zone 40 - 20 feet; human activities have impacted zone a great deal.	2,7 Set 1e,17 QBlow Width of ripanan zone <20 feet; little or no riparian vegetation due to human activities.
	10 9 8	71 1 10605	Carlo April 1023 Auros	
e (RB) 10 E	10 90 8		5 1 4 1 1 3	The same of the sa

Section 10.8.1 Revision No. 4 Date March 1, 1999 Page 1 of 1

### APPENDIX H-1

ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET

Name of Waterbody
Station Number

SLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET

Date: 4/17/19 / 000-

Station Number	_	Investigators	J. ONRal	
Habitat		· / Co	itegory	
Parameter	Optimal	Suboptimal	Marginal	Poor
1 Instream Cover	> 50% mix of snags, submerged logs, undercut banks, or other stable habitat; rubble, gravel may be present.	50-30% mix of stable habitat; adequate habitat for maintenance of populations.	30-10% mix of stable habitat; habitat availability less than desirable.	<10% stable habitat; lack of habitat is obvious.
Score / /	20 19 18 17 16	15 14 13 12 11	70 9 3 7 7	5 114 11 3 2
Pool Substrate Characterization	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.
icore	20 19 18 17 18	15 14 13 12 1	1 1 10 19 V 62 7 1V6 VI	5 4 3 3 6 6
3 Pool Variability	Even mix of large-shallow, large- deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
Score 112	20 18 18 16 15	15 of 18 12 13 to 12 1 11 1	10 19 138 77 8	15年10年12年15日 10
4 Channel Alteration	No Channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 years) may be present, but not recent.	New embankments present on both banks; channelization may be extensive, usually in urban or agriculture lands; and > 80% of stream reach is channelized and disrupted.	Extensive channelization; banks shored with gabion or coment; heavily urbanized areas; instream habitat greatly aftered or removed entirely.
core 10	20 19 18 18 17 16	45 14 13 2 11	10 10 9 8 1 7 F	16-4-3-2-1
5 Sediment Deposition	<20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of islands or point bars.	20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; some new increase in bar formation.	50-80% affected; major deposition; pools shallow, heavily sited; embankments may be present on both banks; frequent and substantial sediment movement during storm events.	Channelized; mud, silt, and/or sand in braided or non-braided channels; pools almost absent due to deposition.
core / i	20 19 18 17 18	15 44 69 49 44	9 8 7 6 7	
-	Bends in stream increase stream	Bends in stream increase stream	Bends in stream increase the	
6 Channel Sinuosity	length 3 to 4 times longer than if it was in a straight line.	length 2 to 3 times longer than if it was in a straight line.	stream length 2 to 1 times longer than if it was in a straight line.	Channel straight, waterway has been channelized for a long distance.
core / eroc	-20 = 39 = 5(8 = 17 = 15 = 1	15 14 13 12 11	10 9 8 7 6	5 4 4 13 dh 2 pr 315 13 0
	Water reaches base of both	Water fills >75% of the available	Water fills 25-75% of the	Very little water in channel and
7 Channel flow Status	lower banks and minimal amount of channel substrate is exposed.	channel.	available channel and/or riffle substrates are mostly exposed.	mostly present as standing pools.
core	20 19 18 17 16	15 14 13 12 11	10 9 8 1/ 6	
8 Condition of Banks	Banks stable; no evidence of erosion or bank failure; <5% affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% affected.	Moderately unstable; 30-60% of banks in reach have areas of erosion.	Unstable; many eroded areas; "raw" areas frequent along straight section and bends; on side slopes, 60-100% of bank has erosional scars.
core /7	20 19 18 17 16	15 15 13 17 17	9 8 7 8	45 4 3 2 M F 100
B1-1/	> 90% of the stream bank surfaces covered by vegetation.	90-70% of the streambank surfaces covered by vegetation.	70-50% of the stream bank surfaces covered by vegetation.	<50% of the streambank surfaces covered by vegetation.
	10. 3. 8	7-1-16-16-1-1	A TOTAL SAMESAN	II - THE TOTAL THE PARTY OF THE
	The 10 cm - Same Sent	THE RESERVE OF THE PROPERTY OF THE PARTY OF	3 3 1 3 1	1.11
Grazing or other disruptive pressure (each bank)	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.	Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.	Disruption of stream bank vegetation is very high; vegetation has been removed to ≤ 2 inches average stubble height.
ore (LB)	10 g 8	III 1955 S. MANAGE	1000 and 100	
	10 9 8	7 6		and the contract of the contra
Riparian vegetative zone Width (each	Width of riparian zone >60 feet; human activities (i.e., parking	Width of riparian zone 60 - 40 feet; human activities have impacted zone only minimally.	Width of riparian zone 40 - 20 feet; human activities have impacted zone a great deal.	Width of riparian zone <20 feet; little or no riparian vegetation due to human activities.
ore (LB)	9 8	AND THE PARTY OF T		
100	The second secon			THE PERSON NAMED IN COLUMN TWO IS NOT THE OWNER.

# ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET

Station Number		Investigators		4/17/19
Habber				
Habitat Parameter	Optimal	Suboptimal	Marginal	
1 Instream Cover	> 50% mix of snags, submerged logs, undercut banks, or other stable habitat, rubble, gravel may be present.	50-30% mix of stable habitat; adequate habitat for	30-10% mix of stable habitat; habitat availability less than desirable.	Poor <10% stable habitat; lack of habitat is obvious.
core >	20 19 18 17 196	150 14 2 13 11 121 - 11	(5) (5) (5) (5) (5) (5)	5 4V 3 2 m
Pool Substrate Characterization	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.
3 Pool Variability	Even mix of large-shallow, large- deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow poots much more prevalent than deep pools.	Majority of pools small-shallow pools absent.
core / I	20 19 18 17 16	15 % May 130 12 1 41	- 710 L 9 1 18 L 7 6 18	四种 经产品 人名英格兰
4 Channel Alteration	No Charmelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 years) may be present, but not recent.	New embankments present on both banks; channelization may be extensive, usually in urban or agriculture lands; and > 80% of stream reach is channelized and disrupted.	Extensive channelization; banks shored with gabion or cement; heavily urbanized areas; instream habitat greatly altered or removed entirely.
core 13	20 19 18 17 16	15 14 13 2 11	10 9 8 7 6	18+4-3-12+1-
5 Sediment Deposition	<20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of islands or point bars.	20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; some new increase in bar formation.	50-80% affected; major deposition; pools shallow, heavity silted; embankments may be present on both banks; frequent and substantial sediment movement during storm events.	Channelized; mud, silt, and/or sand in braided or non-braided channels; pools almost absent due to deposition.
core //	20 19 18 17 16	- Hard Sales and Hard V		
W16	Bends in stream increase stream	15 14 13 12 11 Bends in stream increase stream	Bends in stream increase the	5 4 8 7 2 112
6 Channel Sinuosity	length 3 to 4 times longer than if it was in a straight line.	length 2 to 3 times longer than if it was in a straight line.	stream length 2 to 1 times longer than if it was in a straight line.	Channel straight, waterway has been channelized for a long distance.
ore	Water reaches base of both	15 14 13 10 12 11 11	10 to 9 80 -7 -65m	5.4 4 3 72 4
7 Channel flow Status	lower banks and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel.	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
ore 10	1,20 -19 -18 12 -16		10 9 8 6	5 4 3 2
Condition of Banks	Banks stable; no evidence of erosion or bank failure; <5% affected.	Moderately stable; infrequent, small areas of erosion mostly healed over, 5-30% affected.	Moderately unstable; 30-60% of banks in reach have areas of erosion.	Unstable; many eroded areas; "raw" areas frequent along straight section and bends; on side slopes, 60-100% of bank has erosional scars.
ore	> 90% of the stream bank	15 14 13 12 11 11 19 10 10 11 11 11 11 11 11 11 11 11 11 11	10 9 8 7 6	
Bank Vegetative Protection (each bank)	surfaces covered by vegetation.	surfaces covered by vegetation.	70-50% of the stream bank surfaces covered by vegetation.	<50% of the streambank surfaces covered by vegetation.
ere (LB)	16) (4. 9) (18)	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	5 1 4 6 35 6	
Grazing or other disruptive pressure (each bank)	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.	Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.	Disruption of stream bank vegetation is very high vegetation has been removed to ≤ 2 inches average stubble height.
ire (LB) 10 I	1 10 9 1 8 1 18 1 1 1 1 1 1 1 1 1 1 1 1 1 1	The state of the s		
Riparian vegetative zone Width (each bank)		Width of ripatian zone 60 - 40 feet; human activities have impacted zone only minimally.	Width of riparian zone 40 - 20 feet; human activities have impacted zone a great deal.	Width of riparian zone <20 feet; little or no riparian vegetation due to human activities.

Section 10.8.1
Revision No. 4
Date March 1, 1999
Page 1 of 1

# ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET

Name of Waterbody Station Number Investigators

J. O.N.

Date: 4/17/19

		Investigator		
Habitat	Kirks as setting the	THE PROPERTY OF THE C	stego (	
Parameter	Optimal	Suboptimal	Marginal	Poor
1 Instream Cove	> 50% mix of snags, submerged logs, undercut banks, or other stable habitat; rubble, gravel may be present.	50-30% mix of stable habitat; adequate habitat for maintenance of populations.	30-10% mix of stable habitat; habitat availability less than desirable.	<10% stable habitat; lack of habitat is obvious.
Score	20 48 18 17 16	15 14 15 15	P 10 S 7 6	£ 4 3 2 5
Pool Substrate Characterization		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.
Score	16 20 18 1/7 16°	15 44 13 12 1	10 9 8 7 06	
3 Pool Variability	pools present.	Majority of pools large-deep; very few shallow.	prevalent than deep pools.	Majority of pools small-shallow pools absent.
ocola 11	No Channelization or dredging	15 114 13 12 11		TO STATE SHOW THE THE
4 Channel Alteration	present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 years) may be present, but not recent.	New embankments present on both banks; channelization may be extensive, usually in urban or agriculture lands; and > 80% of stream reach is channelized and disrupted.	Extensive charmelization; banks shored with gabion or cement; heavily urbanized areas; instream habitat greatly altered or removed entirely.
core IT	20 19 18 17 16	15 18 13 12 11	10 9 8 7 6	
5 Sediment Deposition	<20% of bottom affected; minor accumulation of fine and coarse material at snags and submarged vegetation; little or no enlargement of islands or point bars.	20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; some new increase in bar formation.	50-80% affected; major deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent and substantial sediment movement during storm events.	Channelized; mud, silt, and/or sand in braided or non-braided channels; pools almost absent due to deposition.
core	# 20 # 19 IF 18 # 17 16 T	15 14 13 12 11		
	Bends in stream increase stream	Bends in stream increase stream	Bends in stream increase the	
6 Channel Sinuosity	length 3 to 4 times longer than if it was in a straight line.	length 2 to 3 times longer than if it was in a straight line.	stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
core 1 0	20 19 18 17 16	115 114 1131 1121	90 8 8 7 6	3 4 4 3 2 3 3
7 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.	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
core 9	20 49 18 17 16	15 W 13 12 11	(0 9 8 7 8	5 4 3 2
8 Condition of Banks	Banks stable; no evidence of erosion or bank failure; <5% affected.	Moderately stable; infrequent, small areas of erosion mostly healed over, 5-30% affected.	Moderately unstable; 30-60% of banks in reach have areas of erosion.	Unstable; many eroded areas; "raw" areas frequent along straight section and bends; on side slopes, 60-100% of bank has erosional scars.
enoc	20 1 19 18 4 17 16			
			10 9 8 7 6	5 4 3 2
Bank Vegetative 9 Protection (each bank)	> 90% of the stream bank surfaces covered by vegetation.	90-70% of the streambank surfaces covered by vegetation.	70-50% of the stream bank surfaces covered by vegetation.	5. 4 3 2 0 50% of the streambank surfaces covered by vegetation.
9 Protection (each bank)	> 90% of the stream bank surfaces covered by vegetation.	90-70% of the streambank	70-50% of the stream bank	<50% of the streambank surfaces covered by vegetation.
9 Protection (each bank)	> 90% of the stream bank surfaces covered by vegetation.	90-70% of the streambank surfaces covered by vegetation.	70-50% of the stream bank surfaces covered by vegetation.	<50% of the streambank surfaces covered by vegetation.
9 Protection (each bank) ore (LB)	> 90% of the stream bank surfaces covered by vegetation.  Selection 38 38 39 40 40 40 40 40 40 40 40 40 40 40 40 40	90-70% of the streambank	70-50% of the stream bank surfaces covered by vegetation.	<50% of the streambank surfaces covered by vegetation.
9 Protection (each bank) ore (LB) Ore (RB)  Grazing or other disruptive pressure (each bank)	> 90% of the stream bank surfaces covered by vegetation.  10 9 8 Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	90-70% of the streambank surfaces covered by vegetation.  Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.	70-50% of the stream bank surfaces covered by vegetation.  5 4 3 3 5 5 5 6 4 5 5 6 6 6 6 6 6 6 6 6 6 6 6 6	<50% of the streambank surfaces covered by vegetation. □ 10
9 Protection (each bank) core (LB) L\ Grazing or other disruptive pressure (each bank)	> 90% of the stream bank surfaces covered by vegetation.  10 18 8  Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	90-70% of the streambank surfaces covered by vegetation.  Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.	70-50% of the stream bank surfaces covered by vegetation.  5	<50% of the streambank surfaces covered by vegetation. Disruption of stream bank vegetation is very high; vegetation has been removed to ≤ 2 inches average stubble height.
9 Protection (each bank) core (LB)	> 90% of the stream bank surfaces covered by vegetation.  10 9 8 Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.  10 9 8 Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.  10 9 8 Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	90-70% of the streambank surfaces covered by vegetation.  Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.	70-50% of the stream bank surfaces covered by vegetation.  5 5 6 7 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	<50% of the streambank surfaces covered by vegetation. 10 11 12 2 3 10 11 11 12 13 14 16 17 18 19 19 19 10 10 10 10 11 11 12 12 12 13 14 16 16 17 17 18 19 19 19 19 19 10 10 10 10 10 11 11 12 12 12 12 13 14 15 16 17 17 18 19 19 19 19 19 19 19 19 19 19 19 19 19 19 10
9 Protection (each bank) ore (LB) Grazing or other disruptive pressure (each bank) ore (LB) Riparian vegetative zone Width (each	> 90% of the stream bank surfaces covered by vegetation.  10	90-70% of the streambank surfaces covered by vegetation.  Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.  7. 16  7. 16  7. 16  7. 16  7. 16  7. 16  7. 16  7. 16  7. 17  7. 16  7. 16  7. 17  7. 16  7. 17  7. 16  7. 17  7. 16  7. 17  7. 18	70-50% of the stream bank surfaces covered by vegetation.  Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Width of riparian zone 40 - 20 feet; human activities have	<50% of the streambank surfaces covered by vegetation. 10 In the stream bank vegetation is very high; vegetation has been removed to < 2 inches average stubble height. 2 10 Width of riparan zone <20 (eet; little or no riparian vegetation due to human activities.

# ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET

Name of Waterbody Station Number

1 of 1

Page

Investigators J. O'Newl

Habitat Parameter		and the second	ntegory	
rarameter	Optimal	Suboptimal	Marginal	Poor
1 Instream Cover	be present.		30-10% mix of stable habitat; habitat availability less than desirable.	<10% stable habitat; lack of habitat is obvious.
Score	20 49 48 17 16		10 10 19 10 7	* ** *** *** *** *** *** *** *** *** *
Pool Substrate Characterization	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.
Score	20 19 18 17 16	Company of the Compan	10 9 118 7 16	5 4 4 3 2 4 3
3 Pool Variability	Even mix of large-shallow, large- deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow of pools absent.
COTE	No Channelization or dredging		The property of the state of th	型的性格。
4 Channel Alteration	present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 years) may be present, but not recent.	New embankments present on both banks; channelization may be extensive, usually in urban or agriculture lands; and > 80% of stream reach is channelized and disrupted.	Extensive channelization; banks shored with gabion or cement; heavily urbanized areas; instream habitat greatly altered or removed entirely.
core	20 - 19 - 18 - 17 - 16	5 15 1214 13 122 111	10 9 8 7,176	Will the state of
5 Sediment Deposition	<20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no entargement of islands or point bars.	20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; some new increase in bar formation.	50-80% affected; major deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent and substantial sediment movement during storm events.	Channelized mud, silt, and/or sand in braided or non-braided channels; pools almost absent due to deposition.
core	20 19 18 17 16	15 136 12 22 10	s r(0 9 3 7 7 6 -	
	Bends in stream increase stream	Bends in stream increase stream	Bends in stream increase the	5 4 3 2 1
6 Channel Sinuosity	length 3 to 4 times longer than if it was in a straight line.	length 2 to 3 times longer than if it was in a straight line.	stream length 2 to 1 times longer than if it was in a straight line.	Channel straight, waterway has been channelized for a long distance.
core 7	20 15 16 16 18 167		3 8 7 6	-5 -4 -4 -3 - 2 - 4 - 4 - 1
7 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.	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
core	120 19 18 17 16	15 15 15 12 11	10 8 8 7 8	n Simulating 3 - 22 Help + C
8 Condition of Banks	Banks stable; no evidence of erosion or bank failure; <5% affected.	Moderately stable; infrequent, small areas of erosion mostly healed over, 5-30% affected.	Moderately unstable; 30-60% of banks in reach have areas of erosion.	Unstable; many eroded areas; "raw" areas frequent along straight section and bends; on side slopes, 60-100% of bank has erosional scars.
ore	20 19 18 17 716	15 14 13 12 15	\$1000 B # 30	5 4 6 3 124 19 10
Bank Vegetative 9 Protection (each bank)	> 90% of the stream bank surfaces covered by vegetation.	90-70% of the streambank surfaces covered by vegetation.	70-50% of the stream bank surfaces covered by vegetation.	<50% of the streambank surfaces covered by vegetation.
ore (FR)	8 4 10	1 17 San 17 6 AND 1		
	10	CANADA CONTRACTOR	- 5 - 4.4 - 32 Fm	# mm. (2 4 - 4 0
Grazing or other disruptive	grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.	Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.	Disruption of stream bank vegetation is very high; vegetation has been removed to ≤ 2 inches average stubble height.
ore (LB)	10 - 18 - 18	69	The second second	
	10 9 8		10 (5 1 1 4 1 13 1 15 1 15 1 15 1 15 1 15 1	
Riparian vegetative zone Width (each	Width of riparian zone >60 feet; human activities (i.e., parking	Width of ripanian zone 60 - 40 feet; human activities have impacted zone only minimally.	Width of riparian zone 40 - 20 feet; human activities have impacted zone a great deal.	Width of riparian zone <20 feet; little or no riparian vegetation due to human activities.
10 10 10 mm		2		
te (LB)	が 10 一世 10 中世 8 中世 8 中世 1 日 中 1 日 1 日 1 日 1 日 1 日 1 日 1 日 1 日 1		and the state of t	CHARLES TO SECTION OF THE PARTY

# APPENDIX H-1

# ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET [Ca. L. La Callerania Control of the C

Station Number		Investigators		4/17/19
Habitat	是有一种。 第二章	THE TRADE SEARCE GAING CO	deponds and the second	
Parameter	Optimal	Suboptimal	Marginal	Poor
1 Instream Cover	> 50% mix of snags, submerged logs, undercut banks, or other stable habitat; rubble, gravel may be present.	50-30% mix of stable habitat; adequate habitat for maintenance of populations.	30-10% mix of stable habitat; habitat availability less than desirable.	<10% stable habitat; lack of habitat is obvious.
Score 16	20 19 18 17 16	15 14 13 12 14	THE TO THE STATE OF THE	5 4 3 2 1
Pool Substrate Characterization	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.
3 Pool Variability	Even mix of large-shallow, large- deep, small-shallow, small-deep pools present.	15 44 13 12 11 Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow pools absent.
core //	20 19 18 17 16	A 15 14 1 18 1 12 11	1 10 2 1 1 8 1 7 8 1	
4 Channel Alteration	No Channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 years) may be present, but not recent.	New embankments present on both banks; channelization may be extensive, usually in urban or agriculture lands; and > 80% of stream reach is channelized and disrupted.	Extensive channelization; banks shored with gabion or cement, heavily urbanized areas; instream habitat greatly altered or removed entirely.
Score 1	20 19 18 17 16	13 2 15	9 8 7 6	- 4 m - 3 - 72 - 1 - 1
5 Sediment Deposition	<20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of islands or point bars.	20-50% affected; moderate accumulation; substantial	50-80% affected; major deposition; pools shallow, heavily sited; embankments may be present on both banks; frequent and substantial sediment movement during storm events.	Channelized; mud, silt, and/or sand in braided or non-braided channels; pools almost absent due to deposition.
core	20 19 18 17 116	1514131211	7 P P P P P P P P P P P P P P P P P P P	5-4-3-12
6 Channel Sinuosity	Bends in stream increase stream length 3 to 4 times longer than if it was in a straight line.	Bends in stream increase stream length 2 to 3 times longer than if it was in a straight line.	Bends in stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight, waterway has been channelized for a long distance.
core		15 14 13 12 11	-1 30 m/9 8 mil 7 #84s	*(5) - mar in *3 it , 2 in a march
7 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.	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
ore	18 17 16	15 14 (3 (12 .11)	10 19 8 7 6	STUDENT OF 2
8 Condition of Banks	Banks stable; no evidence of erosion or bank failure; <5% affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% affected.	Moderately unstable; 30-60% of banks in reach have areas of erosion.	Unstable; many eroded areas; "raw" areas frequent along straight section and bends; on side slopes, 60-100% of bank has erosional scars.
ore 12	20 79 18 17 16	115 1 141 1 13 12 131	<b>第10 5 9 38 45 6</b>	5 4 1 1 5 5 1 2 4 1
Bank Vegetative Protection (each bank)	> 90% of the stream bank surfaces covered by vegetation.	90-70% of the streambank surfaces covered by vegetation.	70-50% of the stream bank surfaces covered by vegetation.	<50% of the streambank surfaces covered by vegetation.
ore (LB)	10-14 3 11-18	THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NAM		1 1 2 2
ore (RB)	Vanishing and Same 18 to 18	Contract Contract	15 11 11 11	Things to be the House
Grazing or other disruptive pressure (each bank)	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.	Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.	Disruption of stream bank vegetation is very high; vegetation has been removed to ≤ 2 inches average stubble height.
m // D) 5				
The state of the s	10 5 8			2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
JE (RD) J II	Width of riparian zone >60 feet;	Width of riparian zone 60 - 40	Width of riparian zone 40 - 20	Width of riparian zone <20 feet

# ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET

ation Number		Investigators		4/23/19
12.100.1	Control of the contro			
Habitat Parameter		The state of the same of the s		West to the terminal
i didilicisi	Optimal	Suboptimal	Margina/	Poor
1 Instream Cover	> 50% mix of snags, submerged logs, undercut banks, or other stable habitat; rubble, gravel may be present.	50-30% mix of stable habitat; adequate habitat for maintenance of populations.	30-10% mix of stable habitat; habitat availability less than desirable.	<10% stable habitat; lack of habitat is obvious.
ore //	20 10 18 17 16	15 14 8 12 6	16 - S - S - S - T - S - S	5 4 3 2 4
Pool Substrate Characterization	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.
Pool Variability	Even mix of large-shallow, large- deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow pools absent.
ore /	20 19 15 17 16:	Manufacture of the Control of the Co		
Channel Alteration	No Channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 years) may be present, but not recent.	New embankments present on both banks; charmelization may be extensive, usually in urban or agriculture lands; and > 80% of stream reach is channelized and disrupted.	Extensive channelization; bank shored with gabion or cement; heavily urbanized areas; instream habitat greatly altered or removed entirely.
re 1/4	20 19 18 17 16	15 14 13 2 11	10 10 19 HH 8 17 1 6 HH	
Sediment Deposition	<20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of islands or point bars.	20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; some new increase in bar formation.	50-80% affected; major deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent and substantial sediment movement during storm events.	Channelized; mud, silt, and/or sand in braided or non-braided channels; pools almost absent due to deposition.
_ 11 +				
re //	Bends in stream increase stream			5 4 3 2 1
Channel Sinuosity	length 3 to 4 times longer than if it was in a straight line.	Bends in stream increase stream length 2 to 3 times longer than if it was in a straight line.	Bends in stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight, waterway has been channelized for a long distance.
e /U	20" 19 18 17 16	15 4 14 13 12 12	8717 - 62	5 - 2 - 3 - 2 - 1 -
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.	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 poo
e 10	120 18 18 17 16 1	15 14 13 12 71	10 10 10	
Condition of Banks	Banks stable; no evidence of erosion or bank failure; <5% affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% affected.	Moderately unstable; 30-50% of banks in reach have areas of erosion.	Unstable, many eroded areas; "raw" areas frequent along straight section and bends; on side slopes, 60-100% of bank has erosional scars.
- 11	20 19 18 17 18	15 14 13 12 12 11	#10 T 9 8 T 6	SH-30" 3-1-10-1-1-1-1
Book Vanadativa	> 90% of the stream bank surfaces covered by vegetation.	90-70% of the streambank surfaces covered by vegetation.	70-50% of the stream bank surfaces covered by vegetation.	<50% of the streambank surfaces covered by vegetation.
100	10. 10. 15. 30 点面的图片。	Lend 7 Let 1 State 61 To pre-	- 5 A LE 40 TO	
(RB) 5	10 9H to 8HH	· · · · · · · · · · · · · · · · · · ·	15. 4 Marin 3 4 Marin 1	三年十二年十二年
Grazing or other disruptive	grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.	Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.	Disruption of stream bank vegetation is very high; vegetation has been removed to ≤ 2 inches average stubble height.
(LB) 10	9 8			
(RB) 10	10 - 9 3		16 5 4 3 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
Riparian vegetative zone Width (each	Width of riparian zone >60 feet; numan activities (i.e., parking	Width of riparian zone 60 - 40 feet, human activities have impacted zone only minimally.	Width of ripanen zone 40 - 20 feet, human activities have impacted zone a great deal.	Width of riparian zone <00 feet; little or no riparian vegetation du to human activities.

# ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET

Name of Waterbody Station Number Date: 4123/19

Pool Substrate Characterization prevents not made and prevents on the properties of			_ Investigators		
Parameter    Parameter			u The Co	degary T. I.	
Finishment Crows   South Mark Committed   South Committed   Sout	Parameter	Optimal			Poor
Pool Substrate Characterization Frequency of the service of past characterization Frequency of the service of t		logs, undercut banks, or other stable habitat; rubble, gravel may be present.	adequate habitat for maintenance of populations.	30-10% mix of stable habitat; habitat availability less than desirable.	<10% stable habitat; lack of habitat is obvious.
Pool Substrate Characterization Characte	score		15 4 13 12 11	11 10 11 18 11 17 18 11	THE COLUMN TWO IS A STREET
Pool Variability  A Channel Alteration  No Channelsation of decision of decision of the second control of the	Characterization	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	All mud or clay or sand bottom; little or no root mat; no	Hard-pan clay or bedrock; no
Pool Variability of pools large-deep; very fees shallow, largery deep, small-shallow, snall-deep, pools present.    Channel Afferdion	icore (	19 - 19 - 18 WHT - 18	15 6 6 10 12 17	10 179 8 7	
Channel flow Status  Channel f	7.1	deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	prevalent than deep pools.	Majority of pools small-shallow or
Channel Alteration  Deposition  Deposition  Channel Sinuscity  Channel	core				5 T T T T T T T T T T T T T T T T T T T
Sediment Deposition  12  6 Channel flow Status  7 Channel flow Status  8 Condition of Banks stole; no evidence of Banks  90 19 18 17 16 15 14 18 12 11 10 10 2 10 10 10 10 10 10 10 10 10 10 10 10 10	4 Alteration	present.	usually in areas of bridge abutments; evidence of past channelization (>20 years) may	both banks; channelization may be extensive, usually in urban or agriculture lands; and > 80% of stream reach is channelized and	heavily urbanized areas; instream habitat greatly altered
Sediment Deposition or disearch control and sediment accumulation of fine and coarse accumulation of the accumulation of	core	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 + 4 - 3 - 2 - 4 - 0
Bank Vegetative Protection (each bank)  Bank Vegetative Prosection (each bank)  Grazing or other distriptive pressure (each bank)  Grazing or other distriptive distr	5 Sediment Deposition	<20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of islands or point	20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; some new	50-80% affected; major deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent and substantial sediment	Channelized; mud, silt, and/or sand in braided or non-braided channels; pools almost absent
Bends in stream increase stream length 3 to 4 times longer than if it was in a straight line.    10   10   10   10   10   10   10   1	core 12	20 19 18 17 18	45" (K) W2 - 12" (V)		The Substitute to the state of the state of
Channel flow Status  Channel flow Status  Condition of Banks  ailure; <5% affected.  Condition of Banks  Condition of Banks failure; <5% affected.  Condition of Banks failure; <5% affecte	6 1	Bends in stream increase stream length 3 to 4 times longer than if	Bends in stream increase stream length 2 to 3 times longer than if	Bends in stream increase the stream length 2 to 1 times longer	Channel straight; waterway has been channelized for a long
Channel flow Status  Channel flow Status  Channel flow Status  Condition of Banks  I 1	10				
Thannel flow Status  Thannel flow Status  Thannel substrate is exposed.  Thannel substrates are mostly exposed.  Thannel substr	9100				5 4 4 3 5 2 2 1 5 1
Banks stable; no evidence of erosion or bank failure; <5% affected.    Banks stable; no evidence of erosion or bank failure; <5% affected.   Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% affected.   Banks in reach have areas of arosion.   Moderately unstable; 30-60% of banks in reach have areas of arosion.   Unstable; many eroded areas; "raw" areas frequent along straight section and bends; on side slopes, 60-100% of bank has erosional scars.	Status	lower banks and minimal amount of channel substrate is exposed.		available channel and/or riffle	Very little water in channel and mostly present as standing pools.
arcsion or bank failure; <5% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion.  Small areas of erosion.  Small areas of erosion.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion mostly healed over; 5-30% affected.  Small areas of erosion.  Small areas of erosion mostly healed.  Small areas of erosion mostly healed.  Small areas of erosion.  Small areas of erosion mostly healed.  Small areas of erosion mostly healed.  Small areas of erosion.  Small areas of erosion mostly healed.  Small areas of erosion.  Small areas of erosion.  Small areas of erosion mostly healed.  Small areas of erosion mos	core			10 8 8 8 8 6	154 44 3 2 12 14 1
Bank Vegetative 9 Protection (each bank) one (LB)  Grazing or other disruptive pressure (each bank)  ore (LB)  Ore (RB)  Ore (RB)  Riparian vegetative zone Width of nparian zone >60 feet; human activities (i.e., parking lots, roacheds, clearcufs, lawns, or crops) have not impacted zone.  > 90% of the stream bank surfaces covered by vegetation.  90-70% of the stream bank surfaces covered by	8	erosion or bank failure; <5%	small areas of erosion mostly	banks in reach have areas of	Unstable; many eroded areas; "raw" areas frequent along straight section and bends; on side slopes, 60-100% of bank
Bank Vegetative Protection (each bank)  one (LB)  Grazing or other disruptive pressure (each bank)  one (LB)  Ore (RB)  Ore (RB)  Ore (RB)  Wegetative disruption, through pressure (each bank)  Ore (LB)  Ore (RB)  Wight of riparian zone ≥ 60 feet; human activities have impacted zone.  Width of riparian zone ≥ 20 feet; human activities have impacted zone only minimally.  Solve (RB)  Solve	ore 15	20 2 19 18 77 16	15 14 13 12 13	100 9 '8 T 16	9 5 446 2 2 11 112 114 12
Grazing or other disruptive pressure (each bank)  Ora (LB)  Riparian vegetative zone Width of riparian zone ≥60 faet; human activities have wind the feach bank)  Wight of riparian zone ≥60 faet; human activities have or crops) have not impacted zone only minimally.  Ora (LB)  Wight of riparian zone ≥60 faet; human activities have impacted zone only minimally.  Ora (LB)  Wight of riparian zone ≥60 faet; human activities have impacted zone only minimally.  Wight of riparian zone ≥60 faet; human activities have impacted zone a great deal.	Bank Vegetative Protection (each	> 90% of the stream bank	90-70% of the streambank	70-50% of the stream bank	<50% of the streambank
Grazing or other disruptive pressure (each bank)  Ora (LB)  Riparian vegetative zone Width of riparian zone ≥60 faet; human activities have wind the feach bank)  Wight of riparian zone ≥60 faet; human activities have or crops) have not impacted zone only minimally.  Ora (LB)  Wight of riparian zone ≥60 faet; human activities have impacted zone only minimally.  Ora (LB)  Wight of riparian zone ≥60 faet; human activities have impacted zone only minimally.  Wight of riparian zone ≥60 faet; human activities have impacted zone a great deal.	ore (LB)	10	NOT THE RESIDENCE OF TH	PHILIP CONTRACTOR OF THE PRINCIPLE OF TH	Will state of the
Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.   Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.					
Riparian vegetative zone Width of riparian zone >60 feet; human activities (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone only minimally.  Width of riparian zone 60 -40 feet; human activities have impacted zone only minimally.  Or crops) have not impacted zone only minimally.	Grazing or other disruptive pressure (each	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble	bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height	vegetation is very high; vegetation has been removed to ≤ 2 inches average stubble
Riparian vegetative zone Width (each bank)  Riparian zone >60 feet; Midth of riparian zone 60 - 40 feet; human activities have impacted zone only minimally.  Riparian vegetative (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone only minimally.  Riparian vegetative zone developed feet; human activities have impacted zone a great deal.  Width of riparian zone 40 - 20 feet; human activities have impacted zone a great deal.  Width of riparian zone 40 - 20 feet; human activities have impacted zone a great deal.	ore (LB)	6			
Riparian vegetative zone Width of riparian zone >60 feet; human activities (i.e., parking lots, roadbeds, clearcufs, lawns, or crops) have not impacted zone only minimally.  Width of riparian zone 60 - 40 feet; human activities have impacted zone only minimally.  Width of riparian zone 40 - 20 feet; human activities have impacted zone a great deal.  Width of riparian zone 40 - 20 feet; human activities have impacted zone a great deal.	NO (ED)	THE REAL PROPERTY AND ADDRESS OF THE PARTY AND			
rg (LB) 4 19 8	Riparian vegetative zone Width (each	Width of riparian zone >60 feet; numan activities (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted	Width of riparian zone 60 - 40 feet; human activities have	Width of riparian zone 40 - 20 feet; human activities have	Width of riparian zone <20 feet; little or no riparian vegetation due
re (RB)		IN THE STATE OF STATE		The Second of th	

Station Number

### APPENDIX H-1

# ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION

JB2 Day GLI Name of Waterbody

GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET

J.O.Wed Date: 4/23/19 Investigators

Habitat		Ce	tlegor (	
Parameter	Optimal	Suboptimal	Marginal	Poor
1 Instream Cover	> 50% mix of snags, submerged logs, undercut banks, or other stable habitat; rubble, gravel may be present.	50-30% mix of stable habitat; adequate habitat for maintenance of populations.	30-10% mix of stable habitat; habitat availability less than desirable.	<10% stable habitat; lack of habitat is obvious.
Score 1	20 19 18 17 16	15 14 13 12 13	10 4 9 48 7 6	F 14 10 10 1
Pool Substrate Characterization	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.
Score 12	1120 - 39 18: 1971 - 18	15 4 13 12 10	Thomas a second form form	135 Aut 3. 11-2 - 10
3 Pool Variability	Even mix of large-shallow, large- deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
Score //o	20 19 38 317 16	15 10 12 12	1 10 10 19 1 1 8 A 7 8 B	5 4g/4元 3 前之 10km 在图
4 Channel Alteration	No Channelization or dradging present	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 years) may be present, but not recent.	New embankments present on both banks; channelization may be extensive, usually in urban or agriculture lands; and > 80% of stream reach is channelized and disrupted.	Extensive channelization; banks shored with gabion or cement; heavily urbanized areas; instream habitat greatly altered or removed entirely.
icore 15	20 19 18 17 16	15 14 13 12 12	10 5 9 m 8 1 7 1 6 m	5 - 4 3 - 0
5 Sediment Deposition	<20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of islands or point bars.	20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; some new increase in bar formation.	50-80% affected; major deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent and substantial sediment movement during storm events.	Channelized; mud, sill, and/or sand in braided or non-braided channels; pools almost absent due to deposition.
core /Z	20 19 18 17 16	15 14 13 12 11		
	Bends in stream increase stream	Bends in stream increase stream	9 8 6	1 5 4 3 2 9 0
6 Channel Sinuosity	length 3 to 4 times longer than if it was in a straight line.	length 2 to 3 times longer than if it was in a straight line.	Bends in stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight, waterway has been channelized for a long distance.
core /2	20 19 18 17 16	15 14 13 12 11	1 1 30 to 1 3 1 1 8 to 2 1 1 6 to	5 4 3 2 4 10
7 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.	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.
core	20 19 18 17 16	15 14 13 12 14	10 9 8 8 8	
8 Condition of Banks	Banks stable; no evidence of erosion or bank failure; <5% affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% affected.	Moderately unstable; 30-60% of banks in reach have areas of erosion.	Unstable; many eroded areas; "raw" areas frequent along straight section and bends; on side slopes, 60-100% of bank has erosional scars.
		15 14 13 12 12	8 7 6	5 4 5 7 1 1 0
9 Protection (each bank)	> 90% of the stream bank surfaces covered by vegetation.	90-70% of the streambank surfaces covered by vegetation.	70-50% of the stream bank surfaces covered by vegetation.	<50% of the streambank surfaces covered by vegetation.
	With Birth Street Co. 10 The Street	W. 11 - 4 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	10 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -		Last manager and the	Harry Server Private Date
Grazing or other disruptive pressure (each bank)	grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.	Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.	Disruption of stream bank vegetation is very high; vegetation has been removed to ≤ 2 inches average stubble height.
ore (LB) /0	(0) A S (0) A S (0)	1 7 1 6		A COMPANY OF THE PARTY OF THE P
ore (RB) 10	100 9 128	7.00 - 2.00 - 2.00		2 2 1 1 1 2 1 1
-10 (110)		Width of ripanan zone 60 - 40	Width of ripanan zone 40 - 20	Width of ripanan zone <20 feet;
Riparian vegetative zone Width (each bank)	numan activities (i.e., parking	feet; human activities have impacted zone only minimally.	feet; human activities have impacted zone a great deal.	little or no riparian vegetation due to human activities.

ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION
GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET
TB 2 - Resta code

Parameter  1 Instream Cover  2 SOM mix of anga, advantaged and and a state of the s	Station Number	JB2. Restera	Investigators		4/23/19
Personntiar    Personntiar	Habitat		- THE RESIDENCE		
function Covers  2 Pool Substrate Characterization Some Contraction Covers  2 Pool Variability Characterization Covers  3 Pool Variability Characterization Covers  4 Channel Alteration Covers  5 Sediment Deposition Depos	Parameter	Optimal			
Pool Substativation Characterization Cha	. 1	logs, undercut banks, or other stable habitat; rubble, gravel may be present.	adequate habitat for	habitat availability less than	<10% stable habitat; lack of habitat is obvious.
Peol Substrate  Peol Wariability  Peol Variability  Peol Variability  Peol Variability  Peol Variability  Peol Variability  Prosent.  Description  Prosent.  Description  Prosent.  Description  Peol Variability	core			(C 119'11-8 1-17'- But	5 V 3 2 1
Sediment Deposition  Sediment Deposition  Channel Structure of Status  Cha	Characterization	with gravel and firm sand prevalent; root mats and submerged vegetation common.	clay; mud may be dominant; some root mats and submerged vegetation present.	little or no root mat; no submerged vegetation.	
3 Pool Variability personnent, was mail-deep pools prevent	JOIE 10	The second secon	111111		
Channel flow Status  Core  Channel f	10	deep, small-shallow, small-deep pools present.	few shallow.	prevalent than deep pools.	pools absent
Channel Alteration  Sediment Deposition  Sediment Deposition  Channel Sinussity  Channel	A)Ie	No Changeization or dradging			一方"人工"。 不可能去点
20% of bottom affactact, minor accumulation of fine and coarse material at snags and submarged vegetation; filter or no inlargement of islands or point bars.  20 19 18 17 16 3 12 11 10 9 5 4 3 2 11 10 9 5 6 5 6 6 1 1 1 10 1 1 1 1 1 1 1 1 1 1 1 1 1	4		usually in areas of bridge abutments; evidence of past channelization (>20 years) may	both banks; channelization may be extensive, usually in urban or agriculture lands; and > 80% of stream reach is channelized and	shored with gabion or cement; heavily urbanized areas; instream habitat greatly altered
20% of bottom affactact, minor accumulation of fine and coarse material at snage and submarged vegetation, little or no hair-generat of islands or point bars.  20 19 18 17 16 Bends in stream increase stream length 3 to 4 times longer than if it was in a straight line.  20 19 18 17 16 Bends in stream increase stream length 3 to 4 times longer than if it was in a straight line.  20 19 18 17 16 Bends in stream increase stream length 3 to 4 times longer than if it was in a straight line.  20 19 18 17 16 Bends in stream increase stream length 2 to 5 times longer than if it was in a straight line.  20 19 18 17 16 Bends in stream increase stream length 2 to 5 times longer than if it was in a straight line.  20 19 18 17 16 Bends in stream increase stream length 2 to 5 times longer than if it was in a straight line.  20 19 18 17 16 Bends in stream increase stream length 2 to 5 times longer than if it was in a straight line.  20 19 18 17 16 Bends in stream increase stream length 2 to 5 times longer than if it was in a straight line.  20 19 18 17 16 Bends in stream increase stream length 2 to 1 times longer than if it was in a straight line.  20 19 18 17 16 Bends in stream increase stream length 2 to 1 times longer than if it was in a straight line.  20 19 18 17 16 Bends in stream increase stream length 2 to 1 times longer than if it was in a straight line.  20 19 18 17 16 Bends in stream increase stream length 2 to 1 times longer than if it was in a straight line.  20 19 18 17 16 Bends in stream increase stream length 2 to 1 times longer than if it was in a straight line.  20 19 18 17 16 Bends in stream increase stream length 2 to 1 times longer than if it was in a straight line.  30 10 19 18 18 19 19 19 10 18 18 19 19 19 19 19 19 19 19 19 19 19 19 19	core	20 19 18 17 16	15 14 13 12 12 11111	10 449 8 7 6	THE YOURS WE SHADOW
Bends in stream increase stream length 3 to 4 times longer than if it was in a straight line.    Channel flow Status   Condition of Banks   Condition of Ban	5	<20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of islands or point	20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; some new	50-80% affected; major deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent and substantial sediment	Channelized; mud, silt, and/or sand in braided or non-braided channels; pools almost absent
Bands in stream increase stream length 2 to 1 times longer than if it was in a streight line.    Channel Sinuosity   School   Sch	) l	1 30 160 1 30 37 46 1			
Channel   Sinuosity   Sinuos	wre end				5 4 3 42 1127 (
The Channel flow Status  Channel flow Status  Channel flow Status  Channel flow Status  Condition of Banks stable; no evidence of encision or bank failure; <5% affected.  Condition of Banks  table; no evidence of encision mostly healed over; 5-30% affected.  Condition of Banks  Condition of Banks  Condition of Banks stable; no evidence of encision mostly healed over; 5-30% affected.  Condition of Banks  table; no evidence of encision mostly healed over; 5-30% affected.  Condition of Banks  Condition of Banks  Condition of Banks stable; no evidence of encision or bank failure; <5% affected.  Condition of Banks  table; no evidence of encision or bank failure; <5% affected.  Condition of Banks stable; no evidence of encision or bank failure; <5% affected.  Condition of Banks stable; no evidence of encision or bank failure; <5% affected.  Condition of Banks stable; no evidence of encision or bank failure; <5% affected.  Condition of Banks stable; no evidence of encision or bank failure; <5% affected.  Condition of Banks stable; no evidence of encision or bank failure; <5% affected.  Condition of Banks stable; no evidence of encision or bank failure; <5% affected.  Condition of Banks stable; no evidence of encision or bank failure; <5% affected.  Condition of Banks stable; no evidence of encision or banks in reach have areas of encision mostly raw areas of encision.  Condition of Banks stable; no evidence of encision or banks in reach have areas of encision.  Condition of Banks stable; no evidence of encision or banks in reach have areas of encision.  Condition of Banks failure; <5%	Sinuosity	length 3 to 4 times longer than if	length 2 to 3 times longer than if	stream length 2 to 1 times longer	been channelized for a long
Water files 25-75% of the available channel flow Status  Condition of channel substrate is exposed.  Condition of Banks  Condition of	ora 5	20 1/19 1/19 1/17 1/16	115 14 14 15 15 15 15 15 15	9 9 9	to the second of the second of the
Banks stable; no evidence of erosion or bank failure; <5% affected.  Banks  Condition of Banks  Condition of Banks  Bank Vegetative Protection (each bank)  Ore (IB)  Vegetative disruption (IB)  Vegetative disruption (IB)  Vegetative pressure (each bank)  Ore (RB)  Vegetative disruption (IB)  Vegetative disruption (IB)  Vegetative disruption (IB)  Vegetative disruption (IB)  Vegetative pressure (each bank)  Ore (IB)  Vegetative disruption  through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.  Ore (IB)  Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.  Ore (IB)  Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.  Ore (IB)  Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.  Ore (IB)  Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants all plants allowed to grow naturally.  Ore (IB)  Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.  Ore (IB)  Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.  Vegetative zone Width of nparian zone >60 feet, human activities have impacted zone a great deal.  Width of nparian zone <0 if the potential plant stubble height remaining.  Width of nparian zone <0 if the potential plant stubble impacted zone a great deal.  Width of nparian zone <0 if the potential plant stubble impacted zone a great deal.	Status 9	Water reaches base of both lower banks and minimal amount of channel substrate is exposed.	Water fills >75% of the available	Water fills 25-75% of the available channel and/or riffle	Very little water in channel and mostly present as standing pools
Some (LB)  Grazing or other disruptive pressure (each bank)  Vegetative or or other disruption disruption of stream bank surfaces covered by vegetation.  Disruption obvious; patches of bare soil or closely cropped vegetation is very high; vegetation is very high; vegetation potential to any great extent; >1/2 of the potential plant stubble height remaining.  Width of riparian zone >60 feet; human activities have impacted zone only minimally.  Width of riparian zone >60 feet; human activities have impacted zone a great deal.  Width of riparian zone ≥0 fittle or no riparian vegetation to human activities.	ore			10 8 8 17 8	1 3 4 3 10 10 10 10 10 10 10 10 10 10 10 10 10
Bank Vegetative Protection (each bank)  one (RB)  Grazing or other disruptive pressure (each bank)  one (LB)  Grazing or other disruptive pressure (each bank)  one (RB)  TO 50% of the streambank surfaces covered by vegetation.  Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.  Disruption obvious: patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Disruption obvious: patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Disruption obvious: patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Disruption obvious: patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Some (RB)  Width of riparian zone >60 -40 feet; human activities have impacted zone only minimally.  Or of the streambank surfaces covered by vegetation.  Some (RB)  Vegetative zone with surfaces covered by vegetation.  Disruption obvious: patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Disruption obvious: patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Some (RB)  Width of riparian zone >60 -40 feet; human activities have impacted zone a great deal.  Width of riparian zone <20 feet; human activities.  Width of riparian zone <20 feet; human activities have impacted zone a great deal.	8 Banks	erosion or bank failure; <5%	small areas of erosion mostly	banks in reach have areas of	Unstable; many eroded areas; "raw" areas frequent along straight section and bends; on side slopes, 60-100% of bank has erosional scars.
Bank Vegetative Protection (each bank)  Description (BB)  Grazing or other disruptive pressure (each bank)  Disruption evident; almost all plants allowed to grow naturally.  Disruption evident plant stubble height remaining.  Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Soil (LB)  Riparian vegetative zone Width of nparian zone >60 feet; human activities have impacted zone only minimally.  Or (RB)  Width of nparian zone >60 feet; human activities have impacted zone a great deal.  Width of nparian zone <20 feet; human activities.  Vidth of nparian zone <20 feet; human activities have impacted zone a great deal.	ore I f	20 19 178 17 1118	15 14 13 12 21	10 9 8 75 6	
ore (RB)  Grazing or other disruptive pressure (each bank)  The (RB)  The (RB)  We getative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.  Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.  Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Some (RB)  Width of riparian zone <60 feet; human activities have impacted zone only minimally.  Width of riparian zone 40 - 20 feet; human activities have impacted zone a great deal.  Width of riparian zone <20 fittle or no riparian vegetation common; <1/2 of the potential plant stubble height remaining.  Width of riparian zone 40 - 20 feet; human activities have impacted zone a great deal.	9 Protection (each bank)	> 90% of the stream bank	90-70% of the streambank	70-50% of the stream bank	
Grazing or other disruptive pressure (each bank)  The (RB)  Riparian vegetative zone Width of nparian zone >6D feet; human activities have impacted zone only minimally.  Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.  Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Size (RB)  Width of nparian zone >6D feet; human activities have impacted zone only minimally.  Or of the potential plant stubble height remaining.  Width of nparian zone 40 - 20 feet; human activities have impacted zone a great deal.  Width of nparian zone 40 - 20 feet; human activities have impacted zone a great deal.	NO (CD)	10 g   17 18 mg	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
Grazing or other disruptive pressure (each bank)  The (LB)  Riparian vegetative zone Width (each bank)  Riparian vegetative zone Width (each bank)  Grazing or mowing, minimal or not evident; almost all plants stubble height remaining.  affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.  affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.  bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.  Soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.	ore (RB)	9 4 8	0 - 174 - 6 - 4 - 6		THE SECTION AND PROPERTY OF THE SECTION AND PARTY OF THE SECTION AND PA
Riparian vegetative zone Width (each bank)  Riparian vegetative zone bank)  Riparian vegetative zone Width (each bank)  Riparian vegetative zone Width (each bank)  Riparian zone >60 feet; human activities have impacted zone only minimally.  Width of riparian zone 40 - 20 feet; human activities have impacted zone a great deal.  Width of riparian zone 40 - 20 feet; human activities have impacted zone a great deal.	disruptive pressure (each	grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble	bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height	vegetation is very high; vegetation has been removed to ≤ 2 inches average stubble
Riparian vegetative zone Width (each bank)  Riparian vegetative zone Width (each bank)  Riparian vegetative zone Width (each bank)  Riparian zone >60 feet; human activities have impacted zone only minimally.  Width of riparian zone <00 - 40 feet; human activities have impacted zone a great deal.  Width of riparian zone <00 - 20 feet; human activities have impacted zone a great deal.	re /IR) 7	W 40			
Riparian vegetative zone Width of riparian zone >60 feet; human activities (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone.  Width of riparian zone 60 - 40 feet; human activities have impacted zone a great deal.  Width of riparian zone 40 - 20 feet; human activities have impacted zone a great deal.					2 7 7 7
The state of the s	Riparian vegetative zone Width (each	Width of riparian zone >60 feet; human activities (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted	Width of riparian zone 60 - 40 feet; human activities have	feet; human activities have	Width of riparian zone <20 feet, little or no riparian vegetation due to human activities.
one (LB) (Q B B B T	11 N				

ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION

Name of Waterbody Station Number

GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET

Investigators

4/23/19

Hahitat Parameter Optimal Suboptimal > 50% mix of snags, submerged 50-30% mix of stable habitat; 30-10% mix of stable habitat: <10% stable habitat; lack of logs, undercut banks, or other adequate habitat for habitat availability less than habitat is obvious. 1 Instream Cover stable habitat; rubble, gravel may maintenance of populations. be present. 20 1 18 17 15 4 13 11 12 Mixture of substrate materials, Mixture of soft sand, mud, or All mud or clay or sand bottom; Hard-pan clay or bedrock; no with gravel and firm sand clay; mud may be dominant **Pool Substrate** little or no root mat: no root mat or vegetation. Characterization prevalent root mats and some root mats and submerged submerged vegetation submerged vegetation common. vegetation present. THE CHIEF THE GREAT Even mix of large-shallow, large Majority of pools large-deep; very Shallow pools much more Majority of pools small-shallow or deep, small-shallow, small-deep 3 Pool Variability few shallow. prevalent than deep pools. pools absent pools present. 6 Score 15 14 - 13 - 12 No Channelization or dredging Some channelization present. Extensive channelization; banks New embankments present on present usually in areas of bridge both banks; channelization may shored with gabion or cement; Channel abutments; evidence of past be extensive, usually in urban or heavily urbanized areas: Alteration channelization (>20 years) may agriculture lands; and > 80% of instream habitat greatly attered be present, but not recent stream reach is channelized and or removed entirely. disrupted. 0 Score 20 119 7 18 17 <20% of bottom affected; minor 20-50% affected; moderate 50-80% affected; major Channelized; mud, silt, and/or accumulation of fine and coarse accumulation; substantial deposition; pools shallow heavily sand in braided or non-braided material at snags and submerged sediment movement only during silted; embankments may be channels; pools almost absent Sediment vegetation; little or no major storm event; some new present on both banks; frequent due to deposition. Deposition enlargement of islands or point increase in bar formation. and substantial sediment movement during storm events. 10 20 19 18 48 17 16 15 14 13 12 11 70 - 9 - 5 - 7 - 6 Bends in stream increase stream Bends in stream increase stream Bends in stream increase the Channel straight, waterway has length 3 to 4 times longer than if Channel length 2 to 3 times longer than if stream length 2 to 1 times longer been channelized for a long it was in a straight line. Sinuosity it was in a straight line. than if it was in a straight line. distance. **10** 5 15 mental 13 mm 2 - 11 mm 4 3 112 117 11 Water reaches base of both Water fills >75% of the available Water fills 25-75% of the Very little water in channel and lower banks and minimal amount Channel flow channel. available channel and/or riffle mostly present as standing pools. of channel substrate is exposed. Status substrates are mostly exposed. **@** 0 15 114 213 72 11 214 Banks stable; no evidence of Moderately stable; infrequent, Moderately unstable; 30-60% of Unstable; many eroded areas: erosion or bank failure; <5% small areas of erosion mostly banks in reach have areas of 'raw" areas frequent along Condition of affected healed over, 5-30% affected. arosion. straight section and bends; on Ranks side slopes, 60-100% of bank has erosional scars. 0 19: 178 177 118 15 14 13 120 14 > 90% of the stream bank 90-70% of the streambank 70-50% of the stream bank Bank Vegetative <50% of the streambank surfaces covered by vegetation. surfaces covered by vegetation. 9 Protection (each surfaces covered by vegetation. surfaces covered by vegetation. bank) 5 Score (LB) Score (RB) 155-160V Vegatative disruption, through Disruption evident but not Disruption obvious; patches of Disruption of stream bank grazing or mowing, minimal or affecting full plant growth Grazing or other bare soil or closely gropped vegetation is very high; not evident; almost all plants disruptive potential to any great extent; >1/2 vegetation common; <1/2 of the vegetation has been removed to allowed to grow naturally. of the potential plant stubble pressure (each potential plant stubble height 2 inches average stubble bank) height remaining. remaining. Score (LB) Score (RB) 1.6 10 8 Width of riparian zone >60 feet. Width of riparian zone 60 - 40 Width of riparian zone 40 - 20 Width of riparian zone <20 feet; human activities (i.e., parking feet; human activities have feet; human activities have little or no riparian vegetation due vegetative zone lots, roadbeds, clearcuts, lawns, impacted zone only minimally. impacted zone a great deal, to human activities. Width (each or crops) have not impacted bank) 700e 10 Score (LB) mal region THE TOTAL

ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION

GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET Date: 4/24/19 Name of Waterbody J4-2-405 Station Number J. OWE Investigators Habitat Catagory 200 Parameter Optimal Suboptimal Marginal > 50% mix of snags, submerged 50-30% mix of stable habitat, 30-10% mix of stable habitat; <10% stable habitat; lack of logs, undercut banks, or other adequate habitat for habitat availability less than habitat is obvious. 1 Instream Cover stable habitat; rubble, gravel may maintenance of populations. desirable. be present. 12 20 49 16 17 16 15 14 13 17 12 11 1012 2 2 3 4 7 6 Mixture of substrate materials, Mixture of soft sand, mud, or All mud or day or sand bottom; Pool Substrate with gravel and firm sand clay; mud may be dominant; little or no root mat; no root mat or vegetation. Characterization prevalent: root mats and some root mats and submerged submerged vegetation. submerged vegetation common vegetation present. 20 119 144 18 444 Even mix of large-shallow, large Majority of pools large-deep; very Shallow poots much more Majority of pools small-shallow or deep, small-shallow, small-deep 3 Pool Variability few shallow. prevalent than deep pools. pools absent pools present. 10 Score 15 1 14 13 12 11 No Channelization or dredging Some channelization present, New embankments present on Extensive channelization; banks usually in areas of bridge present both banks; channelization may shored with gabion or cement; Channel abutments; evidence of past be extensive, usually in urban or heavily urbanized areas: channelization (>20 years) may Alteration agriculture lands; and > 80% of instream habitat greatly altered be present, but not recent stream reach is channelized and or removed entirely. disrupted 10 Score 20 - 19 18 - 17 16 15 14 13 12 11 <20% of bottom affected; minor 20-50% affected; moderate 50-80% affected; major Channelized; mud, silt, and/or accumulation of fine and coarse accumulation; substantial deposition; pools shallow, heavily sand in braided or non-braided material at snags and submerged sediment movement only during silted; embankments may be channels; pools almost absent Sediment vegetation; little or no major storm event, some new present on both banks; frequent due to deposition. Deposition enlargement of islands or point increase in bar formation. and substantial sediment movement during storm events. 6 Score 20 1/9 18 97 116 15 14 113 12 11 10-19-8-2-6 Bends in stream increase stream Bends in stream increase stream Bends in stream increase the Channel straight, waterway has length 3 to 4 times longer than if Channel length 2 to 3 times longer than if stream length 2 to 1 times longer been channelized for a long 6 Sinuosity it was in a straight line. than if it was in a straight line. it was in a straight line. distance. 15 Score 15 14 13 12 11 11 110 115 一一年 200 美洲一山市 Water reaches base of both Water fills >75% of the available Water fills 25-75% of the Very little water in channel and lower banks and minimal amount Channel flow channel available channel and/or riffle mostly present as standing pools. of channel substrate is exposed. Status substrates are mostly exposed. 10 Score 20 79 18 17 16 15 104 15 12 15 . 10 8 8 8 17 1 6 HET I DE LES TON Banks stable; no evidence of Moderately stable; infrequent, Moderately unstable; 30-60% of Unstable; many eroded areas; erosion or bank failure; <5% small areas of erosion mostly banks in reach have areas of "raw" areas frequent along Condition of 8 affected healed over; 5-30% affected. erosion. straight section and bends; on Banks side slopes, 60-100% of bank has erosional scars Score 15 14 13 12 12 19 18 17 16 90% of the stream bank 90-70% of the streambank 70-50% of the stream bank <50% of the streambank Bank Vegetative surfaces covered by vegetation. surfaces covered by vegetation. 9 Protection (each surfaces covered by vegetation. surfaces covered by vegetation. bank) Score (LB) Score (RB) 10-29 .... 8 Vegetative disruption, through Disruption evident but not Disruption of stream bank Disruption obvious: patches of grazing or mowing, minimal or affecting full plant growth Grazing or other bare soil or closely cropped vegetation is very high; not evident; almost all plants disruptive potential to any great extent; >1/2 vegetation common: <1/2 of the vegetation has been removed to 10 allowed to grow naturally. of the potential plant stubble potential plant stubble height pressure (each ≤ 2 inches average stubble bank) height remaining. remaining. height Scora (LB) Score (RB) 103 Width of riparian zone >60 feet; Width of riparian zone 60 - 40 Width of opanian zone 40 - 20 Width of riparian zone <20 feet: Riparian human activities (i.e., parking feet, human activities have feet; human activities have little or no riparian vegetation due vegetative zone lots, roadbeds, clearcuts, lawns, impacted zone only minimally. impacted zone a great deal. to human activities. Width (each or crops) have not impacted bank) zone 10 Score (LB) Score (RB) C. CHINE CONTROL OF THE

# ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET

Name of Waterbody Station Number

JYL- Restration Investigators

Date: 4/24/19

Habitat		Military Company	AVE TO A TO THE TOTAL OF THE TO	
Parameter	Optimal	Suboptimal	atogory Williams	
			Marginal	Poar
1 Instream Cover	> 50% mix of snags, submerged logs, undercut banks, or other stable habitat, rubble, gravel may be present.	adequate habitat for	30-10% mix of stable habitat; habitat availability less than desirable.	<10% stable habitat, lack of habitat is obvious.
Server 13	the state of the s			
Score	20 18 18 17 16	15 12 13 12 13 11 12 11 11 11 11 11 11 11 11 11 11 11		1 5 4 4 3 42 9 1
Pool Substrate Characterization	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.
Score	18 - 18 - 18 - 18 - 18 - 18	15 14 13 12 17	9 8 5	
3 Pool Variability	Even mix of large-shallow, large- deep, smail-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow of pools absent.
Score	19: 18: 17: 16:		The state of the s	5 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
4 Channel 4 Alteration	No Channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 years) may be present, but not recent.	New embankments present on both banks; channelization may be extensive, usually in urban or agriculture lands; and > 80% of stream reach is channelized and disrupted.	Extensive channelization; banks shored with gabion or cement; heavily urbanized areas; instream habitat greatly aftered or removed entirely.
core 6	20 19 16	15 14 13 12 17	10 .9 . 5 . 7 . 6	
5 Sediment Deposition	<20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of islands or point bars.	20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; some new increase in bar formation.	50-80% affected; major deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent and substantial sediment movement during storm events.	Channelized; mud, silt, and/or sand in braided or non-braided channels; pools almost absent due to deposition.
core /	20 19 18 17 1 16	15 14 118 12 11	10 10 1 1 9 8 1 1 A 16 1	5 4 330 2 30 50
6 Channel Sinuosity	Bends in stream increase stream length 3 to 4 times longer than if it was in a straight line.	Bends in stream increase stream length 2 to 3 times longer than if it was in a straight line.	Bends in stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
	720 113 116 117 116	133 12 131	- 10 10 9 8 - 10 16 H	5 m 4 m 3 m 2 m 1
_ Channel flow	Water reaches base of both lower banks and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel.	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.
eno:	m 20 18 12 16	The second second		
Con Primary	Banks stable; no evidence of erosion or bank failure; <5% affected.	Moderately stable; infrequent, small areas of erosion mostly healed over, 5-30% affected.	Moderately unstable; 30-60% of banks in reach have areas of erosion.	Unstable, many eroded areas; 'raw" areas frequent along straight section and bends; on side slopes, 60-100% of bank has erosional scars.
ore   S	- C 12 19 11 18 1 17 5 16 1	15 13 13 12 10		
B1-14:	> 90% of the stream bank surfaces covered by vegetation.	90-70% of the streambank surfaces covered by vegetation.	70-50% of the stream bank surfaces covered by vegetation.	5 4 3 2 1 0
ore (LB)	WILLIAM STATE OF THE STREET	W. Train miles and		0-1-1-1
ore (RB) 10			5 July 2	
Grazing or other disruptive pressure (each bank)	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.	Disruption obvious, patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.	Disruption of stream bank vegetation is very high; vegetation has been removed to ≤ 2 inches average stubble height.
ora (LB)	(0)			
	1100	7 6		
		Width of riparian zone 60 - 40	Width of riparian zone 40 - 20	Width of riparian zone <20 feet;
Riparian h vegetative zone ki	numan activities (i.e., parking	feet; human activities have impacted zone only minimally.	feet; human activities have impacted zone a great deal.	little or no riparian vegetation due to human activities.

Scare (RB)

### APPENDIX H-1

ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION

GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET Jy- Darnsh Date: 4/24/19 Name of Waterbody Station Number Investigators Habitat Category Parameter Optimal Suboptimal Marginal > 50% mix of snags, submerged 50-30% mix of stable habitat; 30-10% mix of stable habitat; <10% stable habitat; lack of logs, undercut banks, or other adequate habitat for habitat availability less than habitat is obvious 1 Instream Cover stable habitat, rubble, gravel may maintenance of populations. desirable. be present. Score 20 58 18 17 56 15 14 13 12 17 10 L 9 L 8 F 7 6 Mixture of substrate materials, Mixture of soft sand, mud, or All mud or clay or sand bottom; Hard-pan clay or bedrock; no with gravel and firm send **Pool Substrate** clay; mud may be dominant; little or no root mat: no root mat or vegetation. Characterization prevalent root mats and some root mats and submerged submerged vegetation. submerged vegetation common. vegetation present. 15 144 13 112 11 Even mix of large-shallow, large Majority of pools large-deep; very Shallow pools much more Majority of pools small-shallow or deep, small-shallow, small-deep 3 Pool Variability few shallow. prevalent than deep pools. goods absent pools present. 10 Score 15 14 13 12 17 No Channelization or dredging Some channelization present, New embankments present on Extensive channelization: hanks present, usually in areas of bridge both banks; channelization may shored with gabion or cement; Channel abutments; evidence of past be extensive, usually in urban or heavily urbanized areas: channelization (>20 years) may Alteration agriculture lands; and > 80% of instream habitat greatly altered be present, but not recent stream reach is channelized and or removed entirely. disrupted 17 Score 20 19 18 17 16 45 14 13 12 11 Games Spring 17 in <20% of bottom affected; minor 20-50% affected; moderate 50-80% affected: major Channelized; mud, silt, and/o accumulation of fine and coarse accumulation; substantia deposition; pools shallow, heavil sand in braided or con-braided material at snags and submerged sediment movement only during silted; embankments may be channels; pools almost absent Sediment vegetation; little or no major storm event, some new present on both banks; frequent due to deposition. Deposition entargement of islands or point increase in bar formation. and substantial sediment movement during storm events. 0 Score 20 19 18 17 16 100 P 8 7 7 6 Bends in stream increase stream Bends in stream increase stream Bends in stream increase the Channel straight waterway ha Channel length 3 to 4 times longer than if length 2 to 3 times longer than if stream length 2 to 1 times longer been channelized for a long 6 Sinuosity it was in a straight line. it was in a straight line than if it was in a straight line. distance. 11 20 19 19 182 17 16 15 414 134 13. 11 Water reaches base of both Water fills >75% of the available Water fills 25-75% of the Very little water in channel and lower banks and minimal amount Channel flow available channel and/or riffle mostly present as standing pools. Status of channel substrate is exposed. substrates are mostly exposed. 8 Score 14 113 to 12 11 10 11 15 18 11 1 16 1 3 4 4 3 2 4 4 4 4 Banks stable; no evidence of Moderately stable; infrequent. Unstable; many eroded areas; Moderately unstable; 30-60% of erosion or bank failure: <5% small areas of erosion mostly banks in reach have areas of "raw" areas frequent along Condition of 8 affected healed over: 5-30% affected. erosion. straight section and bends; on Banks side slopes, 60-100% of bank has emsional scars 6 19 18 17 16 14 13 12 13 10 19 28 78 > 90% of the stream bank 90-70% of the streambank 70-50% of the stream bank <50% of the streambank Bank Vegetative surfaces covered by vegetation. surfaces covered by vegetation. surfaces covered by vegetation. surfaces covered by vegetation. 9 Protection (each bank) Score (LB) Score (RB) £.J SANTANIO THE SHAPE Vegetative disruption, through Disruption evident but not Disruption obvious; patches of Disruption of stream bank grazing or mowing, minimal or affecting full plant growth Grazing or other bare soil or closely cropped vegetation is very high; not evident: almost all plants disruptive potential to any great extent; >1/2 vegetation common: <1/2 of the vegetation has been removed to allowed to grow naturally. of the potential plant stubble potential plant stubble height pressure (each ≤ 2 inches average stubble bank) height remaining. remaining. Score (LB) Score (RB) Width of riparian zone >60 feet; Width of nparian zone 60 - 40 Width of ripanan zone 40 - 20 Width of riparian zone <20 feet: Riparian human activities (i.e., parking feet, human activities have feet; human activities have little or no riparian vegetation due egetative zone lots, roadbeds, clearcuts, lawns, impacted zone only minimally. impacted zone a great deal. to human activities. Width (each or crops) have not impacted bank) zone Score (LB)

ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION

Name of Waterbody
Station Number

GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET

Investigators

TO-TAB

GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET

Y | 24 | 9

	A	Investigators	1 2 1	
Habitat			ategory III Carlo	Miles III
Parameter	Optimal	Suboptimal	Marginal	Poor
1 Instream Cover	> 50% mix of snags, submerged logs, undercut banks, or other stable habitat, rubble, gravel may be present.	50-30% mix of stable habitat, adequate habitat for maintenance of populations.	30-10% mix of stable habitat; habitat availability less than desirable.	<10% stable habitat; lack of habitat is obvious.
Score	20 19 18 17 46	415 Part (31 F 72 4 fr)	10 - 9 - 9 - 10 -	175 1.4 1.4 1.7 1.7
Pool Substrate Characterization	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.
Score		15 14 13 12 11	9 mil 6 mil 6 mil 6 mil	M.5 4 3 2 3
3 Pool Variability	Even mix of large-shallow, large- deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow o pools absent.
Score	20 10 18 277 16	15 to 10 - 13 to 42 - 44	9 8 - 7 - 6 h	· 万田 [10] · · · · · · · · · · · · · · · · · · ·
4 Channel Alteration	No Channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 years) may be present, but not recent.	New embankments present on both banks; channelization may be extensive, usually in urban or agriculture lands; and > 80% of stream relach is channelized and disrupted.	Extensive channelization; banks shored with gabion or cement; heavily urbanized areas; instream habitat greatly altered or removed entirely.
core [0	20 19 18 17 16	15 4 13 12 31		MI THE STATE OF TH
5 Sediment Deposition	<20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of islands or point bars.	20-50% affected; moderate accumulation; substantial	50-80% affected; major deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent and substantial sediment movement during storm events.	Channeized; mud, silt, and/or sand in braided or non-braided channels; pools almost absent due to deposition.
core (				
core	Bends in stream increase stream	15 14 13 12 11	6 6 8 7 6	5 44 3 2 4 6
6 Channel Sinuosity	length 3 to 4 times longer than if it was in a straight line.	Bends in stream increase stream length 2 to 3 times longer than if it was in a straight line.	Bends in stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
core 8	20 119 # 18 17 17 161	15 36 13 112 131	- 40 H 9 8 T 7 6	
7 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.	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.
core O	18 18 18 17 16 T	15 may 18 × 12 11 1	10 - 5 - 6 - 5 - 6	3 2 2
8 Condition of Banks	Banks stable; no evidence of erosion or bank failure; <5% affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% affected.	Moderately unstable; 30-50% of banks in reach have areas of erosion.	Unstable; many eroded areas; "raw" areas frequent along straight section and bends; on side slopes, 60-100% of bank has erosional scars.
ora	120 1 59 18 37 18 T	- 15 TO 15 T	9 8 1 8	Service Service Committee
D1-14	> 90% of the stream bank surfaces covered by vegetation.	90-70% of the streambank surfaces covered by vegetation.	70-50% of the stream bank surfaces covered by vegetation.	<50% of the streambank surfaces covered by vegetation.
		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1994 300 1994 TV 43 (MITTA)	
	10 m 20 m 20 mm	3. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	The Part of the State of the St	
Grazing or other	grazing or mowing, minimal or not evident; almost all plants	Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble	Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.	Disruption of stream bank vegetation is very high; vegetation has been removed to ≤ 2 inches average stubble height.
disruptive pressure (each bank)		height remaining.	, s	
pressure (each bank)				
pressure (each		<b>5</b>		han to the same of
pressure (each bank)  re (LB)	10 9 8 10 9 3 Width of nparian zone >60 feet numan activities (i.e., parking	<b>5</b>		

Section 10.8.1 Revision No. Date March 1, 1999 Page 1 of 1

#### APPENDIX H-1

# ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION

GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET Name of Waterbody Tr-UD Station Number D'N4 Investigators Habitat Parameter Optimal. Suboptimal Marginal > 50% mix of snags, submerged 50-30% mix of stable habitat; 30-10% mix of stable habitat; <10% stable habitat: lack of logs, undercut banks, or other adequate habitat for habitat availability less than habitat is obvious. 1 Instream Cover stable habitat; rubble, gravel may maintenance of populations. desirable. be present 11 20 19 118 174 116 Score Section 19 (19 19) Mixture of substrate materials, Mixture of soft sand, mud. or All mud or clay or sand bottom; Hard-pan clay or bedrock: no with gravel and firm sand clay; mud may be dominant. Pool Substrate little or no root mat; no root mat or vegetation. prevalent; root mats and some root mats and submerged Characterization submerged vegetation. submerged vegetation common. vegetation present. 10 20 - 10 - 18 - 11, Score 4 3 12 4 Even mix of large-shallow, large-Majority of pools large-deep; very Shallow pools much more Majority of pools small-shallow or 3 Pool Variability deep, small-shallow, small-deep few shallow, prevalent than deep pools. pools absent pools present Score 18:41.18 17:516 145 - 14 18 12 11 No Channelization or dredging Some channelization present. New embankments present on Extensive channelization; banks present usually in areas of bridge both banks; channelization may shored with gabion or cement; Channel abutments; evidence of past be extensive, usually in urban or heavily urbanized areas; channelization (>20 years) may Alteration agriculture lands; and > 80% of instream habitat greatly altered be present, but not recent. stream reach is channelized and or removed entirely. 18 Score 20 19 18 17 16 45mm 44m - 43m 140m - 11 <20% of bottom affected; minor 20-50% affected; moderate 50-80% affected; major Channelized; mud, silt, and/or accumulation of fine and coarse accumulation; substantial deposition; pools shallow, heavi sand in braided or non-braided material at snags and submerger sediment movement only during silted; embankments may be channels; pools almost absent Sediment vegetation; little or no major storm event; some new 5 present on both banks: frequent due to deposition. Deposition enlargement of islands or point increase in par formation and substantial sediment bars movement during storm events. 20 19 18 17 16 Score 15 14 13 12 11 10 9 8 9 6 Bends in stream increase stream Berids in stream increase stream Bends in stream increase the Channel straight; waterway has length 2 to 3 times longer than if Channel length 3 to 4 times longer than if stream length 2 to 1 times longer been channelized for a long it was in a straight line. Sinuosity it was in a straight line. than if it was in a straight line. distance 14 Score 13 12 H1 20 18 18 18 18 18 5 4 A N 3 TH 2 : 17 - 10 Water reaches base of both Water fills >75% of the available Water fills 25-75% of the Very little water in channel and lower banks and minimal amount Channel flow channel available channel and/or riffle mostly present as standing pools. 7 of channel substrate is exposed. Status substrates are mostly exposed. 218 co. 18 - 1/7 t 16 t 1 15 1 12 13 12 12 Score 17 may 1 3 may 2 Banks stable; no evidence of Moderately stable: infrequent Moderately unstable; 30-60% of Unstable; many eroded areas; erosion or bank failure; <5% small areas of erosion mostly banks in reach have areas of "raw" areas frequent along Condition of 8 affected. healed over 5-30% affected arosion. straight section and bends; on Banks side slopes, 60-100% of bank has erosional scars. 119 28 17 16 > 90% of the stream bank 90-70% of the streambank 70-50% of the stream bank <50% of the streambank Bank Vegetative surfaces covered by vegetation. surfaces covered by vegetation. surfaces covered by vegetation surfaces covered by vegetation. Protection (each bank) 10 Score (LB) Score (RB) Vegetative disruption, through Disruption obvious; patches of Disruption evident but not Disruption of stream bank grazing or mowing, minimal or affecting full plant growth Grazing or other bare soil or closely cropped vegetation is very high; not evident; almost all plants potential to any great extent; >1/2 disruptive vegetation common; <1/2 of the vegetation has been removed to allowed to grow naturally. of the potential plant stubble pressure (each potential plant stubble height ≤ 2 inches average stubble height remaining. bank) remaining. height Score (LB) Score (RB) ER Grain Width of riparian zone >60 feet; Width of riparian zone 60 - 40 Width of riparian zone <20 feet; Riparian human activities (i.e., parking feet: human activities have feet; human activities have little or no riparian vegetation due vegetative zone lots, roadbeds, clearcuts, lawns. impacted zone only minimally. impacted zone a great deal. to human activities. Width (each or crops) have not impacted bank) Score (LB) Score (RB)

1 9 10 18 1

THE SOUTH

# ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION

GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET O Date: Name of Waterbody Station Number Investigators Habitat Category Parameter Optimal Suboptimal Marginal > 50% mix of snags, submerged 50-30% mix of stable habitat, 30-10% mix of stable habitat; <10% stable habitat: lack of logs, undercut banks, or other adequate habitat for habitat availability less than habitat is obvious. 1 Instream Cover stable habitat, rubble, gravel may maintenance of populations. desirable. be present. 20 18 18 17 16 Score 15 4 13 11 12 11 10 - 19 - 18 8 ME 72 Mixture of substrate materials, Mixture of soft sand, mud, or All mud or clay or sand bottom. Hard-pan clay or bedrock: no with gravel and firm sand **Pool Substrate** clay; mud may be dominant little or no root mat; no root mat or vegetation. Characterization prevalent root mats and some root mats and submerged submerged vegetation. submerged vegetation common vegetation present. Score 4 12 42 1 0 119 18 17 Even mix of large-shallow, large Majority of pools large-deep; very Shallow pools much more Majority of pools small-shallow or 3 Pool Variability deep, small-shallow, small-deep few shallow prevalent than deep pools. pools absent pools present. 12 Scare #15 m 1/4 m 1/3 m 1/2 m No Channelization or dredging Some channelization present, New embankments present on Extensive channelization: banks present usually in areas of bridge both banks; channelization may shored with gabion or cement; Channel abutments; evidence of past be extensive, usually in urban or heavily urbanized areas: Alteration channelization (>20 years) may agriculture lands; and > 80% of instream habitat greatly altered be present, but not recent stream reach is channelized and or removed entirely. disrupted Score 120 19 18 17 16 20-50% affected; moderate <20% of bottom affected; minor 50-80% affected: major Channelized; mud, silt, and/or accumulation of fine and coarse accumulation; substantial deposition; pools shallow, heav sand in braided or non-braided material at snags and submerged sediment movement only during silted; embankments may be channels; pools almost absent Sediment vegetation; little or no major storm event, some new present on both banks; frequent due to deposition. Deposition enlargement of islands or point increase in bar formation. and substantial sediment movement during storm events. 13 20 19 18 17 16 7 15 14 13 12 10 Score 10 9 8 2 7 76 4 5 1 2 TI 0 Bends in stream increase stream Bends in stream increase stream Bends in stream increase the Channel straight; waterway has Channel length 3 to 4 times longer than if length 2 to 3 times longer than if stream length 2 to 1 times longer been channelized for a long Sinuosity it was in a straight line. it was in a straight line. than if it was in a straight line. distance. 10 20 - 49 - 48 - 17 16 15 114 133 12 111 00 4 1 Water reaches base of both Water fills >75% of the available Water filts 25-75% of the Very little water in channel and lower banks and minimal amount Channel flow channel available channel and/or riffle mostly present as standing pools. of channel substrate is exposed: Status substrates are mostly exposed. 20 19 18 17 16 Score Banks stable; no evidence of Moderately stable; infrequent, Unstable; many eroded areas; Moderately unstable: 30-60% of erosion or bank failure: <5% small areas of erosion mostly banks in reach have areas of "raw" areas frequent along Condition of affected 8 healed over, 5-30% affected. erosion. straight section and bends; on Banks side slopes, 60-100% of bank has erosional scars. 19 18 17 16 14 13 12 14 > 90% of the stream bank 90-70% of the streambank 70-50% of the stream bank <50% of the streambank Bank Vegetative surfaces covered by vegetation. surfaces covered by vegetation. surfaces covered by vegetation. 9 Protection (each surfaces covered by vegetation. bank) Score (LB) Score (RB) (E) (O) Vegetative disruption, through Disruption evident but not Disruption obvious; patches of Disruption of stream bank grazing or mowing, minimal or affecting full plant growth Grazing or other bare soil or closely cropped vegetation is very high; not evident: almost all plants disruptive potential to any great extent; >1/2 vegetation common; <1/2 of the vegetation has been removed to allowed to grow naturally. of the potential plant stubble pressure (each potential plant stubble height ≤ 2 inches average stubble bank) height remaining. remaining. height Score (LB) Score (RB) ##**第**章10字 Width of riparian zone >60 faet; Width of riparian zone 60 - 40 Width of ripanan zone 40 - 20 Width of riparian zone <20 feet: Riparian human activities (i.e., parking feet; human activities have feet human activities have little or no riparian vegetation due vegetative zone lots, roadbeds, clearcuts, lawns, impacted zone only minimally. impacted zone a great deal. to human activities. Width (each or crops) have not impacted bank) zone. Score (LB) Score (RB)



**DA3-Upstream Sampling Site** 





**DA3-Restoration Sampling Site** 





**DA3-Downstream Sampling Site** 





**DAE-Restoration Site (not sampled)** 





**DAE-Downstream Sampling Site** 





**D4-D6-Downstream Sampling Site** 





**D4-D6-Restoration Sampling Site** 



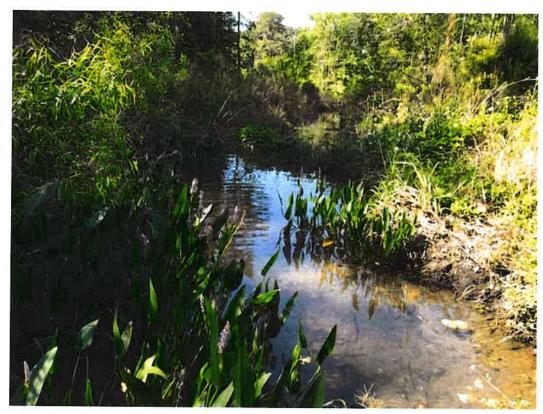


JB1-Upstream Sampling Site





**JB1-Restoration Sampling Site** 





JB2-Downstream Sampling Site





JA-Downstream Sampling Site





J4-2-Upstream Sampling Site





J4-2-Restoration Sampling Site





J4(1-2)-Downstream Sampling Site





**TC2-Tributary Sampling Site** 





TC(1-2)-Upstream Sampling Site





TC(1-2)-Restoration Sampling Site





JB (Bass Pro Shop) Sampling Site



