

Table of Contents

Part I.	What are the Landscape Conditions in the Rainier Subwatershed?	1
Part II.	Characterize Condition of Ecological Processes in Study Area	3
Part III.	Characterize Natural Resource Sites in Study Area	7
Part IV.	Identify and Assess Potential Sites With in the Context of the Landscape	7

List of Tables

Table 5.0	Rainier Ecological Processes Function.....	3
Table 5.1	Final DAU Ecological Benefit Rank	4
Table 5.2	Rainier Environmental Benefit Ranking of Natural Resource Sites.....	7
Table 5.3	Wetland Sites	8
Table 5.4	Riparian Sites	12
Table 5.5	Floodplain Sites	14

Table of Figures

Figure 5.0	Classification Percent Totals for Rainier Subwatershed.....	1
Figure 5.1	Rainier Subwatershed Land Cover	2
Figure 5.2	Rainier Subwatershed Ecological Function	6
Figure 5.3	Rainier Subwatershed Ecological Processes and Site Ranking – Wetlands	11
Figure 5.4	Rainier Subwatershed Ecological Processes and Site Ranking - Riparian.	13
Figure 5.5	Rainier Subwatershed Ecological Processes and Site Ranking - Floodplain	15

Introduction

This section summarizes the methods used to develop the final list of natural resource (wetlands, riparian, and floodplain) restoration and/or enhancement sites. The final stage of the watershed characterization analysis combines the ecological benefits of each DAU and the environmental benefits of each natural resource site to develop a list of natural resource sites that will provide the greatest functional “lift” in the subwatershed.

Part I. What are the Landscape Conditions in the Rainier Subwatershed?

Current conditions

Current land-use within the Rainier sub-watershed was determined by processing Aerial photography and SPOT 10 meter satellite imagery captured in 2009. Approximately six percent of the Rainier Subwatershed is covered by the built environment (see Figure 5.0 and 5.1 Classification Percent Totals for Rainier Subwatershed). The Rainier subwatershed includes the Town of Rainier and the Fort Lewis Rainier Training Area. Much of the area was historically prairie habitat. The Nature Conservancy, in conjunction with Fort Lewis Staff have been conducting various prairie restoration activities such as mowing and fire to control exotic species that have encroached onto the prairie.

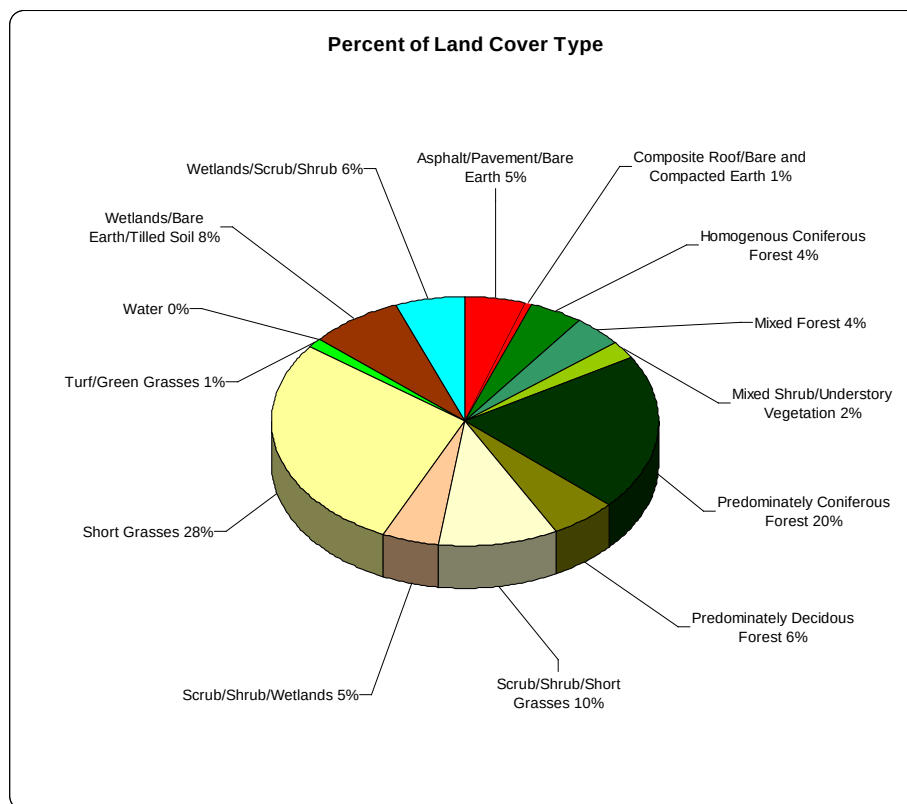


Figure 5.0 Classification Percent Totals for Rainier Subwatershed
Land cover data from 2009 SPOT imagery.

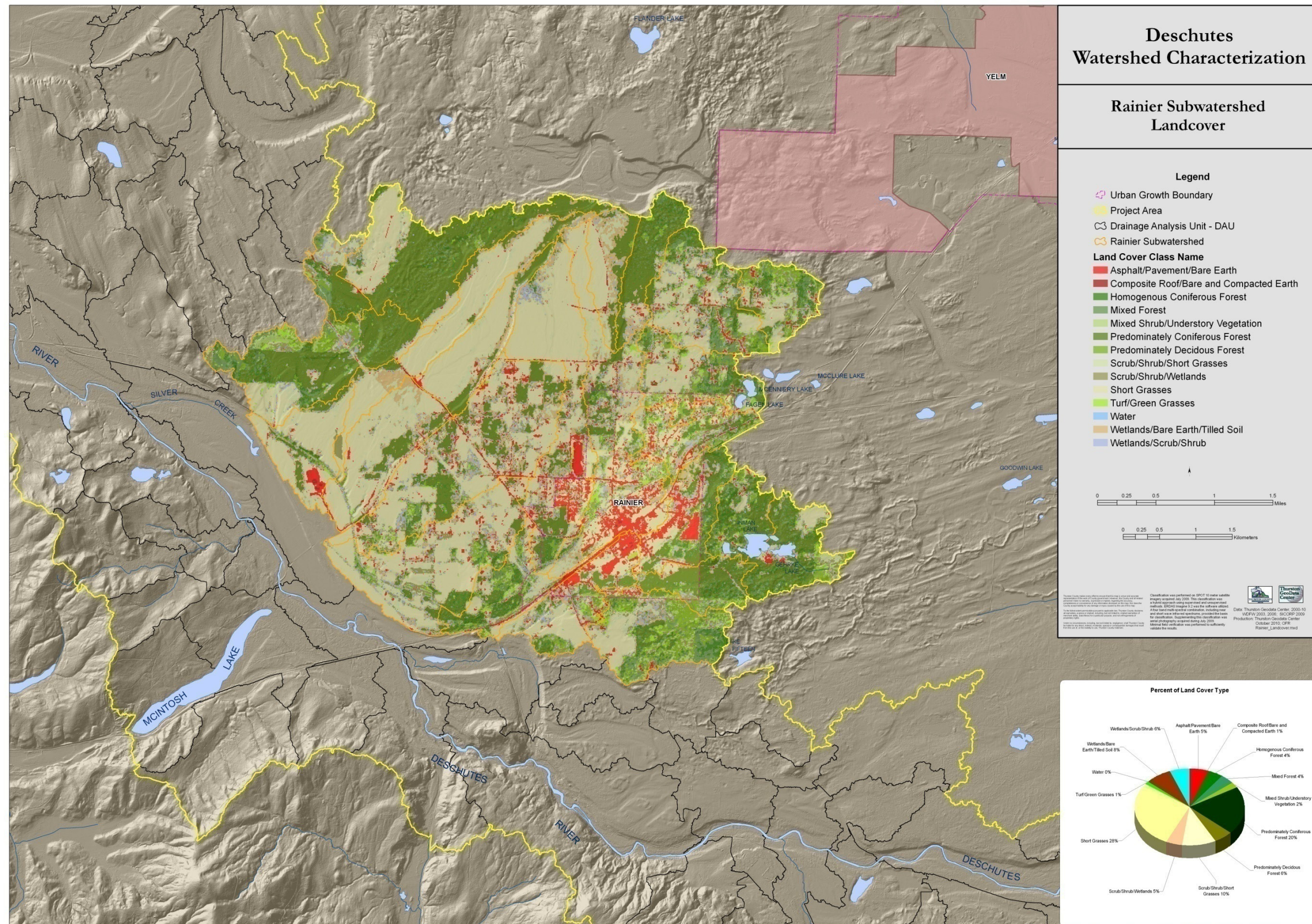


Figure 5.1 Rainier Subwatershed Land Cover

Part II. Characterize Condition of Ecological Processes in Study Area

Five ecological processes and two biological elements were assessed: the delivery and movement of water, sediment, wood, pollutants, and heat. The biological elements include aquatic integrity and habitat connectivity. The Matrix of Pathways and Indicators (MPI) was used to determine the function of each ecological process and biological indicator at the DAU scale. Following the assessment of each individual ecological process and biological element, Rules and Assumptions (Tables 8-14 in the Methods document) were used to rank each DAU as Properly Functioning (PF), At Risk (AR), or Not Properly Functioning (NPF). For complete details of the values used in the MPI, please consult Table 7 in the Methods document. For complete details of the Rules and Assumptions, please consult Tables 8 through 14 in the Methods document. Appendix A of this document contains the Methods document.

There are 24 DAUs totaling 9,531 acres (15 sq miles) in the subwatershed.

Determine the Ecological Benefit of the DAU

Following the assessment of each individual ecological process and biological elements using the indicators above and the application of the Rules and Assumptions, the resulting final ranking of each DAU yields a baseline condition of ecological health for each DAU. All DAUs within the study area having ecological processes that are considered "At Risk" under current land use conditions are identified for further consideration. DAUs in the "At Risk" category for multiple key ecological processes are assumed to provide the greatest potential to maximize environmental benefits when natural resource sites are restored.

Table 5.0 includes each ecological process and biological element with the resulting function level. Subsequently, an aggregation of these processes and elements are used to provide an overall function level and ranking of the DAU.

Table 5.0 Rainier Ecological Processes and Biological Elements Function

DAU Id	Acres	Sq Mi	Aquatic Integrity	Habitat Connectivity	Water	Sediment	Wood	Pollutants	Heat
136	657	1.03	N/A	AR	PF	AR	AR	N/A	AR
138	159	0.25	N/A	PF	AR	AR	PF	N/A	AR
140	221	0.35	N/A	PF	PF	PF	PF	N/A	PF
142	456	0.71	N/A	AR	AR	AR	AR	N/A	AR
143	224	0.35	N/A	PF	AR	AR	N/A	N/A	N/A
145	204	0.32	N/A	PF	AR	AR	N/A	N/A	N/A
146	710	1.11	N/A	PF	AR	AR	N/A	N/A	N/A
147	595	0.93	N/A	AR	PF	AR	AR	N/A	AR
148	698	1.09	N/A	AR	AR	AR	NPF	N/A	NPF
149	299	0.47	N/A	AR	PF	AR	NPF	N/A	NPF
150	447	0.70	N/A	AR	PF	AR	NPF	N/A	NPF
151	337	0.53	N/A	AR	AR	AR	N/A	N/A	N/A
154	248	0.39	N/A	NPF	AR	AR	NPF	N/A	AR

DAU Id	Acres	Sq Mi	Aquatic Integrity	Habitat Connectivity	Water	Sediment	Wood	Pollutants	Heat
156	291	0.46	N/A	AR	PF	AR	NPF	N/A	AR
157	877	1.37	N/A	AR	AR	AR	NPF	N/A	NPF
158	406	0.64	N/A	AR	PF	AR	NPF	N/A	NPF
160	307	0.48	N/A	AR	AR	AR	NPF	N/A	AR
162	203	0.32	N/A	AR	PF	PF	AR	N/A	AR
163	291	0.46	N/A	AR	PF	PF	AR	N/A	AR
164	678	1.06	N/A	AR	AR	PF	N/A	N/A	N/A
165	194	0.30	N/A	AR	PF	PF	NPF	N/A	AR
168	278	0.43	N/A	AR	AR	AR	NPF	N/A	NPF
169	328	0.51	N/A	NPF	AR	AR	NPF	N/A	AR
171	429	0.67	N/A	AR	AR	PF	NPF	N/A	AR

Once the DAU ecological processes and biological function levels are ascertained, the function levels are translated to a ranking scheme. Ecological processes and biological elements which have been identified as "At Risk" are scored higher based upon the potential for enhancement from restored/rehabilitated marginal function levels. The ecological process scores are then ranked according to the weight criteria, and converted to a High, Moderate, or Low process rank.

Table 5.1 illustrates the final ecological benefit rank of each DAU.

Table 5.1 Final DAU Ecological and Biological Benefit Rank

DAU Id	Ecological Processes					Biological Elements		Total Score	Rank
	Water	Sediment	Wood	Pollutants	Heat	Aquatic Integrity	Habitat		
142	3	1	2	0	1	0	1	8	High
160	3	1	0	0	1	0	1	6	Moderate
136	0	1	2	0	1	0	1	5	Moderate
138	3	1	0	0	1	0	0	5	Moderate
147	0	1	2	0	1	0	1	5	Moderate
148	3	1	0	0	0	0	1	5	Moderate
151	3	1	0	0	0	0	1	5	Moderate
154	3	1	0	0	1	0	0	5	Moderate
157	3	1	0	0	0	0	1	5	Moderate
168	3	1	0	0	0	0	1	5	Moderate
169	3	1	0	0	1	0	0	5	Moderate
171	3	0	0	0	1	0	1	5	Moderate
143	3	1	0	0	0	0	0	4	Moderate
145	3	1	0	0	0	0	0	4	Moderate
146	3	1	0	0	0	0	0	4	Moderate
162	0	0	2	0	1	0	1	4	Moderate
163	0	0	2	0	1	0	1	4	Moderate
164	3	0	0	0	0	0	1	4	Moderate
156	0	1	0	0	1	0	1	3	Moderate
149	0	1	0	0	0	0	1	2	Low

DAU Id	Ecological Processes					Biological Elements		Total Score	Rank
	Water	Sediment	Wood	Pollutants	Heat	Aquatic Integrity	Habitat		
150	0	1	0	0	0	0	1	2	Low
158	0	1	0	0	0	0	1	2	Low
165	0	0	0	0	1	0	1	2	Low
140	0	0	0	0	0	0	0	0	Low

The final rank is used in the identification of potential restoration and enhancement sites when the DAUs and resource sites are combined to provide a final list of natural resource sites. Rainier subwatershed has 24 DAUs that have restoration potential (Figure 5.2 Rainier Subwatershed Ecological Function)

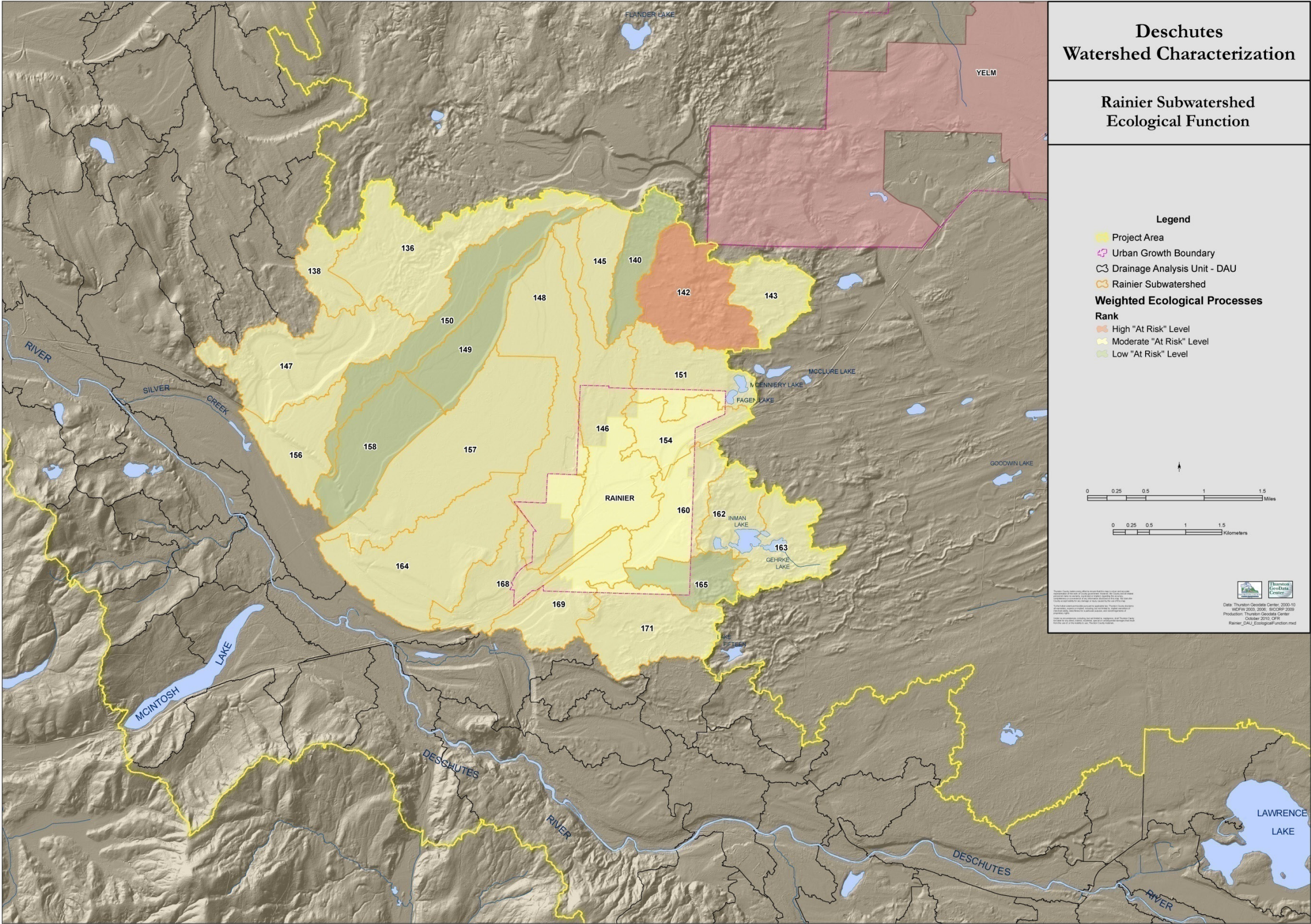


Figure 5.2 Rainier Subwatershed Ecological Function

Part III. Characterize Natural Resource Sites in Study Area

This section evaluates natural resource sites within the study area. The purpose is to determine natural resource sites that can be restored or enhanced in the surrounding landscape that will provide the greatest ecological benefit. This analysis is conducted concurrently with the analyses of the ecological processes. Upon completion of the DAU analysis and the natural resource site analysis, the sites identified are ranked in the context of the DAU and subwatershed landscape.

Determine the Environmental Benefit

The natural resource sites are evaluated based on the attributes assigned during site assessment using Tables 22 to 24 in the Methods document to assign an environmental benefit final score. Once all the attributes have been evaluated, the following ranking criteria are used to rank the sites High, Moderate, and Low.

Following the conversion of natural resource sites from a score to Low, Moderate, or High rank, there were a total of 157 potential restoration or enhancement sites. Table 5.1 details the results.

Table 5.1 Rainier Environmental Benefit Ranking of Natural Resource Sites

Rainier Potential Restoration Sites				
Rank	Wetland	Riparian	Floodplain	Total
High	9	4	0	13
Moderate	63	4	1	69
Low	72	3	0	75

Part IV. Assess Potential Sites within the DAU

This section presents the results of a ranking process for all potential natural resource restoration sites. The ranking of a natural resource restoration site is based on the ranking of each site individually combined with the ranking of the DAU within which the restoration site is located. The result is a final combined score from 0 to 6, with a score of 6 representing those sites with the greatest potential for environmental benefit if restored.

Table 5.2 is used to score the natural resource sites in the context of the DAU. A site with a Low environmental benefit is a preservation site or completely degraded site that would provide a minimal environmental benefit if restored.

Table 5.2 Combined Ranking Score

Ecological Benefit (DAU)	Environmental Benefit (Resource Site)	Total Score
High	High	6
High	Moderate	5
Moderate	High	4

Ecological Benefit (DAU)	Environmental Benefit (Resource Site)	Total Score
Moderate	Moderate	3
Low	High	2
Low	Moderate	1
N/A	Low	0

Thus, the Ecological Benefit (DAU) and the Environmental Benefit (Resource Sites) are ranked to provide a final score from 0 to 6. Following evaluation, a total of 82 sites were ranked within the corresponding DAU.

Results of natural resource restoration site ranking for wetlands, riparian and floodplain (where present) areas are described in the following sections.

The following wetlands, riparian and floodplain sections describe the final combined ecological benefit and environmental benefit ranking of natural resource sites. The following tables include the natural resource environmental score and rank, as well as the combined score when placed in the DAU.

Wetland Sites

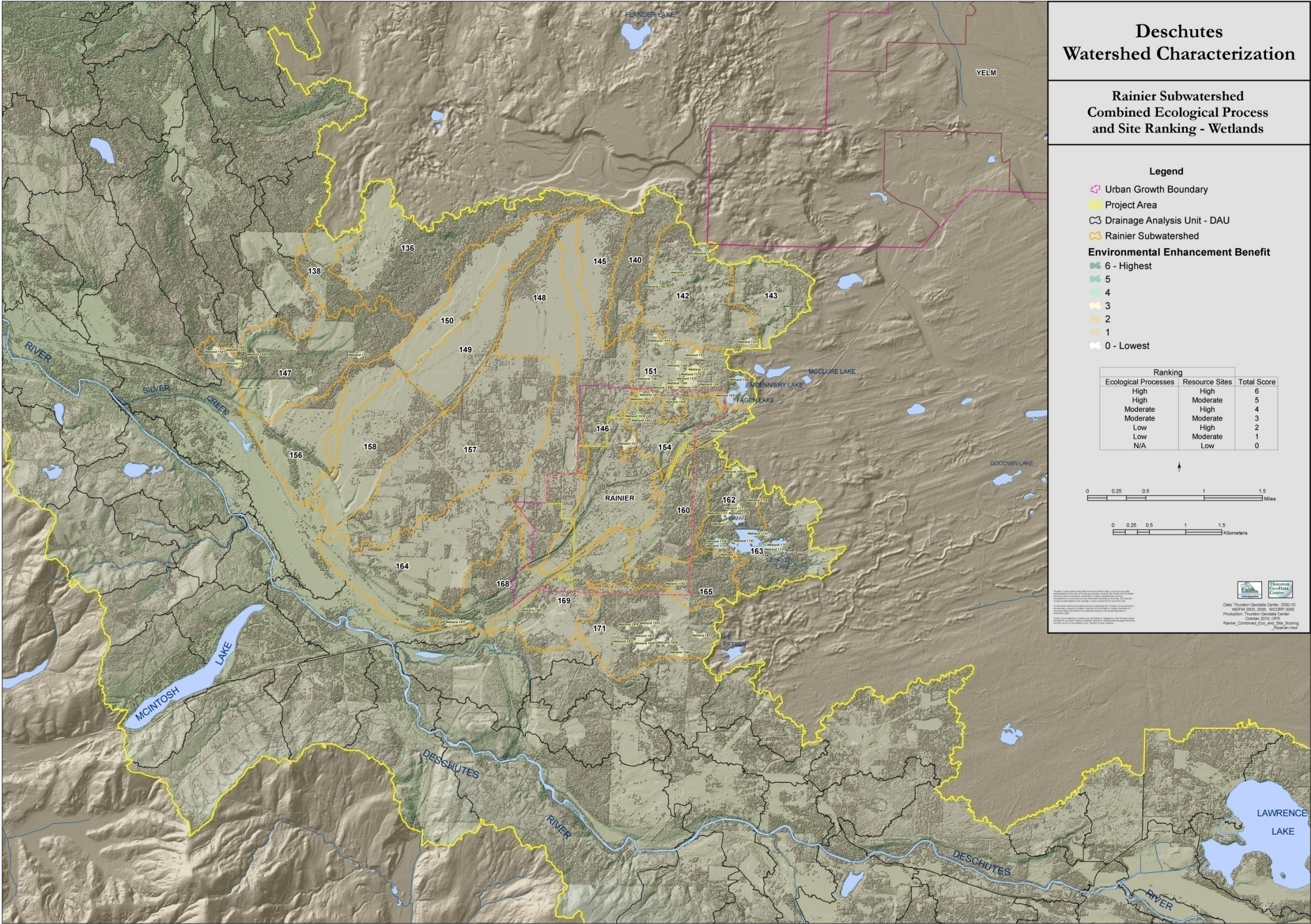
Table 5.3 presents the results of wetland restoration site ranking taking into account the combined wetland restoration potential and the DAU ranking. Figure 5.3 shows the location of each wetland restoration site. Wetland sites ranked Low and less than one acre are not included in the table, but are ranked and available in appendix B.

Table 5.3 Wetland Sites

Site ID	Wetlands Rank	Combined DAU Site Score	Acres
Wetland 1483	Moderate	5	1.736
Wetland 1457	Moderate	5	1.369
Wetland 1824	Moderate	5	0.009
Wetland 1477	Moderate	5	1.201
Wetland 1458	Moderate	5	0.723
Wetland 1508	Moderate	5	0.699
Wetland 1669	High	4	1.354
Wetland 1596	High	4	1.348
Wetland 1750	High	4	1.277
Wetland 1591	High	4	0.969
Wetland 1761	High	4	0.297
Wetland 1639	High	4	2.493
Wetland 1755	High	4	1.363
Wetland 1631	High	4	0.521
Wetland 1500	High	4	0.487
Wetland 1564	Moderate	3	2.068
Wetland 1595	Moderate	3	1.922

Site ID	Wetlands Rank	Combined DAU Site Score	Acres
Wetland 1723	Moderate	3	1.677
Wetland 1598	Moderate	3	1.633
Wetland 1617	Moderate	3	1.193
Wetland 1550	Moderate	3	0.991
Wetland 1566	Moderate	3	0.990
Wetland 1640	Moderate	3	0.607
Wetland 1538	Moderate	3	0.476
Wetland 1594	Moderate	3	0.474
Wetland 1590	Moderate	3	0.399
Wetland 1583	Moderate	3	0.360
Wetland 1542	Moderate	3	0.311
Wetland 1602	Moderate	3	0.309
Wetland 1565	Moderate	3	0.240
Wetland 1539	Moderate	3	0.235
Wetland 1604	Moderate	3	0.200
Wetland 1585	Moderate	3	11.702
Wetland 1570	Moderate	3	7.427
Wetland 1752	Moderate	3	3.937
Wetland 1751	Moderate	3	2.169
Wetland 1551	Moderate	3	1.857
Wetland 1578	Moderate	3	1.386
Wetland 1642	Moderate	3	1.151
Wetland 1668	Moderate	3	1.110
Wetland 1611	Moderate	3	1.064
Wetland 1759	Moderate	3	0.884
Wetland 1818	Moderate	3	0.639
Wetland 1806	Moderate	3	0.586
Wetland 1580	Moderate	3	0.503
Wetland 1603	Moderate	3	0.484
Wetland 1804	Moderate	3	0.457
Wetland 1529	Moderate	3	0.417
Wetland 1828	Moderate	3	0.316
Wetland 1645	Moderate	3	0.310
Wetland 1787	Moderate	3	0.254
Wetland 1666	Moderate	3	0.234
Wetland 1643	Moderate	3	0.217
Wetland 1790	Moderate	3	0.188
Wetland 1743	Moderate	3	5.814
Wetland 1691	Moderate	3	3.174
Wetland 1514	Moderate	3	2.359
Wetland 1562	Moderate	3	2.299
Wetland 1626	Moderate	3	2.045
Wetland 1575	Moderate	3	1.035
Wetland 1735	Moderate	3	0.897
Wetland 1778	Moderate	3	0.822
Wetland 1606	Moderate	3	0.808

Site ID	Wetlands Rank	Combined DAU Site Score	Acres
Wetland 1671	Moderate	3	0.802
Wetland 1641	Moderate	3	0.786
Wetland 1881	Moderate	3	0.343
Wetland 1581	Moderate	3	0.272
Wetland 1652	Moderate	3	0.232
Wetland 1582	Moderate	3	0.110
Wetland 1783	Moderate	1	3.235
Wetland 1764	Moderate	1	1.230
Wetland 1784	Moderate	1	0.463



Riparian condition

The resulting combined score of the natural resource site within the context of the DAU were scored and displayed on p Figure 5.4 Rainier Subwatershed Ecological Processes and Site Ranking – Riparian. Riparian sites ranked Low and not included in the table, but are included in appendix B.

Table 5.4 Riparian Sites

Site ID	Riparian Rank	Combined DAU and Site Score	Acres
Riparian 328	High	4	24.299
Riparian 376	High	4	44.017
Riparian 3300	Moderate	3	126.619
Riparian 388	Moderate	3	27.078
Riparian 301	Moderate	3	38.886
Riparian 408	Moderate	3	129.814
Riparian 350	High	2	148.697
Riparian 393	High	2	200.490

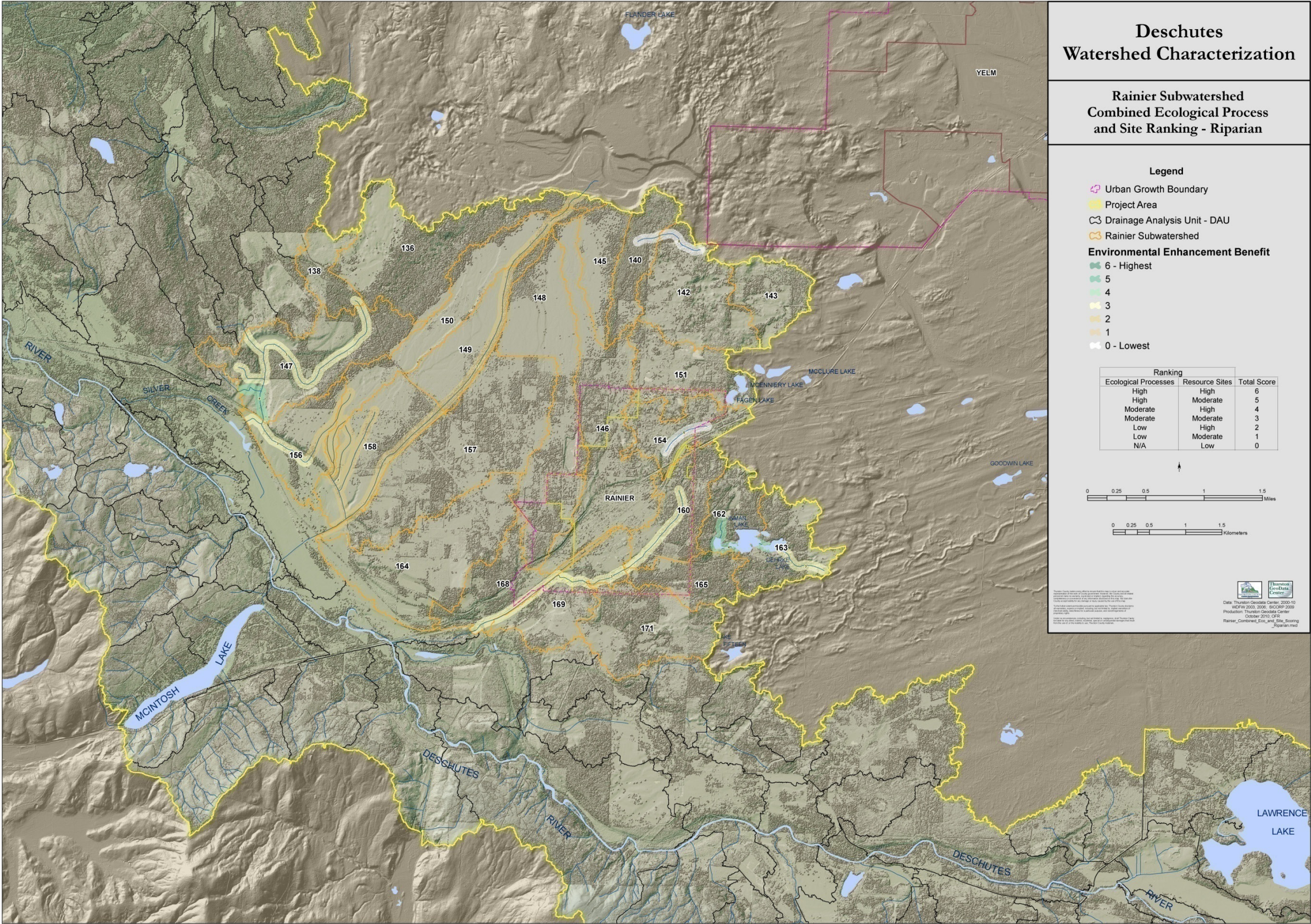


Figure 5.4 Rainier Subwatershed Ecological Processes and Site Ranking - Riparian.

Floodplain Condition

The resulting combined score of the natural resource site within the context of the DAU were scored and displayed on Figure 5.5 Rainier Subwatershed Ecological Processes and Site Ranking – Floodplain. Floodplain sites ranked Low are not included in the table, but are included in appendix B.

Table 5.5 **Floodplain Sites**

Site ID	Floodplain Rank	Combined DAU Site Score	Acres
Floodplain 25	Moderate	3	0.008

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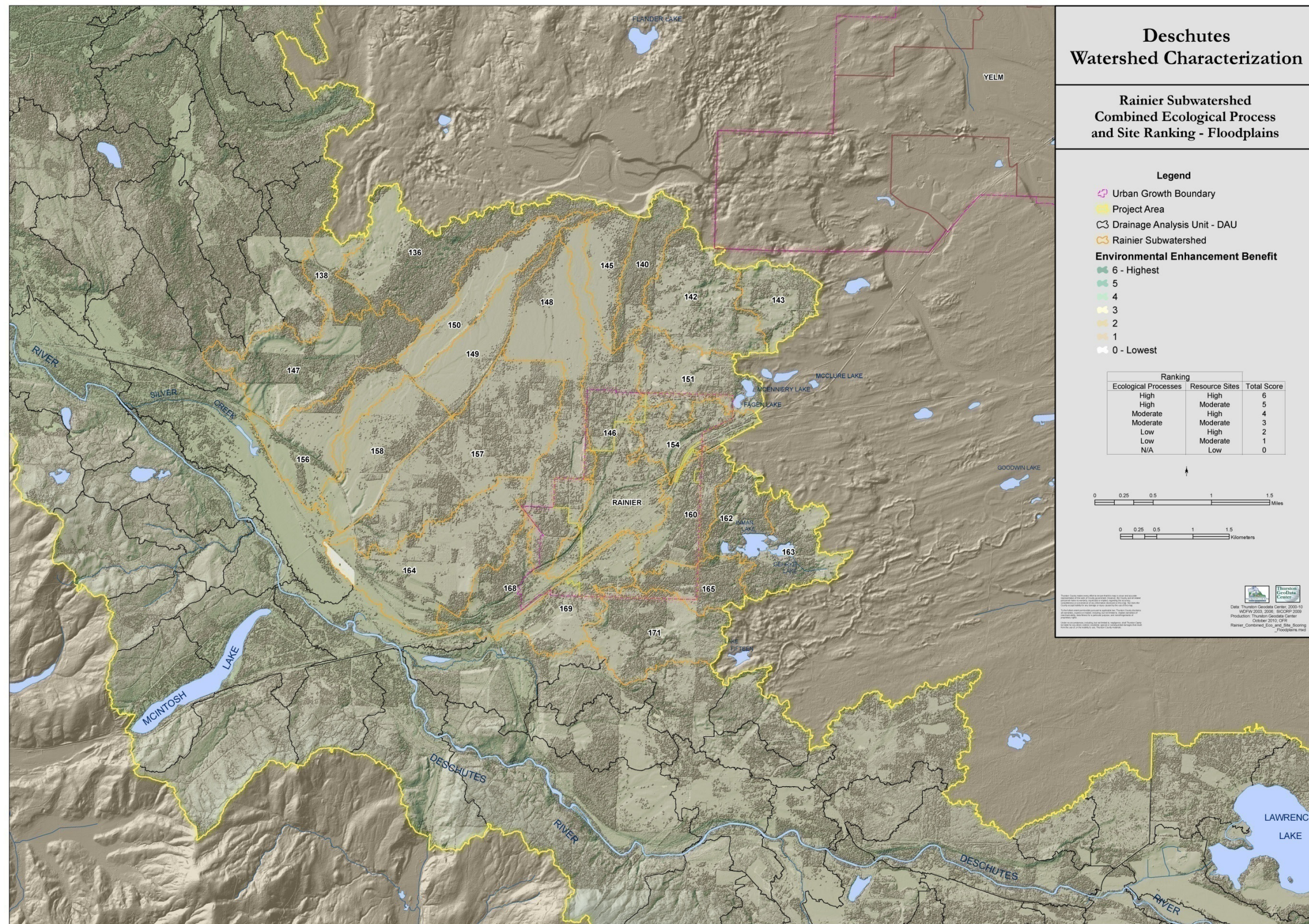


Figure 5.5 Rainier Subwatershed Ecological Processes and Site Ranking - Floodplain