Prequalified Practice Standards – Water Quality Trading Framework (WQTF)

Channel Restoration: Sediment Removal, Low-Flow Channel Creation, Bank Grading, and Riparian Planting

Practice Standards

No.	Element	Description
1	*Description of the practice and its purpose.*	**Direct Removal of Phosphorus.** Excavation of sediment, sediment-bound phosphorus, and organic matter from the channel; creation of a low flow channel with or without sinuosity; grading of the channel's floodplain to drain into low flow channel; and riparian planting with native species. **Reduced Internal Loading of Phosphorus.** Reduction of contact surface between water and sediment, resulting in reduced phosphorus flux and sediment biological oxygen demand. Removal of invasive *Ludwigia*, resulting in elimination of anoxic conditions and reduced phosphorus flux into the water column.
2	*Description of where the practice should be applied*	Flood control channels, natural channels confined by levees, modified channels, degraded natural channels as defined in the most current version of the Sonoma Water Stream Maintenance Program (SMP) Manual.
3	*Guidelines and performance standards for design, installation, and maintenance.*	Guidelines and performance standards can be found in the most current version of the Sonoma Water SMP Manual. Project must also comply with all relevant regulations.
4	*Potential side effects, interactions, and additional benefits of the practice.*	**Additional Benefits.** Direct removal of invasive species and reduced mosquito proliferation. Clearing of invasive plants and brush, increasing visibility and thereby decreasing homeless encampment potential and associated discharges. **Interactions.** Reaches downstream of the project site will receive higher quality water and therefore be improved. **Side Effects.**

		Temporary disruption of riparian habitat required to modify channel. Noise, traffic, dust, and other construction and earth-moving related impacts are anticipated.
5	*Practice-specific baseline requirements*	**Regulatory Baseline.** According to the WQTF, only voluntary actions that are above and beyond any applicable laws, regulatory requirements, or other affirmative obligations such as those established in permits, easements, deed restrictions and/or other binding contracts, or that take place prior to the adoption of a regulatory mechanism that requires those actions, shall be eligible to generate credits. **Physical Baseline.** In the absence of a regulatory baseline, baseline conditions shall be at least equivalent to existing conditions or practices at the project site based on the prior three-year history of the property or operation. **Potential baseline requirements for this practice.** The Russian River Biological Opinion, permits, laws, regulations, plans, etc. may create a different baseline than existing physical conditions based on the requirement to implement specific practices.
6	*Practice-specific maximum credit banking duration*	**Direct Removal of Phosphorus.** 5 years. **Reduced Internal Loading of Phosphorus.** 5 years.
7	*Practice-specific maximum project life*	**Direct Removal of Phosphorus.** Up to 5 years. **Reduced Internal Loading of Phosphorus.** Up to 20 years.
8	*Practice-specific applicable trading ratio*	**Direct Removal of Phosphorus.** Uncertainty Ratio = 1.5 This practice includes direct measurement of pollutant reductions.

		Retirement Ratio = 0.0 This practice is explicitly designed to enhance environmental values. Overall Ratio = 1.5 **Reduced Internal Loading of Phosphorus.** Uncertainty Ratio without measured P flux = 2.0 Uncertainty Ratio with measured P flux = 1.5 Retirement Ratio = 0.0 This practice is explicitly designed to enhance environmental values. Overall Ratio = 1.5 or 2.0
9	*Monitoring requirements as needed to support practice implementation*	All monitoring will be conducted by a third-party credit verifier. **Vegetation Monitoring.** Information collected will include the number or percent of successional species (trees and shrubs) installed and surviving, line intercept cover measurements to track establishment of herbaceous understory and emergent species, square footage of channel planted, estimated percent canopy cover, number or percent of planted trees and shrubs surviving, and the annual cost for implementing the planting program. Site conditions will be documented annually by taking repeat photographs at set reference locations. Monitoring of invasive and exotic plant removal will include tracking the number of invasive or exotic trees removed, length of channel of removal activities, area of removal activities for shrubby or herbaceous species, observing whether recolonization of invasives occurs after removal, and documenting the annual cost for invasive and exotic removal. The monitoring data will be reviewed in annual reports to evaluate the overall success of the revegetation approach. **Reduced Internal Loading of Phosphorus Monitoring.** Channel area covered with *Ludwigia*

		experiences anoxic conditions that lead to phosphorous flux from the sediment to the water column. As such, absent direct measurement of flux, monitoring of reduced internal phosphorous loading will focus on the presence, extent, and area of *Ludwigia* within the project area, and follow methods used to verify pre- and post-construction internal loading. Methods may include, but are not limited to: 1. Topographic surveys, transects, and low elevation aerial photographs collected by a drone will be used to annually verify the area of *Ludwigia* contributing to internal loading. A series of overlapping aerial photographs collected by the drone will be processed into a single high-resolution, distortion-free orthophotograph from which it is possible to distinguish and map *Ludwigia*, riparian vegetation, bank vegetation, and open water. 2. Water surface elevation (stage) and daily discharge from a gage downstream of the project site but upstream of any other significant surface water inputs will be used to determine the inundation depth and duration of the project area to determine the internal loading time period contributing to Phosphorus load over the preceding year. Stage height above surveyed floodplain elevation would indicate floodplain inundation and potentially anoxic conditions in areas occupied by *Ludwigia*. The gage will record data at intervals that allow for a calculation of the duration of the water surface above a specified datum (e.g., floodplain elevation). The average duration of inundation over the previous water year (WY; October 1 at the end of one year through September 30 of the

		next year) would account for recent project area conditions. The average duration in days (divided in half to account for diel variability in photosynthetic activity) will be used as time in the calculations. Where actual measurements of P flux were taken to establish a baseline of flux (and improve the uncertainty ratio), monitoring will require at least annual measurements using equipment and methods of equal or greater precision, covering an area sufficient to represent the entire project site. The results of this monitoring will reveal the actual amount of flux reduced, and therefore the number of credits that can be certified. **Direct Removal of Phosphorus Monitoring.** Monitoring of direct removal depends on accounting for the degree of sedimentation of the excavated low-flow channel. Methods may include, but are not limited to: 1. The width, depth, and area of the excavated portions will be monitored annually through topographic surveys or repeat cross-sectional surveys. 2. Topographic data will be used to construct a digital elevation model (DEM) of the project area within a geographic information system. Successive, annual DEMs will be compared to one another to detect and quantify geomorphic change (scour and fill) from year to year. The geomorphic change analysis would quantify the volumes scour and fill separately, quantify the net volume of scour or fill, and identify areas of channel degradation and aggradation. The data would characterize reach-wide geomorphic processes and potentially identify local, sub-reach areas needing

		maintenance during the project life for sediment removal.

Credit Quantification Methods

No.	Element	Method
10	*Description of predicted practice effectiveness, as supported by site-specific analysis or literature.*	**Direct Removal of Phosphorus.** Provided that removed sediment does not leach P into the watershed, and provided that remaining sediment-sorbed P in the channel does not become bioavailable and therefore introduced into the water column, the practice will remain effective. **Reduced Internal Loading of Phosphorus.** If *Ludwigia* is removed and remains absent, anoxic conditions should not develop to the same degree. In addition, the decrease in the contact surface between the water column and sediment due to the low flow channel will result in a decrease in flux. Provided that *Ludwigia* removal and the low flow channel are maintained, the practice will remain effective.
11	*Technical summary of the method by which water quality credits will be calculated (i.e. credit quantification method), and a description of the method's accuracy, sensitivity and uncertainty.*	**Direct Removal of Phosphorus.** The calculation of the total benefit from sediment removal relies on phosphorus load to the rooting depth of *Ludwigia*. The mass of removed sediment from the volume of sediment is given by: $S_{load} = \rho_{sed} * A_{sed} * D_{root}$ where: S_{load} = Sediment load, kg ρ_{sed} = Sediment bulk density, kg/m^3y A_{sed} = Area of sediment removal, m^2 D_{root} = Mean *Ludwigia* root depth, m The total load of phosphorus removed is based upon the total mass of sediment and the concentration of phosphorus within the mass and can be calculated from: $P_{load} = P_{sed} * \rho_{sed} * A_{sed} * D_{root}$

		where: P_{load} = Sediment total phosphorus load, g P_{sed} = Sediment total phosphorus concentration, g/kg ρ_{sed} = Sediment bulk density, kg/m^3 A_{sed} = Area of sediment removal, m^2 D_{root} = Mean *Ludwigia* root depth, m These two equations can be used to determine the reduction in P over the project life provided adequate data and/or appropriate literature values are obtained. **Reduced Internal Phosphorus Loading.** P flux into the water column occurs according to the following equation: $P_{flux} = E_{dif} (C_{sw} - C_w) / h$ where: P_{flux} = Release of phosphorus from the sediment, grams P/m^2/day E_{dif} = Diffusion coefficient (2 x 10-4 m^2/second or 17.28 m^2/d), m^2/day C_{sw} = Phosphorus concentration of sediment pore water, grams P/m^3 C_w = Phosphorus concentration in the water column, grams P/m_3 h = Active sediment depth (2 cm or 0.02 m), m Given concentrations of phosphorus in the water column and in sediment pore water, one can estimate release of phosphorus to the water column from an area of sediment over time under low-oxygen or anoxic conditions. It is then possible to calculate a phosphorus load for the project area under anoxic conditions through time using: $P_{load} = P_{flux} * A * T$ where:

		P_{load} = Phosphorus load from internal loading, grams P P_{flux} = Release of phosphorus from the sediment, grams P/m^2/day *A* = Area of sediment contributing to internal loading, m^2 *T* = Internal loading time period, day These two equations can be used to determine the reduction in P-flux over the project life provided adequate data and/or appropriate literature values are obtained. **Accuracy, sensitivity, and uncertainty.** All laboratory methods contain measurement error, and sampling error is also inevitable at some scale. Therefore, appropriate significant figures will be used, and all efforts will be made to avoid sampling or measurement bias. Error has the potential to propagate through calculations, therefore all efforts will be made to ensure the data are sound from the start. At the scale on which this practice will be applied, standard measurement instruments and laboratory methods are adequately sensitive to conduct the calculations. Any literature values used will introduce uncertainty into the calculations, and therefore may impact the uncertainty ratio. Where appropriate, calculations will be conducted with a range of literature values to arrive the most conservative estimate of credits generated.
12	*Monitoring required to support the accurate use of the credit quantification method.*	Direct measurement of the variables given in equations in Item 11 would be required to produce the most reliable credit quantification. Therefore, for Direct Removal, direct measurement is required. However, for Reduced Internal Loading, literature values may be used when direct measurement is impractical or infeasible. These literature values must be found in peer reviewed articles, technical documents certified by licensed scientific professionals, or government reports that rely on the above. The Regional Board reserves the right

		to require an alternative value based on manuscripts of equal or greater scholarly rigor. Monitoring will be conducted as described Item 9 in order to ensure credits are awarded in accordance with on-site conditions and actual project effectiveness.
13	*Procedures for applying the credit quantification*	The equations given Item 11 will be populated through direct measurement following established field and laboratory procedures. These procedures will be supplied in the Credit Project Plan. Where this is not possible, literature values will be used. Literature values will be drawn from studies of the most similar sites possible, and will be selected to reflect the most conservative values where multiple values are found. The studies from which the values are derived and the rationale for the value selected will be provided in the Credit Project Plan.
14	*Date or version number of the credit quantification method, and identifying information for the method's developer*	The following reference contains much of the work upon which the credit quantification method is based: *The Freshwater Trust. Water Quality Trading Program Design and Analysis, Task 2 Environmental Benefit Calculation. Prepared for the Sonoma County Water Agency. The Freshwater Trust, Portland, OR.*

Project Review/Verification Procedures

No.	Recommendation	Procedure
15	*Recommended procedures for pre- and post-project site condition assessments, monitoring and project verification activities*	When projects are implemented, the SMP Manual directs that data will be collected at the project area prior to, during, and immediately after project implementation, as required by regulatory permits. Data collected will include: water quality monitoring data (turbidity, temperature, pH); before, during, and after photos; cross section or topographic surveys after sediment removal is conducted; quantification of material removed or placed; length of stream channel maintained; sensitive

		species or other resources encountered at the site during pre-construction surveys or during project implementation; quantity, characteristics, and location of any debris disposed off-site; and any additional information important for project monitoring and verification. Upon implementation, the practice will be evaluated and reviewed in the same manner as other SMP reach-scale sediment management and vegetation management projects. The area and depth of sediment removal estimated will be verified by as-built cross-sectional or topographic surveys, similar to as-built surveys presented in SMP annual reports. Implementation of BMPs and revegetation for the practice will also be confirmed through an annual reporting process. A third-party credit verifier (e.g., a resource conservation district or a qualified non-profit organization) will review the list of best management practices (BMP) for each project activity and verify BMP application. Implementation of revegetation plan will be confirmed through comparison of the project site to the planting plan in the Credit Project Plan, through photo documentation of the site, and through documentation of the exact plant species and quantities installed in the project area. The extent of *Ludwigia* remaining after project implementation will also be recorded along transects used for as-built cross-sectional surveys. Item 9 gives more detailed monitoring protocols needed to ensure credit verification. Pre-project site condition will also be assessed in order to calculate credits following Item 11.
16	*Recommended documentation and reporting for pre- and post-project site condition assessments, monitoring, and project verification activities*	Monitoring of site conditions will the responsibility of the third-party credit verifier, but it will be the credit generator's responsibility to communicate monitoring results annually to the North Coast Regional

		Water Quality Control Board. The credit generator will be responsible for coordinating monitoring reports to all the relevant agencies. The reports will include a description of how the project achieved objectives identified in the proposal, how the project is developing over time, and if the project requires adaptive management or maintenance. Site conditions for credit-generating projects approved under most water quality credit trading frameworks must be independently assessed and documented by a credit seller before and after project implementation. The credit generator will enter into an agreement with a third party to provide initial and annual credit verification. Initial project/credit verification will include: • An administrative review to confirm project eligibility (Regional Board) • A technical review to confirm accurate quantification of measured and estimated water quality credits and completeness of background information (Regional Water Board or third-party credit verifier) • An implementation review to confirm project installation consistent with the approved project proposal (third party credit verifier) o Verify accuracy of measurements used to calculate credits o Determine whether the project was built according to the approved design. Any deviations would be noted and assessed to determine potential changes to credit calculation Annual project/credit verification will include: • Regular site visits throughout the life of credits to assure project is maintained adequately to meet performance standards and generate credits (third party credit verifier)

		o Inspection of all components of the project and surrounding area to ensure proper function/operation (using final engineering specifications) o Documentation of project operation and maintenance through forms, photographs, and data collection where warranted • Notification of deficiencies to credit seller (third party credit verifier) o All deficiencies would be reported to the credit owner after receiving the inspection documentation o These would be appropriately corrected to previously specified conditions within 15 days of discovery, or within 30 days if an alternative improvement is necessary to avoid future failures (the Regional Board will be notified of this latter condition where applicable) o Third party credit verifier would complete a second site visit verifying deficiencies were corrected • Verification letter stating the project passed the annual inspection will be included in the credit generator's annual report (if applicable) to Regional Board (third party credit verifier) • Verification letters for all phosphorus reduction practices will be forwarded to the NCRWQCB as proof that offset credits are being maintained (third party credit verifier)
17	*Recommended conditions / schedule for credit release (if applicable)*	Credits should be released only once verified. Therefore, verification will occur prior to each year of credit release. All will be verified annually over the project life.
18	*Description of requirements for professional certification or special expertise in the design, installation maintenance, credit quantification or verification*	The following expertise may be necessary for this practice: Engineering, Hydrology, Ecology, Geomorphology, Landscape Architecture, or other similar field.

Miscellaneous

No.	**Recommendation**	Procedure

19	*Any other information that could be used to assess the practice's ability to meet the requirements of the WQTF, and meet other legal and regulatory requirements (e.g. likely needed permits, CEQA review, descriptions of similar practices, etc.)*	Regulatory processes likely to be required: California Environmental Quality Act, Clean Water Act section 401, Clean Water Act section 404, California Fish and Wildlife Lake and Streambed Alteration Agreement, and Sonoma County Roiling Permit. The proposer will be responsible for obtaining and documenting all permits related to the practice. Impacts and required mitigation and BMPs associated specifically with a Credit Project Proposal will be detailed in that document.