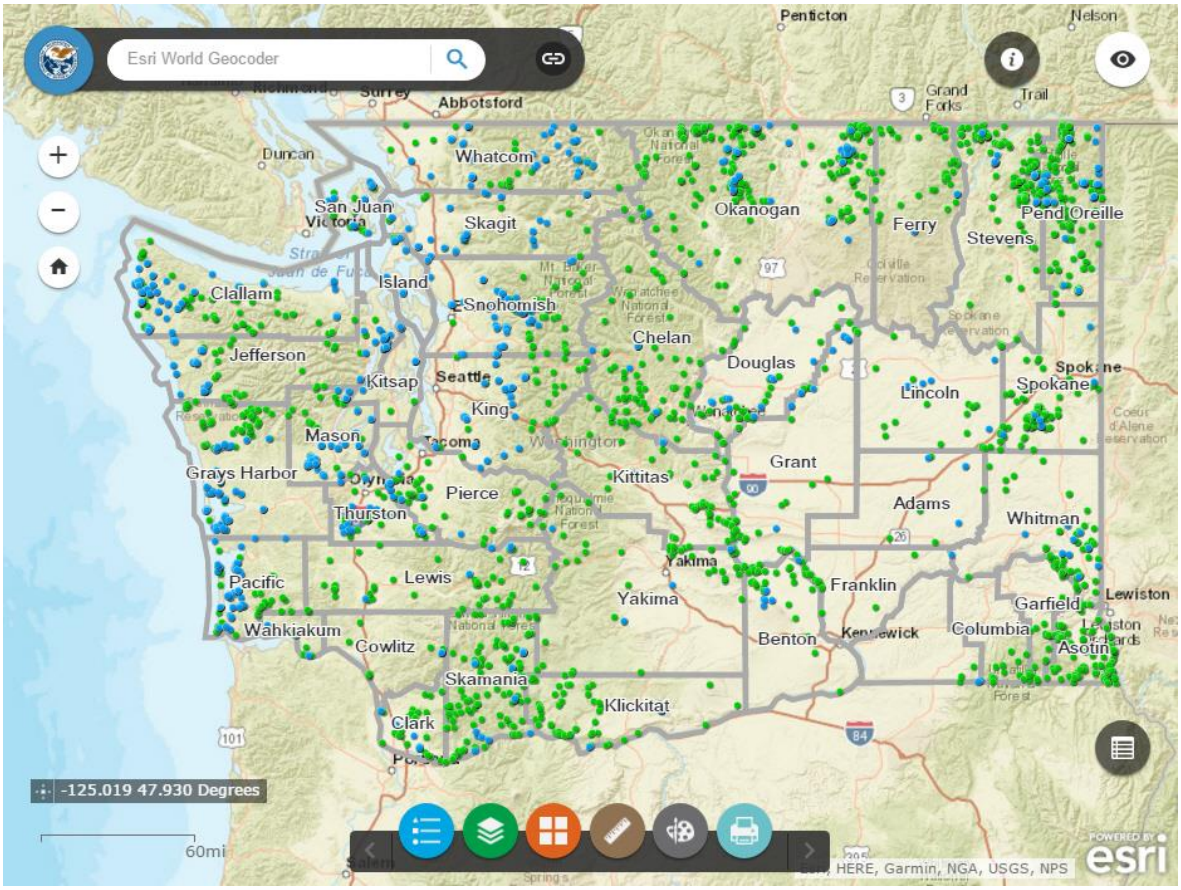
WASHINGTON NATURAL HERITAGE PROGRAM



Advancing and Transferring Natural Heritage Wetland Data: Filling Survey Gaps, Delivering Data via the Web, and Training Wetland Professionals

Prepared for

U.S. Environmental Protection Agency, Region 10

Prepared by

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June 30, 2017

Natural Heritage Report 2017-02

WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES

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ON THE COVER: Screen shot of WNHP's Wetlands of High Conservation online map viewer.

Table of Contents

Acknowledgments

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1 Introduction

This report summarizes work completed in fulfillment of an EPA Region 10 Wetland Program Development Grant (CD-00J78501) titled "*Advancing and Transferring Natural Heritage Wetland Data: Filling Survey Gaps, Delivering Data via the Web, and Training Wetland Professionals.*"

1.1 Project Overview

Project goals were to develop a statewide network of wetland reference standard sites, develop an internet-based map viewer and web site to expand public access to Natural Heritage data, and to develop and provide training for qualified individuals to apply Washington Natural Heritage Program (WNHP) wetland classification and Ecological Integrity Assessment (EIA) methodology. This report provides an overview of accomplished work. Detailed methods and results for identifying reference standard wetlands is provided in a separate report, included as a deliverable for this project (see Section 4.1).

The specific objectives of this project were to:

(1) Conduct field work to identify reference standard sites for wetland types not yet represented in WNHP's database;

(2) develop a web-based map viewer to deliver Wetlands of High Conservation Value (WHCV) and reference standard wetland data;

(3) develop and provide online resources related to identifying wetland types and assessing their ecological condition, and

(4) develop and offer training in applying WNHP's wetland classification and Ecological Integrity Assessment method.

The outcomes of this project are intended to inform land use planning, conservation actions, and wetland permitting decisions. A network of reference standard wetlands provides a statewide, baseline data set to inform management, restoration, and protection efforts by agencies, consultants, and non-profit organizations. An online map viewer will improve and expand public access to WNHP data, which has been identified by Washington Department of Ecology as important for encouraging use of WNHP data within the Wetland Rating System. In addition, an internet-based guide to WNHP's wetland classification and EIA methods will improve awareness of Washington's diverse wetland resources and available tools to assess their current ecological condition. The EIA/classification training course will expand the reach of WNHP inventory efforts by empowering consultants, agency staff, and other interested individuals with the skills needed to collect data critical for the designation of WHCV. In addition, the trainings would enrich the knowledge of wetland professionals about the types and ecological condition of Washington's wetlands.

1.2 Project Scope

This project is focused on wetlands and riparian areas within Washington State. Field work will focus on those wetlands types that currently lack representation of a reference standard site but

may also include sites that meet WHCV criteria. The map viewer will display all WHCV and reference standard wetlands across the State.

2.0 Methods

2.1 Identifying Reference Standard Wetlands

The first step in developing the list of reference standard wetlands was extracting data about high-quality wetlands from WNHP's Biotics database. Next, gaps in that dataset were identified and used to prioritize field work. Upon completion of field work, a stepwise process was implemented to filter the data resulting in a final list of reference standard wetlands. These steps are summarized below. More detailed information can be found in Rocchio and Ramm-Granberg (2017).

2.1.1 Existing Information about High Quality Wetlands

Existing data managed by the WNHP was used to generate a list of known high quality wetlands. Over the past 30 years, WNHP has conducted inventories to identify locations representing high-quality examples of Washington's wetland and riparian ecological types (Kunze 1984, 1986, 1987, 1988, 1989, 1990, 1991, Chappell 1999; Crawford 2003; Rocchio et al. 2015). Those efforts, coupled with data submitted to WNHP by conservation partners, have resulted in the documentation of 1,082 wetland and riparian ecosystem element occurrences in WNHP's Biotics database (Rocchio et al. 2015). These element occurrences are found at over 425 discrete wetland sites (i.e., a given wetland may have more than one element occurrence). The element occurrences are distributed across the state, but most occur in western Washington due to greater inventory effort in that area. Recent inventory (Rocchio et al. 2015) focused efforts in eastern Washington, but a paucity of element occurrences remains in many of the ecoregions east of the Cascade crest. Of those, the Columbia Basin has received the most inventory effort, but degradation from historical and ongoing land use has left few wetlands meeting element occurrence criteria (Crawford 2003). The other ecoregions east of the Cascades have an abundance of U.S. Forest Service lands, which have typically not received as much inventory focus from WNHP. The East Cascades ecoregion is particularly lacking in the number of wetland and riparian element occurrences but, again, this is primarily a reflection of minimal inventory effort as opposed to absence of wetlands of significant conservation value.

Each of the element occurrences has an EORANK, from A-D, reflecting its ecological integrity at the time of the inventory. The EORANK was used to determine which element occurrences had the most intact ecological conditions and thus most closely met the reference standard criteria.

2.1.2 Identifying Data Gaps

In addition to spanning the state's ecoregions, the 1,082 element occurrences also represent a large proportion of the state's wetland ecosystem diversity (as measured by USNVC subgroups). To identify data gaps, each occurrence was assigned to a subgroup. That list was compared to the comprehensive list of wetland and riparian subgroups that are found in Washington to determine data gaps. Data gaps were defined as subgroups with fewer than four occurrences in the WNHP Bitoics database. These subgroups were identified as potential sample targets and were used to guide field work conducted for this project.

2.1.3 Field Assessments

Potential locations of the targeted subgroups were identified based on their known geographical distribution, locations of rare plants that occur in similar habitats, and by conducting roadside surveys through landscapes with a high potential to support them.

Attempts were made to visit as many of the potential sample sites as possible. Occassionally other sites of interest, due to their high-quality and/or rarity, were encountered during travel to potential sample sites. Some of these sites were sampled for this project. When onsite visits were made, Rocchio et al. (*In Press*) was used to classify the wetland to a subgroup and EIA protocols were used to determine ecological integrity (Rocchio et al. 2016).

2.1.4 Developing the Final List of Reference Standard Wetlands

Development of a reference wetland network is a stepwise process of classification, inventory, identifying the range of ecological conditions, and designation of reference standard sites. First, we used the USNVC to classify regional wetland types in Washington. Next, we used embedded biogeographic components of the USNVC and ecoregions to delineate the reference domains. We then used WNHP's Biotics database as the primary source of data to assess the location and current ecological condition of extant examples of the regional wetland types. WNHP's Ecological Integrity Assessment (EIA) methodology (Faber-Langendoen et al. 2016b,c,d,e; Rocchio et al. 2016) was used to determine ecological condition during recent (post-2011) inventory work while older records used Natural Heritage "element occurrence" specifications to determine ecological condition. The EIA method was also used to set reference standard conditions. The final step was to determine which sites match reference standard conditions and which of those are most suitable for designation as reference standard wetlands.

The first consideration was to ensure that the reference standard network represents the diversity of wetland subgroups (per Rocchio et al. *In Progress*) in the state. Each of the 1,082 element occurrences were classified to the appropriate subgroup. Next, within each subgroup, the element occurrence with the highest quality EORANK (i.e., those occurrences closest to exhibiting the reference standard criteria) in each association were identified. For many subgroups, these were element occurrences with an EORANK of "A" (excellent integrity). However, because of varying degrees of loss and degradation on the landscape, not all wetlands are represented by examples functioning within the natural range of variability. For those wetland types, the highest ranked examples would qualify as reference standard sites for that wetland type. For example, the best quality example of wet prairie remaining in western Washington has an EORANK of "C" (fair integrity). Thus, although the site is significantly degraded relative to historical conditions, it is still the best remaining example of wet prairie and would be identified as a potential reference standard wetland.

Next, the degree of protection afforded to the element occurrences was considered. Sites within Natural Area Preserves—or similarly protected areas where the primary objective is management for ecological values—were selected as reference standard sites since such sites are likely to persist in the long-term. If there were no element occurrences for a given subgroup in such areas, occurrences on public lands were selected. If no element occurrences met either of those criteria, occurrences on private lands may have been designated as reference standard wetlands. In all cases, interested researchers should always seek permission and permits prior to visiting any reference standard wetland.

For a more detailed discussion of this effort please refer to Rocchio and Ramm-Granberg (2017).

2.3 Development of an Online Web Viewer

A web map was developed to support WNHP's wetland data within the Washington Department of Ecology's Wetland Rating System. The tool is a very simple online map, based on ESRI's ArcGIS Online and their web mapping application templates. No custom code for the application was used. The WNHP data is stewarded by DNR in an Oracle database. The map includes the WNHP WHCV, reference standard wetlands, and WNHP rare plants and rare nonvascular species along with reference layers such as counties, township/range/section, U.S. Fish and Wildlife Service's National Wetlands Inventory, and some land ownership information. The web map is available to anyone with an internet connection.

2.4 Developing Online Information Concerning Wetland Classification and Ecological integrity Assessments

Content describing WNHP's wetland classification, EIA method, and Floristic Quality Assessment method were incorporated into WNHP's website. Each of these topics were provided their own web page. An overview of each topic is provided and relevant technical reports by WNHP staff are highlighted on each page.

2.5 Developing and Implementing Ecological Integrity Assessment Training Course

The objective of this training was to provide detailed instruction on how to use the *Ecological Classification of Native Wetland and Riparian Vegetation Types of Washington* and Ecological Integrity Assessment (EIA) method (Rocchio et al. 2016) to identify WHCV, which are one of many criteria of Category 1 Wetlands in the Washington Wetland Rating System. Discussing examples of how these tools can be used for other objectives such as ecological monitoring, vegetation and ecosystem mapping, setting conservation priorities, and identifying restoration benchmarks were also targeted as learning objectives.

WNHP submitted a proposal to the Coastal Training Program (CTP) requesting the EIA training be offered through the CTP's class catalogue (http://www.coastaltraining-wa.org/). The training was outlined to be a 2-day course, with time spent both in the office and field. The course was titled "Identifying WHCV Using Vegetation Classification and the Ecological Integrity Assessment Method".

WNHP consulted with colleagues at the New Hampshire and Colorado natural heritage programs to seek input and advice on developing the curriculum. Both of these programs developed a similar EIA training course (also supported with regional, EPA Wetland Program Development Grants). In addition, WNHP staff sought input from colleagues at the Washington Department of Ecology who routinely provide trainings through CTP. Based on this input, WNHP developed a series of Powerpoint presentations and field-based exercises which were tested during a 'dry-run' or pilot training. EPA staff, Washingont Dept. of Ecology, and consultants were invited to this two-day, test of the EIA curriculum. Input from this exercise was crucial to finalizing the curriculum. Most critically, the balance of time over the two days was shifted to more field training. The final itineray of the training is outlined below:

Day 1: *Morning*:

1. Presentation 1 – EIA background; Natural Heritage methodology
2. Presentation 2 –*Ecological Classification of Native Wetland and Riparian Vegetation Types of Washington*

Afternoon:

1. Presentation 3 –EIA protocols
2. Field visit to Chambers Lake forested swamp – review classification and assessment area delineation

Day 2: *Morning*:

1. Travel to field site (transitional bog in Mason County)
2. Classify wetland
3. Review assessment area delineation
4. Apply landscape context and size metrics

Afternoon:

1. Apply condition metrics
2. Calculate EIA score/rank
3. Determine WHCV status
4. Travel home.

3.0 Results/Discussion

3.1 Reference Standard Wetland Gap Analysis

Table 1 shows the results of the data gap analysis for reference standard wetlands. Of the 106 subgroups that occur in Washington, 49 were determined to have fewer than four occurrences. These 49 subgroups were the primary target of field work for this project. Of the 49, 27 had no occurrences in WNHP's database (Table 1).

Table 1. Targeted Subgroups and Potential Sample Sites

USNVC Subgroup	# of EOs in WNHP Database	Potential Sample Sites
Columbia Plateau Alkaline Fen & Seep	3	Below lower treeline in the Columbia Basin
Columbia Plateau Forested Depressional Wetland	0	Turnbull National Wildlife Refuge area
Columbia Plateau Greasewood Flat	2	Northern Douglas County; Lower Crab Creek.
Columbia Plateau Intermittent Riparian Shrubland	3	
Columbia Plateau Intermittent Riparian Woodland	2	
Columbia Plateau Seep & Spring	2	
Columbia Plateau Wet Meadow	1	Consider sites in the "Assessment of Ecological Characteristics and Ecological Integrity of Wetlands in Northern Douglas County, Washington" report.
Columbia Plateau Wooded Vernal Pool	0	New addition to Klickitat Natural Resources Conservation Area. Turnbull National Wildlife Refuge area
North Pacific Eelgrass Bed	0	Padilla Bay; DNR Aquatics Nearshore Habitat Eelgrass Monitoring Data
North Pacific Hardwood Seepage Swamp	2	
North Pacific Interdunal Conifer Swamp	1	Long beach peninsula north to Westport
North Pacific Interior Montane Riparian Forest	0	Northwest portion of Blue Mountains.
North Pacific Intertidal Flat	0	
North Pacific Lowland Headwater Riparian Forest	1	Look at GIS for headwater streams under 1800 ft.
North Pacific Montane Headwater Riparian Forest	0	Consider sites in National Park Service Inventory and Monitoring data
North Pacific Montane Perennial Riparian Forest	0	Floodplains in Cascades/Olympics. Consider sites in National Park Service Inventory and Monitoring data.
North Pacific Raised Bog	2	Potentially Rooses' prairie in Olympic National Park
North Pacific Raised Bog Woodland	2	Potentially Rooses' prairie in Olympic National Park

USNVC Subgroup	# of EOs in WNHP Database	Potential Sample Sites
North Pacific Vernal Pool	0	Lacama Natural Area Preserve, San Juan Islands, Scatter Creek State Wildlife Area.
Palouse Wet Meadow	1	Foothills of Blue Mountains (e.g., Pataha Grasslands Research Natural Area, Rose Creek Preserve)
Rocky Mountain Alpine-Subalpine Seep & Spring	0	Consider sites in National Park Service Inventory and Monitoring data (specifically from North Cascades National Park).
Rocky Mountain Alpine-Subalpine Snowmelt Basin	0	Consider sites in National Park Service Inventory and Monitoring data (specifically from North Cascades National Park).
Rocky Mountain Alpine-Subalpine Streamside Meadow	0	Consider sites in National Park Service Inventory and Monitoring data (specifically from North Cascades National Park).
Rocky Mountain Calcareous Swamp	1	Okanogan Highlands to northeast Washington.
Rocky Mountain Conifer Seepage Swamp	3	
Rocky Mountain Hardwood Basin Swamp	0	Onion Ridge (Stevens County); Eastern Washington montane areas; Turnbull National Wildlife Refuge area
Rocky Mountain Hardwood Seepage Swamp	0	Onion Ridge (Stevens County); Eastern Washington montane areas; Turnbull National Wildlife Refuge area
Rocky Mountain Montane Streamside Marsh & Wet Meadow	2	
Rocky Mountain Montane Seep & Spring	3	
Rocky Mountain Patterned Fen	0	Northeast Washington, especially Selkirk Mountains.
Rocky Mountain Shrub Seepage Swamp	0	Eastern Washington montane areas, especially northeast Washington.
Rocky Mountain Waterfall & Spray Zone	0	Look at occurrences of rare plants that occur in this habitat.
Rocky Mountain Wet Cliff	0	Look at occurrences of rare plants that occur in this habitat.
Temperate Pacific Freshwater Tidal Surge Plain Mud Flat	0	
Temperate Pacific Lowland Freshwater Wet Mudflat	0	
Temperate Pacific Tidal High Salinity Lagoon	3	
Temperate Pacific Tidal Low Salinity Lagoon	1	
Vancouverian Alpine-Subalpine Snowmelt Basin	0	Consider sites in National Park Service Inventory and Monitoring data

USNVC Subgroup	# of EOs in WNHP Database	Potential Sample Sites
Vancouverian Alpine-Subalpine Streamside Meadow	0	Consider sites in National Park Service Inventory and Monitoring data
Vancouverian Interdunal Herbaceous Wetland	2	Long beach peninsula north to Westport
Vancouverian Lowland Seep & Spring	2	
Vancouverian Lowland Streamside Marsh	2	
Vancouverian Montane Seep & Spring	0	Consider sites in National Park Service Inventory and Monitoring data
Vancouverian Montane Streamside Marsh & Wet Meadow	0	Consider sites in National Park Service Inventory and Monitoring data
Vancouverian Shrub Seepage Swamp	0	Consider sites in National Park Service Inventory and Monitoring data
Vancouverian Tidal Surge Plain Shrub Swamp	2	
Vancouverian Waterfall & Spray Zones	0	Look at occurrences of rare plants that occur in this habitat.
Vancouverian Wet Bald	0	Chris Chappell's plot data locations.
Vancouverian Wet Cliff	0	Look at occurrences of rare plants that occur in this habitat.

3.2 Targeted Subgroup Sampling

The spatial and ecological characteristics of these 49 subgroups made identification and inventory of potential reference standard sites difficult. This was due to numerous circumstances including:

- occurring as very small scales (e.g. seeps & springs, wet cliffs/sprayzones,)
- inability to spatially predict their potential location and/or onsite condition (e.g., intermittent riparian areas, seepage swamps)
- difficult to survey due to time and logistic required to access them (e.g., intertidal flats, mudflats, eelgrass beds, alpine types, montane riparian areas)
- inability to identify additional potential sites (e.g., we were unable to locate any additional raised bogs (besides Crowberry) and calcareous swamps)

Thus, searching for reference standard sites was often left to roadside surveys to identify possible candidate sites. As such, field efforts were only able to identify additional ocurrences for 11 subgroups, leaving 38 with fewer than four occurrences (Table 2). In total, 23 new element occurrences were documented as part of the field work.

Capacity limitations did not allow for adequate filtering of existings datasets such as the National Park Service' Inventory and Monitoring plot database and WNHP's rare plant locations as this process requires a review of each record to discern whether a targeted Subgroup could be present.

During the course of the field surveys, high quality examples of other subgroups were encountered. Although these types were not explicitly targeted, data was collected from many of them meeting the criteria of a WHCV (

Table 3). In fact, although the majority of field time was spent looking for and surveying the targeted subgroups, the majority of data collected was from the non-targeted subgroups (

Table 3).

Table 2. Targeted Subgroups Sampled (in bold).

USNVC Subgroup	# of EOs in WNHP Database Prior to Field Work	# of New EOs Documented in this Project
Columbia Plateau Alkaline Fen & Seep	**3**	**1**
Columbia Plateau Forested Depressional Wetland	**0**	**4**
Columbia Plateau Greasewood Flat	2	
Columbia Plateau Intermittent Riparian Shrubland	**3**	**2**
Columbia Plateau Intermittent Riparian Woodland	3	
Columbia Plateau Seep & Spring	1	
Columbia Plateau Wet Meadow	**1**	**1**
Columbia Plateau Wooded Vernal Pool	**0**	**2**
North Pacific Eelgrass Bed	0	
North Pacific Hardwood Seepage Swamp	2	
North Pacific Interdunal Conifer Swamp	1	
North Pacific Interior Montane Riparian Forest	**0**	**3**
North Pacific Intertidal Flat	0	
North Pacific Lowland Headwater Riparian Forest	1	
North Pacific Montane Headwater Riparian Forest	0	
North Pacific Montane Perennial Riparian Forest	0	
North Pacific Raised Bog	2	
North Pacific Raised Bog Woodland	2	
North Pacific Vernal Pool	0	
Palouse Wet Meadow	**1**	**1**
Rocky Mountain Alpine-Subalpine Seep & Spring	0	
Rocky Mountain Alpine-Subalpine Snowmelt Basin	0	
Rocky Mountain Alpine-Subalpine Streamside Meadow	0	
Rocky Mountain Calcareous Swamp	1	
Rocky Mountain Conifer Seepage Swamp	**3**	**2**
Rocky Mountain Hardwood Basin Swamp	0	
Rocky Mountain Hardwood Seepage Swamp	0	
Rocky Mountain Montane Streamside Marsh & Wet Meadow	3	
Rocky Mountain Montane Seep & Spring	**3**	**3**
Rocky Mountain Patterned Fen	**0**	**3**

USNVC Subgroup	# of EOs in WNHP Database Prior to Field Work	# of New EOs Documented in this Project
Rocky Mountain Shrub Seepage Swamp	**0**	**1**
Rocky Mountain Waterfall & Spray Zone	0	
Rocky Mountain Wet Cliff	0	
Temperate Pacific Freshwater Tidal Surge Plain Mud Flat	0	
Temperate Pacific Lowland Freshwater Wet Mudflat	0	
Temperate Pacific Tidal High Salinity Lagoon	3	
Temperate Pacific Tidal Low Salinity Lagoon	1	
Vancouverian Alpine-Subalpine Snowmelt Basin	0	
Vancouverian Alpine-Subalpine Streamside Meadow	0	
Vancouverian Interdunal Marsh	2	
Vancouverian Lowland Seep & Spring	2	
Vancouverian Lowland Streamside Marsh	2	
Vancouverian Montane Seep & Spring	0	
Vancouverian Montane Streamside Marsh & Wet Meadow	0	
Vancouverian Shrub Seepage Swamp	0	
Vancouverian Tidal Surge Plain Shrub Swamp	2	
Vancouverian Waterfall & Spray Zones	0	
Vancouverian Wet Bald	0	
Vancouverian Wet Cliff	0	
Total Targted Sites Sampled		**23**

Table 3. Additional Subgroups Sampled.

USNVC Subgroup	# of EOs in WNHP Database Prior to Field Work	# of New EOs Surveyed For Project
Columbia Plateau Alkaline Wet Meadow	9	1
Columbia Plateau Basin Marsh	7	2
Columbia Plateau Headwater Riparian Shrubland	8	2
Columbia Plateau Perennial Riparian Shrubland	11	3
Columbia Plateau Perennial Riparian Woodland	4	5
North Pacific Coastal Bog Woodland	32	3
North Pacific Conifer Basin Swamp	11	1
North Pacific Conifer Seepage Swamp	46	1
North Pacific Lowland Poor Fen	75	1
North Pacific Open Flat Bog	21	4
North Pacific Open Transitional Bog	19	1
Rocky Mountain Calcareous Fen	9	1
Rocky Mountain Headwater Riparian Forest	10	2

USNVC Subgroup	# of EOs in WNHP Database Prior to Field Work	# of New EOs Surveyed For Project
Rocky Mountain Montane Basin Marsh & Wet Meadow	12	6
Rocky Mountain Perennial Riparian Shrubland	6	5
Rocky Mountain Poor Fen	12	3
Rocky Mountain Shrub Basin Swamp	6	1
Rocky Mountain Shrub Carr	10	1
Vancouverian Alpine-Subalpine Seep & Spring	10	1
	Total Sampled	**44**

3.3 List of Reference Standard Wetland Sites

The list of reference standard wetlands is presented "*Reference Standard Wetlands for Washington State. An Approach Based on the U.S. National Vegetation Classification*", which was submitted as a deliverable for this project. The reference standard wetlands are also included in the online map viewer (http://www.dnr.wa.gov/NHPwetlandviewer).

In summary, 678 reference standard wetlands were identified across the nine ecoregions.

3.4 Online Map Viewer and Related Content

The web map created as part of this project is a web map using tools created by ESRI (http://www.dnr.wa.gov/NHPwetlandviewer). Included are standard tools such as pan, zoom, identify, and query. Users can turn layers on and off and change the basemap. They are also able to measure, create drawings, and print their own maps.

We did not include scientific and common names with the rare plants and nonvascular species layer. This was done deliberately to add a level of security to sensitive information.

A hyperlink to the wetland subgroup descriptions will be added to the tabular data in the web map in the coming months. This will allow users to click on the link in the table to open the appropriate subgroup description document.

The WNHP datasets will be updated ocassionally from WNHP's main database, Biotics. Updates will be done either manually or automatically with a script that runs on a regular basis.

There will be ocassional and ongoing maintenance of the web map, web map application, and WNHP's website hosting this application. This will need to happen when ESRI makes changes to the underlying structure of their system or DNR changes its website.

In the future, this application may need to be housed at DNR if ESRI's web map application templates are no longer supported. In that case, web map developers may be needed to update the application. If time and funding allows, more tools could be built into this application.

3.5 Ecological Integrity Assessment Training

Ecological Integrity Assessment training occurred on Oct. 5-6, 2016 at the Lacey Community Center. Two field sites, Chambers Lake in Lacey, WA and Cranberry Marsh#2 in western Mason

County were visited. Registration for the course reached capacity of 26 individuals and numerous people were placed on a waiting list. Class participants represented State, county, city, and tribal agencies, environmental consultants, students, and interested citizens.

The following materials were produced for the training and are provided as Appendix A: (1) Powerpoint presentation about EIA, Natural Heritage Methdology, and WNHP wetland classification; (2) EIA Manual and field forms; (3) field training handouts

The Coastal Training Program sent a survey out to class participants after the course. The results of that survey are included as Appendix B.

4.0 Summary

4.1 Products and Outputs

Project deliverables/products are listed in Table 4.

4.2 Contributions to Advancing Wetland Conservation

The reference standard wetland network developed for this project provides a statewide baseline data set to inform efforts by agencies, consultants, and non-profit organizations to manage, restore, and protect Washington wetlands. This network showcases sites where data can be collected to describe the natural range of variation associated with relatively intact wetlands. Such information provides benchmarks for comparing ecological integrity of wetlands in the same class, could serve as performance standards for compensatory mitigation, and be used to characterize ecological targets for restoration, and biotic and abiotic benchmarks for biodiversity assessments and conservation goals. Long-term protection of these reference standard wetlands will ensure the sites continue to provide a field-based laboratory suitable for development, calibration, and validation of monitoring and assessment tools as well as opportunities for academic research related to improved management and conservation of Washington's wetland resources.

The information on WNHP's website on wetland classification and ecological integrity assessment tools and online map viewer increase public awareness regarding the diversity, biodiversity significance, and ecological condition of wetlands in Washington State. This awareness may assist in generating increased interest and public support for wetland protection. The map viewer will make data transfer to the public more efficient, which is especially important given that WNHP has minimal staff capacity to respond to information requests from users of the Washington Wetland Rating System. The map viewer provides users a simple and cost-effective solution to accessing information about the location of WHCV and reference standard wetland sites.

Extending the skills and abilities of using WNHP's classification and ecological integrity assessment tools via the EIA training course enhances the understanding of wetland conservation needs while also potentially increasing the inventory of wetland conservation priorities.

4.3 Limitations of Data

The information summarized in this report is based on data collected over a 30-year time frame and represents 1,082 plant association-based WHCV that span across the state. This is a substantial body of work, but data gaps persist.

WNHP has not visited every wetland in Washington, so additional sites that meet WHCV and reference standard criteria may occur on the landscape. WHCVs appear to be concentrated in western Washington, but this is primarily an artifact of the disproportionate inventory work performed in this region of the State. On the other hand, western Washington, especially the Puget lowlands, faces the greatest threats from development and other intensive land uses, so there is real urgency for conservation in this area. The Columbia Basin has also undergone extensive

Table 4. Products from this Project

Project Objectives/Tasks	Product	Comments
Objective 1: Quality Assurance Project Plan, Field Preparation, and Study Site Determination **Task 1**: A Quality Assurance Project Plan will be completed prior to project implementation. **Task 2**: Field Preparation - identify survey sites, contact landowners, create field maps, develop field forms, prepare data recorders, etc.	Quality Assurance Project Plan for *Advancing and Transferring Natural Heritage Wetland Data: Filling Survey Gaps, Delivering Data via the Web, and Training Wetland Professionals*.	Previously submitted to EPA in March, 2015.
Objective 2: Field Work and Data Entry and Analysis **Task 3**: Conduct two seasons of field work to assess ecological condition, associated stressors, and functions of targeted wetlands throughout Washington. **Task 4**: Analyze and summarize field data; enter data into Biotics.	Washington Wetland Reference Standard Site Database	Included in the accompanying CD as a Microsoft Excel workbook.
	Element occurrence records in WNHP's Biotics database.	Data from sites meeting element occurrence criteria were entered int WNHP's Biotics database. Although only selected data is available to the public (via the online web viewer—see below), WNHP can query and provide data upon request.
Objective 3: Develop Online Map Viewer and Web Page and Develop and Implement Training **Task 5**: Develop web viewer and website structure. **Task 6**: Develop content for web viewer and website. **Task 7**: Develop EIA curriculum and deliver training to targeted audiences	Wetlands of High Conservation Value and reference standard wetland map viewer	http://www.dnr.wa.gov/NHPwetlandviewer
	Online information about classification and ecological integrity assessment of Washington's wetland and riparian areas.	http://www.dnr.wa.gov/NHPwetlands http://www.dnr.wa.gov/NHP-EIA http://www.dnr.wa.gov/NHP-FQA
	Ecological Integrity Assessment Training Course	http://www.coastaltraining-wa.org/event-2262888 The training materials and presentations are included in the accompanying CD.
Objective 4: Report Writing **Task 8**: Complete final report describing all aspects (introduction, methodology, results, and conclusions) of the project.	*Reference Standard Wetlands of Washington State. An Approach Based on the U.S. National Vegetation Classification*	This report summarizes the methods used to identify wetland reference standard sites in Washington. Included in the accompanying CD
	Two articles published in National Wetlands Newsletter about reference sites.	Brooks, R.P., D. Faber-Langendoen, G. Serenbetz, **J. Rocchio**, E. D. Stein, and K. Waltz. 2016. Toward Creating a National Reference Wetlands Registry. National

Project Objectives/Tasks	Product	Comments
		Wetland Newsletter, Vol. 38, No. 3. Online: http://file.dnr.wa.gov/publications/amp_nh_ref_wetland_registry.pdf Faber-Langendoen, W. Nichols, **J. Rocchio**, K. Waltz, J. Lemly, R. Smith, and K. Snow. 2016. Rating the Condition of Reference Wetlands Across States: NatureServe's Ecological Integrity Assessment Method. National Wetland Newsletter, Vol. 38, No. 3. Online: http://file.dnr.wa.gov/publications/amp_nh_ref_wetland_condition.pdf

land conversion and continues to experience numerous stressors. The reason for the paucity of WHCV in the Columbia Basin ecoregion is primarily due to: (1) wetlands are uncommon due to the dry climate; (2) the ecoregion has a long history of land conversion and grazing impacts; and (3) non-native species such as *Phalaris arundinaceae* dominate most freshwater wetlands in the ecoregion. In addition, some ecosystem types have received more inventory attention than others. Continued effort to address gaps in knowledge of wetland types and conservation significance at higher elevations is recommended in order to fully understand the biodiversity values of Washington wetlands.

4.4 Outreach & Information Transfer

The products listed in Table 4 are available from WNHP's website (http://www.dnr.wa.gov/natural-heritage-program) or by contacting WNHP.

4.4.1 Presentations

WNHP has given two presentations about our efforts to identify reference standard wetlands:

1. "Wetland Reference Sites for Washington State. A U.S. National Vegetation Classification-based Approach". Presented at Biodiversity Without Boundaries Conference, Traverse City, Michigan. April 28, 2015

2. "Identifying Washington's Benchmark Wetlands. An Approach Based on Ecological Integrity, USNVC, and Natural Area Preserves". Presented at Biodiversity Without Boundaries Conference. Ottawa, Ontario. April 11, 2017.

4.4.2 Publications and Reports

WNHP produced a report summarizing the approach and results of identifying reference standard wetlands for Washingotn State. This report, *Reference Standard Wetlands of Washington State. An Approach Based on the U.S. National Vegetation Classification*, can be downloaded from WNHP's website: http://www.dnr.wa.gov/NHPecoreports

WNHP participated in a national workgroup moderated by NatureServe to develop a national wetland registry using Natural Heritage methods. This project was funded by an EPA Headquarters Wetland Program Development Grant awarded to NatureServe. One outcome of this workgroup was a series of articles in the National Wetland Newsletter. WNHP ecologist Joe Rocchio collaborated with Dr. Robert Brooks of Pennsylvania State University and others on a paper describing collaborative efforts to develop a national registry of wetland reference sites. Another article was published with NatureServe colleagues discussing the role the EIA plays in identifying reference sites. These articles are cited below:

Brooks, R.P., D. Faber-Langendoen, G. Serenbetz, **J. Rocchio**, E. D. Stein, and K. Waltz. 2016. Toward Creating a National Reference Wetlands Registry. National Wetland Newsletter, Vol. 38, No. 3. Online: http://file.dnr.wa.gov/publications/amp_nh_ref_wetland_registry.pdf

Faber-Langendoen, W. Nichols, **J. Rocchio**, K. Waltz, J. Lemly, R. Smith, and K. Snow. 2016. Rating the Condition of Reference Wetlands Across States: NatureServe's Ecological Integrity Assessment Method. National Wetland Newsletter, Vol. 38, No. 3. Online: http://file.dnr.wa.gov/publications/amp_nh_ref_wetland_condition.pdf

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Faber-Langendoen, D., W. Nichols, F.J. Rocchio, K. Walz, and J. Lemly. 2016b. An Introduction to NatureServe's Ecological Integrity Assessment Method. NatureServe, Arlington, VA.

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Appendix A. EIA Training Materials

These documents are provided in the accompanying CD.

Appendix B. EIA Training Course Participant Survey