Guidance for Applicants and Grantees:
Metrics Reporting and Monitoring

B.1.1 Purpose and Intended Uses

The purpose of this document is to provide guidance to NFWF Great Lakes programs applicants/grantees including Sustain Our Great Lakes (SOGL), Chi-Cal Rivers Fund, and Southeast Michigan Resilience Fund when reporting on project activities and metrics during full proposal development and subsequent metric tracking after grant award.

The specific project types this appendix addresses includes:

- Section B.2: Fish passage improvements
- Section B.3: Stream/channel restoration or naturalization
- Section B.4: Riparian restoration
- Section B.5: Brook trout habitat improvements
- Section B.6: Wetland reconnection
- Section B.7: Wetland hydrology improvements
- Section B.8: Wetland habitat/vegetation improvements
- Section B.9: Implementation of agricultural best management practices
- Section B.10: Installation of green infrastructure for stormwater retention
- Section B:11: Invasive Species Control

Please note that in some cases, grantees may need to follow guidance for multiple project types depending on the scope of project activities proposed.

B.1.2 General Guidance on Activity/Metrics Reporting

The National Fish and Wildlife Foundation (NFWF) requests that applicants/grantees report on proposed project activities using Easygrants or, when specified, by including information in the narrative of the full proposal, additional required uploads, and subsequent interim report narratives. NFWF uses this information to inform individual project funding recommendations, track grant/project progress throughout the life of a grant, and summarize outcomes across projects to assess program impact. To ensure reporting and tallying is done correctly, grantees should follow the guidance in this document to the extent feasible, including specifics about how to gather and report relevant data.

Applicants are encouraged to always use the notes function while completing the full proposal metrics section in EasyGrants to add informative metrics details.

B.2 Stream Fish Passage Improvement Projects

B.2.1 Relevant Project Types

Applicants/grantees should follow this guidance if their projects are intended to improve fish passage in streams or rivers. Project types may include **dam removals, road-stream crossing replacements, and fish passage structure installations**. If the project is also intended to restore stream geomorphology or improve instream habitat, see additional guidance under Section B.3. If the project is also intended to decrease sediment loads, see additional guidance under Section B.9. If the project is focused on wetland reconnection, follow the guidance under Section B.6 instead.

B.2.2 Relevant Easygrants Metrics

- Fish passage improvements – # fish passage barriers rectified
- Fish passage improvements – Miles of stream opened

B.2.3 Guidance for Applicants/Grantees Gathering of Relevant Data

During proposal development, the applicant/grantee should estimate the miles of habitat that will be opened from the proposed barrier removal. This should include the miles of upstream habitat until the next barrier upstream (or end of flowline) as well as the miles of downstream habitat until the next barrier downstream (or large water body, such as a lake). This estimate should include both the mainstem of the stream or river and smaller tributaries. To accurately estimate the number of stream miles opened, the grantee could use an online mapping tool (e.g., Fishwerks; https://greatlakesconnectivity.org/) or conduct a geographic information system (GIS) analysis. For standardization, applicants/grantees should use a 1:100,000 scale for flowlines. Since no barrier inventory is totally complete and error-free, the grantee should also coordinate with the appropriate state agency [e.g., Department of Natural Resources (DNR)] and/or other agency/organization [e.g., U.S. Fish and Wildlife Service (USFWS), U.S. Geological Service (USGS), Great Lakes Fishery Commission (GLFC)] for information on other known barriers. This is important to validate the upstream barriers are captured in the online mapping tool or GIS analysis. Following restoration, the grantee should confirm that the project adequately removed or mitigated the proposed barrier.

A few considerations:

- Avoid double-counting miles of stream habitat that was opened and reported in a previous NFWF grant. Use the additional upload to explain new miles and overall impact.
- Using a flowline dataset at a resolution scale of 1:100,000 will likely miss smaller tributaries, especially those in the headwaters of streams and fringing wetlands. While this could result in an underestimate of stream miles opened, it is important to use a standard resolution in flowlines across projects. In some cases, it is possible that grantees may be interested in some stream reaches that are not captured at this resolution. If this is the case, grantees should use a different dataset that covers the area of interest.
- A number of distinct barrier inventories are available for the Great Lakes region (and most of them have been incorporated into Fishwerks). However, none of these datasets are totally complete and error-free. To address this, grantees should coordinate with the appropriate state agency (e.g., DNR) and/or other agency/organization (e.g., USFWS, USGS, GLFC) for information on known barriers upstream, and confirm they are included in the barrier inventory.

B.2.3.1 Online Mapping Tool, Such as Fishwerks

A variety of tools are available online that inform aquatic connectivity (see Moody et al., 2017 for a review). For this specific application, Fishwerks (https://greatlakesconnectivity.org/) is recommended since it is user-friendly offers coverage across the entire Great Lakes Basin, and has been recently updated. However, other online mapping applications are relevant to the Great Lakes region, including USFWS's FishXing (https://www.fs.fed.us/biology/nsaec/fishxing/), the GLFC's Sea Lamprey Control Map (http://data.glfc.org/), and The Nature Conservancy's Northeast Region Aquatic Barrier Prioritization (http://maps.freshwaternetwork.org/northeast/). Each of these tools features a different underlying database; the Fishwerks database is the most complete of the set.

B.2.3.2 Overview and Application of Fishwerks

Fishwerks is a web-based decision support tool that integrates online mapping with optimization tools to assist users in selecting a portfolio of barrier removal projects that maximizes habitat gains for migratory fish in the Great Lakes Basin under a user-specified budget and geographic domain (https://greatlakesconnectivity.org/). Key data layers underlying the tool include (1) an inventory of potential barriers (dams, road crossings, and waterfalls), that are mapped onto (2) stream flowlines throughout the Great Lakes Basin (both United States and Canada), where every watershed is associated with (3) a list of migratory fish species likely to be found there. The barrier inventory in the U.S. portion includes road crossings from the U.S. Census Bureau’s Topologically Integrated Geographic Encoding and Referencing (TIGER) database and dam locations from the U.S. Army Corps of Engineers’ (USACE’s) National Inventory of Dams. The stream flowlines are from the Great Lakes Aquatic Habitat Framework (GLAHF) database (1:100,000 scale for flowlines), which were slightly modified to remove stream miles with less than a 1 km^2 catchment basin. Users can query Fishwerks to determine the current barriers in a watershed, and quantify the amount of miles that would be opened if any one or more barriers were removed. Fishwerks was developed by the cross-sector team, including Peter McIntyre at the University of Wisconsin-Madison’s Center for Limnology, Michael Ferris from the Wisconsin Institutes for Discovery, Matt Diebel from the Wisconsin DNR, and Patrick Doran from The Nature Conservancy.

Fishwerks also allows users to solve for optimal scenarios of barrier removals based on the total habitat access gained for a specified overall budget. These optimization models are important for analyzing trade-offs and cumulative habitat gain from multiple potential projects. Grantees are recommended to use Fishwerks prior to project initiation, as the optimization approach offers information on how a particular set of projects compares to alternatives. Registered users can ground-truth and update dam/culvert information for more accurate optimization scenarios. In addition to visualizing the distribution of any migratory species in the Great Lakes, Fishwerks also provides result graphics on a species-specific basis. Results are also provided in the form of channel length or area gained per dollar of removal costs.

The tool requires little technical skill due to its user interface, and all of its functionality is available for use at no cost.

B.2.3.3 GIS Analysis

Stream miles opened can also be determined by conducting a GIS analysis using geospatial data (e.g., stream flowline, barrier inventory). Potential recommended options include the National Hydrography Dataset Plus (NHD +; https://www.epa.gov/waterdata/nhdplus-national-hydrography-dataset-plus), a dataset developed and maintained by the USGS and the U.S. Environmental Potential Agency (EPA), or the GLAHF Great Lakes Hydrography Dataset (https://www.glahf.org/watersheds/). For standardization, grantees should use a 1:100,000 scale for flowlines. For barrier locations, potential recommended options include the U.S. Census Bureau’s TIGER database (http://www.census.gov/geo/maps-data/data/tiger-line.html), the USACE’s National Inventory of Dams (http://nid.usace.army.mil/cm_apex/f?p=838:12), and the North Atlantic Aquatic Connectivity Collaborative (https://streamcontinuity.org/index.htm). In addition, Fishwerks is in the process of releasing shapefiles for their entire database, including the hydrography, barrier locations, and estimated passability values.

B.2.4 Guidance for Applicant/Grantee Reporting in Easygrants

Reporting fish passage improvements. Applicants/grantees should report the number of fish passage improvements in Easygrants using the following metric: “Fish passage improvements –

passage barriers rectified" (required). In the notes section of this metric, **indicate the specific type of fish passage improvemen**t (e.g., large dam removal, small dam removal, fish passage structure, road-stream crossing improvement/replacement). If there are different types of improvements, indicate the number of each type of improvement. This Easygrants metric should be used to report the *total* number of passage barriers rectified, including those done for wetland or stream connectivity and/or sediment reduction. For example, if a project is replacing one road-stream crossing that is intended to both improve connectivity and reduce sediment loadings, this road-stream crossing should only be reported once. This is essential to avoid double-counting.

Reporting steam miles opened. Applicants/grantees should report the number of stream miles opened in Easygrants using the following metric: "Fish passage improvements – Miles of stream opened". This value should be determined using the guidance outlined in Section B.2.4. In the notes section, indicate how the stream miles opened were estimated (e.g., specific tools and/or datasets used). If the project is also intended to restore stream geomorphology or improve instream habitat, the applicable stream miles may also be reported using the metric of "Instream restoration – Miles restored" (see Section B.3)

B.2.5 Additional Resources

If using an online mapping tool, below are some potential options:

- Fishwerks tool and online tutorial (recommended): https://greatlakesconnectivity.org/
- USFWS's FishXing: https://www.fs.fed.us/biology/nsaec/fishxing/
- The Great Lakes Fisheries Commission's Sea Lamprey Control Map: http://data.glfc.org/
- The Nature Conservancy's Northeast Region Aquatic Barrier Prioritization: http://maps.freshwaternetwork.org/northeast/.

If conducting a GIS analyses, below are some potential data sources:

- ArcGIS: https://www.arcgis.com/features/index.html
  - Add-ons for evaluating aquatic connectivity in ArcGIS (Moody et al., 2017): Barrier Analysis Tool, CADSS, FIPEX, RivEX
- USGS's NHD + (1:100,000 flowline resolution): https://www.epa.gov/waterdata/nhdplus-national-hydrography-dataset-plus
- GLAHF database (1:100,000 flowline resolution): https://www.glahf.org/watersheds/
- U.S. Census Bureau's TIGER: http://www.census.gov/geo/maps-data/data/tiger-line.html
- USACE's National Inventory of Dams: http://nid.usace.army.mil/cm_apex/f?p=838:12
- North Atlantic Aquatic Connectivity Collaborative: https://streamcontinuity.org/index.htm.

B.3 Stream/Channel Restoration or Naturalization Projects

B.3.1 Relevant Project Types

Applicants/grantees should follow this guidance if their projects are intended to restore stream geomorphology or improve instream habitat. Project types may include removing impoundments, naturalizing the stream channel configuration, managing existing sediment loads, or installing instream habitat structures (e.g., log jams, log drops, individual logs, boulders). If the project is also intended to improve fish access, see additional guidance under Section B.2. If the project is also intended to improve brook trout habitat, see additional guidance under Section B.5. If the project is focused on riparian restoration, follow the guidance under Section B.4 instead.

B.3.2 Relevant Easygrants Metrics

- Instream restoration – Miles restored.

B.3.3 Guidance for Grantee Gathering of Relevant Data

During proposal development, the applicant/grantee should estimate the linear miles of stream/channel habitat that are anticipated to be restored or naturalized. This will likely be based on the type and areal extent of restoration that is proposed. To accurately estimate the number of stream miles restored or naturalized, the applicant/grantee could use an online mapping tool (e.g., Google maps; https://www.google.com/maps) or conduct a GIS analysis. For standardization, grantees should use a 1:100,000 scale for flowlines (if applicable). Following restoration, the grantee should confirm that the restoration activities were conducted as planned (e.g., during the as-built survey) and the estimate should be adjusted as needed. A follow-up assessment may be needed to ensure installed structures or channel modifications have not been washed out.

One consideration when estimating stream miles restored or naturalized is:

- Using a flowline dataset at a resolution scale of 1:100,000 will likely miss smaller tributaries, especially those in the headwaters of streams and fringing wetlands. While this could result in an underestimate of miles restored, it is important to use a standard resolution in flowlines across projects. In some cases, it is possible that grantees may be interested in some stream reaches that are not captured at this resolution. If this is the case, grantees should use a different dataset that covers the area of interest (and specify the type used in Easygrants; see below).

B.3.3.1 Online Mapping Tool

There are a variety of mapping tools available to estimate the miles of stream/channel habitats that will be restored/naturalized, including Google maps (https://www.google.com/maps), Google Earth (https://www.google.com/earth/), or a Draft Logic's Distance Calculator Tool (https://www.daftlogic.com/projects-google-maps-distance-calculator.htm). Using the online mapping tool, grantees can identify the specific sections that are intended to be improved and use the distance calculator to determine the total linear miles that will be restored or naturalized. When using the linear measurement tool, additional points can be dropped to follow the meander of the river to ensure that the distance calculator does not underestimate the length of a meandering stream reach.

B.3.3.2 GIS Analysis

If applicants/grantees have in-house expertise, they can also determine stream miles restored or naturalized by conducting a GIS analysis using geospatial data (e.g., stream flowline, restoration footprint). For stream flowlines, potential sources include NHD + (https://www.epa.gov/waterdata/nhdplus-national-hydrography-dataset-plus), a dataset developed and maintained by the USGS and EPA, or the GLAHF Great Lakes Hydrography Dataset (https://www.glahf.org/watersheds/). For standardization, grantees should use a 1:100,000 scale for flowlines (if applicable). Grantees should overlay the shapefiles of the restoration footprint with the stream miles, and determine the total linear miles that will be restored or naturalized. If habitat improvements are expected to extend beyond the restoration footprint (e.g., benefit downstream habitat), then those should be estimated as well.

B.3.4 Guidance for Applicant/Grantee Reporting in Easygrants

Reporting instream restoration: Applicants/grantees should report the number of stream miles restored or naturalized in Easygrants using the following metric: “Instream restoration – Miles restored.” This should include all relevant activities, including removing impoundments, naturalizing stream channel configurations, managing existing sediment loads, or installing instream habitat structures. In the notes section of this metric, indicate the specific type of restoration activities and how the number of miles was estimated (e.g., tools and/or datasets). To avoid double-counting, do not include other outcomes such as miles of stream opened.

B.3.5 Additional Resources

- Draft Logic’s Distance Calculator Tool: https://www.daftlogic.com/projects-google-maps-distance-calculator.htm.

If conducting GIS analyses, below are some potential data sources:

- USGS’s NHD + (1:100,000 flowline resolution): https://www.epa.gov/waterdata/nhdplus-national-hydrography-dataset-plus
- GLAHF database (1:100,000 flowline resolution): https://www.glahf.org/watersheds/.

B.4 Stream Riparian Restoration Projects

B.4.1 Relevant Project Types

Applicants/grantees should follow this guidance if their projects are intended to restore riparian habitat along stream or river banks. Project types may include stabilizing stream banks, controlling invasive vegetation, and/or planting native riparian vegetation. If the project is also intended to reduce sediment inputs, also see guidance under Section B.9. If the project is focused on instream habitat restoration, follow the guidance under Section B.3 instead.

B.4.2 Relevant Easygrants Metrics

- Riparian restoration – Miles restored.

B.4.3 Guidance for Grantee Gathering of Relevant Data

During proposal development, the applicant should estimate the linear miles of riparian habitat that are anticipated to be restored. This will likely be based on the type and areal extent of the restoration that is being proposed. To accurately estimate the number of miles restored, grantees could use an online mapping tool (e.g., Google maps; https://www.google.com/maps) or conduct a GIS analysis. For standardization, applicants/grantees should use a 1:100,000 scale for flowlines (if applicable). Following restoration, the grantee should confirm that the restoration activities were conducted as planned (e.g., during the as-built survey) and the estimate should be adjusted as needed.

One consideration when estimating riparian habitat restored is:

- Using a flowline dataset at a resolution scale of 1:100,000 will likely miss smaller tributaries, especially those in the headwaters of streams and fringing wetlands. While this could result in an underestimate of miles restored, it is important to use a standard resolution in flowlines across projects. In some cases, it is possible that grantees may be interested in some stream reaches that are not captured at this resolution. If this is the case, grantees should use a different dataset that covers the area of interest (and specify the type used in Easygrants; see below).

B.4.3.1 Online Mapping Tool

There are a variety of mapping tools available to estimate the miles of riparian habitat that will be restored, including Google maps (https://www.google.com/maps), Google Earth (https://www.google.com/earth/), or a Draft Logic's Distance Calculator Tool (https://www.daftlogic.com/projects-google-maps-distance-calculator.htm). Using the online mapping tool, applicants/grantees can identify the specific sections that are intended to be improved and use the distance calculator to determine the total linear miles that will be restored. When using the linear measurement tool, additional points can be dropped to follow the meander of the river to ensure that the distance calculator does not underestimate the length of a meandering stream reach.

B.4.3.2 GIS Analysis

Miles of riparian restoration can also be determined by conducting a GIS analysis using geospatial data (e.g., stream flowline, restoration footprint). For stream flowlines, potential sources include NHD + (https://www.epa.gov/waterdata/nhdplus-national-hydrography-dataset-plus), a dataset developed and maintained by the USGS and the EPA, or the GLAHF Great Lakes Hydrography Dataset (https://www.glahf.org/watersheds/). For standardization, applicants/grantees should use a 1:100,000 scale for flowlines (if applicable). Grantees should overlay the shapefiles of the restoration footprint with the stream miles, and determine the total linear miles that will be improved.

B.4.4 Guidance for Applicant/Grantee Reporting in Easygrants

Reporting riparian restoration: Applicants/grantees should report the number of miles of riparian restoration in Easygrants using the following metric: "Riparian restoration – Miles restored".This should include all relevant activities, including stabilizing stream banks, controlling invasive vegetation, and planting native vegetation. In the notes section of this metric, indicate the specific type of restoration activities and how the number of miles was estimated (e.g., tools and/or datasets). This Easygrants metric should be used to estimate the *total* footprint of all riparian restoration activities. This will be essential to avoid double-counting (i.e., it will allow NFWF to confidently add up "Riparian restoration – Miles restored" to tabulate the total number of miles on which riparian restoration activities have occurred).

B.4.5 Additional Resources

- Draft Logic's Distance Calculator Tool: https://www.daftlogic.com/projects-google-maps-distance-calculator.htm.

If conducting GIS analyses, below are some potential data sources:

- USGS's NHD + (1:100,000 flowline resolution): https://www.epa.gov/waterdata/nhdplus-national-hydrography-dataset-plus
- GLAHF database (1:100,000 flowline resolution): https://www.glahf.org/watersheds/.

B.5 Wetland Reconnection Projects

B.5.1 Relevant Project Types

This guidance applies to any wetland projects that are focused on eliminating fish passage barriers through the installation of fish passages, sediment removal, or the removal of hard structures. If applicants/grantees are also simultaneously improving wetland hydrology or habitat structure (such as invasive species control), they should also review Sections B.7 and B.8, respectively. If the project is focused on stream connectivity outside of wetlands, follow the guidance under Section B.2 instead.

B.5.2 Relevant Easygrants Metrics

- Fish passage improvements – # fish barriers rectified
- Acres of lake/pond/wetland habitat opened

B.5.3 Guidance for Grantee Gathering of Relevant Data

During proposal development, the applicant should estimate the amount of wetland acres that will be newly accessible to fish in adjacent waterways after the fish barriers have been removed. Following restoration, the grantee should confirm that restoration activities were conducted as planned (e.g., during the as-built survey) and the estimate should be adjusted as needed.

Depending on the type of restoration that is planned, the applicant/grantee may be able to estimate the number of acres made newly accessible using an online mapping tool (e.g., Google maps; https://www.google.com/maps) or through conducting a GIS analysis. See below for more about each approach.

B.5.3.1 Online Mapping Tool

A variety of mapping tools are available to estimate the area of wetland habitat that will be opened, including Google maps (https://www.google.com/maps) or Google Earth (https://www.google.com/earth/). Using the online mapping tool, grantees can identify the specific areas that are likely to be newly accessible and use the area calculator to determine the total acres that will be restored.

B.5.3.2 GIS Analysis

Acres of habitat restored can also be determined by conducting a GIS analysis using geospatial data. If a fish passage barrier is removed, for example, one can assess the size of the wetland affected using data from the Great Lakes Coastal Wetlands Consortium (see https://greatlakesinform.org/data-catalog/item/71).

B.5.4 Guidance for Applicant/Grantee Reporting in Easygrants

Applicants/grantees should report the acres of wetland habitat newly accessible due to restoration in Easygrants using the following metrics:

- **Reporting fish passage improvements – # fish passage barriers rectified**. Grantees should report how many barriers were removed, or fish passages installed, as a part of the project. In the notes section of this metric, indicate the specific type of fish passage improvement (e.g., large dam removal, small dam removal, fish passage structure). If there are different types of improvements, indicate the number of each type of improvement. This Easygrants metric should be used to report the *total* number of passage barriers rectified, including those done for wetland or stream connectivity and/or sediment reduction. This is essential to avoid double-counting (i.e., it will allow NFWF to confidently add up "fish passage improvements – # passage barriers rectified" to tabulate the total number of barriers rectified).
- **Reporting acres of lake/pond/wetland habitat opened**. Grantees should indicate the number of wetland acres made newly accessible to fish passage.

B.6 Wetland Hydrology Improvement Projects

B.6.1 Relevant Project Types

This guidance applies to any wetland projects that are focused on improving habitat quality through the use or removal of water control structures, which can help restore key natural hydrological dynamics. If grantees are also simultaneously improving wetland connectivity or habitat structure, they should also review Sections B.6 and B.8, respectively.

B.6.2 Relevant Easygrants Metrics

- Number of structures installed
- Acres with restored hydrology

B.6.3 Guidance for Applicant/Grantee Gathering of Relevant Data

B.6.3.1 Acres with Restored Hydrology

To estimates the overall acres with restored hydrology, the applicant/grantee should estimate the total amount of wetland acres that will be restored through the installation of water control structures. Following restoration, the grantee should confirm that restoration activities were conducted as planned (e.g., during the as-built survey) and the estimate should be adjusted as needed. Depending on the type of restoration that is planned, the grantee may be able to estimate the number of acres made newly accessible to fish using an online mapping tool (e.g., Google maps; https://www.google.com/maps) or through conducting a GIS analysis. See below for more about each approach.

Online Mapping Tool

A variety of mapping tools are available to estimate the area of wetland habitat that will be opened, including Google maps (https://www.google.com/maps) or Google Earth (https://www.google.com/earth/). Using the online mapping tool, grantees can identify the specific areas that are likely to be newly accessible and use the area calculator to determine the total acres that will be restored.

GIS Analysis

Acres of habitat restored can also be calculated by conducting a GIS analysis using geospatial data. If a fish passage barrier is removed, for example, one can assess the size of the wetland affected using data from the Great Lakes Coastal Wetlands Consortium (see https://greatlakesinform.org/data-catalog/item/71).

B.6.4 Guidance for Applicant/Grantee Reporting in Easygrants

Applicants/grantees should report on the following metrics in Easygrants:

- **Reporting # structures installed**. Grantees should report how water control structures were installed as part of the project.
- **Reporting acres with restored hydrology**. Grantees should indicate the number of wetland acres improved through the use or removal of the water control structures.

B.6.5 Additional Resources

- The IWMM Program provides publically available protocols for conducting vegetation surveys as described above (http://iwmmprogram.org/protocols-data-forms/), as well as online tutorials at no cost. IWMM staff can also be consulted on an as-needed basis for technical assistance.

B.7 Wetland Habitat/Vegetation Improvement Projects

B.7.1 Relevant Project Types

This guidance applies to any wetland projects that are improving wetland vegetation through direct vegetation planting. If grantees are also simultaneously improving wetland connectivity and/or wetland hydrology, or invasive species control, they should also review Sections B.6, B.7, and B.8.

B.7.2 Relevant Easygrants Metrics

- Wetland restoration – acres restored.

B.7.3 Guidance for Applicant/Grantee Reporting in Easygrants

Applicants/grantees should report on the following metrics in Easygrants:

- **Reporting wetland restoration – acres restored.** Grantees should describe the number of acres wetland restoration is occurring through vegetative enhancements. Do not include wetland connectivity and/or wetland hydrology acres, or acres invasive species control.

B.7.4 Additional Resources

- The IWMM provides publically available protocols for conducting vegetation surveys (http://iwmmprogram.org/protocols-data-forms/) as well as online tutorials at no cost. IWMM staff can also be consulted on an as-needed basis for technical assistance related to wetland monitoring.

B.8 Invasive Species Control

This guidance applies to any projects that are controlling invasive species needed to sustain or enhance the benefits of previous habitat restorations and new restoration. This work includes the retreatment or management to control invasive species that have received initial treatment or to expand existing invasive control efforts through the management of invasive species on new/previously untreated acres adjacent or strategically connected to existing control efforts.

B.8.1 Relevant Easygrants Metrics

- Removal of invasives – acres restored
- Removal of invasives – acres retreated

B.8.2 Guidance for Grantee Gathering of Relevant Data

During proposal development, the applicant should estimate the amount of acres that will be newly treated or retreated for invasive species control.

Depending on the type of restoration that is planned, the applicant/grantee may be able to estimate the number of acres treated using an online mapping tool (e.g., Google maps;

https://www.google.com/maps) or through conducting a GIS analysis. See below for more about each approach.

B.8.2.1 Online Mapping Tool

A variety of mapping tools are available to estimate the area habitat that will be treated, including Google maps (https://www.google.com/maps) or Google Earth (https://www.google.com/earth/). Using the online mapping tool, grantees can identify the specific areas that are likely to be newly accessible and use the area calculator to determine the total acres that will be restored.

B.8.3 Guidance for Applicant/Grantee Reporting in Easygrants

Applicants/grantees should report on the following metrics in Easygrants:

- **Reporting removal of invasives – acres restored.** Report the number of wetland acres on which invasive species control was conducted on new acres. If invasive species control has already been conducted on acres, use "acres retreated metric".
- **Reporting removal of invasives – acres retreated.** Report the number of acres receiving additional retreatment post initial treatment.

B.9 Implementation of Agricultural Best Management Practice Projects

B.9.1 Relevant Project Types

Applicants/grantees should follow this guidance if their projects are intended to reduce phosphorus and sediment inputs to surface waters. Project types may include the development of farm nutrient plans, enrollment in Farm Bill programs, installation of BMPs, and road-stream crossing improvements/replacements. If the project is also intended to benefit aquatic connectivity, see additional guidance under Section B.2 (for streams) or Section B.6 (for wetlands).

B.9.2 Relevant Easygrant Metrics

- Fish passage improvements – # passage barriers rectified
- Pounds of phosphorus avoided (annually)
- Pounds of nitrogen avoided (annually)
- Pounds of sediment avoided (annually).

B.9.3 Guidance for Grantee Gathering of Relevant Data

While grantees may make direct measurements of phosphorus, nitrogen or sediment loads at their individual sites, it is likely that those data may be difficult and expensive to obtain. Therefore, guidance is provided regarding several models or tools that grantees can use to estimate "pounds of phosphorus avoided (annually)", "pounds of nitrogen avoided (annually)" or "pounds of sediment avoided (annually)." Below are some models and tools that can be used to make the appropriate estimates. Some of the models, as described below, require users to run two separate model scenarios: a baseline model run to establish initial phosphorus and sediment loadings and a model run incorporating implemented BMPs to calculate the resulting pollutant load reduction. Although several viable tools or models are provided for grantees to use to estimate these metrics, this list is not exhaustive. To ensure accurate results, applicants/grantees should use the tools or models that they are comfortable executing and have the required expertise to run correctly. In some instances, the tool or model that grantees are most comfortable using may not be included in the list below.

B.9.3.1 Agricultural Policy/Environmental eXtender Model

Overview

The Agricultural Policy/Environmental eXtender (APEX) model is an open-source, physically based model that allows users to simulate the effect of agricultural practices on hydrology, soil erosion, and nutrient loss within small-medium watersheds and heterogeneous farms (https://epicapex.tamu.edu/apex/). The model requires weather (user defined or from model database), soil, land management, and site geographic data as inputs.

Application

Applicants/grantees can use the APEX model to estimate the reduction in phosphorus or sediment loadings to surface waters. APEX can model the cumulative impacts of numerous BMPs, including the implementation of grass waterways, strip cropping, terrace systems, buffer strips/vegetated filter strips, drainage systems, crop rotations, plant competition, plant burning, grazing patterns of multiple herds, varying fertilizers, liming, irrigation practices, manure management, stream restoration, wetland creation, and furrow diking. While there is no direct way to model the impacts of road-stream crossing improvements/replacement in APEX, grantees could potentially model the impacts using a proxy like stream restoration.

The APEX model is data intensive and capable of simulating real-world physical processes. Therefore, use of the APEX model requires expertise and special training. However, the developers (Texas A&M University) frequently host training workshops, have set up a modeling forum, and update the model periodically based on user feedback.

A few considerations if using the APEX model include:

- Applicants/grantees will need to run APEX separately to first establish the baseline conditions and then evaluate the impact of project implementation. To report progress toward the NFWF sediment and phosphorus metrics, grantees will need to calculate the difference between these two scenarios (annual reductions).
- The APEX model outputs annual phosphorus yield (sum of soluble phosphorus yield and mineral phosphorus yield) in kilograms per hectare (kg/ha) and annual sediment yield in tons per hectare (t/ha). Therefore, to report phosphorus and sediment reductions in Easygrants, grantees will need to first convert the output from kilograms or tons to pounds, and then multiply by the area of the subarea or watershed (hectares).
- The APEX model is appropriate at the small-medium watershed scale. It will be difficult to capture a change in model outputs if grantee projects are at a much smaller scale.
- Since grantees will be able to set their own model time period, they should either choose a time period that is representative of the climate conditions that occurred in the past year or a longer time period that represents the average conditions of their project location.

Additional Resources

- APEX tool download: https://epicapex.tamu.edu/model-executables/
- APEX model documentation and user guide: https://epicapex.tamu.edu/manuals-and-publications/
- APEX modeling forum: https://groups.google.com/forum/#!forum/agriliferesearchmodeling.

B.9.3.2 Long-Term Hydrologic Impact Assessment Low Impact Development Model

Overview

The Long-Term Hydrologic Impact Assessment/Low Impact Development (L-THIA/LID) model is a modeling tool that helps evaluate the benefits of LID or changes to land use management practices. Purdue University created the tool (https://engineering.purdue.edu/mapserve/LTHIA7/lthianew/lidIntro.php) and it can be applied in the Great Lakes region on a small "lot"-sized scale up to a larger watershed-scale. For inputs, it requires daily precipitation, soil, and land use data for the modeled area; however, L-THIA/LID already has most of these inputs incorporated. Users can adjust the percent of impervious service for an area or select the LID practice incorporated in the area, and then run the model to estimate the reduction or change in non-point source total phosphorus and sediment loads.

Application

Applicants/grantees can use L-THIA/LID to estimate the reductions in phosphorus or sediment loadings to surface waters. It can model the benefits of LID practices in two ways. The first way is by allowing users to adjust the percent of imperviousness for particular land uses. The second way is at the "lot-level" and includes allowing users to choose from a set of BMPs, including bioretention basins, swales, connected gutters and curbs, rain barrels, cisterns, porous pavement, narrowing impervious surfaces, green space, conservation practices, and green roofs. The model can only estimate changes to phosphorus or sediment loads if there are changes to impervious surfaces or soil infiltration rates. Therefore, it cannot model some management practices such as changing fertilizer application processes or road-stream crossing improvements/replacements.

L-THIA/LID is user-friendly and requires a minimal time investment to run effectively. The model is designed to be run on a lot-level, but can also be run in an area as large as an eight-digit Hydrologic Unit Code (HUC). The user can either select a watershed or draw a boundary to define the area to model.

A few considerations if using L-THIA/LID:

- L-THIA/LID outputs average annual phosphorus loads and average annual sediment loads in pounds with and without the implementation of LID. Therefore, grantees will need to calculate the difference between loadings with and without LID implementation in order to report phosphorus and sediment reductions in Easygrants.
- L-THIA/LID calculates average annual runoff using 30 years of existing weather data. Accordingly, the tool represents average conditions for grantee project locations and is, therefore, unable to represent the climate conditions that occurred in the past year.

Additional Resource

- L-THIA/LID tool and tutorial: https://engineering.purdue.edu/mapserve/LTHIA7/lthianew/lidIntro.php.

B.9.3.3 Spreadsheet Tool for Estimating Pollutant Load

Overview

The Spreadsheet Tool for Estimating Pollutant Load (STEPL) is a Microsoft Excel-based tool that calculates nutrient and sediment loads from different land uses, and the load reductions that would result from the implementation of different BMPs (see http://it.tetratech-ffx.com/steplweb/). It is a tool available at no cost that was developed for the EPA Office of

Water. The STEPL tool calculates annual phosphorus loading based on the runoff volume and phosphorus concentration. It calculates annual sediment load based on the Universal Soil Loss Equation and the sediment delivery ratio.

Application

Applicants/grantees can use STEPL to estimate the reductions in phosphorus or sediment loadings to surface waters. The spreadsheet tool can model the impacts of a large variety of BMPs for pastureland, cropland, forest, user-defined land use type, feedlots, and urban land uses. It also allows users to set parameters for increased sediment loads from gully formations and impaired streambanks. The BMPs that can be applied to the various land uses include, but are not limited to, porous pavements, reduced tillage systems, filter strips, grass swales, stream bank stabilization, and settling basins. While there is no direct way to model the impacts of road-stream crossing improvements/replacements in STEPL, grantees could potentially model the impacts using a proxy like stream bank stabilization.

This tool is data-driven, simple, and easy-to-use. There is training and support available in person and online. STEPL is capable of evaluating the effects of implementing a broad range of BMPs. The user can provide local data to derive inputs or easily search for input data on the STEPL online data input server. Although STEPL is a simple tool, it requires some training. Users will need a basic understanding of Microsoft Excel, hydrology, erosion, and pollutant loading processes.

A few considerations if using the STEPL tool:

- STEPL outputs the total phosphorus load reduction by subwatershed in pounds/year and the total sediment load reduction by subwatershed in tons/year. Therefore, the annual phosphorus load reduction estimated with STEPL can be directly reported in Easygrants, while the sediment load reductions will need to be converted from tons/year to pounds/year.
- STEPL calculates average annual runoff using 30 years of existing weather data. Accordingly, the tool represents average conditions for grantee project locations and is, therefore, unable to represent the climate conditions that occurred in the past year.

Additional Resources

- STEPL model introduction: http://it.tetratech-ffx.com/steplweb/
- STEPL model download, example files, and user guide: http://it.tetratech-ffx.com/steplweb/models$docs.htm.

B.9.3.4 Soil and Water Assessment Tool

Overview

The Soil and Water Assessment Tool (SWAT) is used to predict the impact of changes to land use and land management practices on water, nutrients, or sediment over time. It is managed by Texas A&M University and the U.S. Department of Agriculture (USDA; see http://swat.tamu.edu/software/arcswat/). The model is physically based (i.e., local field data for physical parameters can be input into the model) and is operated at a daily time-step. It can be used on a river basin- or watershed-scale. The tool is not intended to model individual events (e.g., flooding, fires), but to model changes to sediment or water quality over a longer period of time. SWAT requires information about weather, soil properties, topography, vegetation, and land management practices occurring in the watershed. SWAT can model physical processes (e.g., sediment movement and nutrient cycling) using only those input types; therefore, users can still model changes to sediment and nutrient loads in watersheds in locations where they do not have local water quality or sediment monitoring data.

Application

Applicants/grantees can use SWAT to estimate the reductions in phosphorus or sediment loadings to surface waters. SWAT can model the impacts of a variety of different BMPs, including vegetated buffers and/or filter strips, cover crops, tillage practices, wetland restoration, manure management, street sweeping, stream bank stabilization, and enhanced nutrient management. While there is no direct way to model the impacts of road-stream crossing improvements or replacements in SWAT, grantees could potentially model the impacts using a proxy-like stream bank stabilization.

SWAT is a complex model that requires expertise and specialized training. The developers provide updates and new versions of the model, and host workshops and conferences to help educate users. This tool is available at no cost to users.

A few considerations if using SWAT:

- Applicants/grantees will need to run SWAT separately to first establish the baseline conditions and then evaluate the impact of project implementation. To report progress toward the NFWF sediment and phosphorus metrics, grantees will need to calculate the difference between these two scenarios (i.e., annual reductions).
- SWAT outputs sediment yield in metric tons/hectare/time step and total phosphorus yield (sum of organic phosphorus yield, soluble phosphorus yield, and mineral phosphorus yield) in kilograms/hectare/time step. Therefore, to report phosphorus and sediment reductions in Easygrants, grantees will need to annualize the phosphorus and sediment yields, convert values from kilograms or tons to pounds, and then multiply by the area of the subwatershed or watershed (hectares).
- The SWAT model is appropriate at the river basin or watershed scale. It will be difficult to capture a change in model outputs if grantee projects are at a much smaller scale.
- Since grantees will be able to set their own model time period, they should either choose a time period that is representative of the climate conditions that occurred in the past year or a longer time period that represents the average conditions of their project location.

Additional Resources

- SWAT tool: http://swat.tamu.edu/software/swat-executables/
- SWAT documentation and user guide: http://swat.tamu.edu/documentation/.

B.9.4 Guidance for Grantee Reporting in Easygrants

Reporting road-stream crossings replaced/improved. Applicants/grantees should report the number of road-stream crossing replaced or improved in Easygrants using the following metric: “Fish passage improvements – # passage barriers rectified.” In the notes section of this metric, applicants/grantees should indicate that the project was a road-stream crossing improvement/replacement project. This Easygrants metric should be used to report the *total* number of passage barriers rectified, including those done for aquatic connectivity and/or sediment reduction. For example, if a project is replacing one road-stream crossing that is intended to both improve connectivity and reduce sediment loadings, this road-stream crossing should only be reported once. This is essential to avoid double-counting (i.e., it will allow NFWF to confidently add up “Fish passage improvements – # passage barriers rectified” to tabulate the total number of barriers rectified as well as the subset that are road-stream crossings).

Reporting annual phosphorus reductions. Applicants/grantees should report phosphorus reductions in Easygrants using the following metric: "Pounds of phosphorus avoided (annually)." In the notes section of this metric, grantees should indicate the model or tool that was used to estimate this metric.

Reporting annual nitrogen reductions. Applicants/grantees should report phosphorus reductions in Easygrants using the following metric: "Pounds of nitrogen avoided (annually)." In the notes section of this metric, grantees should indicate the model or tool that was used to estimate this metric.

Reporting annual sediment reductions. Applicants/grantees should report sediment reductions in Easygrants using the following metric: "Pounds of sediment avoided." Note that although this is not explicitly stated in Easygrants, grantees should report annual reductions. In the notes section of this metric, grantees should indicate the model or tool that was used to estimate this metric.

B.10 Installation of Green Infrastructure for Stormwater Retention Projects

B.10.1 Relevant Project Types

G Applicants/grantees should follow this guidance if their green infrastructure projects are intended to increase urban stormwater storage capacity. Installations may include rain gardens, green roofs, pervious surfaces, and constructed wetlands. If the project is also intended to reduce phosphorus or sediment inputs, see guidance under Section B.9.

B.10.2 Relevant Easygrant Metrics

- Sq ft of green infrastructure, sq ft of bioretention installed, sq ft of green roof installed
- Volume of stormwater storage added annually (gallons).

B.10.3 Guidance for Grantee Gathering of Relevant Data

Applicants/grantees can use several models or tools to estimate "Volume stormwater storage added (gallons)." Some models and tools that are available to make the appropriate estimates are presented below. Although several viable tools are provided for grantees to use to estimate this metric, this list is not exhaustive. To ensure accurate results, grantees should use tools or models they are comfortable implementing and have the required skill set to execute correctly. In some instances, the tool or model that grantees are most comfortable using may not be included in the list below or the grantee may rely on estimates from engineering plans. For all green infrastructure-related grantee-reported metrics, grantees should report the tool or model they used to estimate stormwater retention in Easygrants. If a grantee relies on estimates obtained from engineering plans, the grantee should report that as well.

B.10.3.1 i-Tree

Overview

i-Tree is a suite of no cost, peer-reviewed software from the USDA Forest Service (see https://www.itreetools.org/). The i-Tree toolkit quantifies the environmental services that are provided by trees. There are 11 different i-Tree applications that range in difficulty of use and vary in required inputs (i.e., i-Tree Eco, i-Tree Landscape, i-Tree Hydro, i-Tree Design, i-Tree Canopy, i-Tree Species, i-Tree MyTree, i-Tree Streets, and i-Tree Vue, i-Tree Database, and i-Tree Storm).

Application

Applicants/grantees can use i-Tree to estimate the gallons of stormwater intercepted by tree planting projects. i-Tree Hydro is a simulation tool that analyzes how changes in the extent of tree canopy cover or changes in the surface cover affect urban stormwater retention, and is likely of most relevance to the Great Lakes Program. i-Tree Eco and i-Tree Streets could also help grantees report increased urban stormwater retention, but i-Tree Eco is relatively data-intensive and i-Tree Streets focuses on management strategies and costs. i-Tree Hydro requires inputs for elevation data, land cover data, and weather data. However, the user can access some of the required data through the tool itself because it includes access to topographic, stream gauge, and weather gauge data. Among other outputs, the program provides an estimate of the reduction in annual stormwater runoff due to changes in land cover parameters.

The i-Tree suite is available at no cost, there is a large user base, and there are many online tutorials available. Although i-Tree Streets is relatively easy-to-use, it will require some training.

A few considerations if using i-Tree Hydro:

- Applicants/grantees will need to run a "Base Case" or a baseline scenario; and an "Alternative Case" or "with project" scenario. Reductions in stormwater runoff between the Base Case and Alternative Case are output in cubic meters/hour. Grantees will need to first annualize the reductions in stormwater runoff and then convert them from cubic meters to gallons before reporting progress toward the NFWF stormwater retention outcome.
- The i-Tree suite of software is intended to only quantify the environmental benefits that are provided by trees. Similarly, the i-Tree Hydro tool only captures the stormwater reduction that results from changes in tree and impervious cover.
- Since applicants/grantees will be able to set their own model time period, they should either choose a time period that is representative of the climate conditions that occurred in the past year, or a longer time period that represents the average conditions of their project location.

Additional Resources

- i-Tree tools: https://www.itreetools.org/applications.php
- i-Tree manuals: https://www.itreetools.org/resources/manuals.php
- i-Tree online tutorials: https://www.itreetools.org/resources/videos.php.

B.10.3.2 National Stormwater Calculator Tool

Overview

EPA's National Stormwater Calculator (SWC) is a tool that estimates the annual amount of rainwater runoff from a specific site. The tool makes estimates based on local soil conditions, land cover, and historical rainfall records. The SWC tool requires several inputs, including soil characteristics, slope, local weather data, and the amount of the drainage area that is impervious. However, the user can access some of the required data regarding these inputs through the tool itself, as it has the capability to link to national databases with information on topography and local weather data. It models pre- and post-construction stormwater runoff discharges (in inches) using the EPA Storm Water Management Model (SWMM).

Application

Applicants/grantees can use SWC to model the impacts of seven green infrastructure practices: rooftop disconnection, rainwater harvesting, rain gardens, green roofs, street planters, infiltration basins, and porous pavements on stormwater retention.

SWC is a user-friendly desktop application. Users can determine how specific green infrastructure changes can affect runoff. There are many online resources available to help users effectively utilize the tool, including a user manual, a descriptive video, and a fact sheet.

A few considerations if using SWC:

- Applicants/grantees will need to use the SWC tool to separately estimate the baseline scenario and the “with project” scenario. To report progress toward the NFWF stormwater outcome, grantees will need to calculate the difference in average annual runoff between these two scenarios.
- To estimate the amount of runoff retained in an average year in gallons, grantees will need to convert inches of rainfall to a volume of water using the following calculation:

    Inches of runoff retained x square feet of modeled area/12.

  The inches of runoff retained is divided by 12 to express the data in feet rather than inches. After the multiplication, the amount of water captured by the green infrastructure is expressed in cubic feet. To covert this to gallons, grantees can then multiply this number by 7.48 (1 ft^3 of water is 7.48 gallons).

- Since applicants/grantees will be able to set their own model time period, they should either choose a time period that is representative of the climate conditions that occurred in the past year or a longer time period that represents the average conditions of their project location.

B.10.3.3 Additional Resource

- SWC tool and user guide: https://www.epa.gov/water-research/national-stormwater-calculator.

B.10.3.4 STEPL

Overview

STEPL is a Microsoft Excel-based tool that primarily calculates nutrient and sediment loads from different land uses and the load reductions that would result from the implementation of different BMPs (see http://it.tetratech-ffx.com/steplweb/). However, STEPL can now also estimate flow volume reductions for urban LID and infiltration BMP practices. It is a tool available at no cost that was developed for the EPA Office of Water.

Application

Applicants/grantees can use STEPL to estimate increases in stormwater retention related to the following urban LID and infiltration practices: infiltration basins, devices, swales, trenches, cisterns, rain barrels, bioretention basins, dry wells, filter/buffer strips, vegetated and wet swales, porous pavement, oil/grit separators, and sand filters.

This tool is data-driven, simple, and easy-to-use. There is training and support available in person and online. STEPL is capable of evaluating the effects of implementing a broad range of urban LID and infiltration BMP practices. The user can provide local data to derive inputs or easily search for input data on the STEPL online data input server. Although STEPL is a simple tool, it requires some training. Users will need a basic understanding of Microsoft Excel, hydrology, and erosion.

A few considerations if using STEPL:

- STEPL outputs the flow volume reductions in gallons/year by urban land use type in each watershed. Therefore, to estimate increases in stormwater retention, grantees will need to sum the annual flow volume reductions over the different urban land use types before reporting in Easygrants.
- STEPL calculates average annual runoff using 30 years of existing weather data. Accordingly, the tool represents average conditions for grantee project locations and is, therefore, unable to represent the climate conditions that occurred in the past year.

Additional Resources

- STEPL model introduction: http://it.tetratech-ffx.com/steplweb/
- STEPL model download, example files, and user guide: http://it.tetratech-ffx.com/steplweb/models$docs.htm.

B.10.3.5 L-THIA/LID

Overview

The L-THIA/LID model is a modeling tool that helps evaluate the benefits of LID or changes to land use management practices. Purdue University created the tool (https://engineering.purdue.edu/mapserve/LTHIA7/lthianew/lidIntro.php) and it can be applied in the Great Lakes region on a small "lot"-sized scale up to a larger watershed-scale. For inputs, it requires daily precipitation, soil, and land use data for the modeled area; however, L-THIA/LID already has most of these inputs incorporated. Users can adjust the percent of impervious service for an area or select the LID practice incorporated in the area and then run the model to estimate the reduction or change in average annual runoff volume.

Application

Applicants/grantees can use L-THIA/LID to estimate increases in stormwater retention due to the installation of green infrastructure projects. It can model the benefits of LID practices in two ways. The first way is by allowing users to adjust the percent of imperviousness for particular land uses. The second way is at the "lot-level" and includes allowing users to choose from a set of BMPs, including bioretention basins, swales, connected gutters and curbs, rain barrels, cisterns, porous pavement, narrowing impervious surfaces, green space, conservation practices, and green roofs.

L-THIA/LID is user-friendly and requires a minimal time investment to run effectively. The model is designed to be run on a lot-level, but can be run in an area as large as an eight-digit HUC. The user can either select a watershed or draw a boundary to define the area to model.

A few considerations if using L-THIA/LID:

- L-THIA/LID outputs average annual runoff volume in acre-feet with and without the implementation of LID. Therefore, grantees will need to calculate the difference between runoff volume with and without LID implementation, and convert the volume in acre-feet to gallons before reporting stormwater retention changes in Easygrants.

- L-THIA/LID calculates average annual runoff using 30 years of existing weather data. Accordingly, the tool represents average conditions for grantee project locations and is, therefore, unable to represent the climate conditions that occurred in the past year.

Additional Resource

- L-THIA/LID tool and tutorial: https://engineering.purdue.edu/mapserve/LTHIA7/lthianew/lidIntro.php.

B.10.4 Guidance for Grantee Reporting in Easygrants

Reporting green infrastructure installation. Applicants/grantees should report green infrastructure installation in Easygrants using the following metrics: “Sq ft of bioretention installed,” “Sq ft of green roof installed,” and “Sq ft of green infrastructure.” Grantees should use the Easygrants metric that represents the specific green infrastructure installation (Sq ft of bioretention installed or Sq ft of green roof installed). If there is no Easygrants metric that represents the specific installation, grantees can use the Easygrants metric “Sq ft of green infrastructure.” Grantees should not include installations that they report in Sq ft of bioretention installed or Sq ft of green roof installed in their estimate for Sq ft of green infrastructure.

Reporting stormwater retention. Applicants/grantees should report stormwater retention in Easygrants using the following metric: “Volume stormwater storage added annually (gallons).” In the notes section of this metric, grantees should indicate the model or tool that was used to estimate this metric. Note that although this is not explicitly stated in Easygrants, grantees should report the annual volume of stormwater retained.