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National Rivers and Streams Assessment 2018/19

Site Evaluation Guidelines

Version 1.0



NOTICE

The intention of the National Rivers and Streams Assessment 2018/19 is to provide a comprehensive “State of Flowing Waters” assessment for rivers and streams across the United States. The complete documentation of overall project management, design, methods, quality assurance, and standards is contained in four companion documents, including:

National Rivers and Streams Assessment 2018/19: Quality Assurance Project Plan (EPA-841-B-17-001)

National Rivers and Streams Assessment 2018/19: Site Evaluation Guidelines (EPA-841-B-17-002)

National Rivers and Streams Assessment 2018/19: Field Operations Manual- Wadeable (EPA-841-B-17-003a)

National Rivers and Streams Assessment 2018/19: Field Operations Manual- Non-Wadeable (EPA-841-B-17-003b)

National Rivers and Streams Assessment 2018/19: Laboratory Operations Manual- Non-Wadeable (EPA-841-B-17-004)

This document (*Site Evaluation Guidelines [SEG]*) contains an overview of the processes involved in locating a sampling site, evaluating the site, and selecting appropriate alternate sites when necessary, and is based on the guidelines developed and followed in the Western Environmental Monitoring and Assessment Program (Peck et al. 2003) and the National Rivers and Streams Assessment 2008/09 and 2013/14. Methods described in this document are to be used specifically in work relating to the NRSA 2018/19. Mention of trade names or commercial products in this document does not constitute endorsement or recommendation for use. More detail of the project overview and of specific methods for field sampling, sample handling, and sample processing can be found in the appropriate companion document.

The suggested citation for this document is:

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1 INTRODUCTION

This document is provided to clarify all of the steps involved in the process of locating and evaluating a sampling site for the National Rivers and Streams Assessment (NRSA) 2018/19. There are five steps involved in this process (**Figure 1.1**):

- Locate the index site (“X-site”) on a topographic map
- Verify that the X-site is aligned with an actual channel segment using geospatial data programs
- Obtain permission to access the site
- Verify that the site is sampleable
- Sample the site *OR* replace with an alternate site

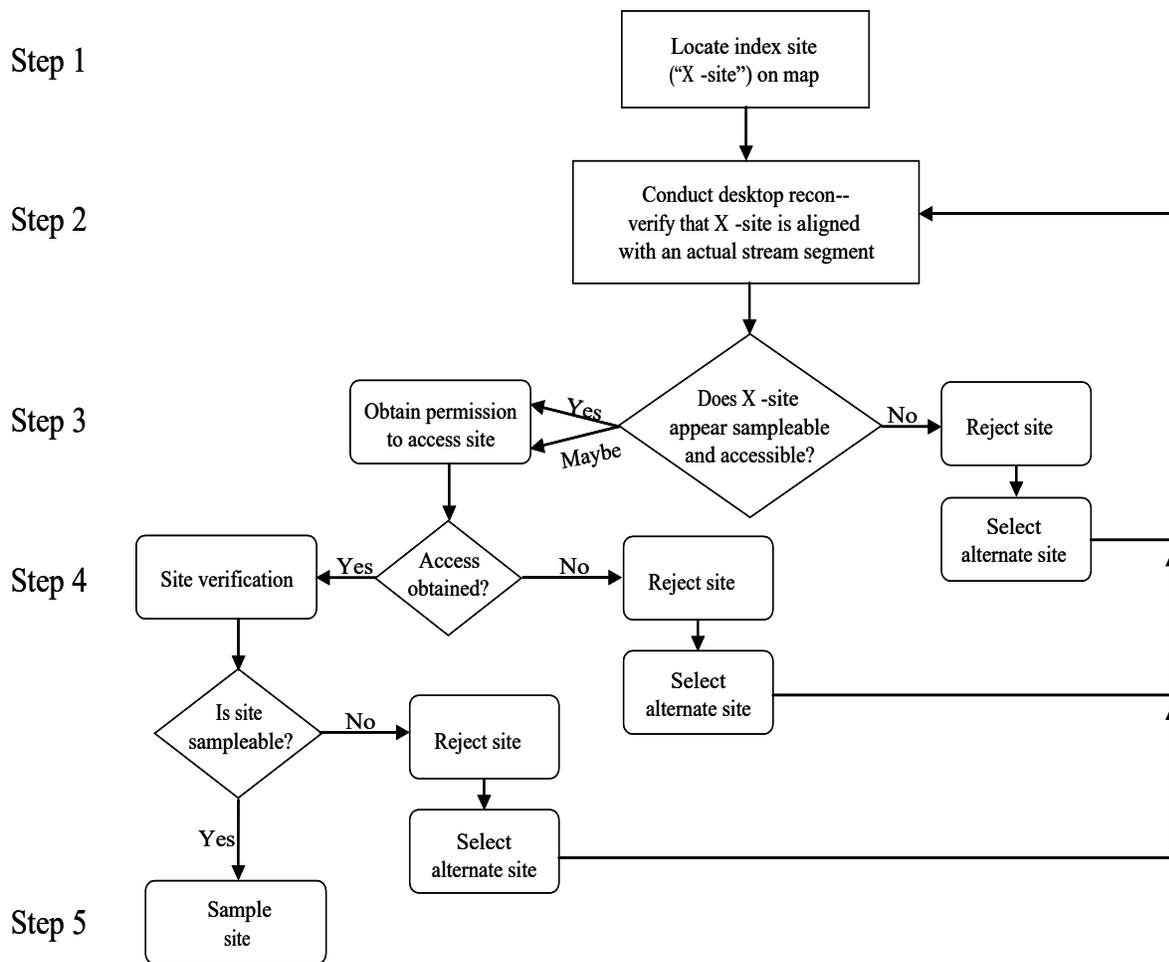


Figure 1.1. Site Evaluation Process

Field crews must assemble a dossier containing important locational and access information for each site they are scheduled to visit. The dossier must contain the appropriate maps, contact information, copies of permission letters (if applicable), and access instructions. If the field crew is not a state agency, he/she must interact with the state to verify site locations. Before a site visit, each field crew should confirm access to the waterbody if possible. The landowner(s) listed in the dossier should be contacted

to confirm permission to sample and to identify any revisions to the information in the dossier.

2 SURVEY DESIGN

2.1 Target Population

The target populations consist of all streams and rivers within the 48 contiguous states that have flowing water during the study index period excluding portions of tidal rivers up to head of salt (defined as < 0.5 ppt for this study). The study index period extends from the beginning of June to the end of September and is generally characterized by base flow conditions. The target population includes the Great Rivers. Run-of-the-river ponds and pools are included while reservoirs with greater than seven-day residence time are excluded. A complete definition of the target population is given in the field operations manual.

2.2 Sample Frame

The sample frame was derived from the medium National Hydrography Dataset (NHD), in particular NHD-Plus. Attributes from NHD-Plus and additional attributes added to the sample frame that are used in the survey design are:

- **MajorRiver:** rivers identified as major rivers or additional rivers in the book: Rivers of North America.
- **Strahler order**
- **Strahler category** where categories are RiversMajor (5th and higher), RiversOther (5th and higher but not considered a Major River), LargeStreams (3rd, 4th order), and SmallStreams (1st, 2nd order).
- **BorderRiver:** rivers and streams that occur on state and country boundaries. Each reach is identified by two-state postal codes such as MO:IL for the portion of the Mississippi river that forms the boundary between Missouri and Illinois. A border river/stream is assigned to one of the two states for the survey design.
- **Ecological Reporting Region:** Nine aggregated Omernik ecoregions that are used for reporting.
- **Omernik and North American ecoregions** Levels I, II, III and IV.

2.3 Survey Design

The NRSA 2018/19 survey design consists of two separate designs to address the dual objectives of (1) estimating current status and (2) estimating change in status for all flowing waters:

- Resample design applied to NRSA 2008/09 and NRSA 2013/14 sites
- New site design for NRSA 2018/19

Five basic panels are used for NRSA 2018/19 (below). Each of the following panels have “Base” sites an “Oversample” sites (**Table 6.1**):

- **NRS18_08TS3R2:** sites from NRSA 2008/09 that were sampled twice in 2008/09 and then sampled twice again in 2013/14 (a few exceptions). TS3 designates that the site will have been sampled in all three NRSA surveys. R2 designates a site that will be sampled twice in 2018/19.

- **NRS18_08TS3**: sites from NRSA 2008/09 that were sampled once in 2008/09 and sampled again in 2013/14. TS3 designates that the site will have been sampled in all three NRSA surveys.
- **NRS18_13TS2R2**: sites from NRSA 2013/14 that were sampled twice in 2013/14. TS2 designates that the site will have been sampled in two NRSA surveys. R2 designates a site that will be sampled twice in 2018/19.
- **NRS18_13TS2**: sites from NRSA 2013/14 that were sampled once in 2013/14 and will be sampled again in 2018/19. TS2 designates that the site will have been sampled in two NRSA surveys.
- **NRS18_18**: new sites selected for NRSA 2018/19 that will be sampled once in 2018/19.

The survey design is explicitly stratified by state for both designs. The unequal probability categories are specific to survey design used for NRSA 2008/09, NRSA 2013/14 and NRSA 2018/19. In all cases the categories are specific combinations of Strahler order categories and NARS nine aggregated ecoregions. In addition, a minimum of 20 sites (Resample and New) was guaranteed in each state and a maximum of 75 sites was the limit for an individual state.

2.4 Resample Sites

The Resample survey design is a subsample of the NRSA 2008/09 sites and NRSA 2013/14 sites that were target and sampled in NRSA 2008/09 and NRSA 2013/14. The major objective for this design is change estimation, although all sites sampled in 2013/14 will be used when change is estimated. The resample design has four panels:

- **NRS18_08TS3R2** – 96 sites (two per state) from NRSA 2008/09 sites that were sampled twice in 2008/09 and that were also sampled twice in 2013/14 and will be sampled twice in 2018/19. In each state one site is a stream (Strahler order 1-4) and one site is a river (Strahler order 5-10). Note that Arizona sites visited twice are both rivers since no streams were available that were visited twice in prior surveys.
- **NRS18_08TS3** – 366 sites that were sampled once in 2008/09, once in 2013/14 and will be sampled once in 2018/19. Approximately 50% of sites in each state will be streams and 50% will be rivers. Sample size for each state is based on sample size used in 2013/14.
- **NRS18_13TS2R2** - 96 sites (two per state) from NRSA 2013/14 sites that were sampled twice in 2013/14 and will be sampled twice in 2018/19. In each state one site is a stream (Strahler order 1-4) and one site is a river (Strahler order 5-10). Note that Vermont sites visited twice are both streams since no rivers were available that were visited twice in prior surveys.
- **NRS18_13TS2** – 400 sites that were sampled once in 2013-14 and will be sampled once in 2018-19. Approximately 25% of sites in each state will be SmallStreams(1st-2nd), LargeStreams (3rd-4th), RiversMajor (5th+) and Rivers Other (5th+). Sample size for each state is based on sample size used in 2013-14.

This results in 958 unique sites in the Resample Design. Allocation of sites to NARS aggregated ecoregions is proportional to the number sampled in the prior surveys.

2.5 New Sample Sites

The NRSA 2018/19 new site survey design is a new survey design where the expected sample sizes are based on the nine ecological reporting regions and four categories of RiversMajor (5th and greater), RiversOther (5th and greater but not Major Rivers), LargeStreams (Strahler order 3rd, 4th), and SmallStreams (Strahler order 1st, 2nd). Allocation of number of sites to states is proportional to stream length. The New Site Design is explicitly stratified by state. Unequal probability categories are 36 combinations of NARS nine aggregated ecoregions and four Strahler order categories (SS – small streams (1st-2nd), LS – large streams (3rd-4th), RM – major rivers (5th+) and RO – other rivers (5th+). In addition, a minimum of 20 sites (Resample and New) was guaranteed in each state and the maximum number of sites (Resample and New) was set at 75 for an individual state.

First, each state was assigned one site for each unequal probability category of streams and rivers that occur in the state. This allocated 754 sites in the New Site Design which were allocated to the states proportional to their stream and river lengths.

3 LOCATING THE INDEX SITE ON MAPS

Stream sampling points were chosen from the "blue line" stream network represented on 1:100,000 scale USGS maps, following a systematic random site selection process developed for NRSA 2018/19. Each point is referred to as the "index site" or "X-site." The "X-site" is the mid-point of the segment to be sampled. The latitude/longitude of the X-site was listed on a regional sampling site spreadsheet that was distributed electronically to the field crews and EPA Regional Coordinators.

The line work for US EPA's National Hydrologic Database – Plus (NHD-Plus) is based on 1:100,000-scale Digital Line Graphs and, therefore, will not match exactly with the 1:24,000-scale maps. Use the NHD-Plus line to locate important features such as confluences or bends in the channel to assist in placing the X-site accordingly on the 1:24,000-scale (or 7.5") map. All NHD-Plus lines are shown even though many are not channel traces. Line segments for lakes, inundated areas, wetlands, and, occasionally, even map boundaries are shown as NHD-Plus line work. Site name, site ID, state, Strahler category, ecoregion, base/oversample panel and provided coordinates are also included in the site evaluation spreadsheet. All information, including the longitude/latitude, refers to the location of the X-point.

If you have any questions about the site maps or how to use them please contact Richard Mitchell (202-566-0644, mitchell.richard@epa.gov).

4 OBTAINING PERMISSION TO ACCESS CANDIDATE SITE

Each field crew is responsible for obtaining permission for their sampling crew to access their sampling sites. Obtaining permission prior to the sampling day is often important to minimize loss of time on the part of the field crew. An in-person visit is an effective way to establish contact with landowner(s). Past surveys have found that landowners are more likely to grant permission if they meet with a study representative than if their only contact is through a phone call or letter. If a personal visit cannot be made, a phone call is considered the best alternative. A local representative may be more effective in securing permission, so it is important to request assistance at this level if you are not local to the area. If attempts to reach the landowner(s) through an in-person visit or telephone call are unsuccessful, a

letter should be mailed (see **Figure 4.1** for an example) with a fact sheet on the survey (**Appendix A**) and a permission slip for the landowner(s) to return (**Appendix B**). Included in this package should be a return-addressed and postage-paid envelope with a specific date by which the permission slip should be returned. A signed permission slip is important to use as documentation on the day of sampling. Some crews will choose to deal with access issues on the day of the sampling event. This method is usually adequate if a desk-top reconnaissance shows that the area around the site includes enough public land to gain access to the waterway. If the site is in an area that is largely privately owned land, waiting until the day of sampling could pose unnecessary delays and access issues that should have been resolved prior to the scheduled sampling day.

Landowner information can often be obtained from the county tax assessor office. Tax assessor maps will display landowner boundaries, addresses and, oftentimes, phone numbers. This information enables the crew to contact landowners before the sampling day, and identifies which landowner owns which portions of the stream or river banks. The provision of county maps for the field crews will help clarify access to the targeted sampling reach.

(Date)

Dear Landowner:

The US Environmental Protection Agency, in cooperation with state agencies, is conducting an environmental assessment of rivers and streams across the United States. A computer was used to randomly select these streams. A total of approximately 1,800 sampling sites in rivers and streams were selected for sampling in 2018 and 2019. Water quality chemistry, aquatic life, and habitat will be evaluated at each site. The findings of the study will not be used for enforcement or regulatory purposes.

We are contacting you prior to the site visit to obtain permission (form enclosed) to access the sampling site. We have enclosed a copy of a topographic map(s) with the site(s) identified by an "X" at the specific point on the stream to be sampled. We realize that working on your property is a privilege and we will respect your rights and wishes at all times.

Please return the completed Access Permission Form in the enclosed envelope by (date). If you have any questions concerning this request, please contact me (phone number). We are looking forward to hearing from you.

Sincerely,
(Name)
NRSA 2018-19 Crew Leader

Figure 4.1. Example Permission Cover Letter

5 SITE VERIFICATION

While traveling from a base location to a site, record a detailed description of the route taken on the **Verification Form (front)**. This information will allow others to find the site again if it is selected for a repeat visit in the future. Upon reaching the X-site for a stream or river channel, confirm its location and that the team is at the correct location. Record the information on the **Verification Form (front)**. Complete a **Verification Form** for each site visited (regardless of whether it is sampled), following the procedures described below.

5.1 Site Verification Procedures

1. Find the site location in the field corresponding to the X-site coordinates and the "X" marked on the map (X-site) prepared for each site. Record the routes taken and other directions on the **Verification Form** so that others can visit the same location in the future.
2. Use a GPS receiver to confirm the latitude and longitude of the X-site with the coordinates for the site. Make sure the GPS unit is set to reference the NAD 83 geospatial data set. Record these coordinates in decimal degrees on the **Verification Form**.
3. Use all available means to ensure that you are at the correct location as marked on the map including: 1:24,000 USGS map, topographic landmarks, county road maps, local contacts, etc.
4. Scan the channel upstream and downstream from the X-site, determine whether the site is sampleable using the guidelines provided below, and mark the appropriate box on the **Verification Form**.
5. Do not sample non-target or "Non-sampleable Permanent", "Non-sampleable Temporary" or "No Access" sites. Place an "X" in the "NO" box for "Did you sample this site?" and check the appropriate box in the "Non-sampleable Permanent", "Non-sampleable Temporary" or "No Access" section of the **Verification Form**; provide detailed explanation in comments section.

5.2 Sampleable Categories

If the site is target and sampleable, assign one of the following sampling status categories (**Table 5.1**) to the stream. Record the category on the Verification Form.

Table 5.1 Sampleable Categories

Category	Description
Wadeable	There is continuous water flow and >50% of the sample reach is wadeable.
Boatable	Boat is required for sampling > 50% of sample reach.
Partial Sampled by Wading	Sampled by wading (>50% of reach sampled).
Partial Sampled by Boat	Sampled by boat (>50% of reach sampled).
Wadeable or Boatable Interrupted	The flow of water is not continual, but there is water in the sample reach (e.g., isolated pools); >50% of the reach has water present.

Altered Channel	There is a stream at the location marked with the X-site on the map, but the stream channel does not appear the way it is drawn on the map. An example of this is a channel rerouting following a flood event that cut off a loop of the stream. Establish a new X-site at the same relative position in the altered channel. (Make careful notes and sketches of the changes on the Verification Form.)
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5.3 Non-Sampleable Categories

If the site is non-target and/or not sampleable, assign one of the categories in **Table 5.2**, **Table 5.3**, or **Table 5.4** to the stream. Record the category on the Verification Form and replace the site with the appropriate oversample site (see **Section 6**).

5.3.1 Non-Sampleable (permanent condition; stream/river becomes non-target)

Table 5.2 Non-Sampleable Categories (permanent condition)

Category	Description
Dry Channel	A discernible stream channel is present but there is no water anywhere within a 150-m reach centered on the X-site. If determined at the time of the sampling visit, record as "Dry-Visited"; if site was determined to be dry (or otherwise non-perennial) from another source and/or field verified before the actual sampling visit, record as "Dry-Not Visited."
Wetland	(No definable stream channel) there is standing water present, but no definable stream channel. In cases of wetlands surrounding a recognizable stream channel, define the site as sampleable but restrict sampling to the stream channel.
Map Error	No evidence that a water body or stream channel was ever present at the coordinates provided for the X-site.
Impounded Stream	The stream is submerged under a lake or pond due to man-made or natural (e.g., beaver dam) impoundments. If the impounded stream, however, is still wadeable, record the stream as "Altered" and sample.
Tidal	The site in question occurs near a coast and is below the head of salt. If the site has a salinity of greater than 0.5 parts per thousand.
Other	The site is non-target for reasons other than those above. Examples include underground pipelines or a non-target canal. A sampling site must meet both of the following criteria to be classified as a non-target canal: <ul style="list-style-type: none"> • The channel is constructed where no natural channel has ever existed. • The sole purpose/usage of the reach is to transfer water. There are no other uses of the waterbody by humans (e.g., fishing, swimming, boating).

5.3.2 Non-Sampleable (temporary condition; stream/river can be revisited)

Table 5.3 Non-Sampleable Categories (temporary condition)

Category	Description
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Not Boatable	Unable to reach a site with a boat. Site should be rescheduled for another visit this year.
Not Wadeable	Unable to reach a site without a boat. Site should be rescheduled for another visit this year.
Other	The site could not be sampled on that particular day, but is a target site. Examples include a recent precipitation event that has caused unrepresentative conditions or the crew assessing the site does not perform both protocols and cannot complete the methods necessary for said site. Site should be rescheduled for another visit this year.

5.4 No Access to Site Categories

Table 5.4 No Access to Site Categories

Category	Description
Access Permission Denied	You are denied access to the site by the landowners.
Permanently Inaccessible	Site is unlikely to be sampled by anyone due to physical barriers that prevent access to the site (e.g., cliffs).
Temporarily Inaccessible	Site cannot be reached at the present time due to barriers that may not be present at some future date (e.g. forest fire, high water, road temporarily closed, unsafe weather conditions). Site may be sampled at a later date, however if deemed necessary, can be replaced.
Other	Site may not be sampled for other unforeseen reasons. Please explain in the comments section of the site evaluation spreadsheet.

The primary distinction between "Sampleable" and "Non-Sampleable" rivers or streams is based on the presence of a defined channel and water content. If the site is non-sampleable or inaccessible, the site visit is completed, and no further sampling activities are conducted. The site must then be replaced by an alternative site.

5.5 Blackwater Sites

For the NRSA 2018/19, we are looking to evaluate how many target sites are considered "blackwater" sites by the field sampling crews and local experts. If the site you are sampling is a blackwater site, please mark that on the field **Verification form (front)** and sample the site. This is for data analysis purposes only and should not be a factor in site evaluation.

5.6 Tidal Sites

The NRSA design includes sites that are **above the head of salt**. This means that tidal sites are included in the NRSA target population that are above the head of salt. Consult the NOAA head of salt maps for reconnaissance information about these sites in relation to the head of salt. Mark if sites are tidally influenced on the Site Verification Form.

However, sites are considered non-target if they are below the head of salt. In addition to looking at the NOAA maps, crews must evaluate tidal sites salinity levels in the field. Sites that are tidal and exceed the salinity threshold of > 0.5 ppt are considered non-target and should not be sampled. They should be replaced following the over-sample procedures.

5.7 Run-of-the-River Reservoirs

Large streams and rivers with run-of-the-river reservoirs on them are considered target for the NRSA 2018/19. The determination if a site with a dam is a run of the river or a reservoir is based on the residency time of the water. **Sites with less than seven-day residence time are considered TARGET for the NRSA. Sites with greater than seven-day residence time are considered NON-TARGET for the NRSA.**

6 SELECTING ALTERNATE SITES

The sampling site lists for the NRSA 2018/19 are organized by state and replacement is done within the state. Each spreadsheet contains a list of all primary (panel=base) and alternate (panel=oversample) sites in the state. The sites are listed on the spreadsheet in the order in which they were randomly selected. **All primary (base) sites must be evaluated for potential sampling and must be sampled unless they are determined to be non-target, non-sampleable, or not accessible.** If a primary site is rejected, then it will be replaced by an alternate site within the same state, ecoregion and size class category. **However, there are some caveats to this as described below (Table 6.2).**

6.1 Site Sampling Categories

There are five sampling categories for the NRSA 2018/19 (**Section 2.3**). Site replacement is based on the 2018/19 oversample panel (Table 6.1).

If a primary site is deemed non-target or non-sampleable during the reconnaissance process or in the field, a site from the replacement site must be selected. The replacement must be done within the state and within the site categories (size and, in some cases, ecoregion).

For example, if it was a 1st or 2nd order stream from the NRS18_18_BaseSS_XXX within the Coastal Plains ecoregion of Arkansas it must be replaced by a 1st or 2nd order stream from the NRS18_18_BaseSS_XXX within the Coastal Plains ecoregion within Arkansas. **The replacement site must be the next site in site ID order that is in the same category. Oversample sites MUST be replaced in order.** If a site is dropped it must be replaced by the next oversample site in that category. **Table 6.1** lists the site categories with their replacement codes.

Table 6.1 Site Replacement oversample panel

NRSA 2018-19 panel	Base sites within 2018-19 panel	Over sample sites within 2018- 19 panel that will be used as replacement sites within the panel
NRS18_08TS3R2	NRS18_08TS3R2_BaseStream	NRS18_08TS3R2_OverStream
NRS18_08TS3R2	NRS18_08TS3R2_BaseRiver	NRS18_08TS3R2_OverRiver
NRS18_08TS3	NRS18_08TS3_BaseStream	NRS18_08TS3_OverStream
NRS18_08TS3	NRS18_08TS3_BaseRiver	NRS18_08TS3_OverRiver
NRS18_13TS2R2	NRS18_13TS2R2_BaseStream	NRS18_13TS2R2_OverStream
NRS18_13TS2R2	NRS18_13TS2R2_BaseRiver	NRS18_13TS2R2_OverRiver
NRS18_13TS2	NRS18_13TS2_BaseSS	NRS18_13TS2_OverSS
NRS18_13TS2	NRS18_13TS2_BaseLS	NRS18_13TS2_OverLS
NRS18_13TS2	NRS18_13TS2_BaseRO	NRS18_13TS2_OverRO
NRS18_13TS2	NRS18_13TS2_BaseRM	NRS18_13TS2_OverRM
NRS18_18	NRS18_18_BaseSS_XXX	NRS18_18_OverSS_XXX
NRS18_18	NRS18_18_BaseLS_XXX	NRS18_18_OverLS_XXX
NRS18_18	NRS18_18_BaseRO_XXX	NRS18_18_OverRO_XXX
NRS18_18	NRS18_18_BaseRM_XXX	NRS18_18_OverRM_XXX

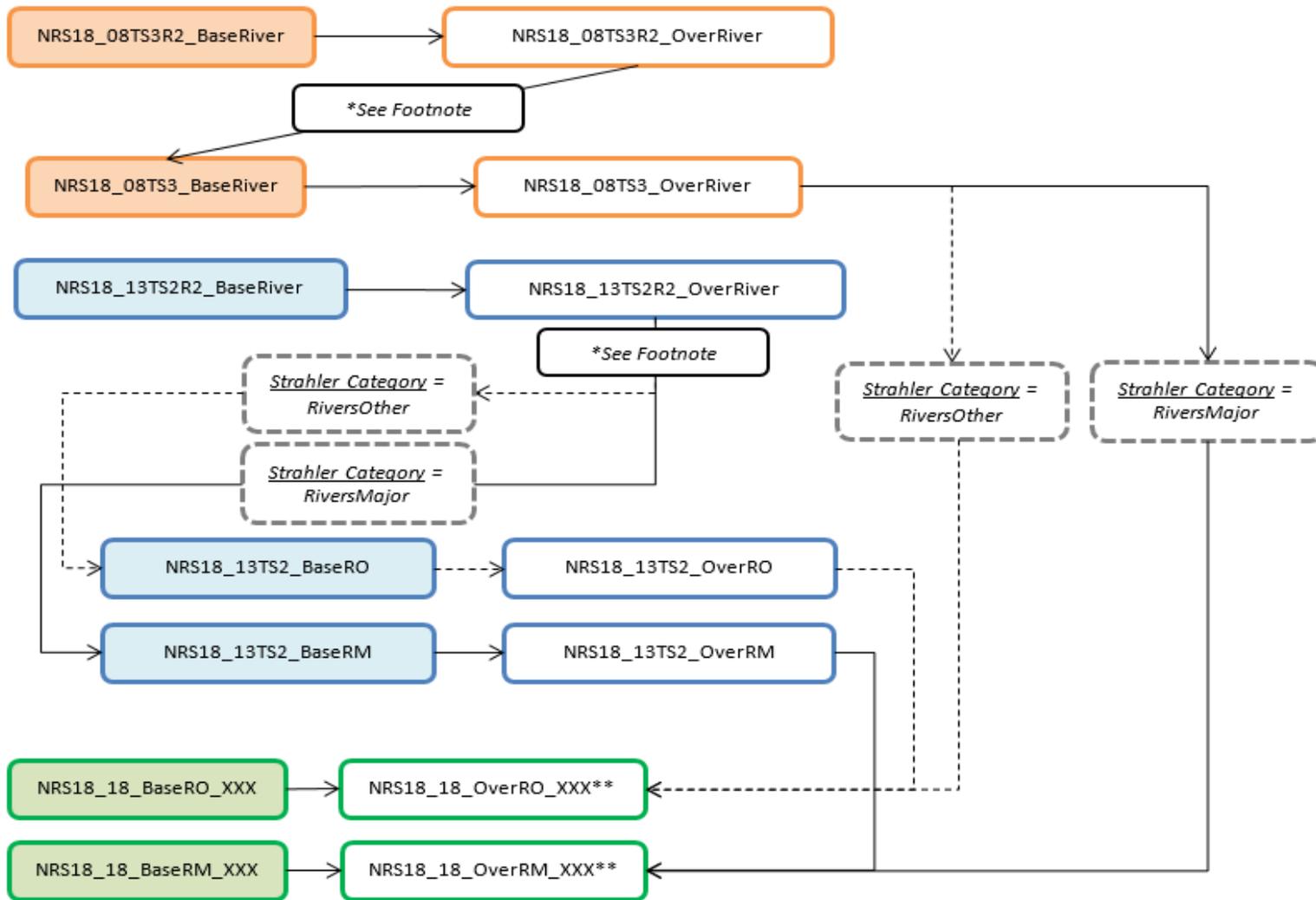
XXX (found only in the NRS18_18 panel) designates one of the nine aggregated ecoregions: Coastal Plains (CPL), Northern Appalachian (NAP), Northern Plains (NPL), Southern Appalachian (SAP), Southern Plains (SPL), Temperate Plains (TPL), Upper Midwest (UMW), Western Mountains (WMT) or Xeric (XER). Base sites and oversample sites within each state are broken into six tabs within the site evaluation spreadsheet. Panels with “R2” are sites that will be sampled twice in 2018/19. If no over sample sites are available, or all over sample sites have been used, for an “R2” panel, then the next site in SiteID order within the same basic panel is used. For example, if no over sample site are available in panel NRS18_08TS3R2_BaseStream, then use first site in panel NRS18_08TS3_BaseStream as the revisit site AND add an additional oversample site that will be sampled once in 2018/19 (see alternate replacement plans in **Table 6.2**).

6.2 Sampling Sites from Previous Surveys

If a primary site is rejected because it is non-target, non-samplable, or not accessible, then it will be replaced by an alternate site within the same state, size class category and, in some cases, ecoregion. **However, there are some caveats to this as the sampling regime in 2008/09 and 2013/14 were different and therefore the alternative sites do not necessarily rely on the Strahler category or the ecoregion.** Should there be a need to select an alternative site of the revisit sites from 2008/09 and 2013/14, specific instructions can be found in **Table 6.2**. Flowcharts for site selection of rivers and streams based on Base panel can be found in **Figure 6.2.1** and **Figure 6.2.2**, respectively.

Table 6.2 Alternative Site Selection Instructions

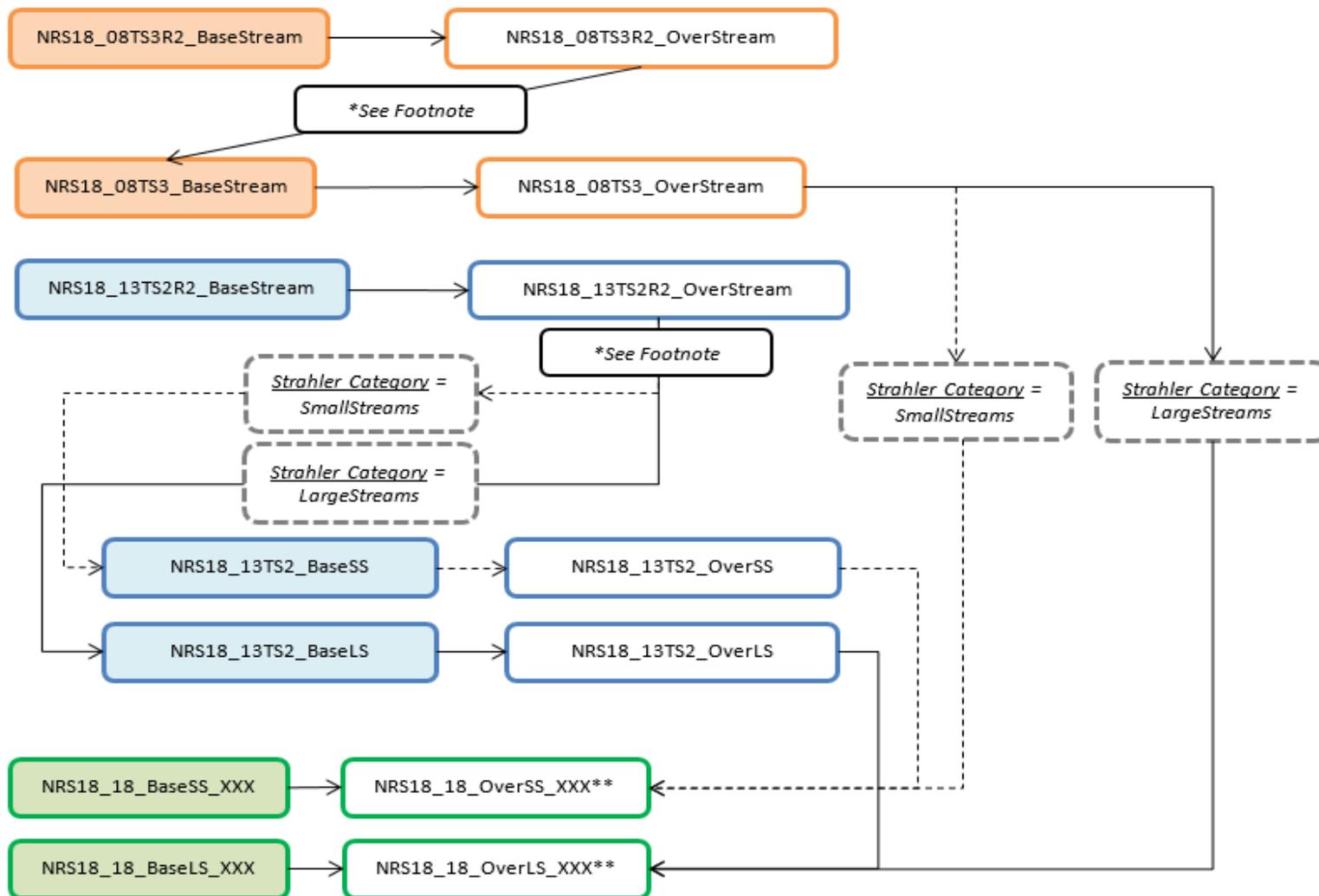
Original Site	Primary Oversample Replacement Site	Replacement Site If No Oversample Site is Available
<p>NRS18_08TS3R2_BaseRiver NRS18_08TS3R2_BaseStream</p>	<p>NRS18_08TS3R2_OverRiver NRS18_08TS3R2_OverStream</p>	<p>NRS18_08TS3_BaseRiver* NRS18_08TS3_BaseStream*</p> <p>*Please replace with first BASE site on list within the respective Resampled Rivers/ Streams tabs. This replacement must be sampled TWICE. The base site that was used must be replaced with an available oversample site to compensate for the shift in sites. Strahler Category and Ecoregion do not matter in the selection of oversample sites for this panel.</p> <p>If the NRS1808TS3_BaseRiver/Stream site is used, an oversample site will be needed to compensate for the use of that base site.</p>
<p>NRS18_08TS3_BaseRiver NRS18_08TS3_BaseStream</p>	<p>NRS18_08TS3_OverRiver NRS18_08TS3_OverStream</p>	<p>NRS18_18_OverXX_XXX* NRS18_18_OverXX_XXX*</p> <p>*Please replace with first available OVERSAMPLE site on list within the respective Resampled Rivers/ Streams tabs. This replacement site is only sampled ONCE. The oversample site used must match in Strahler Category (XX) as well as Ecoregion (XXX). These oversample sites are found in subsequent “Major/Other Rivers and Large/Small Streams” tabs within the Site Evaluation Spreadsheet.</p>
<p>NRS18_13TS2R2_BaseRiver NRS18_13TS2R2_BaseStream</p>	<p>NRS18_13TS2R2_OverRiver NRS18_13TS2R2_OverStream</p>	<p>NRS18_13TS2_BaseRO/RM (found in respective tabs on spreadsheet) NRS18_13TS2_BaseLS/SS (found in respective tabs on spreadsheet)</p> <p>*Please replace with first available BASE site within the respective Resampled Rivers/ Streams tab. This replacement site will be sampled TWICE. Strahler Category and Ecoregion do not matter in the selection of oversample sites for this panel. These oversample sites are found in subsequent “Major/Other Rivers and Large/Small Streams” tabs within the Site Evaluation Spreadsheet.</p> <p>If the NRS18_13TS2_BaseRiver/Stream site is used, an oversample site will be needed to compensate for the use of that base site.</p>
<p>NRS18_13TS2_BaseRO/RM NRS18_13TS2_BaseLS/SS</p>	<p>NRS18_13TS2_OverRO/RM NRS18_13TS2_OverLS/SS</p>	<p>NRS18_18_OverXX_XXX* NRS18_18_OverXX_XXX*</p> <p>*Please replace with first available OVERSAMPLE site on list. This replacement site is only sampled ONCE. The oversample site used must match in Strahler Category (XX) as well as Ecoregion (XXX). These oversample sites are found in subsequent “Major/Other Rivers and Large/Small Streams” tabs within the Site Evaluation Spreadsheet.</p>
<p>NRS18_18_BaseXX_XXX</p>	<p>NRS18_18_OverXX_XXX</p>	<p>If all sites in NRS18_18_BaseXX_XXX have been evaluated, then sites in SiteID order from NRS18_18_OverXX_XXX are used. XX designates the Strahler Category used where XXX designates one of the nine aggregated ecoregions: CPL, NAP, NPL, SAP, SPL, TPL, UMW, WMT, or XER. Base sites must be replaced with an oversample site within the same Strahler Category and same ecoregion. Replacement sites will be found in the same tab as the original base site.</p>



*When replacing a Revisit (R2) site with a Base Site, Re-designate the Base site as a Revisit site **AND** replace the Base site with an appropriate oversample site

**Examine Ecoregion Field in site spreadsheet. Choose replacement in the same ecoregion

Figure 6.2.1 Site Replacement Plan (primary and alternate) for Rivers. Shaded cells represent Base sites and white cells represent oversample sites.



*When replacing a Revisit (R2) site with a Base Site, Re-designate the appropriate Base site as a Revisit site **AND** replace the dropped Base site with an appropriate oversample site

**Examine Ecoregion Field in site spreadsheet. Choose replacement in the same ecoregion

Figure 6.2.2 Site Replacement Plan (primary and alternate) for Streams. Shaded cells represent Base sites and white cells represent oversample sites.

6.3 State Designs

Six states have state-specific survey designs: Arizona, Kansas, New Hampshire, Oklahoma, Texas, and Virginia. These designs are described below. In addition, a state may implement a state-level survey using the national design for their state. The above survey design describes the national survey design and sets the required number of sites that must be sampled within each state. If a state implements a state-level design, the NRSA 2018/19 design sites must be sampled as part of the state-wide design. It is critical that the site replacement process be followed and that the state communicate to the NRSA 2018/19 coordinator whether only the required NRSA 2018/19 sites will collect all the NRSA indicators or if all state-level sites will collect all the NRSA indicators. This information is required by the NRSA staff to know what sites evaluated should be included in the weight adjustment after field implementation.

6.3.1 Arizona

Arizona plans to conduct a state-level assessment and a special study on warm water streams and rivers. The sample frame and the survey design used for NRSA 2018/19 will be used. That is, no special design is required. Additional over sample sites were selected to ensure that sufficient sites will be available to achieve their required sample sizes. It is anticipated that only the required 27 NRSA 2018/19 sites will become part of the national assessment. The additional sites will not have all national indicators collected. After all sites are evaluated and field work is completed, two weight adjustments will be necessary. One to account for the sites evaluated to sample the 27 national sites and one to account for all sites evaluated to complete the state-level assessment and special study. Sites must be replaced within the panels as described above and in SiteID order within the panels. For the special study, additional criteria, such as sites below 5,000 feet (warm water) and not on tribal land may be used. Sites must be replaced in SiteID order within these additional categories as well.

6.3.2 Kansas

The Kansas state-specific design is based on the Kansas Surface Water Register (KSWR) GIS layer of officially recognized streams and rivers within the state. It is based on the 1:24000 NHD. The current version was provided by Kansas during the summer 2016. The NRSA design team restricted the GIS layer to the state of Kansas borders and added variables to match those used for all NRSA states. In prior studies, it was determined that the KSWR includes streams and rivers that meet the definition of the NRSA target population. The survey design consists of the Resample Design for Kansas as describes above and an equal probability survey design for new sites. Since the NRSA 2013/14 survey design for new sites for Kansas was also an equal probability survey design, most sites are selected with equal probability. That is not the case for NRSA 2008/09 sites where an unequal probability design was used. The panels and number of sites are:

- NRS18_08TS3R2: 2 sites from NRSA 2008/09 to be sampled twice in 2018/19. Required for NRSA 2018/19. If site cannot be sampled, then use oversample sites as described for all states.
- NRS18_08TS3: 9 sites from NRSA 2008/09 to be sampled once in 2018/19. Required for NRSA 2018/19. If site cannot be sampled, then use oversample sites as described for all states.
- NRS18_13TS2R2: 2 sites from NRSA 2013/14 to be sampled twice in 2018/19. Required for NRSA 2018/19. If site cannot be sampled, then use oversample sites as described for all states.

- NRS18_18: 33 new sites selected with equal probability. Required for NRSA 2018/19. If site cannot be sampled, then use oversample sites as described for all states.
- State-level design: The additional oversample sites for NRS18_18 (1650 sites) to be used as necessary to satisfy site replacement requirements and for Kansas to use for the state-level design in 2018/19 as well as in future years until the next NRSA design in 2023/24.

6.3.3 New Hampshire

New Hampshire provided a state-specific sample frame based on NHD 1:24,000. They explicitly identified stream reaches that are in the NHDPlus 1:100,000 sample frame. These categories are identified in the NH State Specific sample frame under the variable STATE_SF with the values of Include_100K if from NHDPlus and Include_24K for additional streams not in NHDPlus.

6.3.4 Oklahoma

The following objectives are to satisfy the 2018-2022 Oklahoma Statistical Survey design with the 2018-2019 NRSA component built into the overall study. The survey design must be able to satisfy the required elements of Oklahoma's statewide 5-year assessment, which are described in detail below. The primary reporting goal of the upcoming survey is to provide an overall statewide condition assessment. Additionally, Oklahoma will report on the condition of several subpopulations, including aggregated ecoregions, large and small waterbodies, and interim reports to meet integrated 305(b) reporting requirements. Finally, the study should be connected across Oklahoma's previous surveys to allow for a substantive trend analysis. To meet these study and reporting needs, the design should meet the following requirements. 1. The target sample size will be 120 sites. The first two years will focus on completing the NRSA study with continued sampling through 2022 to satisfy $n=120$. The survey design will be sampled to facilitate not only an eventual statewide condition assessment using all 120 sites, but several interim statewide condition assessments to meet Oklahoma's integrated reporting requirements for section 305(b) of the CWA. 2. The survey design must be ecoregionally representative and will include an aggregated ecoregion component. In both the 2005-2007 (Oklahoma R-EMAP) and the 2013-2017 survey (NRSA 2), Oklahoma was divided into 3 aggregate ecoregional subpopulations: Western Plains/Tablelands, Temperate Forests, and Forested Plains/Flint Hills. To facilitate a statistically meaningful condition assessment of each aggregated ecoregion, each aggregated ecoregion will have 40 target sites. 3. The survey design will be representative of all waterbody sizes. As in the most recent survey design, waterbodies will be divided into Strahler size classes. The Oklahoma component will mirror the NRSA classification sizes creating the following subpopulations: RiversMajor, RiversOther, LargeStreams, and SmallStreams. Each subpopulation will have an associated oversample panel. The reporting goal is to provide a statistically meaningful condition assessment of each Strahler subpopulation. 4. The Survey design will have a trend component referenced to Oklahoma's 3 previous surveys: 2005-2007 (Oklahoma R-EMAP), 2008-2012 (NRSA 1), and 2013-2017 (NRSA 2). Resample sites from each study should be included to allow for analysis of trends through each study period.

6.3.5 Texas

The survey design consists of two separate designs to address the dual objectives of (1) estimating current status and (2) estimating change in status for all flowing waters: Resample design applied to

NRSA 2008-9 and NRSA 2013-14 sites. New site design for NRSA 2018-19. Sample Size Requirements would like to have approximately an equal number of sites for the seven (7) Texas Biological Regions and approximately an equal number of sites by Strahler categories: SmallStreams, LargeStreams, RiversMajor, and RiversOther within those regions. Also like to have approximately an equal number of sites sampled in prior years and new sites. NRSA 2018-19 requires 71 sites for Texas. Texas plans to add 10 sites to achieve 81 sites. The survey design does not explicitly identify the 71 NRSA sites or the 10 additional Texas sites.

6.3.6 Virginia

Virginia conducts state-level probability surveys. Given that the design is compatible with NRSA 2018/19, the NRSA design will consist of the panels from the Resample Design and the sites from the Virginia state-level survey. No New Site Design is required for Virginia. Virginia samples by year and that process must be followed for NRSA 2018/19.

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7 LITERATURE CITED

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