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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 Moxlie Creek Subwatershed?

Current conditions

Current land-use within the Offut lake sub-watershed was determined by processing Aerial photography and SPOT 10 meter satellite imagery captured in 2009. Approximately 35% of the Moxlie Creek Subwatershed is covered by the built environment (see Figure 11.0 and 11.1 Classification Percent Totals for Moxlie Creek Subwatershed). Moxlie Creek subwatershed is highly urbanized with the lower reach of the creek in a pipe under the City of Olympia. However, the middle reach is buffered by a good riparian and upland zone of conifer tree cover.

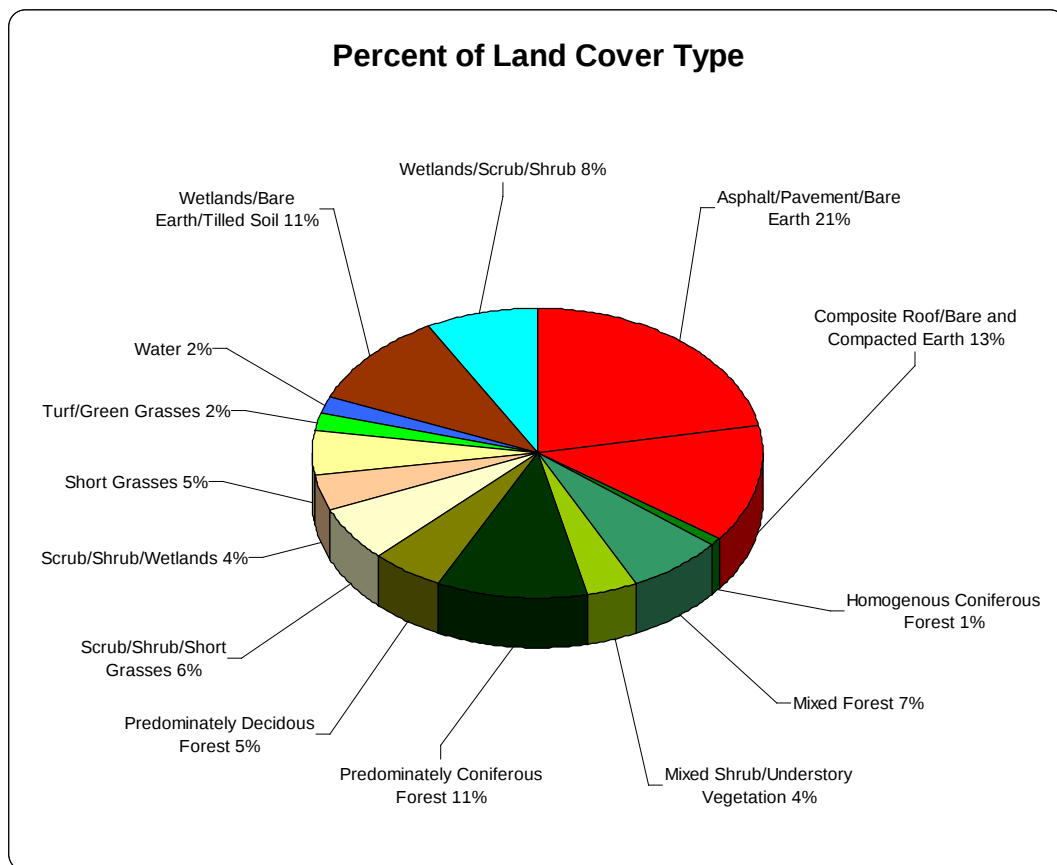


Figure 11.0 Classification Percent Totals for Moxlie Creek Subwatershed
Land cover data from 2009 SPOT imagery.



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 20 DAUs totaling 7,547 acres (12 sq miles) in the Percival Creek subwatershed.

Determine 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 11.0 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 11.0 Moxlie Creek Ecological and Biological Function

DAU Id	Acres	Sq Mi	Aquatic Integrity	Habitat Connectivity	Water	Sediment	Wood	Pollutants	Heat
28	212	0.33	N/A	NPF	NPF	AR	NPF	N/A	AR
30	154	0.24	N/A	NPF	NPF	AR	N/A	NPF	N/A
32	439	0.69	NPF	NPF	NPF	AR	NPF	NPF	AR
34	322	0.50	NPF	NPF	NPF	AR	NPF	AR	AR
36	380	0.59	N/A	AR	NPF	AR	NPF	N/A	AR
38	368	0.58	AR	AR	AR	AR	NPF	N/A	AR
39	554	0.87	N/A	NPF	NPF	AR	NPF	N/A	AR
40	209	0.33	NPF	AR	NPF	AR	NPF	N/A	NPF
41	370	0.58	AR	PF	AR	AR	PF	N/A	AR
47	352	0.55	AR	AR	NPF	AR	PF	N/A	AR
50	387	0.60	N/A	AR	NPF	AR	PF	N/A	AR
51	497	0.78	N/A	AR	AR	AR	NPF	AR	AR
55	425	0.66	N/A	NPF	NPF	AR	NPF	AR	AR

DAU Id	Acres	Sq Mi	Aquatic Integrity	Habitat Connectivity	Water	Sediment	Wood	Pollutants	Heat
59	708	1.11	N/A	NPF	NPF	AR	N/A	AR	N/A
60	536	0.84	AR	AR	AR	AR	NPF	N/A	AR
64	249	0.39	AR	AR	AR	AR	NPF	N/A	NPF
69	456	0.71	AR	NPF	AR	AR	NPF	N/A	AR
71	276	0.43	N/A	AR	NPF	AR	NPF	N/A	AR
77	365	0.57	N/A	NPF	NPF	AR	AR	AR	NPF
82	291	0.45	N/A	NPF	AR	AR	AR	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 11.1 illustrates the final ecological and biological function rank of each DAU

Table 11.1 Final DAU Ecological and Biological Benefit Rank

DAU Id	Ecological Processes					Biological Elements		Total Score	Rank
	Water	Sediment	Wood	Pollutants	Heat	Aquatic Integrity	Habitat		
38	3	1	0	0	1	1	1	7	High
51	3	1	0	1	1	0	1	7	High
60	3	1	0	0	1	1	1	7	High
82	3	1	2	0	1	0	0	7	High
41	3	1	0	0	1	1	0	6	Moderate
64	3	1	0	0	0	1	1	6	Moderate
69	3	1	0	0	1	1	0	6	Moderate
47	0	1	0	0	1	1	1	4	Moderate
77	0	1	2	1	0	0	0	4	Moderate
34	0	1	0	1	1	0	0	3	Moderate
36	0	1	0	0	1	0	1	3	Moderate
50	0	1	0	0	1	0	1	3	Moderate
55	0	1	0	1	1	0	0	3	Moderate
71	0	1	0	0	1	0	1	3	Moderate
28	0	1	0	0	1	0	0	2	Low
32	0	1	0	0	1	0	0	2	Low
39	0	1	0	0	1	0	0	2	Low
40	0	1	0	0	0	0	1	2	Low
59	0	1	0	1	0	0	0	2	Low
30	0	1	0	0	0	0	0	1	Low

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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. Moxlie Creek Subwatershed has 20 DAUs that have restoration potential (Figure 11.2 Moxlie Creek Subwatershed Ecological Function).

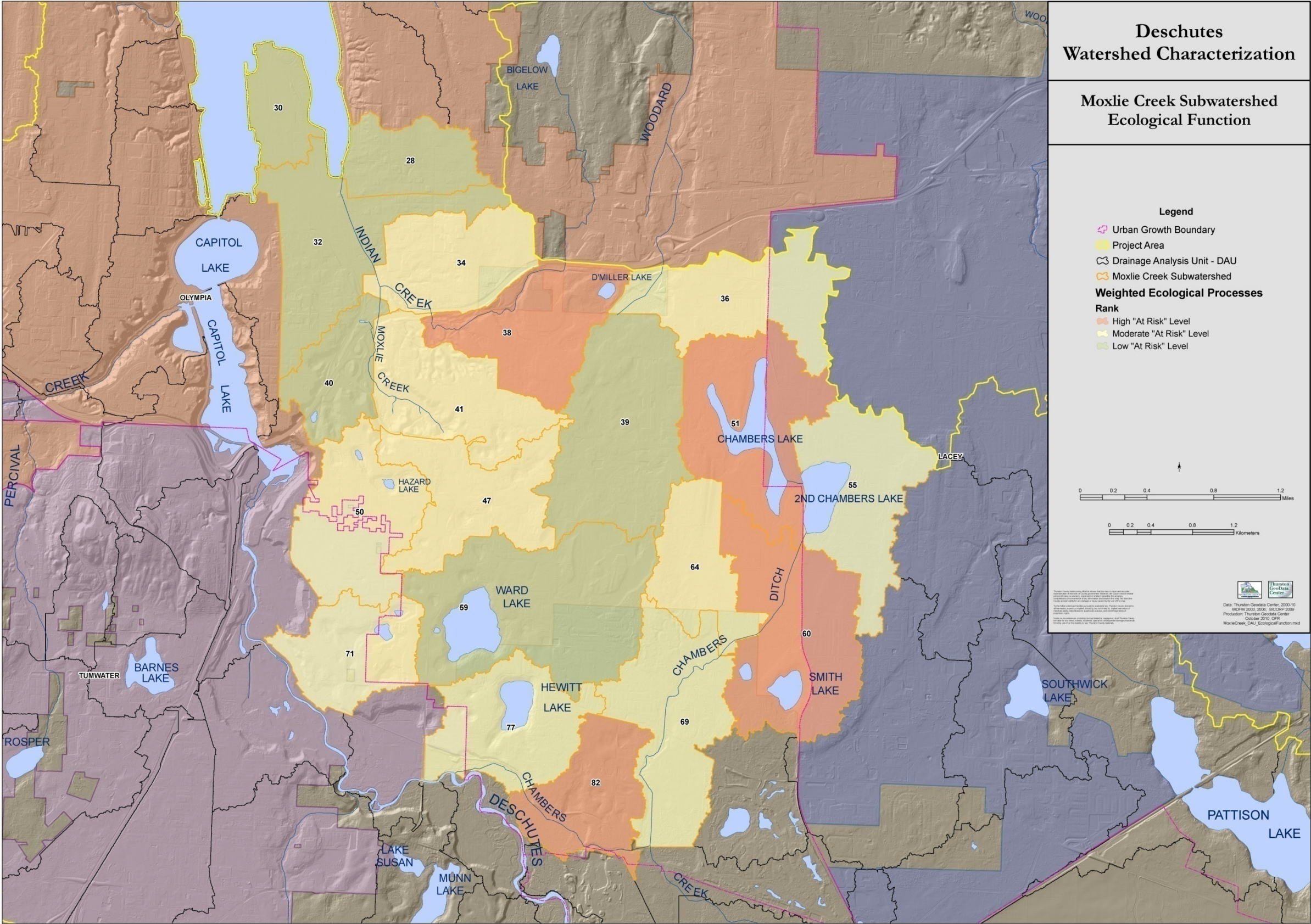


Figure 11.2 Moxlie Creek Subwatershed Ecological Function

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 of the Resource Sites

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 256 potential restoration or enhancement sites for their environmental benefit if restored. Table 11.1 details the results.

Table 11.1 Moxlie Creek Environmental Benefit Ranking of Natural Resource Sites

Moxlie Creek Potential Restoration Sites				
Rank	Wetland	Riparian	Floodplain	Total
High	57	4	0	61
Moderate	115	6	3	124
Low	66	4	1	71

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 11.2 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 11.2 Combined Ranking Score

Ecological Benefit (DAU)	Environmental Benefit (Resource Site)	Total Score
High	High	6
High	Moderate	5
Moderate	High	4
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 185 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.

Wetlands

Table 11.3 presents the results of wetland restoration site ranking taking into account the combined wetland restoration potential and the DAU ranking. Figure 11.4 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 11.3 Wetland Sites

Site ID	Wetlands Rank	Combined DAU Site Score	Acres
Wetland 2842	High	6	1.94
Wetland 267	High	6	5.14
Wetland 607	High	6	1.73
Wetland 586	High	6	0.22
Wetland 272	High	6	0.21
Wetland 891	High	6	0.00
Wetland 2791	High	6	28.54
Wetland 425	High	6	24.74
Wetland 299	High	6	3.32
Wetland 568	High	6	3.25
Wetland 313	High	6	3.23
Wetland 558	High	6	3.10
Wetland 754	High	6	2.99
Wetland 731	High	6	2.80

Site ID	Wetlands Rank	Combined DAU Site Score	Acres
Wetland 2843	High	6	2.74
Wetland 467	High	6	2.02
Wetland 580	High	6	1.31
Wetland 305	High	6	1.02
Wetland 546	High	6	0.47
Wetland 585	High	6	0.20
Wetland 775	High	6	0.06
Wetland 620	High	6	5.51
Wetland 278	High	6	0.94
Wetland 604	High	6	0.73
Wetland 269	High	6	0.65
Wetland 593	High	6	0.54
Wetland 289	High	6	0.52
Wetland 540	High	6	0.33
Wetland 273	High	6	0.09
Wetland 2844	Moderate	5	3.92
Wetland 792	Moderate	5	0.63
Wetland 615	Moderate	5	0.34
Wetland 544	Moderate	5	0.18
Wetland 394	Moderate	5	0.10
Wetland 656	Moderate	5	0.09
Wetland 650	Moderate	5	0.08
Wetland 400	Moderate	5	0.08
Wetland 545	Moderate	5	0.07
Wetland 646	Moderate	5	0.05
Wetland 766	Moderate	5	9.20
Wetland 527	Moderate	5	2.64
Wetland 533	Moderate	5	0.95
Wetland 320	Moderate	5	0.87
Wetland 354	Moderate	5	0.71
Wetland 851	Moderate	5	0.55
Wetland 374	Moderate	5	0.44
Wetland 550	Moderate	5	0.34
Wetland 584	Moderate	5	0.22
Wetland 502	Moderate	5	0.20
Wetland 395	Moderate	5	0.14
Wetland 329	Moderate	5	42.39
Wetland 334	Moderate	5	17.56
Wetland 280	Moderate	5	4.13
Wetland 352	Moderate	5	3.65
Wetland 318	Moderate	5	2.51
Wetland 328	Moderate	5	2.45
Wetland 569	Moderate	5	1.50
Wetland 304	Moderate	5	0.98
Wetland 307	Moderate	5	0.67
Wetland 351	Moderate	5	0.54
Wetland 295	Moderate	5	0.37

Site ID	Wetlands Rank	Combined DAU Site Score	Acres
Wetland 343	Moderate	5	0.21
Wetland 406	Moderate	5	0.15
Wetland 422	Moderate	5	0.11
Wetland 2847	Moderate	5	0.10
Wetland 384	Moderate	5	0.10
Wetland 451	Moderate	5	0.09
Wetland 377	Moderate	5	0.06
Wetland 530	Moderate	5	0.03
Wetland 275	High	4	3.94
Wetland 286	High	4	13.57
Wetland 500	High	4	0.43
Wetland 839	High	4	4.66
Wetland 287	High	4	3.54
Wetland 292	High	4	1.18
Wetland 641	High	4	0.59
Wetland 618	High	4	0.29
Wetland 719	High	4	0.20
Wetland 621	High	4	0.06
Wetland 893	High	4	4.31
Wetland 539	High	4	3.50
Wetland 524	High	4	1.07
Wetland 281	High	4	1.04
Wetland 842	High	4	0.64
Wetland 447	High	4	0.19
Wetland 703	High	4	0.14
Wetland 449	Moderate	3	49.60
Wetland 783	Moderate	3	27.03
Wetland 314	Moderate	3	18.72
Wetland 896	Moderate	3	16.89
Wetland 890	Moderate	3	9.10
Wetland 393	Moderate	3	5.72
Wetland 626	Moderate	3	1.72
Wetland 337	Moderate	3	0.80
Wetland 528	Moderate	3	0.66
Wetland 270	Moderate	3	0.55
Wetland 504	Moderate	3	0.55
Wetland 932	Moderate	3	0.30
Wetland 506	Moderate	3	0.23
Wetland 921	Moderate	3	4.78
Wetland 764	Moderate	3	2.29
Wetland 923	Moderate	3	2.10
Wetland 369	Moderate	3	1.65
Wetland 463	Moderate	3	1.20
Wetland 477	Moderate	3	0.91
Wetland 442	Moderate	3	0.89
Wetland 277	Moderate	3	0.74
Wetland 471	Moderate	3	0.52

Site ID	Wetlands Rank	Combined DAU Site Score	Acres
Wetland 441	Moderate	3	0.38
Wetland 589	Moderate	3	0.28
Wetland 561	Moderate	3	0.22
Wetland 444	Moderate	3	0.20
Wetland 480	Moderate	3	0.19
Wetland 532	Moderate	3	0.12
Wetland 571	Moderate	3	0.12
Wetland 443	Moderate	3	0.11
Wetland 564	Moderate	3	0.10
Wetland 520	Moderate	3	0.05
Wetland 526	Moderate	3	0.05
Wetland 364	Moderate	3	8.35
Wetland 577	Moderate	3	8.16
Wetland 481	Moderate	3	6.97
Wetland 787	Moderate	3	3.50
Wetland 433	Moderate	3	1.65
Wetland 933	Moderate	3	1.29
Wetland 588	Moderate	3	0.84
Wetland 476	Moderate	3	0.76
Wetland 282	Moderate	3	0.76
Wetland 487	Moderate	3	0.59
Wetland 435	Moderate	3	0.54
Wetland 311	Moderate	3	0.48
Wetland 554	Moderate	3	0.09
Wetland 2845	Moderate	3	0.01
Wetland 293	High	2	19.98
Wetland 365	High	2	0.80
Wetland 345	High	2	7.18
Wetland 722	High	2	5.89
Wetland 344	High	2	1.37
Wetland 322	High	2	1.25
Wetland 316	High	2	1.11
Wetland 382	High	2	1.02
Wetland 315	High	2	0.75
Wetland 448	High	2	0.57
Wetland 306	High	2	0.25
Wetland 350	Moderate	1	4.71
Wetland 250	Moderate	1	1.15
Wetland 268	Moderate	1	0.54
Wetland 595	Moderate	1	0.53
Wetland 381	Moderate	1	0.27
Wetland 336	Moderate	1	0.20
Wetland 252	Moderate	1	0.20
Wetland 492	Moderate	1	0.19
Wetland 495	Moderate	1	0.18
Wetland 598	Moderate	1	0.18
Wetland 288	Moderate	1	0.12

Site ID	Wetlands Rank	Combined DAU Site Score	Acres
Wetland 632	Moderate	1	63.44
Wetland 353	Moderate	1	4.64
Wetland 633	Moderate	1	4.08
Wetland 690	Moderate	1	1.48
Wetland 691	Moderate	1	1.00
Wetland 490	Moderate	1	0.94
Wetland 419	Moderate	1	0.36
Wetland 380	Moderate	1	0.25
Wetland 521	Moderate	1	0.09
Wetland 522	Moderate	1	0.07
Wetland 752	Moderate	1	0.67
Wetland 575	Moderate	1	0.53
Wetland 242	Moderate	1	0.35
Wetland 609	Moderate	1	0.31
Wetland 421	Moderate	1	0.18
Wetland 537	Moderate	1	0.16
Wetland 321	Moderate	1	0.13

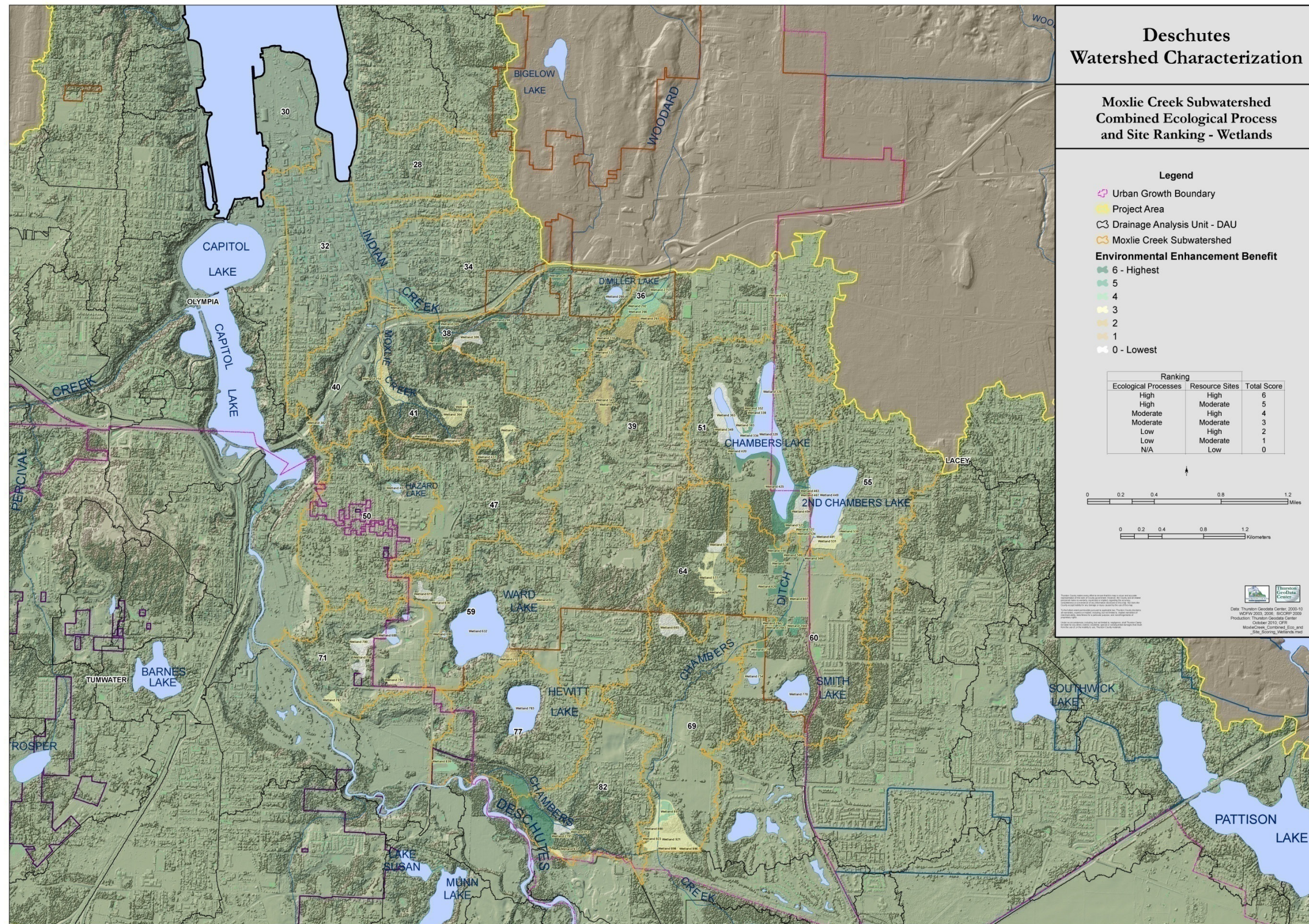


Figure 11.3 Moxlie Creek Subwatershed Ecological Processes and Site Ranking - Wetlands

Riparian condition

The resulting combined score of the natural resource site within the context of the DAU were scored and displayed on Figure 11.4 Moxlie Creek Subwatershed Ecological Processes and Site Ranking – Riparian. Riparian sites ranked Low are not included in the table, but are ranked and available in appendix B.

Table 11.4 Riparian Sites

Site ID	Riparian Rank	Combined DAU and Site Score	Acres
Riparian 176	High	6	54.49
Riparian 221	High	6	0.18
Riparian 200	High	6	68.01
Riparian 212	High	4	46.64
Riparian 209	Moderate	5	4.30
Riparian 214	Moderate	3	0.38
Riparian 224	Moderate	3	5.82
Riparian 107	Moderate	1	133.94
Riparian 149	Moderate	3	5.96
Riparian 3230	Moderate	5	0.69

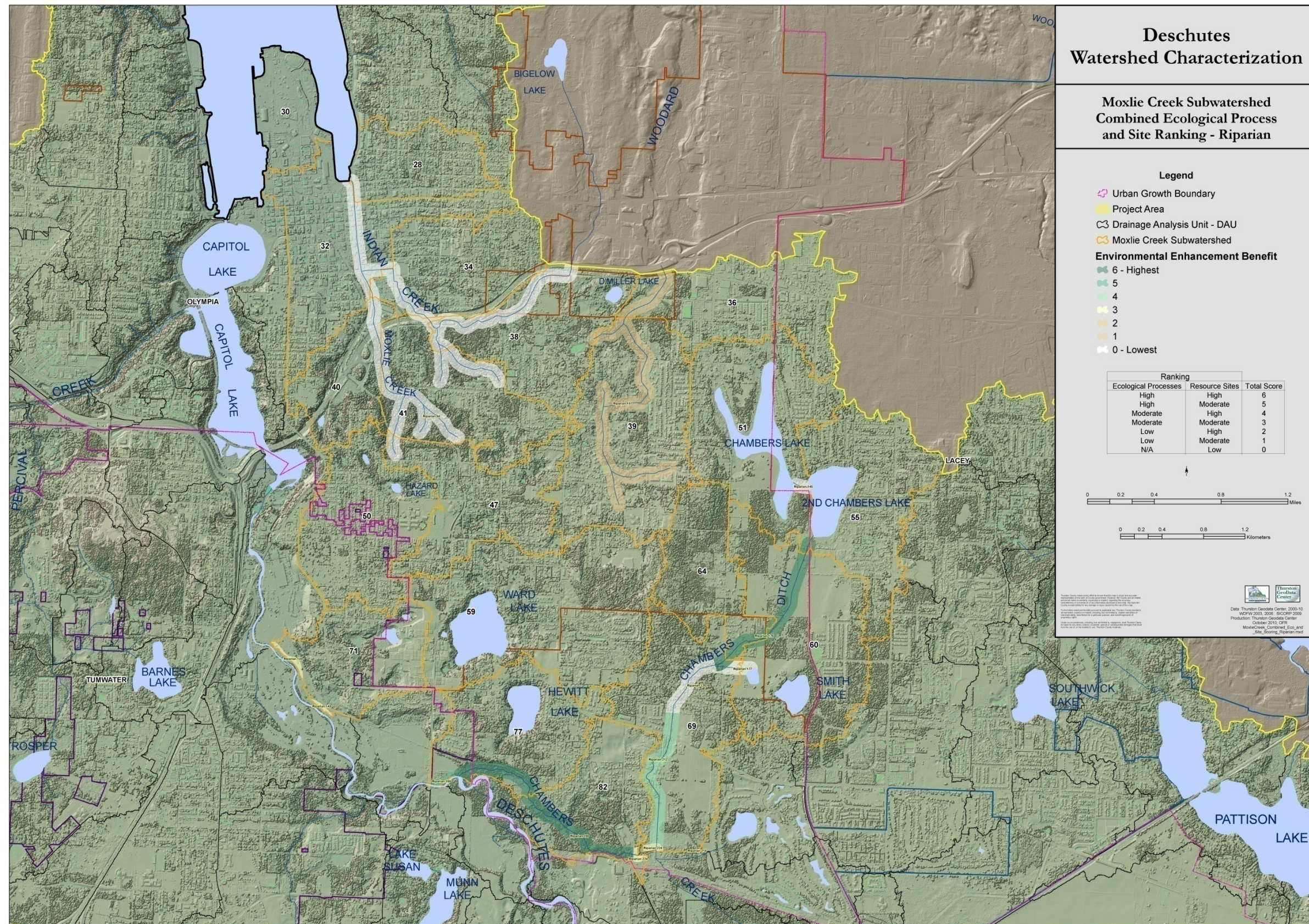


Figure 11.4 Moxlie Creek Subwatershed Ecological Processes and Site Ranking - Riparian

Floodplain Condition

The resulting combined score of the natural resource site within the context of the DAU were scored and displayed on Figure 11.6 Moxlie Creek Subwatershed Ecological Processes and Site Ranking - Floodplain. Floodplain sites ranked Low are not included in the table, but are ranked and available in appendix B.

Table 11.6 Floodplain Sites

Site ID	Floodplain Rank	Combined DAU Site Score	Acres
Floodplain 1	Moderate	3	19.56
Floodplain 2	Moderate	3	0.32
Floodplain 4	Moderate	3	14.10

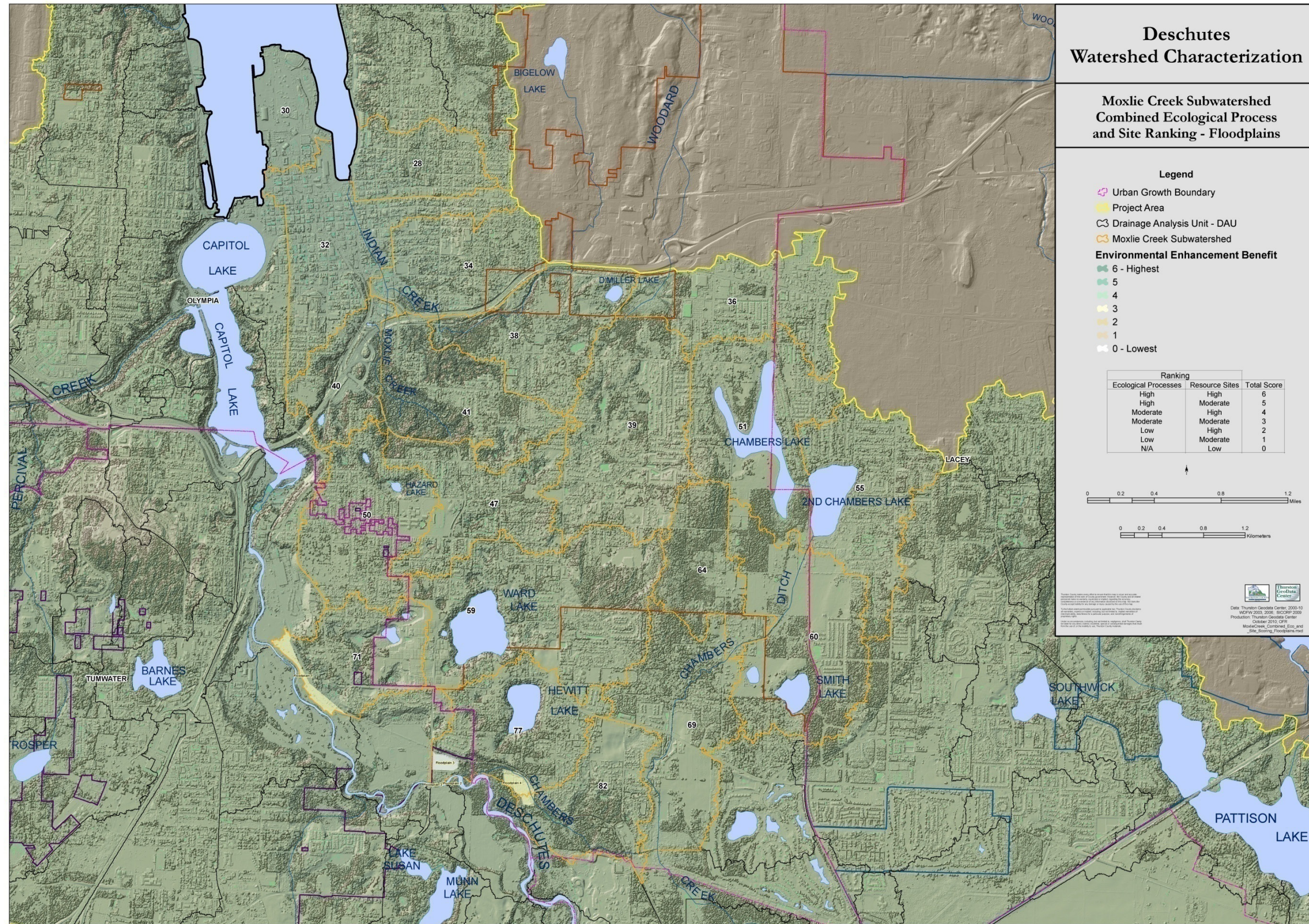


Figure 11.5 Moxlie Creek Subwatershed Ecological Processes and Site Ranking - Floodplain