Appendix F
Channel Complexity Analysis

Channel and floodplain complexity have been identified as major objectives for the Touchet River, and complexity has increasingly been associated with juvenile salmonid rearing and overwintering, as well as benefits for many other aquatic species. Because of this multi-species and multiple-life stage benefit, it is important to examine a reach's complexity at lower flows such as the 1-year flood event used in this analysis. The 1-year flood inundation extent was generated from the HEC-RAS 1D hydraulic model using hydrologic regressions from the U.S. Geological Survey (USGS) StreamStats database (USGS 2019). For this assessment, river complexity refers to the geomorphic condition of multi-threaded or anastomosing channels, side channels, and split flow. Floodplain complexity is often characterized by small, dynamic channels that interact freely with the surrounding floodplain. While greater floodplain complexity typically results in a larger total water surface area, it is distinct from floodplain connectivity in that it examines individual flow paths separated by floodplain.

Flows such as the 1-year event are more indicative of side channels that are active during frequent high-flow events and serve as important high-velocity refugia for juvenile salmonids. Island density and perimeter highlighted by this analysis are indicators of a river's interaction with its riparian zone. These metrics help identify the quantity of river edge habitat, which provides cover and shade and supplies woody debris to the channel. Islands also provide hydraulic refugia and increase habitat heterogeneity, benefiting multiple life stages of salmonids.

1.1 Analysis Overview

The concept for the Standardized Complexity Evaluation (SCE) discussed in this section was largely influenced by the River Complexity Index (RCI) shown in Equation F-1. RCI is a method of measuring complexity at bankfull flow proposed by (Brown 2002; Beechie et al. 2017). The method takes the product of reach sinuosity and node density, a measure of channel connections in a reach. A more complete explanation of the RCI method can be found in "River Complexity Index (RCI): A Standard Method" (Buelow et al. 2017).

Equation F-1

$$RCI = S * (1 + D) = \left(\frac{Main\ Channel\ Length}{Valley\ Centerline\ Length}\right) * \left(1 + \frac{Number\ of\ Stream\ Nodes}{Valley\ Centerline\ Length}\right)$$

where:
RCI = River Complexity Index for a reach
S = Sinuosity of the reach
D = Node density of the reach

Note: RCI equation from "River Complexity Index (RCI): A Standard Method" (Buelow et al. 2017). Originally developed by Brown 2002.

The SCE developed in this analysis draws from the basic parameters of RCI by using the sinuosity of the reach and the number of islands in the reach, as shown in Figure F-1. For this assessment, RCI presents three problems that led to the development and use of the new method, SCE, for this assessment. First, the nodes described in the RCI method are difficult to capture and define using Light Detection and Ranging (LiDAR)-produced digital elevation model (DEM) and GIS data processing techniques. Second, RCI does not sufficiently capture the complexity gained through a single long side channel, as explained in more detail below. Finally, the RCI method presents no way to weight different complexity factors (sinuosity and node density).

In order to address the first problem, islands were counted instead of nodes. Because every pair of nodes represents an island, counting the number of islands per reach can be used as a scalable representation for node density, as shown in Figure F-1. Islands can be easily recognizable as distinct polygons in GIS applications, and statistics on where and how big these islands are can be quickly generated. Water surface polygons for the 1-year flow were generated using a 1D HEC-RAS model and the direct outputs from the LiDAR water surface data. For a complete discussion on the modeling, see Appendix D of this report.

For this assessment, a minimum length was defined by Reach Group to limit the analysis to islands that were greater than this minimum length, as shown in Table F-1. The RCI method recommends choosing the bankfull width as the threshold for island length, and the SCE method used in this analysis follows that recommendation. Bankfull widths at the 1-year event were measured at characteristic unconfined, but non-complex reaches within each Reach Group. The minimum lengths were assessed by Reach Group to provide a consistent metric to compare reaches of significantly different wetted flow widths. It should be noted that, because islands were used instead of nodes, the complexity values produced by this analysis are not directly comparable to the RCI method. For more details on how island data are extracted from the data set, see Section 1.4 of this appendix.

Table F-1
Minimum Island Length by Reach Group for Complexity Analysis

Reach Group	Minimum Length (feet)	Location Measured
Lower Mainstem Touchet	110	Upper MS-5
Upper Mainstem Touchet, Touchet Waitsburg, Touchet Dayton	100	Lower MS-9
Lower North Fork Touchet	80	Upper NF-4
Upper North Fork Touchet	40	Upper NF-6
Lower Wolf Fork Touchet	40	Lower WF-4
Upper Wolf Fork Touchet	35	Mid-Upper WF-7
Robinson Fork Touchet	25	RF-2
South Fork Touchet, South Fork Rainwater	45	Upper SF-1
Coppei Waitsburg, Upper Coppei	25	Upper C-5

Note:
Touchet Dayton and Touchet Waitsburg Reach Groups were added into the Upper Mainstem reach group and Coppei Waitsburg was added to the Upper Coppei reach group to avoid using an artificially constrained width as a reference.

To further narrow the selection of islands, only islands within the 2-year "connected" floodplain from the connectivity analysis were selected to contribute to complexity. For a greater discussion of the connectivity analysis, see Appendix E. Initially, certain reaches with many islands in the "disconnected" floodplain were scoring highly despite having poor complexity in the active channel. To eliminate these disconnected islands, GIS filter was applied to only select the islands within the 2-year connected floodplain for this analysis.

In order to more accurately represent a single long side channel in the SCE method, a third parameter was used to characterize complexity in addition to sinuosity and island density: island perimeter length. Through the analysis, it was observed that several reaches with long side channels were scoring more poorly in the complexity analysis than expected from field observations when using only sinuosity and island density. While a single long side channel may not represent as much complexity as many smaller side channels and split flows, it does represent significantly more complexity than a confined single thread channel, as shown in Figure F-2. Therefore, the island perimeter length parameter was added into the calculation of complexity to account for these situations, as well as to provide a more complete and accurate view of complexity within the project area. Figure F-3, attached to this appendix, shows the final results for all three metrics for each project area.

Figure F-1
Islands (using Standardized Complexity Evaluation) vs. Nodes (using River Complexity Index)

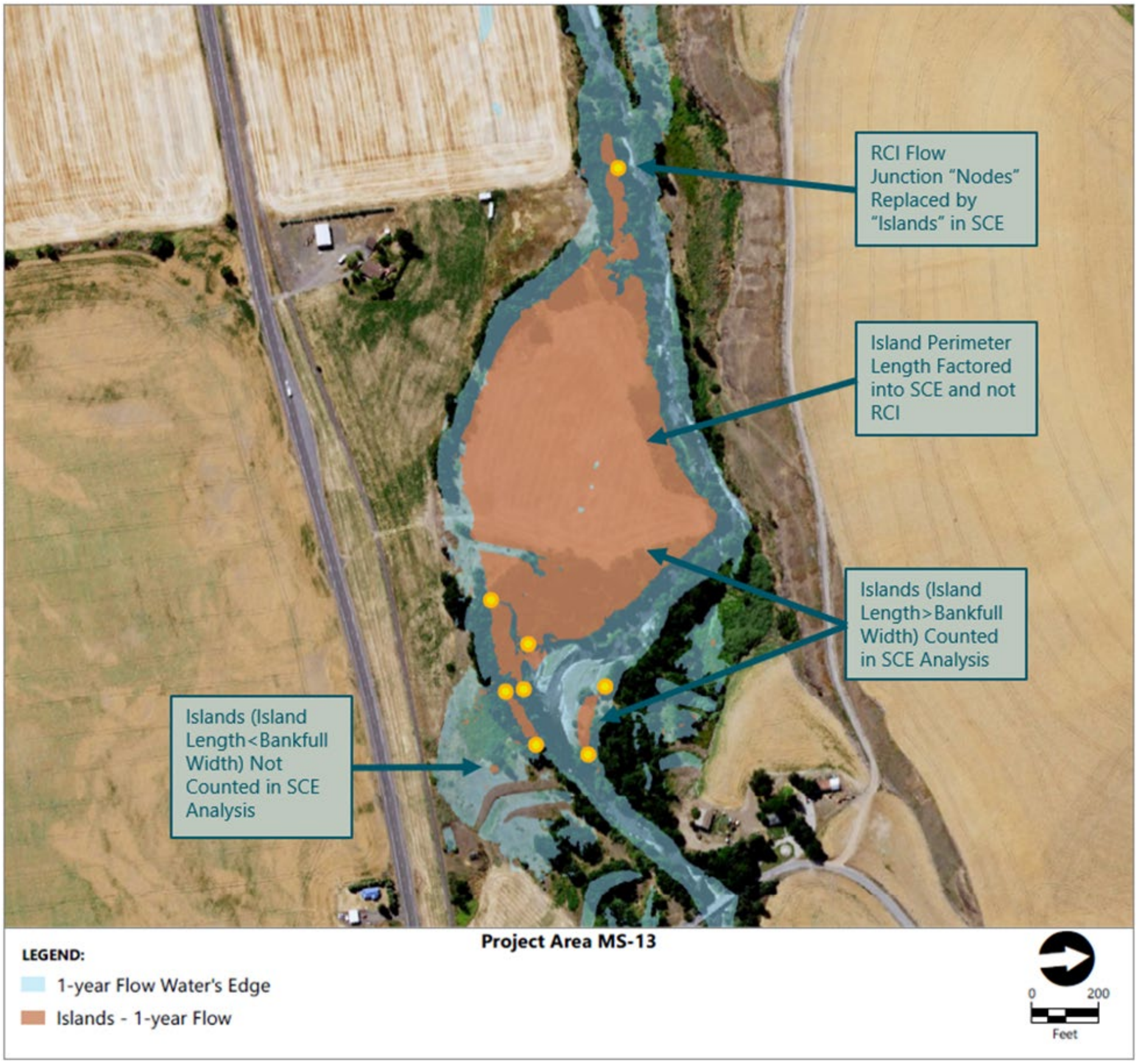


Figure F-2
Complexity Comparison

Note: RCI values were standardized based on the same standardization techniques in SCE to obtain comparable values.

The complexity evaluation used in this analysis sums these three parameters, as shown in Equation F-2. In order to account for differing reach lengths, each parameter was divided by the length of the valley (already included in the calculation of sinuosity) and standardized such that the maximum value across all project areas was 1. Standardizing all three parameters allows for each parameter to be examined initially on an equal footing, without weighting any parameter without purpose. After the standardization, it is then possible to choose weighting factors based on the perceived contribution to complexity.

Equation F-2

$$W_s(\mathrm{S}) + W_i(\mathrm{I}) + W_p(\mathrm{P}) = \text{Standardized Complexity Evaluation (SCE)}$$

where:

W_x = Weighting factor for the given parameter
S = Standardized sinuosity per project area
I = Island count per valley length per project area, standardized across all three flows
P = Island perimeter per valley length per project area, standardized across all three flows

The utility of this tool is that these factors can be weighted differently, and the amount of influence a specific factor has on the complexity evaluation can be changed based on a specific need. As shown in Equation F-2, each of these parameters was weighted based on perceived importance to the Touchet River, staying consistent with the values used with the Touchet River: 0.5 for island count, 0.4 for island perimeter, and 0.1 for sinuosity. Sinuosity in the Touchet basin has some variation, but was not determined to be a significant contributor to complexity because some sinuous but confined reaches were valued too highly when sinuosity was weighted strongly. The number of flow paths and islands, as well as island shape irregularity, were determined to be more important contributors to complexity in the Touchet basin as demonstrated in Figure F-2.

It should be noted that, because of the way the complexity index is calculated, the resulting values are comparable only to other reaches in this analysis. Should this method be applied to other river systems, the resulting values would only be relative to that system. This method is not meant to compare complexity between river systems but rather to examine the complexity of a reach compared to other reaches within the system. The goal of using a different minimum island length by reach group was to standardize the complexity index to enable comparison between reaches of varying discharge and bankfull width. Although the weighting factors of each parameter were maintained from the Tucannon River analysis, comparisons between basins may not be applicable because the islands were selected using the additional constraint of the 2-year connected floodplain.

1.2 Complexity Trends and Patterns

This section briefly describes some of the basin-wide trends and findings from the complexity analysis. A more detailed breakdown of how this analysis applies to individual project areas and reaches is discussed in Appendix I. It should be noted that because of data limitations the 1-year flow was the lowest flow for which the complexity analysis could be performed. Ideally the complexity analysis would also be performed on one or two other representative flows such as a mean summer flow and a mean winter flow. Therefore, it should be taken into consideration with this analysis that this level of complexity only happens on average for one flow event a year, and may not be fully representative of complexity at other flows that are important to focal species life stages. However, what this analysis does is provide an estimation of that complexity that can be reasonably extrapolated to other flows, and more importantly provides a baseline for future assessments where this analysis can be performed on lower flows as well as the 1-year flow.

From a basin-wide perspective, complexity generally increases with upstream distance on the forks due to a generally declining trend in levees and confining structures. The opposite trend is true in the mainstem because the lower mainstem from Waitsburg to Prescott is much less confined and more complex than the upper mainstem reach between Dayton and Waitsburg. Within reach groups, complexity patterns are chiefly governed by locations of confining structures and channel incision. The majority of Coppei Creek from the mouth to project area C-6 had very poor complexity scores and field investigations confirmed that Coppei Creek is highly incised and disconnected from its floodplain. The complexity analysis also accurately ranked both the Touchet Dayton and Touchet Waitsburg reaches as low complexity because both reaches are confined by levees on both banks. These trends can be seen in Figure F-4, attached to this appendix.

Notable areas with high complexity include the Lower Wolf Fork Touchet reach below the confluence with the Robinson Fork and the Upper South Fork project areas. Both reaches have relatively few confining features and large channel migration areas, allowing the river to spread out across the floodplain and form multiple channels and islands. Although these areas are complexity strongholds, restoration actions could further strive for an anastomosing channel character by helping stabilize and vegetate existing island complexes.

Correlations between complexity and the other analysis metrics of connectivity and excess transport capacity were limited. Since connectivity scores rank a project area's potential floodplain if encroachments are removed, an inverse correlation between complexity and connectivity might be expected, but no clear trend was observed. Similarly, no pattern was drawn comparing the excess transport capacity results to the SCE results; however, the importance of slope and sediment supply driving channel complexity should be emphasized. Reaches that were linearized or confined should be expected to have high sediment transport capacity and less sediment storage. Similarly, low gradient reaches should have greater sediment accumulation, allowing the river to spread out across the floodplain and create a complex channel network. Areas of high complexity in the Touchet basin including the Upper South Fork and Lower Wolf Fork had more gradual slopes than other areas of similar stream order. In a remote river system, complexity might increase with downstream distance, but human infrastructure confounds this trend in the Touchet basin because the low gradient floodplains offer the ideal location for agriculture and towns and their associated levees.

1.3 Scoring for Prioritization

The complexity analysis performed for the Touchet basin uses only the 1-year flow due to lack of available data. Ideally this analysis would be performed with one or several other lower flows to identify the complexity at a range of low-flow conditions. However, because only complexity results for the 1-year flow are available, the entire complexity metric is based off the 1-year flow.

The next step in the prioritization process is to rank, classify, and score each project area in each of the three metrics (Complexity, Connectivity, and Excess Transport Capacity). Project areas are ranked in the Complexity metric from best to worst by the scores determined using the weightings described in Table F-2. Each project area then has a rank for the Complexity metric and can be classified and scored according to the classification and scoring systems outlined in Table F-2.

The need for this step comes from the fact that the most benefit from restoration actions does not necessarily come from the projects that rank the highest. Because restoration work has been performed in this watershed for several years, some areas already have excellent complexity and rank the highest in that metric. But performing additional complexity-targeted restoration work on these areas would provide very little benefit. Therefore, through discussion with the basin stakeholders, it was decided that the classification and scoring system for complexity would not target the best or the worst ranked project areas in complexity but rather those with moderate complexity scores as shown in Table F-2. This approach takes into account that the moderately complex reaches still have the opportunity to improve in complexity, but they are also not so homogenous that a great deal of restoration work would be required to raise the complexity. Table F-2 describes the concepts behind the classifications and scoring for Complexity.

Table F-2
Complexity Classifications and Scoring

Percentile Rank	Class	Class Score	Metric Score Threshold[1]	Class Conceptualization
90th to Top	1	0	0.55	Project areas in this class are the most complex in the assessment area and therefore have very little additional complexity potential to be gained. Restoration efforts targeting complexity should focus instead on raising other project areas towards this level.
60th to 90th	2	3	0.27	Project areas in this class have moderately high complexity scores, such that restoration efforts should quickly achieve gains in the complexity of the reach pushing it towards the upper 10% of project areas. These project areas should be a secondary target for complexity-focused restoration efforts.
40th to 60th	3	5	0.20	Project areas in this class have the most potential for complexity gains and may currently be subpar for geomorphic processes and habitat conditions. The high potential in these areas means any effort will provide excellent benefit. These areas should be the primary target of complexity-focused restoration efforts in order to maximize benefit for effort.
10th to 40th	4	1	0.11	Complexity in project areas of this class falls below average for the assessment area, and complexity-focused restoration in these reaches should only be targeted after areas where it will be easier to maximize the benefit gained for the effort. These areas should be the last targeted for restoration focused on complexity.
Bottom to 10th	5	0	0	Project areas in this class are the least complex in the assessment area and would likely require a large amount of restoration effort to make only marginal gains in complexity. Restoration efforts for complexity should focus on areas with more easily achievable complexity.

Notes:

1. This is the score that defines the lower limit for the corresponding classification for this metric. These data can be used to track progression of project areas and compare to how they would rank according to the levels of this assessment, as new restoration projects are complete and new data become available.

1.4 Detailed Instructions for Performing this Analysis

Part of the purpose of this assessment is to define repeatable and data driven methods for assessing project areas and how they have progressed in relation to their goals. This section provides the detailed steps taken to perform the complexity analysis of the Touchet River so that these analyses can be repeated in the future for additional analyses and evaluation of progress. Table F-3 provides the data that will need to be collected to reassess the project areas for complexity.

Table F-3
Raw Data Needed to Perform SCE Analysis

Data Needed	Used For	Source
Topography digital elevation model (DEM)	1D or 2D hydraulic modeling[2]	LiDAR, preferably blue/green and 0.5-meter horizontal accuracy or greater
Hydrology	Flows used in hydraulic modeling	Hydrologic gage data, hydrologic regressions[4]
Water surface inundation boundaries[1]	Calculation of islands count and island perimeters	1D or 2D hydraulic modeling results, or as a product of LiDAR flown at the desired flow[5]
River centerline	Calculation of sinuosity	Aerials or LiDAR
Valley centerline	Calculation of sinuosity, ICPVL[3], and PPVL[3]	Aerials or LiDAR
Project area delineations	Calculation of all metrics per project area	Project area shapefiles from this assessment

Notes:

1. Water surface boundaries should be for the flows desired for the analysis: in this assessment the 1-year flow.
2. In order to fully capture complexity.
3. Island count per project area valley length (ICPVL) and perimeter per project area valley length (PPVL), as described below.
4. See Appendix C for a description of hydrologic regressions used to develop hydrology for the Touchet basin.
5. With blue-green LiDAR now commonly available, water surface shapefiles are easily produced with LiDAR flights. This has the effect of providing the necessary inundation information on whatever flow for which the LiDAR is collected. Ideally, in the future, LiDAR flights would be timed during low-flow conditions.

The following steps will assume the user has adequate GIS knowledge and access to the same data sources as those produced in this report.

1. This analysis uses the 1-year flow inundation boundary. The 1-year flow boundary was obtained as a HEC-RAS 1D model output. See the main report and Appendix D for details on the hydraulic modeling methods and hydrologic analysis.
2. The water surface elevation rasters were imported into GIS as simple polygon shapefiles. These were manually reviewed and corrected for inconsistencies and differences from the conditions noted during field observations.
3. GIS was used to separate the void spaces of each flow polygon into their own polygon shapefile. These areas represent the islands for analysis.
4. The minimum bounding geometry was then calculated for each island using the “Convex Hull” approach. The island shapefiles were then filtered to include only islands with a minimum length of the minimum bounding geometry greater than the minimum widths shown in Table F-1.
5. Only the islands within the 2-year connected floodplain were selected to confine the analysis to the active channel.

6. GIS was used to calculate the perimeter of each island as well as which project area each island occurs in. These figures are summed together for each project area, and from this the "island count per project area" and "perimeter sum per project area" seen in Table F-1 was calculated. Islands that span two project areas were counted as 0.5 islands in each for the island count, and only the length of the perimeter that occurred in each project area was counted in the perimeter sum.
7. Both the river centerline and the valley center line were manually digitized from the aerial photographs and relative elevation maps. These were used to calculate the valley length and river length for each project area shown in Table F-4. Sinuosity was also calculated by dividing the river length by the valley length.
8. These three statistics form the basis for this analysis: island count per project areas, island perimeter per project area, and sinuosity.
9. As shown in Table F-4, island count per project area and island perimeter per project area were divided by the valley length to standardize and obtain the island count per project area valley length (ICPVL) and perimeter per project area valley length (PPVL).
10. The ICPVL and PPVL were each standardized across all project areas by dividing by the largest value of the respective statistic (see Equation F-3). Sinuosity was also standardized to the largest value. These three standardized statistics are shown for each project area in Table F-4.
11. Finally, these three statistics were summed with weighting factors shown in Equation F-4. These provide the final SCE values shown in Table F-4.

Equation F-3

$$\text{Standarized CS } = \frac{CS_i}{CS_{\max all\ Project\ Areas}}$$

where:

CS = Complexity statistic (either ICPVL or PPVL)

Equation F-4

$$W_s(\mathrm{S}) + W_i(\mathrm{I}) + W_p(\mathrm{P}) = \text{Standardized Complexity Evaluation (SCE)}$$

where:

W_s = 0.1: weighting factor chosen for the standardized sinuosity
W_i = 0.5: weighting factor for standardized ICPVL
W_p = 0.4: weighting factor for standardized PPVL
S = Standardized sinuosity per project area
I = Island count per valley length per project area, standardized across all project areas
P = Island perimeter per valley length per project area, standardized across all project areas

1.5 References

Beechie, T.J., O. Stefankiv, B.L. Timpane-Padgham, J.E. Hall, G.R. Pess, M.L. Rowse, M.C. Liermann, K.L. Fresh, and M.D. Ford, 2017. *Monitoring Salmon Habitat Status and Trends in Puget Sound: Development of Sample Designs, Monitoring Metrics, and Sampling Protocols for Large River, Floodplain Delta, and Nearshore Environments*. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-137. https://doi.org/10.7289/V5/TM-NWFSC-137

Brown, A.G., 2002. “Learning from the past: palaeohydrology and palaeoecology.” *Freshwater Biology* 47: 817-829.

Buelow, K., K. Fischer, J. O’Neal, Z. Seilo, and R. Ventres-Pake, 2017 [unpublished]. “River Complexity Index (RCI): A Standard Method.”

USGS, 2019. StreamStats in Washington. Available at: https://streamstats.usgs.gov/ss/.

Tables

Table F-4
Complexity Analysis Results

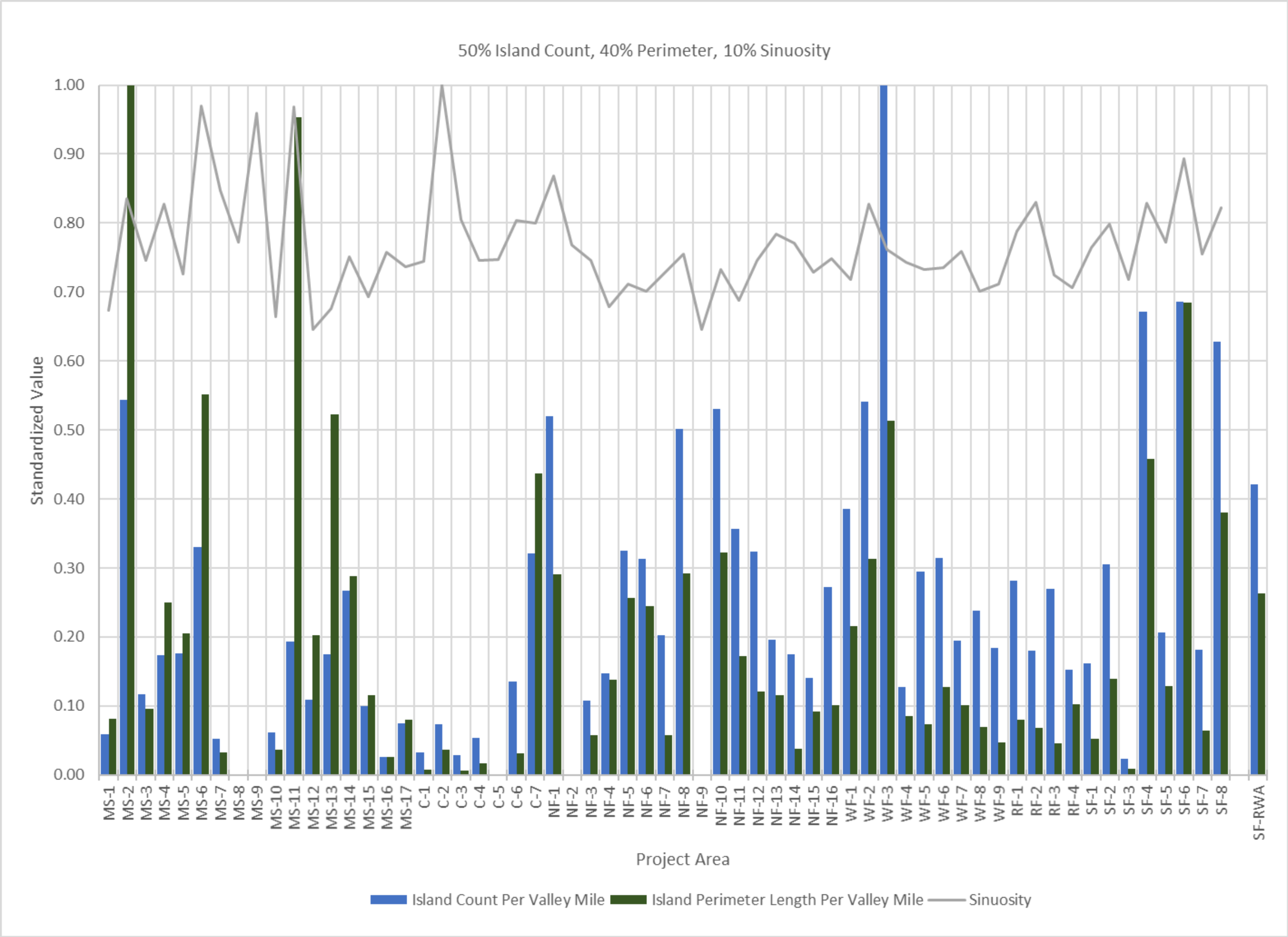
Project Area	River Length (mi)	Valley Length (mi)	Island Count	Island Count Per Valley Length	Standardized ICPVL	Sinuosity	Standardized Sinuosity	Island Perimeter (ft)	Perimeter per Valley Length (ft/ft)	Standardized PPVL	SCE
MS-1	1.001	1.000	2.000	2.000	0.058	1.001	0.673	1779.912	0.337	0.081	0.129
MS-2	1.534	1.233	23.000	18.652	0.544	1.244	0.836	26939.563	4.138	1.000	0.756
MS-3	1.666	1.501	6.000	3.997	0.117	1.110	0.746	3146.665	0.397	0.096	0.171
MS-4	2.901	2.356	14.000	5.942	0.173	1.231	0.827	12847.136	1.033	0.250	0.269
MS-5	1.427	1.322	8.000	6.053	0.177	1.080	0.726	5927.308	0.849	0.205	0.243
MS-6	1.660	1.150	13.000	11.301	0.330	1.443	0.969	13855.055	2.281	0.551	0.482
MS-7	1.418	1.125	2.000	1.778	0.052	1.261	0.847	792.661	0.133	0.032	0.124
MS-8	0.692	0.602	0.000	0.000	0.000	1.150	0.772	0.000	0.000	0.000	0.077
MS-9	1.257	0.880	0.000	0.000	0.000	1.428	0.959	0.000	0.000	0.000	0.096
MS-10	1.396	1.413	3.000	2.123	0.062	0.988	0.664	1129.915	0.151	0.037	0.112
MS-11	0.871	0.604	4.000	6.617	0.193	1.442	0.969	12582.458	3.942	0.953	0.574
MS-12	1.281	1.332	5.000	3.755	0.110	0.962	0.646	5907.124	0.840	0.203	0.201
MS-13	0.669	0.665	4.000	6.011	0.175	1.006	0.676	7599.337	2.163	0.523	0.364
MS-14	1.590	1.421	13.000	9.147	0.267	1.119	0.752	8962.421	1.194	0.289	0.324
MS-15	1.356	1.314	4.500	3.425	0.100	1.032	0.693	3315.312	0.478	0.116	0.166
MS-16	2.516	2.231	2.000	0.896	0.026	1.128	0.758	1237.097	0.105	0.025	0.099
MS-17	0.641	0.585	1.500	2.565	0.075	1.097	0.737	1025.218	0.332	0.080	0.143
C-1	1.009	0.910	1.000	1.099	0.032	1.109	0.745	140.871	0.029	0.007	0.093
C-2	1.186	0.797	2.000	2.510	0.073	1.488	1.000	642.502	0.153	0.037	0.151
C-3	1.241	1.035	1.000	0.966	0.028	1.198	0.805	152.499	0.028	0.007	0.097
C-4	1.815	1.634	3.000	1.835	0.054	1.111	0.746	621.856	0.072	0.017	0.108
C-5	0.734	0.660	0.000	0.000	0.000	1.111	0.747	0.000	0.000	0.000	0.075
C-6	1.034	0.865	4.000	4.627	0.135	1.196	0.804	591.831	0.130	0.031	0.160
C-7	1.083	0.909	10.000	10.995	0.321	1.191	0.800	8686.318	1.809	0.437	0.415
NF-1	0.471	0.365	6.500	17.819	0.520	1.292	0.868	2316.619	1.203	0.291	0.463
NF-2	0.692	0.606	0.000	0.000	0.000	1.143	0.768	0.000	0.000	0.000	0.077
NF-3	1.204	1.085	4.000	3.687	0.108	1.110	0.746	1364.249	0.238	0.058	0.151
NF-4	1.002	0.993	5.000	5.036	0.147	1.009	0.678	2979.083	0.568	0.137	0.196
NF-5	0.665	0.628	7.000	11.150	0.325	1.059	0.712	3525.086	1.063	0.257	0.337
NF-6	1.216	1.166	12.500	10.721	0.313	1.043	0.700	6224.272	1.011	0.244	0.324
NF-7	0.935	0.863	6.000	6.955	0.203	1.083	0.728	1073.324	0.236	0.057	0.197
NF-8	1.373	1.221	21.000	17.204	0.502	1.125	0.756	7786.262	1.208	0.292	0.443
NF-9	0.524	0.545	0.000	0.000	0.000	0.961	0.645	0.000	0.000	0.000	0.065

Table F-4
Complexity Analysis Results

Project Area	River Length (mi)	Valley Length (mi)	Island Count	Island Count Per Valley Length	Standardized ICPVL	Sinuosity	Standardized Sinuosity	Island Perimeter (ft)	Perimeter per Valley Length (ft/ft)	Standardized PPVL	SCE
NF-10	1.318	1.209	22.000	18.199	0.531	1.091	0.733	8528.758	1.336	0.323	0.468
NF-11	0.671	0.655	8.000	12.215	0.356	1.024	0.688	2465.075	0.713	0.172	0.316
NF-12	0.851	0.767	8.500	11.085	0.323	1.110	0.746	2017.013	0.498	0.120	0.284
NF-13	1.131	0.969	6.500	6.710	0.196	1.168	0.785	2444.797	0.478	0.116	0.223
NF-14	0.766	0.668	4.000	5.990	0.175	1.147	0.771	557.146	0.158	0.038	0.180
NF-15	1.010	0.932	4.500	4.830	0.141	1.084	0.728	1868.883	0.380	0.092	0.180
NF-16	1.555	1.395	13.000	9.318	0.272	1.114	0.749	3077.121	0.418	0.101	0.251
WF-1	0.688	0.644	8.500	13.208	0.385	1.068	0.718	3039.820	0.895	0.216	0.351
WF-2	1.327	1.078	20.000	18.556	0.541	1.231	0.827	7374.922	1.296	0.313	0.479
WF-3	0.910	0.802	27.500	34.286	1.000	1.134	0.762	9003.856	2.126	0.514	0.782
WF-4	1.015	0.918	4.000	4.357	0.127	1.106	0.743	1719.933	0.355	0.086	0.172
WF-5	0.755	0.693	7.000	10.102	0.295	1.090	0.732	1114.313	0.305	0.074	0.250
WF-6	0.914	0.835	9.000	10.773	0.314	1.095	0.735	2336.415	0.530	0.128	0.282
WF-7	1.018	0.901	6.000	6.662	0.194	1.130	0.759	1993.362	0.419	0.101	0.214
WF-8	0.640	0.614	5.000	8.143	0.238	1.043	0.701	937.353	0.289	0.070	0.217
WF-9	0.673	0.636	4.000	6.292	0.184	1.059	0.712	660.029	0.197	0.048	0.182
RF-1	0.729	0.622	6.000	9.644	0.281	1.172	0.788	1080.693	0.329	0.080	0.251
RF-2	0.599	0.485	3.000	6.184	0.180	1.235	0.830	717.331	0.280	0.068	0.200
RF-3	0.582	0.540	5.000	9.266	0.270	1.078	0.725	533.984	0.187	0.045	0.226
RF-4	0.605	0.576	3.000	5.209	0.152	1.050	0.706	1285.074	0.423	0.102	0.187
SF-1	0.617	0.543	3.000	5.525	0.161	1.137	0.764	620.847	0.217	0.052	0.178
SF-2	1.362	1.147	12.000	10.466	0.305	1.188	0.798	3477.856	0.574	0.139	0.288
SF-3	1.324	1.237	1.000	0.808	0.024	1.070	0.719	237.825	0.036	0.009	0.087
SF-4	1.338	1.085	25.000	23.039	0.672	1.233	0.828	10852.325	1.894	0.458	0.602
SF-5	1.294	1.127	8.000	7.100	0.207	1.148	0.772	3153.068	0.530	0.128	0.232
SF-6	0.679	0.511	12.000	23.505	0.686	1.330	0.894	7640.561	2.834	0.685	0.706
SF-7	1.262	1.123	7.000	6.234	0.182	1.124	0.755	1568.808	0.265	0.064	0.192
SF-8	1.023	0.837	18.000	21.516	0.628	1.223	0.822	6948.183	1.573	0.380	0.548

Notes:
ft: foot/feet
ICPVL: island count per project area valley length
mi: mile
PPVL: perimeter per project area valley length
SCE: Standardized Complexity Evaluation

Figures



Filepath: \\bellingham2\bell2\Projects\Columbia Conservation District\Touchet River Restoration\Reports and Deliverables\Single Report\Appendices\Appendix Figures\Figure F-3.docx

ANCHOR QEA

Figure F-3

Breakdown of Three Complexity Metrics for SCE

Geomorphic Assessment and Restoration Prioritization
Upper Touchet Basin Habitat Restoration

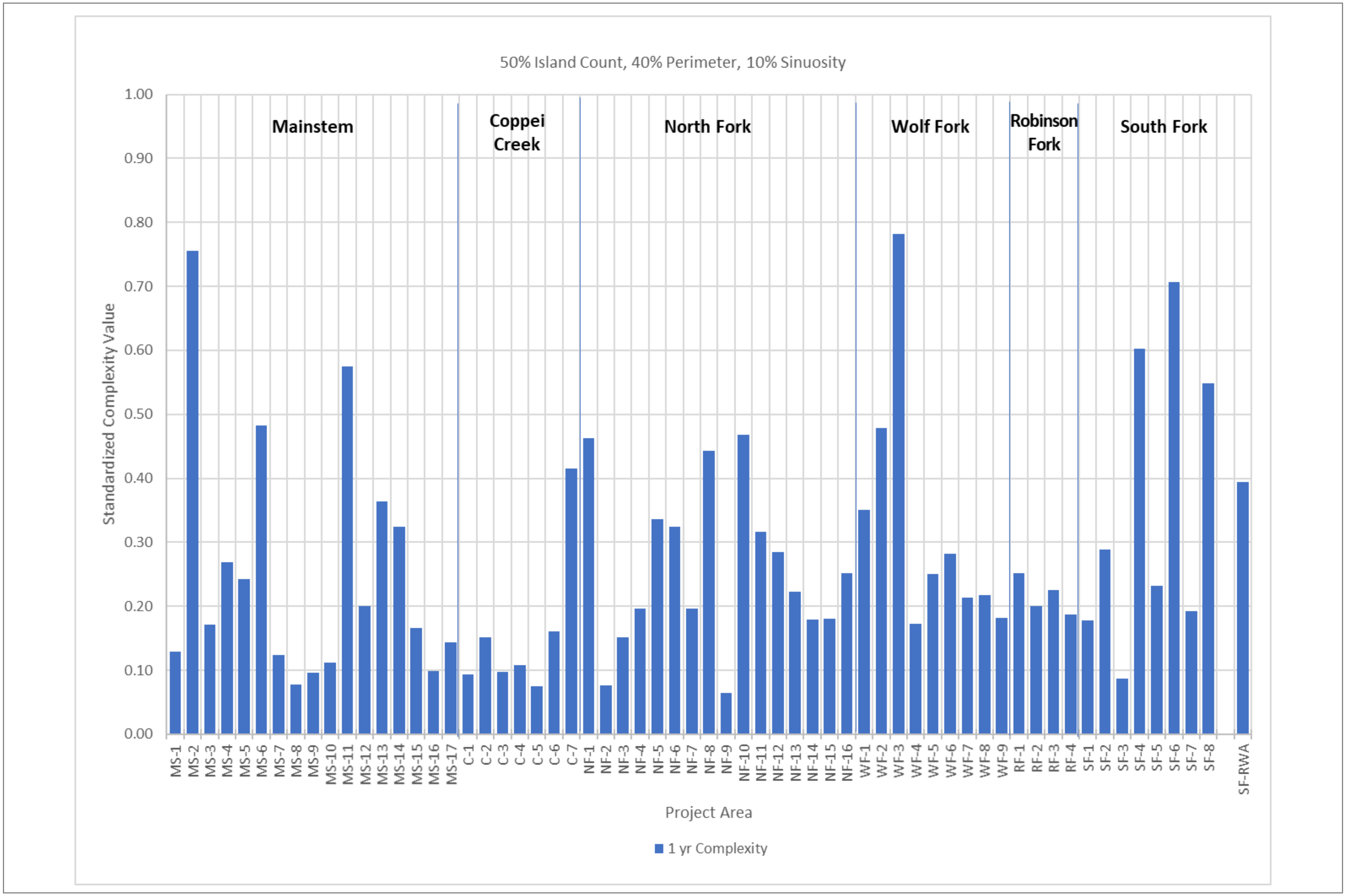


Figure F-4
Basin Summary of 1-year Complexity Scores
Geomorphic Assessment and Restoration Prioritization
Upper Touchet Basin Habitat Restoration