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TRANSMITTAL FORM

To: **Ann Kenny**
Department of Ecology
NW Regional Office
3190 160th Ave. S.E.
Bellevue, WA 98008

Date: **July 12, 2001**
Project Number: **556-2912-001 (03)**
Project Name: **Master Plan Update Improvements Sea-Tac International Airport**

We are transmitting the following materials:

STIA - Wetland Photographs and Maps - Three copies of report.

STIA - Natural Resource Mitigation Plan - four tables:

Table 7.7-1	Final performance standards, evaluation approach, and contingency measures for the Auburn wetland mitigation project.
Table 5.1-7	Final performance standards, evaluation approaches, and contingency measures for mitigation projects at Vacca Farm
Table 5.2-12	Final performance standards, evaluation approach, and contingency measures for replacement drainage channels.
Table 5.3-6	Final performance standards, evaluation approach, and contingency measures for monitoring borrow area wetlands.

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Sincerely,

cc: Katie Walter, Shanon & Wilson

Jim Kelley

Table 5.2-12. Final performance standards, evaluation approach, and contingency measures for replacement drainage channels.

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
1^. Construct the replacement channel to convey the 100-year, 24-hour design storm, and seepage water collected by the embankment drain layer and adjacent areas.	Replacement channels will meet or exceed design criteria for high flow. Channel depths will be a minimum of 2 ft deep with side slopes of 3:1 or flatter; or if slopes are steeper, log and rock weirs will protect channel banks.	Verify with record drawings.	Enlarge channel if conveyance is inadequate.
2. Direct water in drainage channels to discharge points in or adjacent to riparian wetlands along Miller Creek (Wetlands A13, 18, 37a, 39, 44a, R9).	Flowing water will be present in Segment B and Segment C from December to June in years of normal rainfall . Groundwater in wetlands with predominantly organic soils (Portions of Wetland 18, 37a, R14a, A14b, and 44a) will be within 10 inches of the soil surface at least between March and mid-June in years of normal rainfall. Other wetlands with predominantly mineral soils will have soils saturated in the upper part to mid-April in years of normal rainfall. Wetland indicator status of the dominant plant species will not differ from pre-project conditions at the end of the monitoring period. The wetland hydrology observed following project construction is sufficient to maintain the hydric soil conditions observed in the wetland and the types of wetland vegetation present prior to construction.	Measurements of channel baseflow by installing weirs that allow quantity of water flowing through channels to be determined. Map organic and inorganic soils. Monitor duration and depth to water table in wetlands to determine if wetland hydrology persists. The data will be related to the wetland indicator status of dominant wetland plants, the information on vegetation tolerance of various hydrologic regimes, and the intensity of reducing soil conditions (i.e. iron reduction (creating mottled and gleyed soil colors) or organic matter accumulation). This analysis will be used to determine whether the post-construction hydrology observed through monitoring can reasonably be expected to maintain the wetland soils and	Modify discharge points from channel to wetlands to meet performance standards. Divert treated stormwater from up slope stormwater ponds to drainage channels. Improve drainage paths to convey water to wetlands. Remove obstructions and/or enlarge channels as needed. Reconfigure drainage channels to maintain flows (i.e., longer drainage channels to collect more water for distribution to wetlands). Divert treated stormwater from up slope stormwater ponds to drainage channels (the source of this stormwater could be from biofiltration swales, filter strips, etc. treating runoff from the perimeter road). Reconfigure discharge (i.e., location, size and number of discharge points that distribute water to wetlands from drainage channels).

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
		vegetation currently present in the wetlands.	
3. Plant native shrubs at greater than 2,100 individuals per acre and native trees at greater than 280 trees per acre along channel banks.	Shrub density will be at least 2,100 individuals per acre. Tree density will be at least 280 stems per acre. Average tree and shrub survival will be at least 80% during the first 3 monitoring years. Average canopy cover of native species will be at least 80% by monitoring year 15. By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline. Canopy cover of non-native invasive species will be no more than 10% by monitoring year 15.	Vegetation sampling (plots, transects, or plotless techniques) to estimate cover, density, mortality, and invasive species.	If standards are not met: Select species that are better adapted to existing hydrologic conditions. Install additional plant material. Install protective collars to reduce herbivore damage. Control/reduce non-native invasive species.

^Indicates a key design standard to be determined from the as-built condition. These standards typically do not require ongoing monitoring.

Table 5.1-7. Final performance standards, evaluation approaches, and contingency measures for mitigation projects at Vacca Farm.

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
I. Relocation of Miller Creek			
1.[A] Construct low flow channel 8 feet wide with 1:1 slopes and 0.5 ft deep to convey summer base flows.	Maintain a a minimum water depth of 0.25 ft (with flows of 0.5 cfs).	Dry and wet season measurements of water depths and velocities.	Evaluate factors responsible for not meeting performance standards. Adjust channel depth or channel bottom width using habitat features such as logs, boulders, root wads, etc., or regrading channel if necessary.
2.[A] Construct high flow channel 32 feet wide, with side slopes of 2:1 (typical) from depths of 0.5 to 1.0 ft to provide capacity for wet season base flow.	Wet season (October to April) average base flow depth is 1 ft (at 5 cfs).	See above.	See above.
3. The channel cross section will provide an average dry season base flow velocity that is greater than the silt transport velocity (0.7 ft/sec).	Flow velocities will exceed 0.7 cfs.	Measurements of stream velocity.	Alter velocities in low-flow channel using woody debris or boulders. Add increased amounts of LWD, boulders, or gravel bars to increase velocity.
4. Design a natural channel with stable gravel bottom in riffle sections suitable for spawning of cutthroat trout.	Substrates will contain less than 20% fine sediments (i.e., sand or smaller) in riffle sections.	Riffle areas will be delineated as part of the as built plans. A volumetric assessment of substrate (using McNeil cores or bulk samples) will be performed to document substrate conditions.	If fine sediments are present, evaluate sources and potential stabilization methods to control or eliminate fine sediments. Alter velocities in low-flow channel using woody debris or boulders.
5. Channel flow velocity is less than the gravel movement velocity (4 ft/sec) for the 100-year flow.	Scoured channel bottom sections, if present, shall not cumulatively exceed 10 linear feet. Bed material size will not increase significantly compared to as-built conditions.	A volumetric assessment of substrate (using McNeil cores or bulk samples) will be used to document substrate conditions. Channel surveys will be performed to evaluate the presence of scouring or erosion.	Adjust width of channel, replace spawning gravels, and/or repair any eroded channel banks with bioengineering or additional streambank plantings.
6. Flows greater than the annual peak flow will overtop the channel and inundate the adjacent floodplain restoration.	Flows greater than 40 cfs will overtop the stream banks and flow into the floodplain.	Measure water elevations in the stream channel and floodplain and relate to stream flow and as built topography (e.g., floodplain	Adjust bank height, channel morphology, or roughness to alter amounts of over bank flow. Regrade channel banks if necessary.

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
		elevation and berm height).	
7. Provide instream habitat features such as deflectors and overhanging logs as needed to maximize available habitat.	A minimum of 20 in-stream habitat features (e.g., LWD, overhanging logs, deflector logs, or root wads) will be present. Numbers of habitat features remain stable or increase compared to as-built condition.	Measure abundance, sizes, and location of LWD in the new channel.	If losses of LWD occur, evaluate factors contributing to reduction in LWD (e.g., high flows) and address. Add LWD to channel as necessary.
8. Provide approximately 3.0 acres of vegetated buffer on the east side of the channel. Establish native vegetation along channel banks and the riparian zone of the new channel.	Establish 3.0 acres of native shrub/forested riparian zone and upland buffers with an average tree density of at least 280 stems/acre and shrub density of at least 2,100 individuals per acre. Average survival of planted trees and shrubs in the first 3 monitoring years shall be at least 80%; cover of native species will be 80% by year 15. Cover of non-native invasive species will be no greater than 10% by monitoring year 15.	Vegetation sampling (plots, transects, or plotless techniques) to measure stem density plant cover, count live and dead plants, and measure cover of non-native invasive species.	Install additional plants if necessary. Identify substitute native species that are adapted to site conditions. Eliminate or reduce the abundance of non-native invasive species. Install protective collars to reduce herbivore damage.
9. Densely plant woody vegetation along the new channel to cover open water and reduce use of the area by waterfowl.	Canopy cover extending over the low flow channel will be 80 percent by the end of the monitoring period.	Vegetation sampling to determine tree and shrub cover.	Add additional plants if areas of exposed stream channel are present.
II. Wetland Enhancement and Restoration			
1.[A] Provide for approximately 5.94 acre-ft of flood storage on Vacca Farm to compensate for approximately 5.24 acre-ft filled for the embankment. Excavate drainage swales to provide positive drainage from the floodplain and prevent standing water during non-flood periods.	Provide 5.9 acre-ft of flood storage to compensate for 5.2 acre-ft filled for the embankment. The floodplain area will slope towards drainage swales which connect to Miller Creek.	Record drawings and hydrologic monitoring to verify necessary flood storage is present	Regrade area if not excavated to specifications. Modify design of swales to improve drainage conditions if necessary.
2. Use excavated material from grading the floodplain to create topographic	Topographic features (mounds, ridges) will be constructed at a density of 4 per	Determine density from record survey.	Construct additional features if project has not been built to specifications.

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
variation in the floodplain.	acre.		
3. Remove ditches and drains to reduce drainage rates and improve wetland hydrology. Grade floodplain to elevations that restore wetland hydrology.	Groundwater levels in the floodplain wetlands will be within 10 inches of the soil surface for at least the period between March and June during years of normal precipitation.	Hydrologic monitoring using shallow wells. Evaluate hydrologic conditions relative to recent precipitation.	Modify grading, drainage swales, or channel configuration to decrease or promote soil saturation.
4. Restore and enhance approximately 9.24 acres of farmed wetlands, wetland, and prior converted cropland in the floodplain and wetlands around Lora Lake with native vegetation. Enhance approximately 1.8 acres of floodplain and Lora Lake shoreline buffer with native vegetation (see Table 5.1.1).	The restoration area will be a minimum of 11 acres.	Determine area from record survey.	Modify construction if not built as specified.
5. Plant native shrub species in these areas at densities of greater than 2,100 per acre. Intersperse native trees in this area.	Shrub and tree survival will average at least 80% in the first 3 monitoring years. At that time, at least 2,100 shrubs/acre will remain. Percent canopy cover of native species will be at least 80% by year 15. Non-native invasive species cover will be no more than 10% by year 15 in newly planted areas. By the end of year 3, the number of species of trees and shrubs will not decrease by more than 10% from the number installed at baseline.	Vegetation sampling (plots, transects, or plotless techniques) measure vegetation cover and diversity.	If standards are not met: • Select species that are better adapted to existing hydrologic conditions. • Install additional plant material. • Install protective collars to reduce herbivore damage. • Control/reduce non-native invasive species.
6. Plant the floodplain with native trees, shrubs, and tall grasses (see Table 5.1-11 and 5.1-12) to deter waterfowl.	Percent canopy cover of native species will be at least 80% by year 15.	Vegetation sampling (plots, transects, or plotless techniques) to estimate canopy cover.	See above.

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
7. Enhance existing forested wetland south of Lora Lake with native trees and shrubs. Total density of planted material will be greater than 250 stems/acres (trees) and 1,700 individuals per acre (shrubs).	Percent canopy cover of native species will be at least 80% by year 15.	Vegetation sampling (plots, transects, or plotless techniques) to estimate canopy cover.	See above.
III. Lora Lake Buffer Enhancement			
1. Plant a 25-ft buffer (0.60 acre) around Lora Lake with native trees and shrubs. Plant native tree species at densities of greater than 280 per acre. Plant native shrub species at densities of greater than 2,100 per acre.	Average survival of planted stock will be at least 80% in the first 3 monitoring years. Following year 3, at least 280 trees per acre and 2,100 shrubs per acre will be present. Percent canopy cover of native species will be at least 80% by year 15. By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline. Non-native invasive species cover will be no more than 10% by year 15 in newly planted areas.	Vegetation sampling (plots, transects, or plotless techniques), as described above.	Contingency measures for vegetation performance standards are described above.
2. Concrete bulkhead will be removed and shoreline graded to a stable slope configuration.	Record drawings and photo documentation verify that the concrete bulkhead has been removed. New shoreline of Lora Lake will have a slope of 3:1 or less.	Record drawings to verify removal and bulkheads and slope of shoreline.	Remove all structures and bulkhead areas to be consistent with design. Re-grade as necessary to be consistent with design.

[A]Compliance with this performance standard will be determined from the as-built drawing, and will generally not require ongoing monitoring.

Table 5.3-6. Final Performance Standards, Evaluation Approach, and Contingency Measures for Monitoring Borrow Area Wetlands.

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
Maintain wetland hydrology by redirecting surface water runoff to the wetlands near Borrow Area 1.	Soils in wetlands near Borrow Area 1 (Wetlands 48 and B15) will be saturated to the surface from December to April in years of normal rainfall.	Shallow groundwater monitoring wells.	Minor regrading to direct surface water runoff to wetlands
Maintain wetland hydrology by directing groundwater seepage and surface water runoff via an interceptor swale to wetlands in and near Borrow Area 3.	Wetland 30 will have shallow standing water up to 24 inches deep during the breeding season for resident amphibians (i.e., December to April).	Shallow groundwater monitoring wells.	Adjust length and discharge points of interceptor swale system
	Wetland 29 will have soils saturated to the surface from December to April in years of normal rainfall.	Shallow groundwater monitoring wells.	Adjust length and discharge points of interceptor swale system

Table 7.7-1. Final performance standards, evaluation approach, and contingency measures for the Auburn wetland mitigation project.

Design Criteria	Performance Standard[1]	Evaluation Approach	Contingency Measures
1. Use a perched water table to establish wetlands at the approximate final grades of: East Basin: 41 ft to 38 ft in emergent wetlands 42 ft to 41 ft in shrub wetlands 45 ft to 42 ft in forested wetlands Below 38 ft in open-water wetland West Basin: 42 ft to 44 ft in emergent wetlands 44 to 47 ft in shrub wetlands 47 to 49 ft in forested wetlands Below 42 ft in open-water wetland	Wetland areas will meet the following hydrology criteria: In forested areas, soils will be saturated within the upper 12 inches for a minimum of 2 weeks during the growing season. In shrub areas, soils will be saturated within the upper 6 inches for a minimum of 6 weeks during the growing season. In emergent zones, soils will be saturated to the soil surface for 6 months.	Measure hydrology using ground water monitoring wells, soil pits, and staff gages.	Modify surface drainage features or control elevations of drainage channels. Minor regrading if necessary
2. Plant five forested wetland plant associations that are similar in composition to naturally occurring plant associations. Use native deciduous and evergreen species such as black cottonwood, Oregon ash, red alder, western red cedar, and Sitka spruce. Forested communities will have a native shrub understory with species such as salmonberry, twinberry, red-osier dogwood, red elderberry, willows, and vine maple.	Forested wetlands will cover at least 36 acres of the mitigation site. Native upland forest habitat will be established on approximately 16 acres of the mitigation site.	Measured using record surveys, vegetation monitoring, and mapping. Verify areas available for vegetation zones on completion of grading and prior to planting.	Replant as necessary to achieve desired vegetation. Adjust planting areas to match as-built grades and planned vegetation zones.

AR 050679

Design Criteria	Performance Standard[1]	Evaluation Approach	Contingency Measures
3. Plant native tree species at densities greater than 280 trees per acre. Plant native shrub species in forested communities at densities greater than 1,800 plants per acre.	Forested wetlands will have at least 80% cover of native species by monitoring year 15. Forested wetlands will have no more than 10% cover of non-native invasive species by monitoring year 15. Average survival of planted stock will be at least 80% in the first 3 monitoring years. At this time tree species density will be at least 280 trees per acre in forested wetland areas and shrub density will be at least 1,800 individual plants per acre in areas of the forested wetland that are planted with shrubs (i.e., over 25% to 50% of the area). By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline.	Verify using record surveys and vegetation monitoring. Vegetation sampling (plots, transects, or plotless techniques) to determine plant mortality, density, cover, and presence of invasive species. Vegetation analysis will employ statistically valid sampling and analysis procedures.	Replant as necessary to meet required density. If standards are not met: Select species that are better adapted to existing hydrologic conditions. Install additional plant material. Install protective collars to reduce herbivore damage. Control/reduce non-native invasive species. Implement integrated weed management plan, which may include test plots to evaluate potential control methods, mechanical removal, manual controls (i.e., chopping, digging) mowing, mulching, biological control, and/or herbicides.

AR 050680

Design Criteria	Performance Standard[1]	Evaluation Approach	Contingency Measures
3. Plant an association of native shrub wetland species that is similar in composition to naturally occurring shrub wetlands, including species such as Pacific willow, Hooker's willow, Sitka willow, red-osier dogwood, and twinberry.	Shrub wetlands will cover at [redacted] acres of the mitigation site. Species composition in the shrub wetland will include at least a 5% component of each native species planted. Average survival of planted stock will be at least 80% during the first 3 monitoring years. Following year 3, shrub density will be at least 2,100 plants per acre in shrub wetland areas. Canopy cover of native species will be at least 80% by monitoring year 15. Shrub areas will have no more than 10% cover of non-native invasive species by monitoring year 15. By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline.	See above.	See above.
4. Plant an association of native emergent	Emergent wetlands and open-water	See above.	See above.

Design Criteria	Performance Standard[1]	Evaluation Approach	Contingency Measures
wetland species similar in composition to naturally occurring emergent wetlands. Use native species that are suited to seasonally and/or permanently flooded conditions, such as water parsley, hardstem bulrush, and common spike rush.	habitat will cover at least 6.8 acres of the mitigation site. Native emergent wetland species will contribute at least 90% of plant cover in areas planted with emergent species by monitoring year 15.		
5. Plant native emergent species in approximately 0.05-acre monotypic patches.	Species composition (stem density or percent composition) in the emergent wetland will include at least a 5% component of each native species planted. Emergent areas will have no more than 10% cover of non-native invasive species by monitoring year 15. By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline.	See above.	See above.
6. Establish an approximately 100-ft-wide forested buffer around the perimeter of the mitigation site. The buffer will be densely planted with native trees and shrubs to provide site protection and discourage access to the site by people or domestic animals.	Average survival of planted stock in the buffer will be at least 80% during the first 3 monitoring years. Canopy cover of native species in the buffer will be at least 80% by monitoring year 15. Canopy cover of non-native invasive species will be no more than 10% by monitoring year 15.	See above.	See above.
7. Provide year-round shallow water with patches of emergent vegetation as feeding	Permanently flooded emergent wetlands will have shallow-water habitat (<12	Hydrologic monitoring and vegetation surveys.	Replant or minor regrading as necessary.

Design Criteria	Performance Standard[1]	Evaluation Approach	Contingency Measures
habitat for dabbling duck species.	inches deep) near the edges, with emergent vegetation and bottom detritus interspersed throughout.		
8. Provide ponded water areas for water resting habitat.	Ponded water at least 26 inches deep will occur in open areas of at least 1 acre from December through May.	Hydrologic monitoring.	Minor regrading as necessary.
9. Plant forested wetland adjacent to shrub, emergent, and open-water habitats.	Perch sites in the forested canopy will overhang emergent wetland areas.	Vegetation monitoring, site mapping.	Replant as necessary.
Plant portions of the forested wetland with shrub understory species to provide a multiple-layered canopy adjacent to the shrub portion of the wetland.	Forested wetlands will have a shrub understory of approximately 1,800 individual plants per acre over 25% to 50% of the area, depending on the planting zone.		
	Evidence of songbird nesting (nests, breeding territories, or observations of breeding behavior) will be present.	Seasonal surveys for wildlife.	
10. LWD (stumps and logs of native species) placed throughout the forested wetland to provide year-round cover for small mammals.	LWD placed at densities of 50 pieces per acre (approximately 25 ft on-center).	As-built surveys for wood placement and topography.	Supplement with more wood as necessary.
Low hummocks constructed in the shrub wetland areas to provide non-saturated soils for burrowing small mammals.	Shrub hummocks (with a minimum area of 150 ft^2 at elevation 43 ft) at least 4 per acre in the shrub zone.	As-built surveys to verify grades; vegetation surveys. Wildlife surveys.	
	Evidence of small mammal use (nests, feeding signs, observations) will be present.		
11. Provide attachment substrate for breeding amphibian species in areas of	At least 50% of live and dead stems in ponded emergent wetland areas will be species with stem diameters less than	Vegetation surveys.	Replant as necessary.

Design Criteria	Performance Standard[1]	Evaluation Approach	Contingency Measures
ponded water.	0.25 inch.		
	Evidence of amphibian breeding (egg masses, larval stages) will be present.	Amphibian surveys during the breeding season.	
12. Screen the wetland from off-site areas.	Forest and shrub buffers (100-ft-wide) screen the site.	Vegetation surveys.	Replant as necessary.
13. Enhance habitat functions of existing wetland.	Plant sections of the existing wetland with native trees and shrubs at densities of at least 2,100 individual plants per acre for shrubs and at least 280 stems per acre for native trees.	Vegetation sampling (plots, transects, or plotless techniques) to determine plant mortality, density, cover, and presence of invasive species.	If standards are not met: Select species that are better adapted to existing hydrologic conditions. Install additional plant material. Install protective collars to reduce herbivore damage. Control/reduce non-native invasive species. Implement integrated weed management plan, which may include test plots to evaluate potential control methods, use of mechanical removal, manual controls (i.e., chopping, digging) mowing, mulching, biological control, and/or herbicides

[1] All hydrologic criteria (water depths, soil saturation, etc.) must be met during years of normal rainfall, which is considered to be years when rainfall amounts are statistically similar to the long term average ($p>0.10$).

Table 7.7-1. Final performance standards, evaluation approach, and contingency measures for the Auburn wetland mitigation project.

Design Criteria	Performance Standard[1]	Evaluation Approach	Contingency Measures
1. Use a perched water table to establish wetlands at the approximate final grades of: East Basin: 41 ft to 38 ft in emergent wetlands 42 ft to 41 ft in shrub wetlands 45 ft to 42 ft in forested wetlands Below 38 ft in open-water wetland West Basin: 42 ft to 44 ft in emergent wetlands [redacted] [redacted] Below 42 ft in open-water wetland	Wetland areas will meet the following hydrology criteria: In forested areas, soils will be saturated within the upper 12 inches for a minimum of 2 weeks during the growing season. In shrub areas, soils will be saturated within the upper 6 inches for a minimum of 6 weeks during the growing season. In emergent zones, soils will be saturated to the soil surface for 6 months.	Measure hydrology using ground water monitoring wells, soil pits, and staff gages.	Modify surface drainage features or control elevations of drainage channels. Minor regrading if necessary
2. Plant five forested wetland plant associations that are similar in composition to naturally occurring plant associations. Use native deciduous and evergreen species such as black cottonwood, Oregon ash, red alder, western red cedar, and Sitka spruce. Forested communities will have a native shrub understory with species such as salmonberry, twinberry, red-osier dogwood, red elderberry, willows, and vine maple.	Forested wetlands will cover at least 36 acres of the mitigation site. Native upland forest habitat will be established on approximately 16 acres of the mitigation site.	Measured using record surveys, vegetation monitoring, and mapping. Verify areas available for vegetation zones on completion of grading and prior to planting.	Replant as necessary to achieve desired vegetation. Adjust planting areas to match as-built grades and planned vegetation zones.

Design Criteria	Performance Standard[1]	Evaluation Approach	Contingency Measures
3. Plant native tree species at densities greater than 280 trees per acre. Plant native shrub species in forested communities at densities greater than 1,800 plants per acre.	Forested wetlands will have at least 80% cover of native species by monitoring year 15. Forested wetlands will have no more than 10% cover of non-native invasive species by monitoring year 15. Average survival of planted stock will be at least 80% in the first 3 monitoring years. At this time tree species density will be at least 280 trees per acre in forested wetland areas and shrub density will be at least 1,800 individual plants per acre in areas of the forested wetland that are planted with shrubs (i.e., over 25% to 50% of the area). By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline.	Verify using record surveys and vegetation monitoring. Vegetation sampling (plots, transects, or plotless techniques) to determine plant mortality, density, cover, and presence of invasive species. Vegetation analysis will employ statistically valid sampling and analysis procedures.	Replant as necessary to meet required density. If standards are not met: Select species that are better adapted to existing hydrologic conditions. Install additional plant material. Install protective collars to reduce herbivore damage. Control/reduce non-native invasive species. Implement integrated weed management plan, which may include test plots to evaluate potential control methods, mechanical removal, manual controls (i.e., chopping, digging) mowing, mulching, biological control, and/or herbicides.

AR 050686

Design Criteria	Performance Standard[1]	Evaluation Approach	Contingency Measures
3. Plant an association of native shrub wetland species that is similar in composition to naturally occurring shrub wetlands, including species such as Pacific willow, Hooker's willow, Sitka willow, red-osier dogwood, and twinberry.	Shrub wetlands will cover at least [redacted] acres of the mitigation site. Species composition in the shrub wetland will include at least a 5% component of each native species planted. Average survival of planted stock will be at least 80% during the first 3 monitoring years. Following year 3, shrub density will be at least 2,100 plants per acre in shrub wetland areas. Canopy cover of native species will be at least 80% by monitoring year 15. Shrub areas will have no more than 10% cover of non-native invasive species by monitoring year 15. By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline.	See above.	See above.
4. Plant an association of native emergent	Emergent wetlands and open-water	See above.	See above.

Design Criteria	Performance Standard[1]	Evaluation Approach	Contingency Measures
wetland species similar in composition to naturally occurring emergent wetlands. Use native species that are suited to seasonally and/or permanently flooded conditions, such as water parsley, hardstem bulrush, and common spike rush.	habitat will cover at least 6.8 acres of the mitigation site. Native emergent wetland species will contribute at least 90% of plant cover in areas planted with emergent species by monitoring year 15.		
5. Plant native emergent species in approximately 0.05-acre monotypic patches.	Species composition (stem density or percent composition) in the emergent wetland will include at least a 5% component of each native species planted. Emergent areas will have no more than 10% cover of non-native invasive species by monitoring year 15. By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline.	See above.	See above.
6. Establish an approximately 100-ft-wide forested buffer around the perimeter of the mitigation site. The buffer will be densely planted with native trees and shrubs to provide site protection and discourage access to the site by people or domestic animals.	Average survival of planted stock in the buffer will be at least 80% during the first 3 monitoring years. Canopy cover of native species in the buffer will be at least 80% by monitoring year 15. Canopy cover of non-native invasive species will be no more than 10% by monitoring year 15.	See above.	See above.
7. Provide year-round shallow water with patches of emergent vegetation as feeding	Permanently flooded emergent wetlands will have shallow-water habitat (<12	Hydrologic monitoring and vegetation surveys.	Replant or minor regrading as necessary.

Design Criteria	Performance Standard[1]	Evaluation Approach	Contingency Measures
habitat for dabbling duck species.	inches deep) near the edges, with emergent vegetation and bottom detritus interspersed throughout.		
8. Provide ponded water areas for water resting habitat.	Ponded water at least 26 inches deep will occur in open areas of at least 1 acre from December through May.	Hydrologic monitoring.	Minor regrading as necessary.
9. Plant forested wetland adjacent to shrub, emergent, and open-water habitats.	Perch sites in the forested canopy will overhang emergent wetland areas.	Vegetation monitoring, site mapping.	Replant as necessary.
Plant portions of the forested wetland with shrub understory species to provide a multiple-layered canopy adjacent to the shrub portion of the wetland.	Forested wetlands will have a shrub understory of approximately 1,800 individual plants per acre over 25% to 50% of the area, depending on the planting zone.		
	Evidence of songbird nesting (nests, breeding territories, or observations of breeding behavior) will be present.	Seasonal surveys for wildlife.	
10. LWD (stumps and logs of native species) placed throughout the forested wetland to provide year-round cover for small mammals.	LWD placed at densities of 50 pieces per acre (approximately 25 ft on-center).	As-built surveys for wood placement and topography.	Supplement with more wood as necessary.
Low hummocks constructed in the shrub wetland areas to provide non-saturated soils for burrowing small mammals.	Shrub hummocks (with a minimum area of 150 ft^2 at elevation 43 ft) at least 4 per acre in the shrub zone.	As-built surveys to verify grades; vegetation surveys. Wildlife surveys.	
	Evidence of small mammal use (nests, feeding signs, observations) will be present.		
11. Provide attachment substrate for breeding amphibian species in areas of	At least 50% of live and dead stems in ponded emergent wetland areas will be species with stem diameters less than	Vegetation surveys.	Replant as necessary.

Design Criteria	Performance Standard[1]	Evaluation Approach	Contingency Measures
ponded water.	0.25 inch.		
	Evidence of amphibian breeding (egg masses, larval stages) will be present.	Amphibian surveys during the breeding season.	
12. Screen the wetland from off-site areas.	Forest and shrub buffers (100-ft-wide) screen the site.	Vegetation surveys.	Replant as necessary.
13. Enhance habitat functions of existing wetland.	Plant sections of the existing wetland with native trees and shrubs at densities of at least 2,100 individual plants per acre for shrubs and at least 280 stems per acre for native trees.	Vegetation sampling (plots, transects, or plotless techniques) to determine plant mortality, density, cover, and presence of invasive species.	If standards are not met: Select species that are better adapted to existing hydrologic conditions. Install additional plant material. Install protective collars to reduce herbivore damage. Control/reduce non-native invasive species. Implement integrated weed management plan, which may include test plots to evaluate potential control methods, use of mechanical removal, manual controls (i.e., chopping, digging) mowing, mulching, biological control, and/or herbicides

[1] All hydrologic criteria (water depths, soil saturation, etc.) must be met during years of normal rainfall, which is considered to be years when rainfall amounts are statistically similar to the long term average ($p>0.10$).