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Offices: Richmond, VA | Nashville, TN | HQ: Stow, OH | (800) 940-4025

CASE STUDIES IN MUSSEL SURVEYS, RELOCATIONS, AND PERMITTING

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Sampling Types

- Qualitative
  - Un-structured sampling used to create a species list for a project area
- Semi-Quantitative
  - Loosely structured sampling used to determine species present at a site and determine abundance and relative abundance among species
    - e.g. Timed searches
- Quantitative
  - Structured sampling that determine species presence and density in sampled areas within a project area
    - e.g. Quadrat Sampling

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Sampling Protocols and Guidelines

- **Survey Protocols**
  - Pros: Standardized, rapid agency coordination, repeatable, easily performed
  - Cons: Nuance of individual projects is lost, can lead to un-necessary sampling
- **Survey Guidelines**
  - Pros: Allows methodology flexibility, on-site malacologist can easily make judgement calls in the field
  - Cons: Relies on expertise of the malacologist performing the survey
- **Neither (Case-by-Case)**
  - Pros: Project specific methods to obtain the most relevant data.
  - Cons: Project timeline and budget uncertainty.

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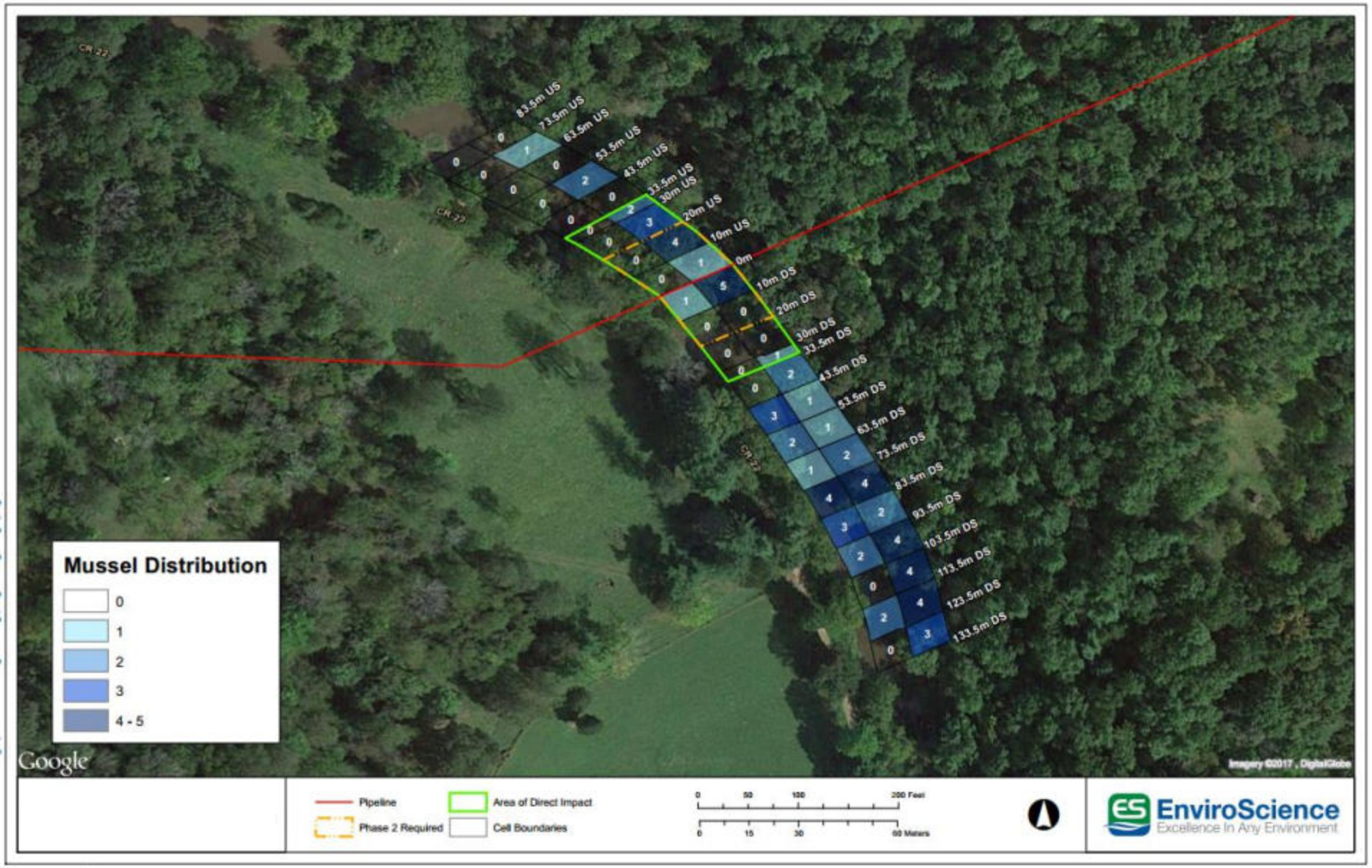

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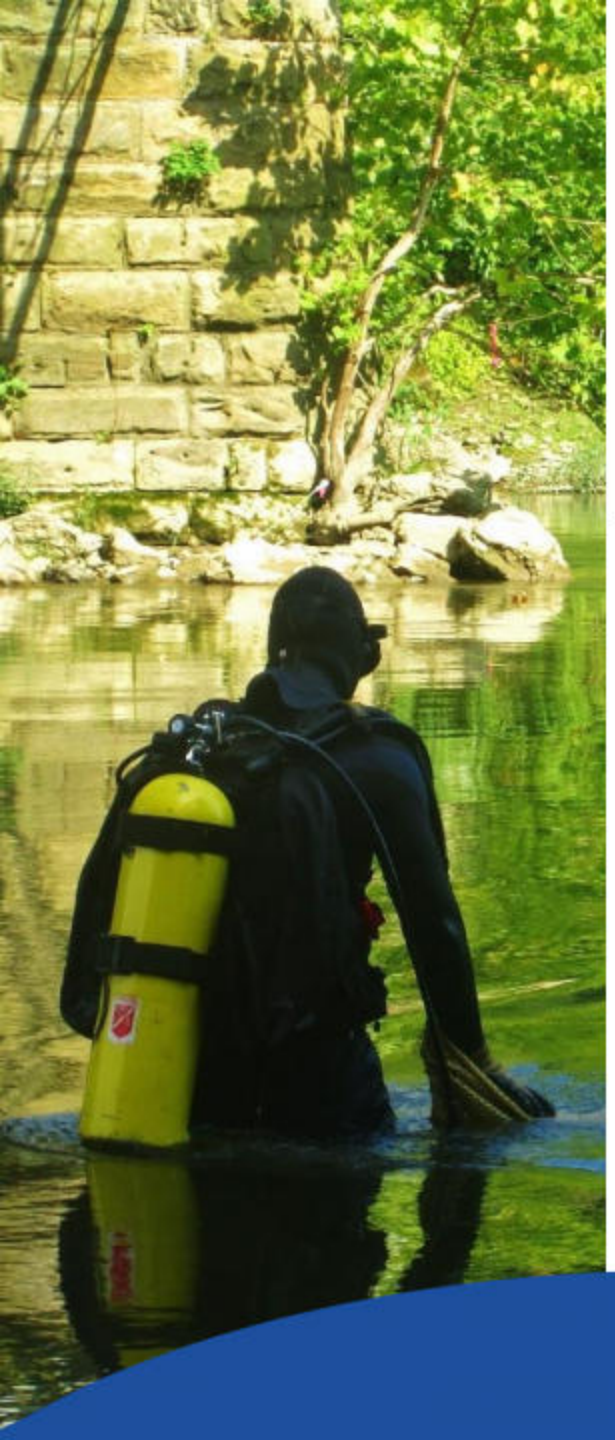

Appendix A

WV Mussel Stream List

County	Stream	Stream Group
Ritchie	Goose Creek	1
Ritchie	South Fork Hughes River	2
Ritchie	Middle Fork South Fork Hughes River	1
Ritchie	Indian Creek	1,2(1/2)
Ritchie	Leatherbark Creek	1,2(1/2)
Ritchie	Spruce Creek	1, 2(1/2)
Ritchie	Slab Creek	1,2(1/2)
Ritchie	Bone Creek	1,2(1/2)
Ritchie	Otterslide Creek	2(1/2)
Roane	Big Sandy Creek	1
Roane	Left Hand Creek	1
Roane	Pigeon Run	1
Roane	Granny Creek	1
Roane	Middle Fork Big Sandy Creek	1
Roane	Hollywood Trace Fork	1

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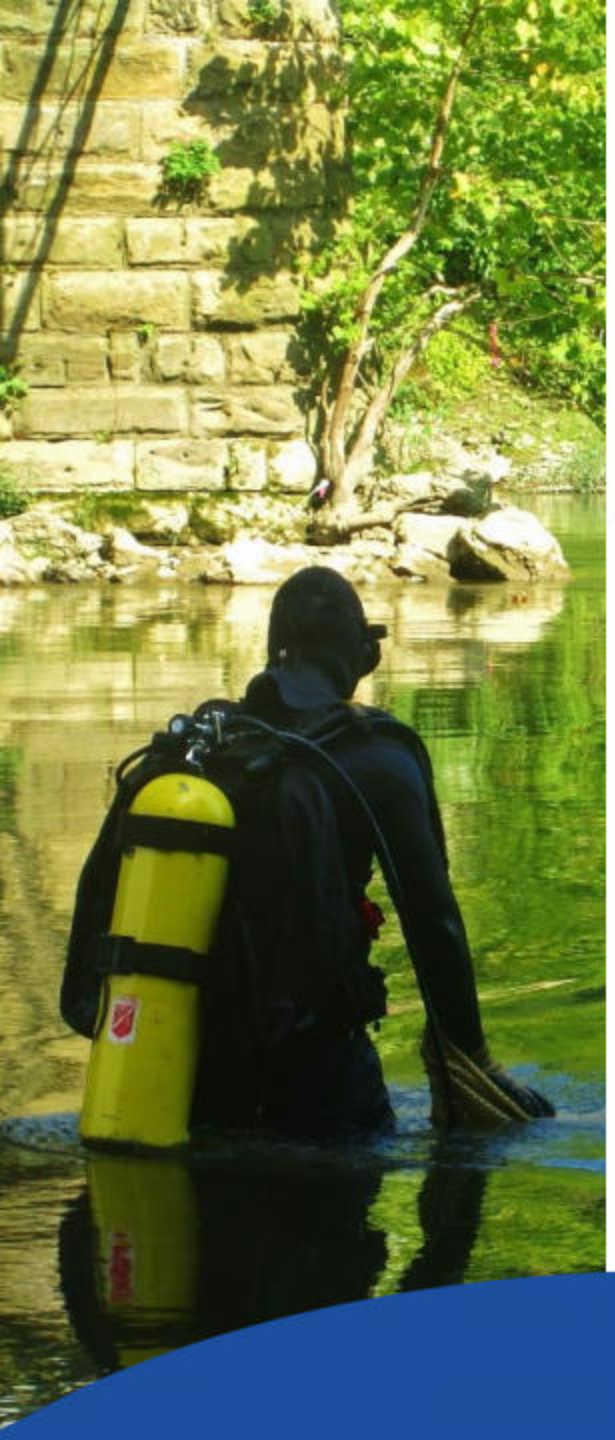

Table 3. Summary of buffer requirements and maximum transect spacing for various types of stream disturbances. Units are in meters. Survey extent shall include all buffers and the area of direct impact (ADI). After demonstrating need and receiving approval, mussels may be relocated from area described (salvage zone).

	US Buffer	DS Buffer	L Buffer	Salvage Zone (ADI + Buffer Below)		Maximum Transect Spacing
				US & L	DS	
Group 4	Potential Phase 2 Surveys Required If Phase 1 Trigger Met					
Dredging (Maintenance)	150	500	150	10	10	50
Barge Loading (active facility)*	25	25	25	5	10	50
Barge Loading (new or expanding US or DS, see page 11 for required buffers) *						
Scoping Projects		Project Specific				100
Bridge Projects	50	100	BB	5	10	10
Waterline/Pipeline Corridor Disturbances	50	100	BB	5	10	10
Water Intakes (at shoreline)	10	10	10	5	10	na cells
Shoreline Protection	10	10	10	5	10	na cells
Projecting Dike Structures	10	20	10	5	10	na cells
Outfalls	10	MZ + 100	10	PS		PS
Group 3	Relocation at time of survey if approved					
Dredging (Maintenance)	50	150	50	10		50
Linear Projects	25	25	25	5	10	50
Scoping Projects		Project Specific				100
Bridge Projects	10	25	BB[b]	5	10	na cells
Waterline/Pipeline Corridor Disturbances	10	25	BB	5	10	na cells
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Outfalls	10	MZ + 20	10	PS		na cells
Group 2	Potential Phase 2 Surveys Required If Phase 1 Trigger Met					
Scoping Projects		Project Specific				10
Bridge Projects	50	100	BB	5	10	10
Waterline/Pipeline Corridor Disturbances	50	100	BB	5	10	10
Water Intakes (at shoreline)[a]	10	10	10	5	10	na cells
Shoreline Protection	10	10	10	5	10	na cells
Outfalls	10	MZ + 20	10	PS		10
Group 1	Relocation at time of survey if approved					
All Projects	10	25	10 or BB	5	10	TS

[a] additional monitoring may [illegible] required, see page 13

TS Qualitative Timed Search Surveys permitted

PS Project Specific

[illegible] Bank to Bank

US Upstream

[illegible] Lateral

[illegible] Downstream

na cells not applicable, cells required

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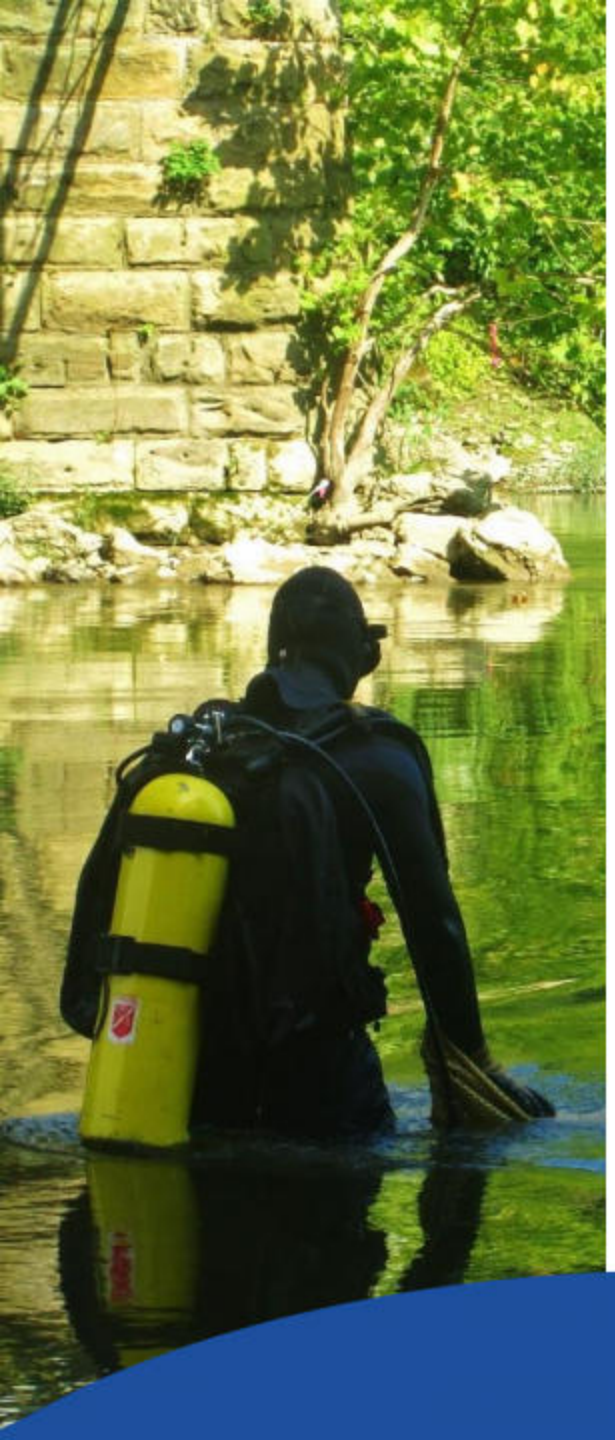

Mussel Survey Scope of Work Summary Sheet 2016

Form Date: 4/29/2016

Project Title:

Project Company:
Mussel Contractor: EnviroScience, Inc.
Lead Malacologist: Matthew Johnson
Project Contractor:
Divers: if applicable

Date Submitted:
Date Revised:

(If Mussel Contractor sub-contracting)
lead diver that can provide QA/QC survey effort

County: Ritchie
Stream: South Fork Hughes River

Group (Circle One): 1 2 3 4
Location Description:

If Group 1 or 2, Receiving Stream: Little Kanawha River

NOTE: Watershed Area < 10sq mi US of ADI, no survey needed, unless Group 2 (1/2)

Project Type: Pipeline Corridor Disturbance (corresponds to Table 3, WV Mussel Survey Protocol)

ADI Length:	67m	ADI Width:	8 to 8	Salvage area:	
US Buffer Length:	50m	US Buffer Width:	8 to 8	US Buffer Length:	5m
DS Buffer Length:	100m	DS Buffer Width:	8 to 8	DS Buffer Length:	10m
Lateral Buffer Length:	N/A	Lateral Buffer Width:	N/A	Lateral Buffer Width:	8 to 8

Phase 1 Survey Method: Transect [ ] Cells [X] Other [ ]

# Transects/Length (m):	Cell Size (mxm):	Cell Search Effort (Min/m²)
	ADI: 10m x 10m	20 - 50min
	USB: 10m x 10m	20 - 50min
	DSB: 10m x 10m	20 - 50min

Minimum search effort for cells is 0.2min/m² if no mussels are found or 0.5min/m² if any mussels are found

Spacing Between Transects (M)

Coordinates (Decimal Degrees, NAD83)

Upstream End US Buffer:	Long.		Lat	
Upstream End ADI:	Long.		Lat	
ADI Center:	Long.		Lat	
Downstream End ADI:	Long.		Lat	
Downstream End DS Buffer:	Long.		Lat	

Map: Show ADI, USB, DSB and survey layout

Did you provide? Justification must be provided in scope of work

Addressed Alternative Methods	[X] Yes	Provide Description in Scope
Addressed Alternative Sites	[X] Yes	Provide Description in Scope

Phase 2 Methods (Group 2):

Quadrats excavated _____ Be sure to define area on Map/Diagram
Salvage area only

Request for Relocation: [ ] Yes [ ] No

Method:
(check one) [ ] Cell Size (mxm): _____ Cell Search Effort (Min/m²) _____ (minimum)
[ ] Moving Transect:
[ ] Other: _____

Multiple passes are to be made through the area until less than 5 % of the number collected on the original pass are recovered on the final pass or less

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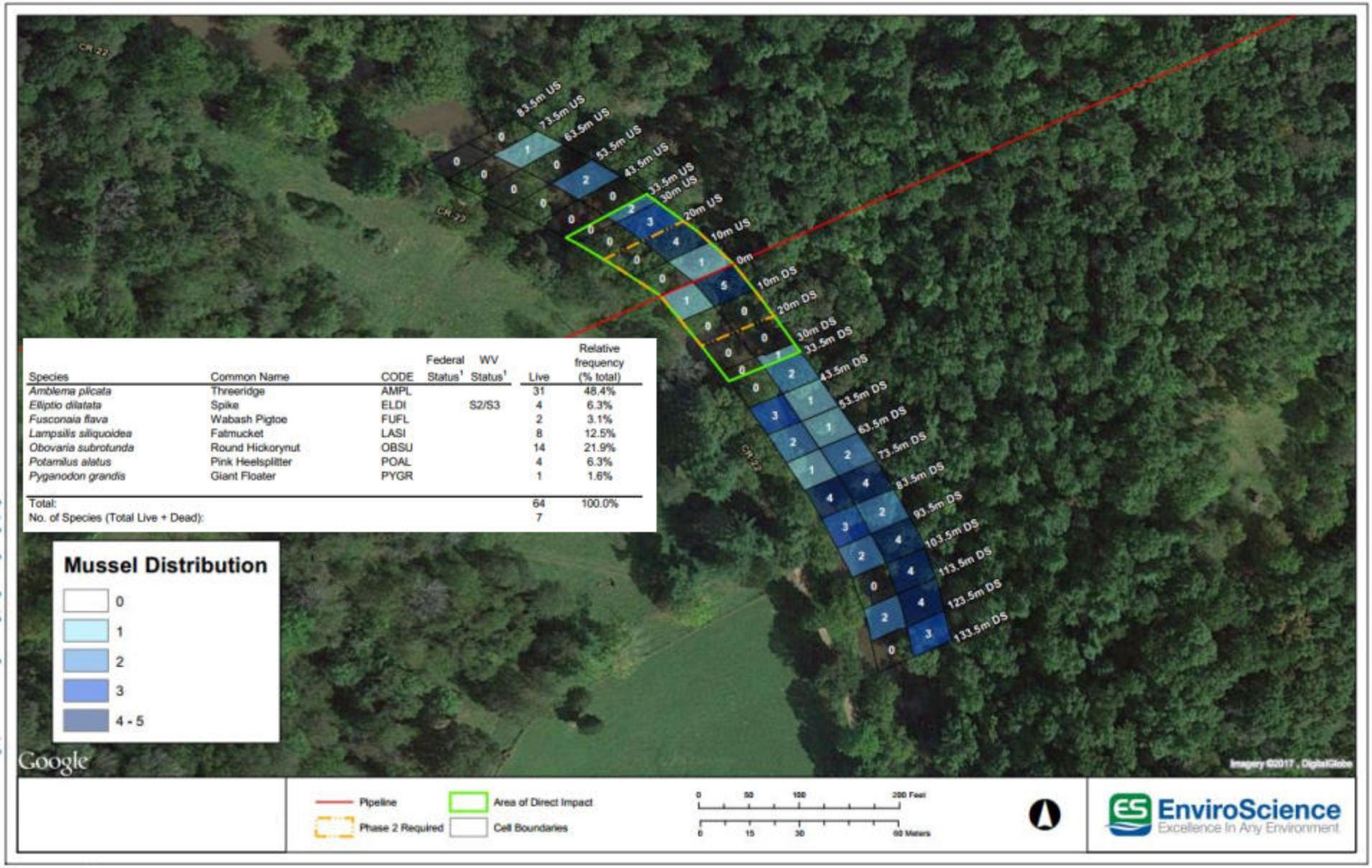
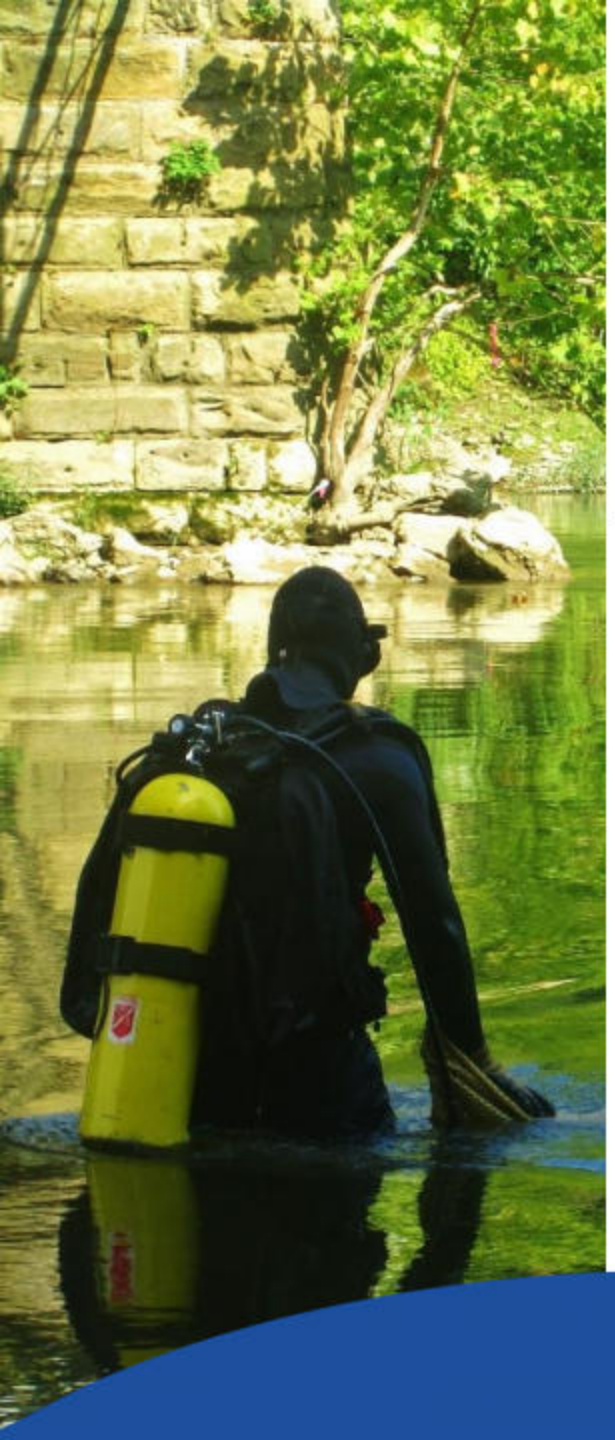


Species	Common Name	CODE	Federal Status[1]	WV Status[1]	Live	Relative frequency (% total)
Amblema plicata	Threeridge	AMPL			31	48.4%
Elliptio dilatata	Spike	ELDI		S2/S3	4	6.3%
Fusconaia flava	Wabash Pigtoe	FUFL			2	3.1%
Lampsilis siliquoidea	Fatmucket	LASI			8	12.5%
Obovaria subrotunda	Round Hickorynut	OBSU			14	21.9%
Potamilus alatus	Pink Heelsplitter	POAL			4	6.3%
Pyganodon grandis	Giant Floater	PYGR			1	1.6%
Total:					64	100.0%
No. of Species (Total Live + Dead):					7	



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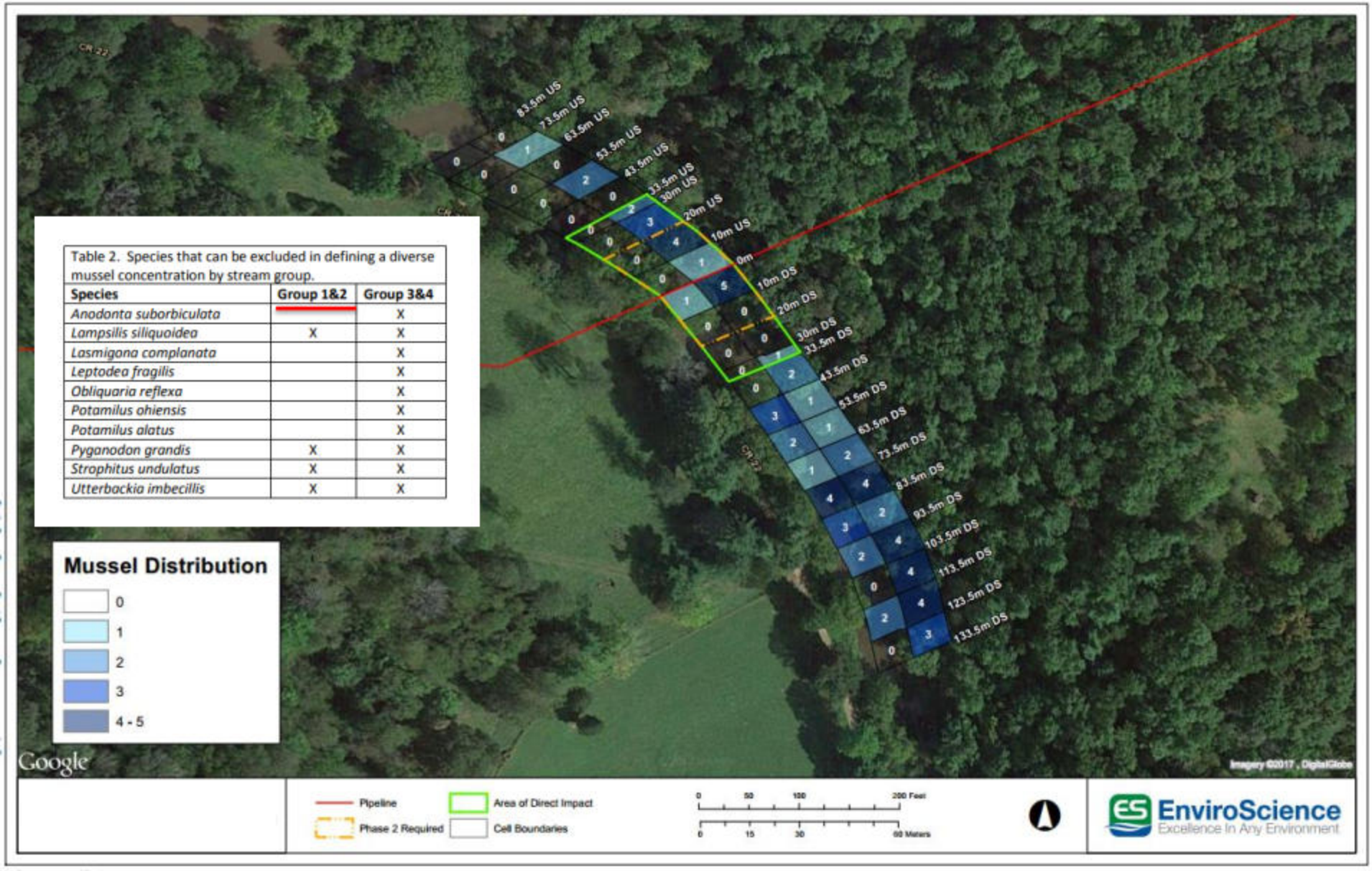

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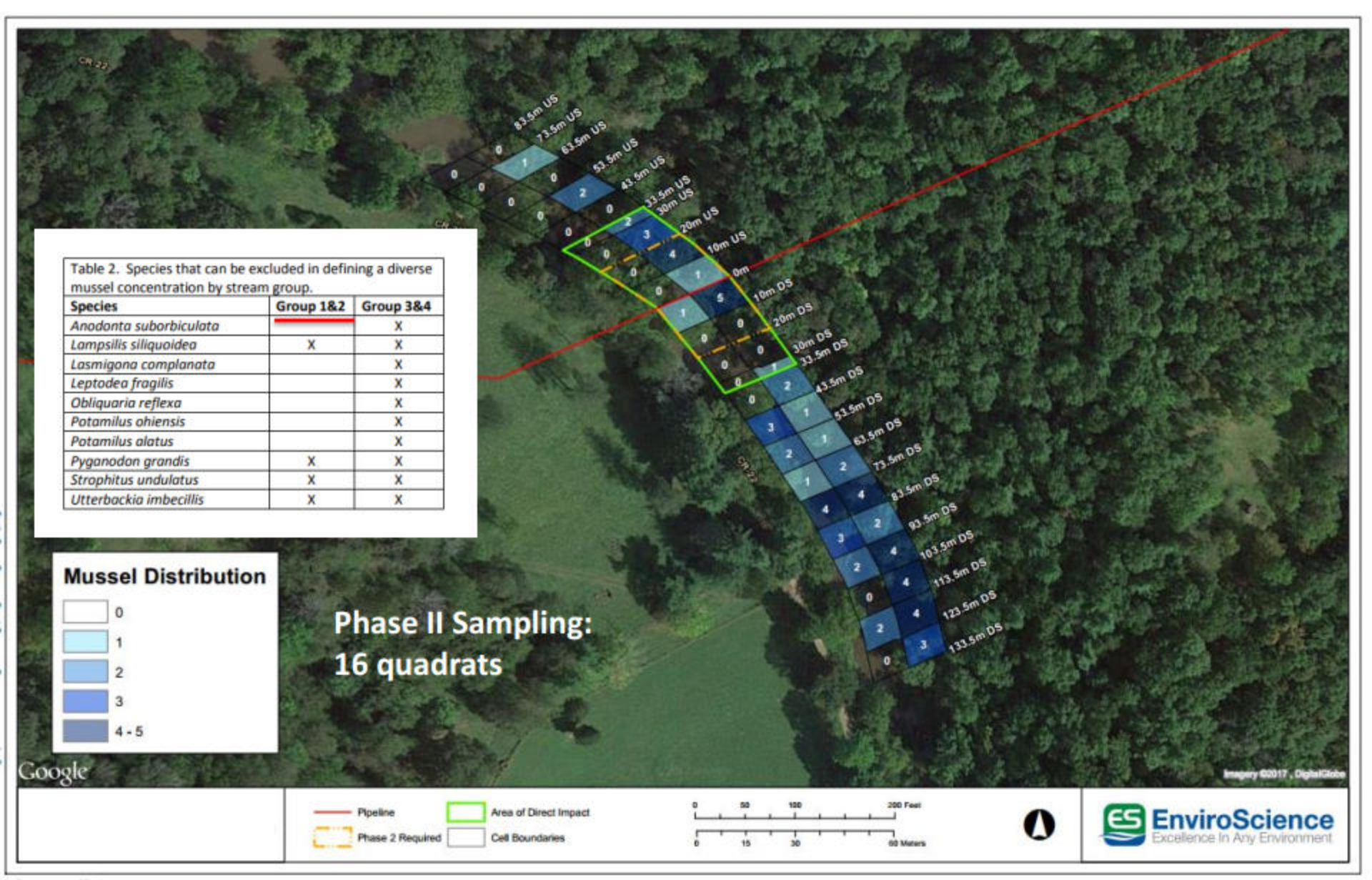

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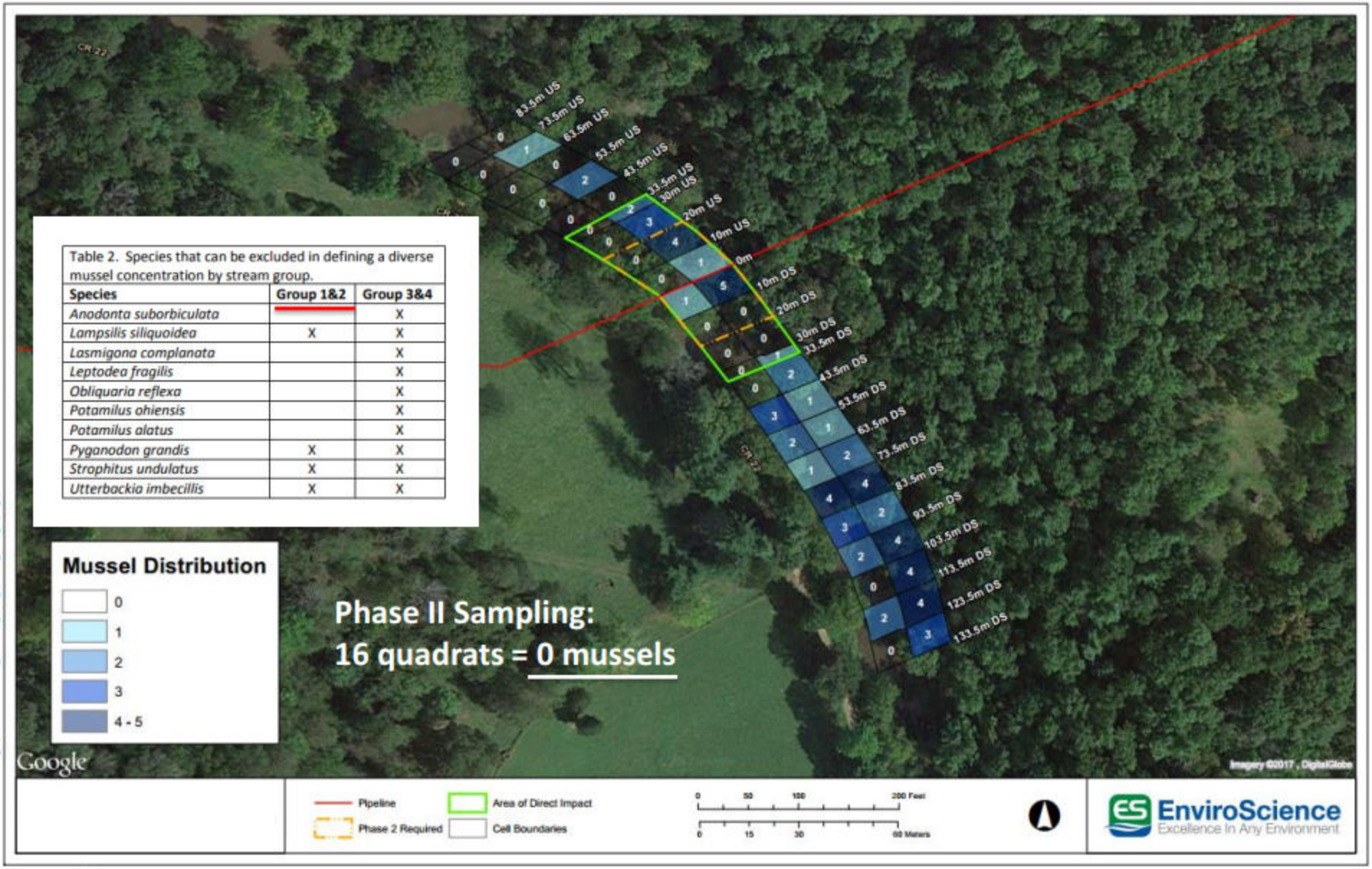

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Enclosure 1: Federal and State Listed Mussel Species in Virginia

U.S. Fish and Wildlife Service: Environmental Conservation Online System (ECOS) (http://ecos.fws.gov/ecp/)

Virginia Department of Game and Inland Fisheries: Special Legal Status Faunal Species in Virginia (http://www.dgif.virginia.gov/wildlife/virginiatescspecies.pdf)

Enclosure 2: Mussel Survey and Relocation Guidelines in Virginia

There are four general assessment/survey types including:

A. **Land-based review -** land-based site visit used to determine whether a water-based survey (site assessment, abbreviated, or full survey) is warranted. During a land-based review, the surveyor should look for obvious signs that would negate the need for additional, water-based surveys. For example, if it can be determined that the water body is non-perennial and/or contains no potential mussel habitat, it is unlikely that additional surveys would be needed or recommended by VDGIF or FWS. If it is determined that suitable habitat is present, the appropriate survey will be recommended. Photographs of the project site clearly showing instream habitat conditions, as well as a thorough site description, should be sent to VDGIF and FWS for review in lieu of the site assessment. If it is determined that suitable habitat is present, the appropriate survey will be recommended.

B. **Site assessment -** 20 m upstream / 80 m downstream. A site assessment is recommended to determine if suitable habitat is present at a project location and may be recommended if the presence of a listed species is questionable. If suitable habitat is present, the appropriate survey will be recommended even in the absence of mussels, since the site assessment does not serve as a substitute for a mussel survey; however, the presence of freshwater mussels should be documented during the assessment.

C. **Abbreviated survey -** 100 m upstream / 400 m downstream of project footprint.

D. **Full survey -** 200 m upstream / 800 m downstream of project footprint.

The assessment/survey type is based on the scope of the project, potential impacts, and known species distributions. Survey lengths are measured from the project footprint. *Survey distances have primarily been developed for projects where physical alteration/disturbance of the stream is the primary impact (e.g., bridge repair/replacement, utility line crossings, etc.). Potential impacts from projects involving activities such as point and non-point source discharges, water intakes, and mining may require greater survey lengths and different methods.*

Project applicants should contract with a qualified mussel [illegible] Enclosures 3 and 4 provide [illegible]ed mussel surveyors. If a pre-approve[illegible]s [illegible] survey [illegible]'s qualifications and propos[illegible]design to FWS and VDGIF a [illegible]. Individuals [illegible]e federally listed threatened

Approved Surveyors in Virginia for:
ATLANTIC SLOPE FRESHWATER MUSSELS

This list contains the names of individuals who are qualified to conduct habitat assessments/surveys for the referenced species in Virginia. If you select an individual not on this list to conduct habitat assessments/surveys for the referenced species, provide that individual's qualifications to this office for review and approval 60 days prior to the start of the survey. If a habitat assessment determines there is habitat for one or more of the referenced species, a species survey by an approved surveyor is needed. If the survey determines that any rare species are present, contact this office to allow us the opportunity to work with you to avoid or minimize adverse effects to rare species and their habitats during project design and implementation. Email correspondence and survey results to virginiafieldoffice@fws.gov. Inclusion of names on this list does not constitute endorsement by the U.S. Fish and Wildlife Service or any other U.S. Government agency.

Last Updated:	21 March 2016

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Approved Surveyors in Virginia for:
TENNESSEE RIVER DRAINAGE FRESHWATER MUSSELS

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Last Updated:	14 April 2015

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Virginia Survey Examples

Land-based Review

Site Assessment

Abbreviated/Full Survey

Custom Survey

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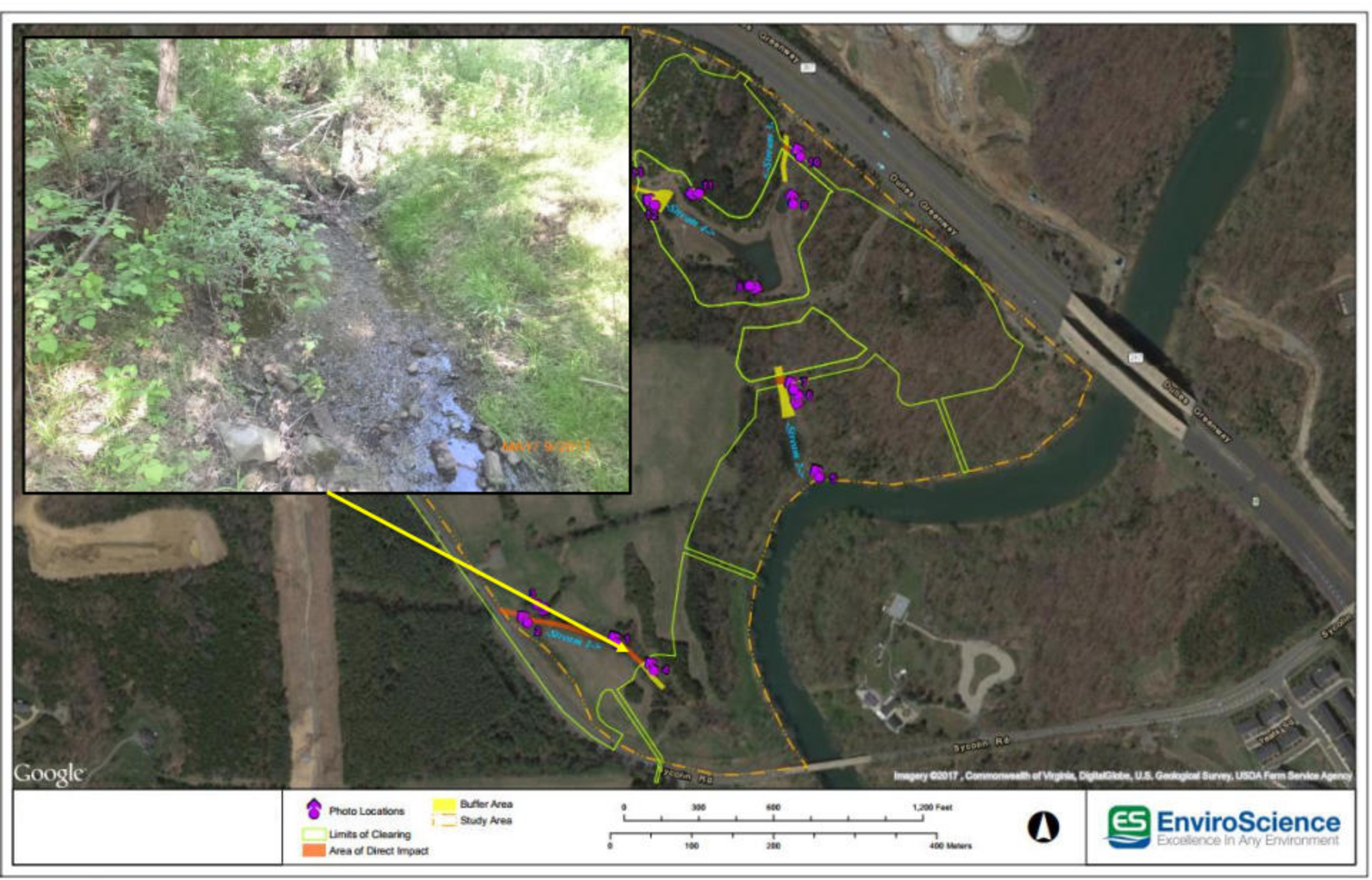

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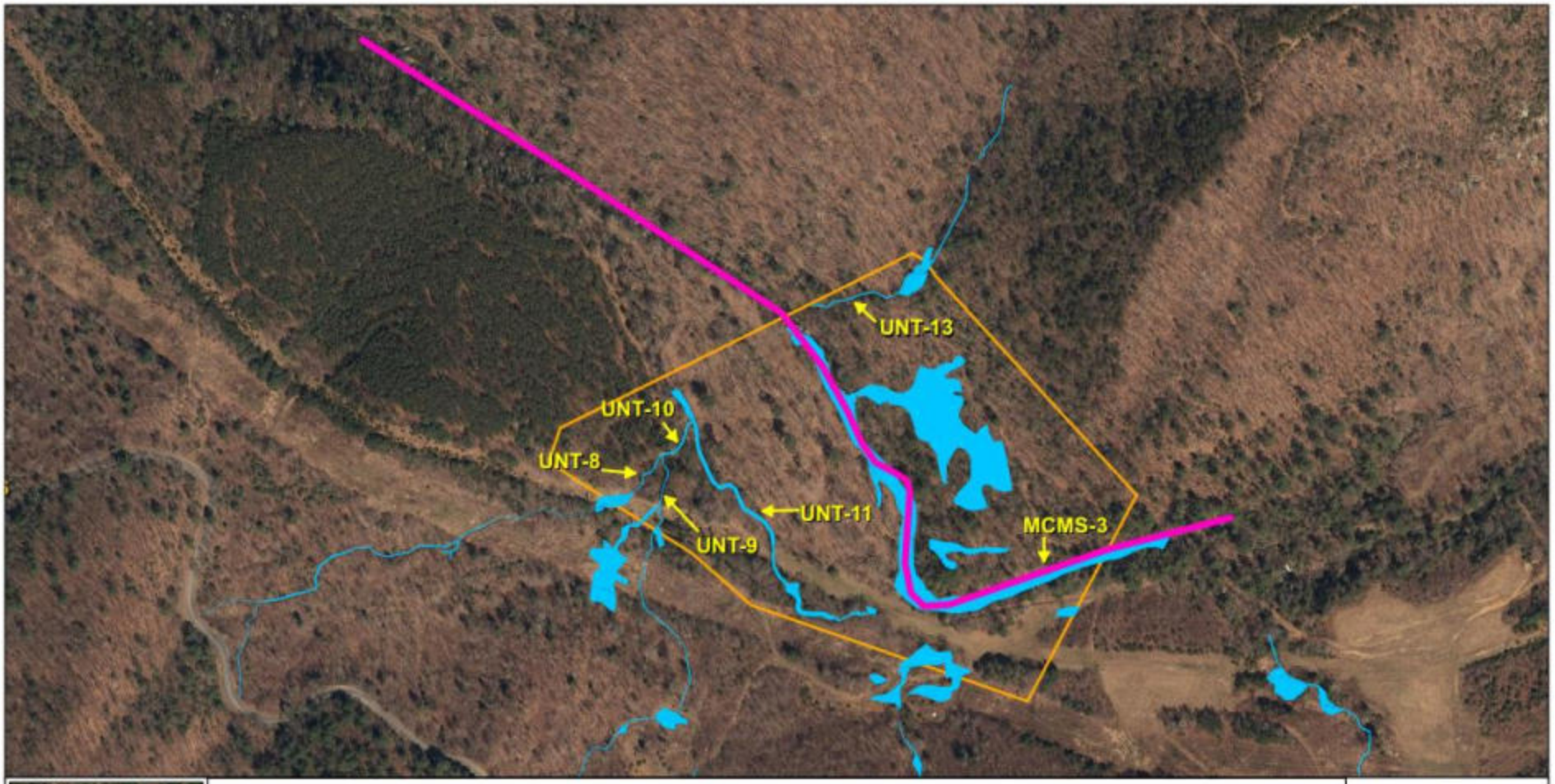

Figure 1.07. Mussel Survey and Habitat Evaluation Areas.

Abbreviated Mussel Survey | Mussel Habitat Assessment Area | Waters of the US (Provided by Client)

1.07

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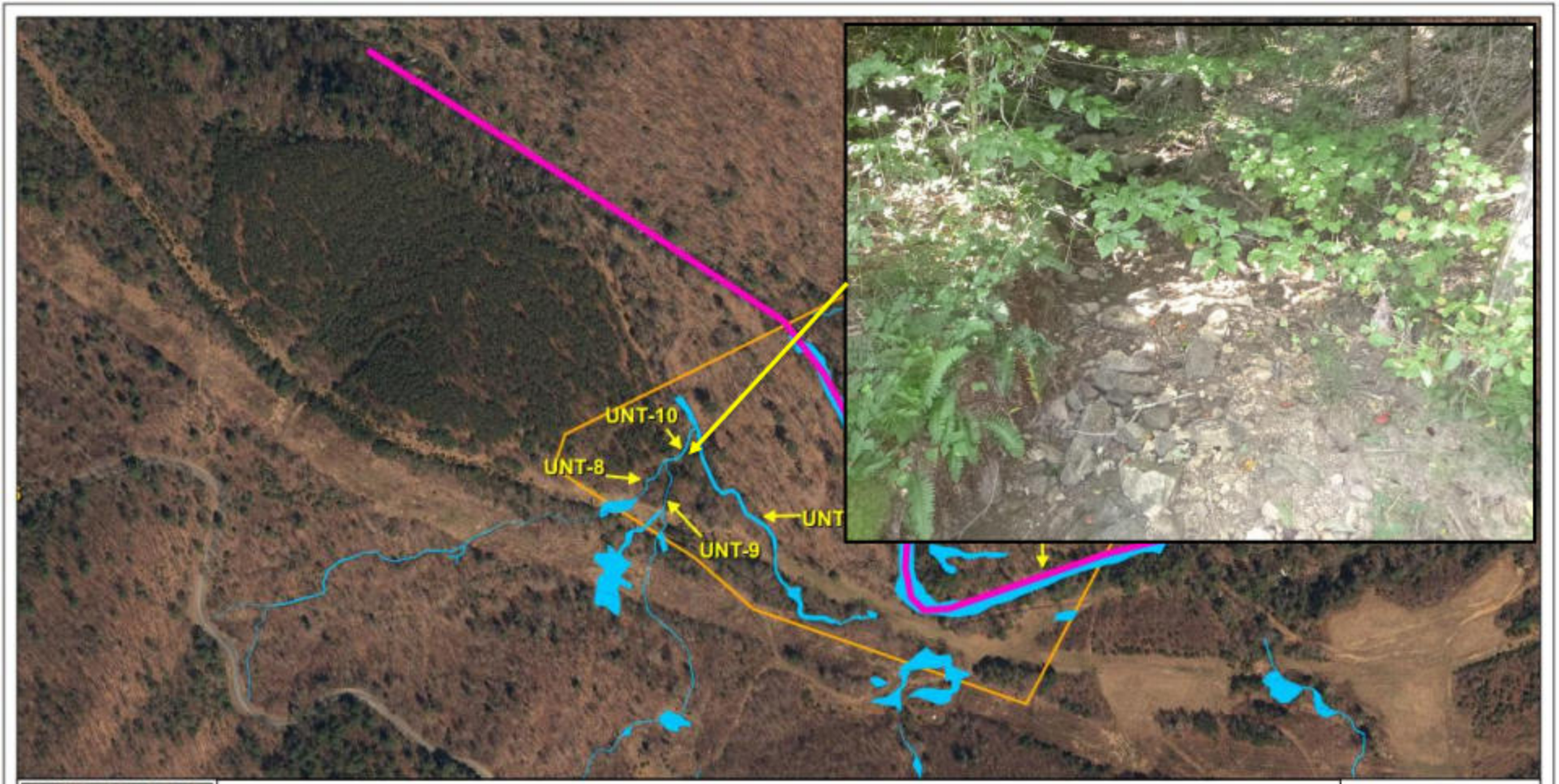

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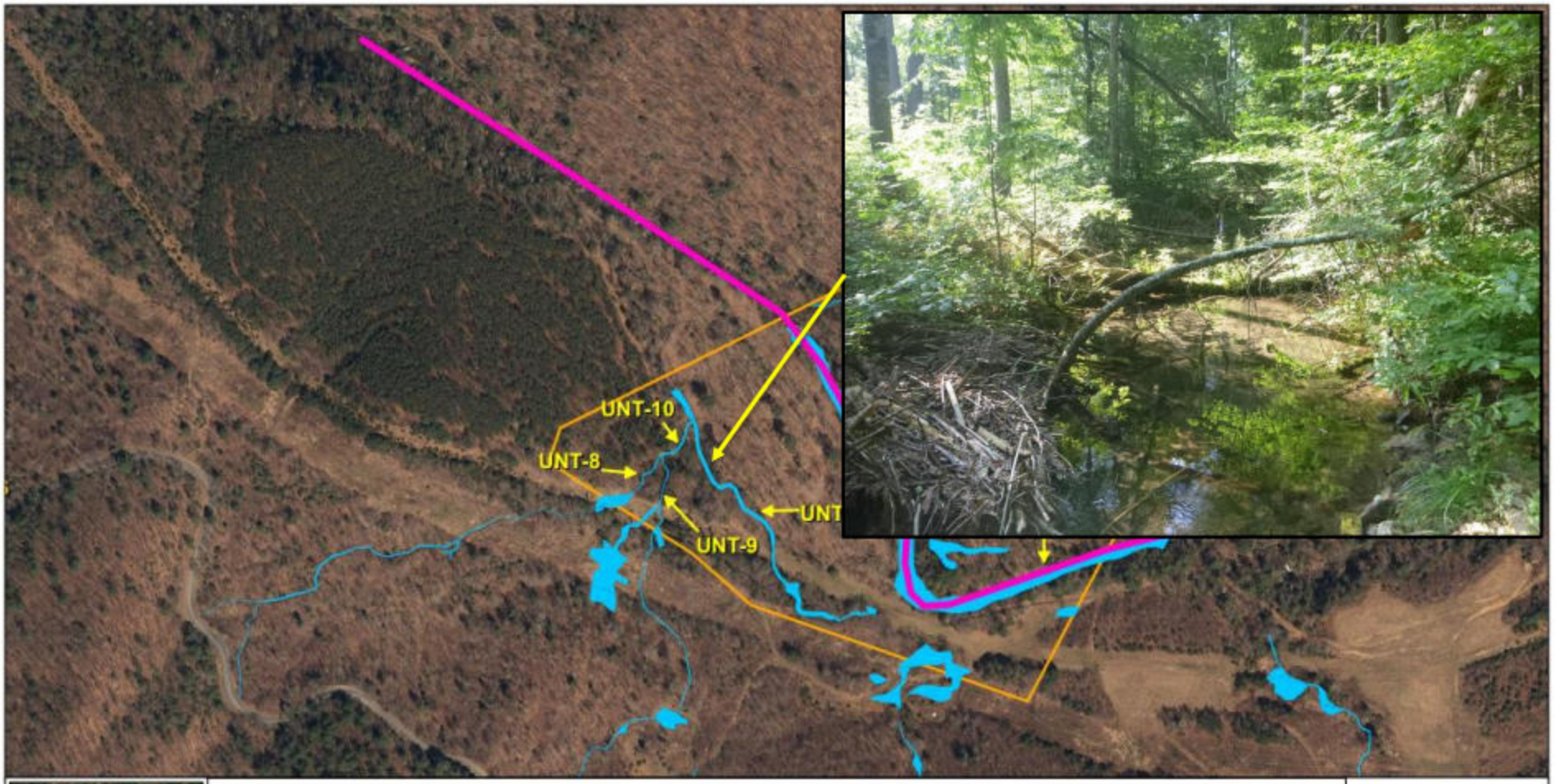

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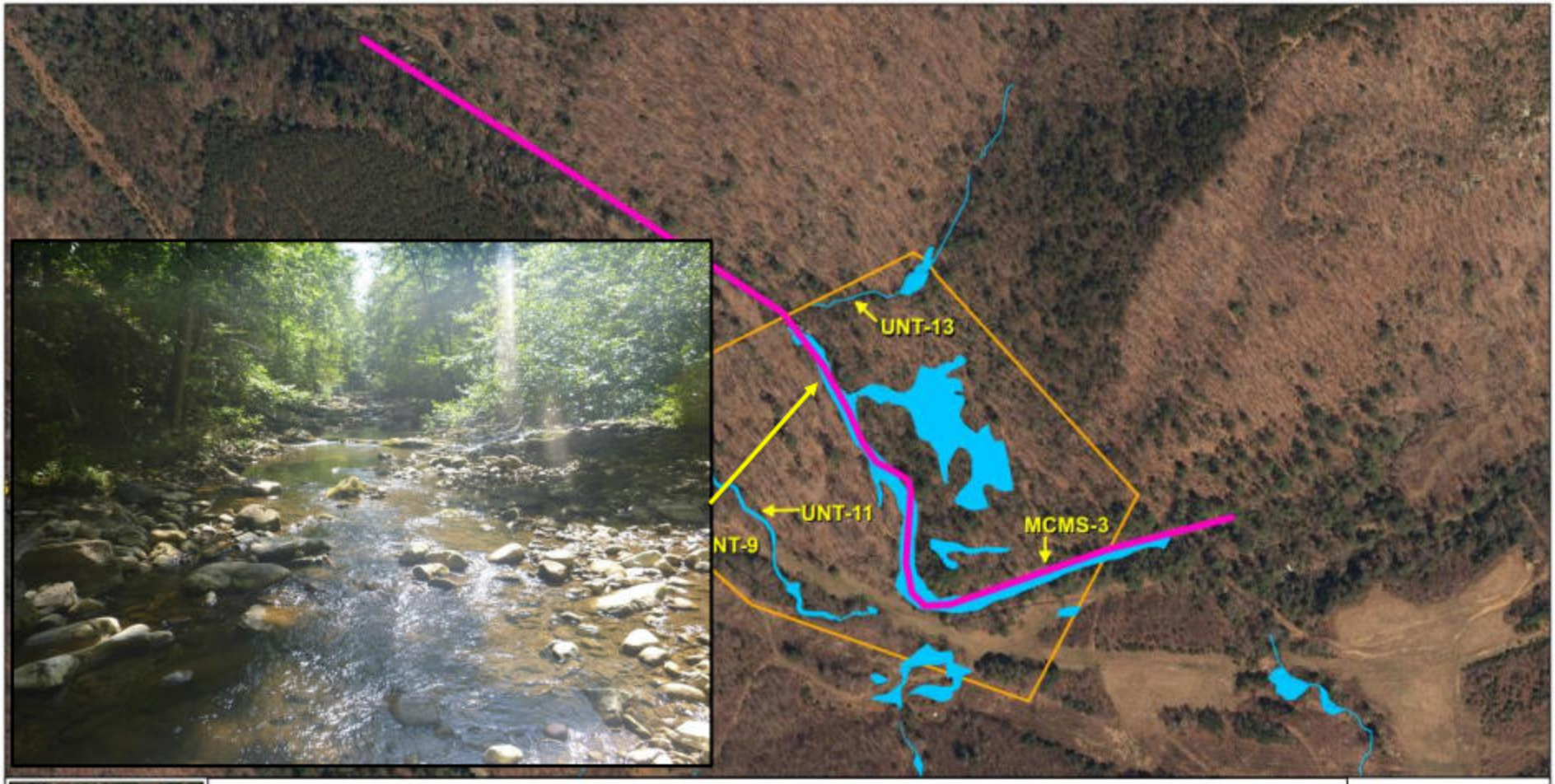

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PFBC-DES-NDS (Rev 03/11/2016)

PENNSYLVANIA FISH & BOAT COMMISSION
Division of Environmental Services
Natural Diversity Section
450 Robinson Lane
Bellefonte, PA 16823-9620

QUALIFIED SURVEYORS FOR FRESHWATER MUSSELS in the INTERIOR BASIN (OHIO, ERIE, AND GENESEE WATERSHEDS)

58 Pa. Code §75.5 provides that in order to conduct surveys for endangered or threatened fish (fish, amphibians, reptiles and aquatic invertebrates) species or their habitat in connection with an application for a proposed or planned development activity, a surveyor must be deemed qualified by the Pennsylvania Fish and Boat Commission (PFBC). An individual who wishes to be qualified by the PFBC to conduct surveys for endangered or threatened species must demonstrate to the PFBC's satisfaction that he or she meets the qualified surveyor requirements as approved by the Executive Director and published in the *Pennsylvania Bulletin*. The following list includes persons deemed qualified by the PFBC to possess skills and to have experience in properly searching for and finding Threatened or Endangered Freshwater Mussel species and in identifying their critical habitat. Persons not on this list but who have documented experience in conducting scientific studies of, or successful searches for, Threatened or Endangered Freshwater Mussel species and their critical habitat may submit their qualifications to the Natural Diversity Section for review and possible inclusion as a qualified surveyor. When applicable, a qualified surveyor must meet the requirements pertaining to scientific collector's permits and special permits for endangered and threatened species. All permitted collector's encounters with Threatened or Endangered Freshwater Mussel species must be reported in writing to the PFBC's Natural Diversity Section.

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PFBC-DES-NDS (Rev. 03/11/2016)

PENNSYLVANIA FISH & BOAT COMMISSION
Division of Environmental Services
Natural Diversity Section
450 Robinson Lane
Bellefonte, PA 16823-9620

QUALIFIED SURVEYORS FOR FRESHWATER MUSSELS in the ATLANTIC SLOPE (DELAWARE, POTOMAC, AND SUSQUEHANNA WATERSHEDS)

58 Pa. Code §75.5 provides that in order to conduct surveys for endangered or threatened fish (fish, amphibians, reptiles and aquatic invertebrates) species or their habitat in connection with an application for a proposed or planned development activity, a surveyor must be deemed qualified by the Pennsylvania Fish and Boat Commission (PFBC). An individual who wishes to be qualified by the PFBC to conduct surveys for endangered or threatened species must demonstrate to the PFBC's satisfaction that he or she meets the qualified surveyor requirements as approved by the Executive Director and published in the *Pennsylvania Bulletin*. The following list includes persons deemed qualified by the PFBC to possess skills and to have experience in properly searching for and finding Threatened or Endangered Freshwater Mussel species and in identifying their critical habitat. Persons not on this list but who have documented experience in conducting scientific studies of, or successful searches for, Threatened or Endangered Freshwater Mussel species and their critical habitat may submit their qualifications to the Natural Diversity Section for review and possible inclusion as a qualified surveyor. When applicable, a qualified surveyor must meet the requirements pertaining to scientific collector's permits and special permits for endangered and threatened species. All permitted collector's encounters with Threatened or Endangered Freshwater Mussel species must be reported in writing to the PFBC's Natural Diversity Section.

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Section 1. Experience Related to Finding and Identifying Endangered & Threatened Species

- Within the mussel faunal group for which qualification is sought, the applicant must have personally found at least 20 live individual Pennsylvania or federally listed mussels from seven or more unique sites within the past five years using survey methods approved by PFBC (see Section 3 for list of protocols). For the purpose of these requirements, "site" is defined as a one-mile long waterway segment. Sites sampled more than once do not count towards the total. For those seeking qualification to survey in the Ohio Basin, at least three of these seven sites must be in Pennsylvania. For those seeking qualification to survey in the Delaware, Potomac, or Susquehanna Basin, sites may be outside of Pennsylvania. Freshly dead and relic mussels, or those found by others on a survey team, do not count toward the minimum of 20 live individual endangered or threatened mussels.

Section 2. Additional Education and Training Related to Identification, Habitat, and Natural History

- Include relevant certifications and certificates (Certified or Associate Fisheries Professional, SCUBA certification, continuing education credits/courses, etc.).

Section 3. Protocol Implementation.

To be deemed qualified by the PFBC, surveyors must demonstrate to the PFBC's satisfaction that they are familiar with accepted species survey protocols. Accepted mussel survey protocols are listed here. Variations of these protocols or other protocols must be reviewed and approved by the PFBC.

Protocol References:

Smith, D.R., Villella, R.F., and D.P. Lemarie. 2001. Survey protocol for assessment of endangered freshwater mussels in the Allegheny River, Pennsylvania. Journal of the North American Benthological Society 20(1): 118—132

Smith, D.R. 2006. Survey design for detecting rare freshwater mussels. Journal of the North American Benthological Society 25(3): 701—711

Ohio River Valley Ecosystem Mollusk Subgroup. 2004. Draft protocol for mussel surveys in the Ohio River where dredging/disposal/development activity is proposed (clarified April 2004)

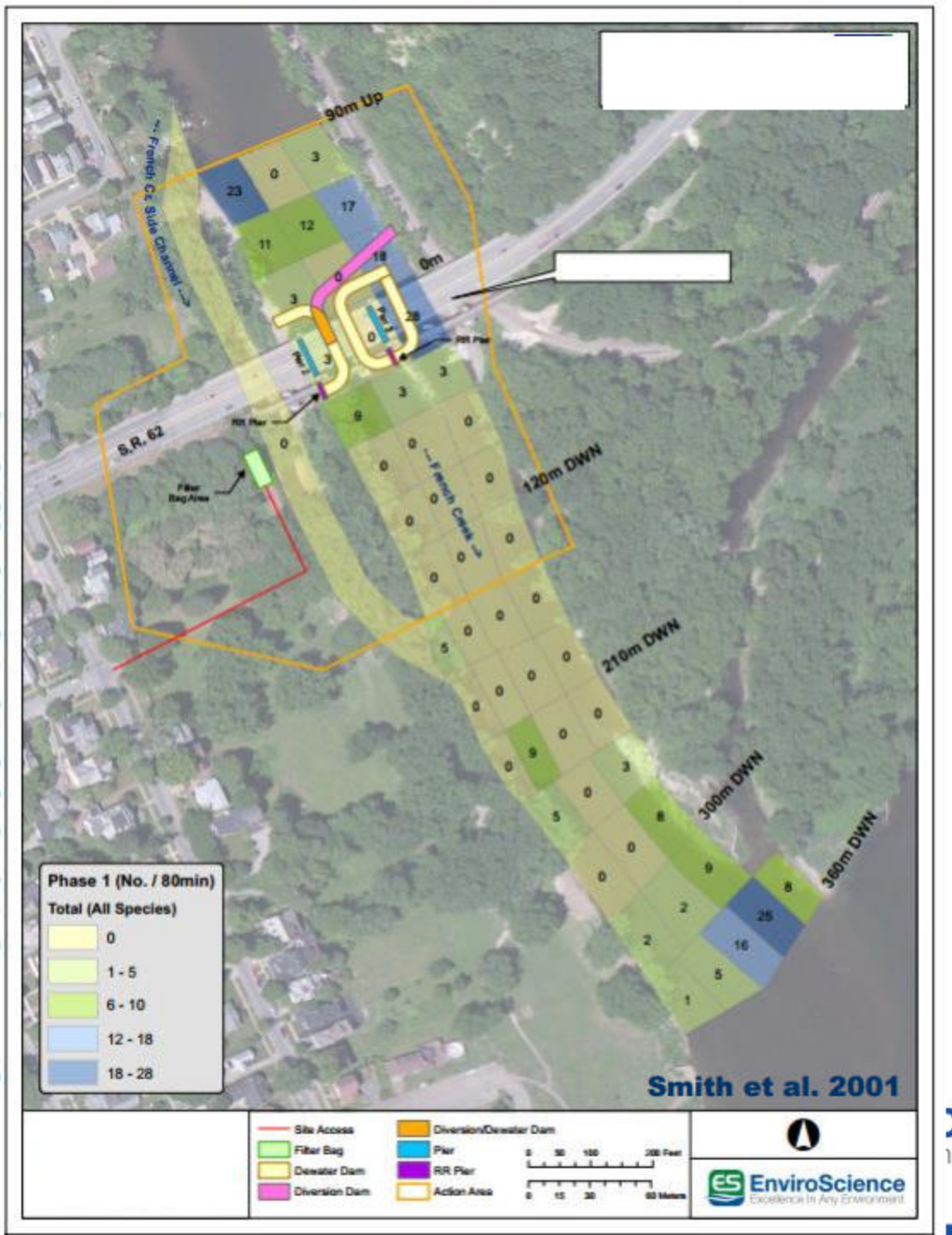
Adaptive Management Group. 2007. A mussel sampling protocol to assess potential commercial dredging sites in Pools 2,3,4,5,7,8, and 9 in the Allegheny River and the Dashields, Montgomery, and New Cumberland Pools in the Ohio River, Pennsylvania (7 May 2007)

3. Reptiles Qualified Surveyor Requirements

a. Bog Turtle

Section 1. Experience Related to Finding and Identifying Bog Turtle

Applicant must demonstrate the ability to find and identify adult and juvenile life stages of the Bog Turtle.


90m Up
0m
120m DWN
210m DWN
300m DWN
360m DWN
S.R. 62
French Ck. Slide Channel
French Creek
Fiber Bag Area
RR Pier
Phase 1 (No. / 80min)
Total (All Species)
0
1 - 5
6 - 10
12 - 18
18 - 28
Smith et al. 2001
Site Access
Fiber Bag
Dewater Dam
Diversion Dam
Diversion/Dewater Dam
Pier
RR Pier
Action Area
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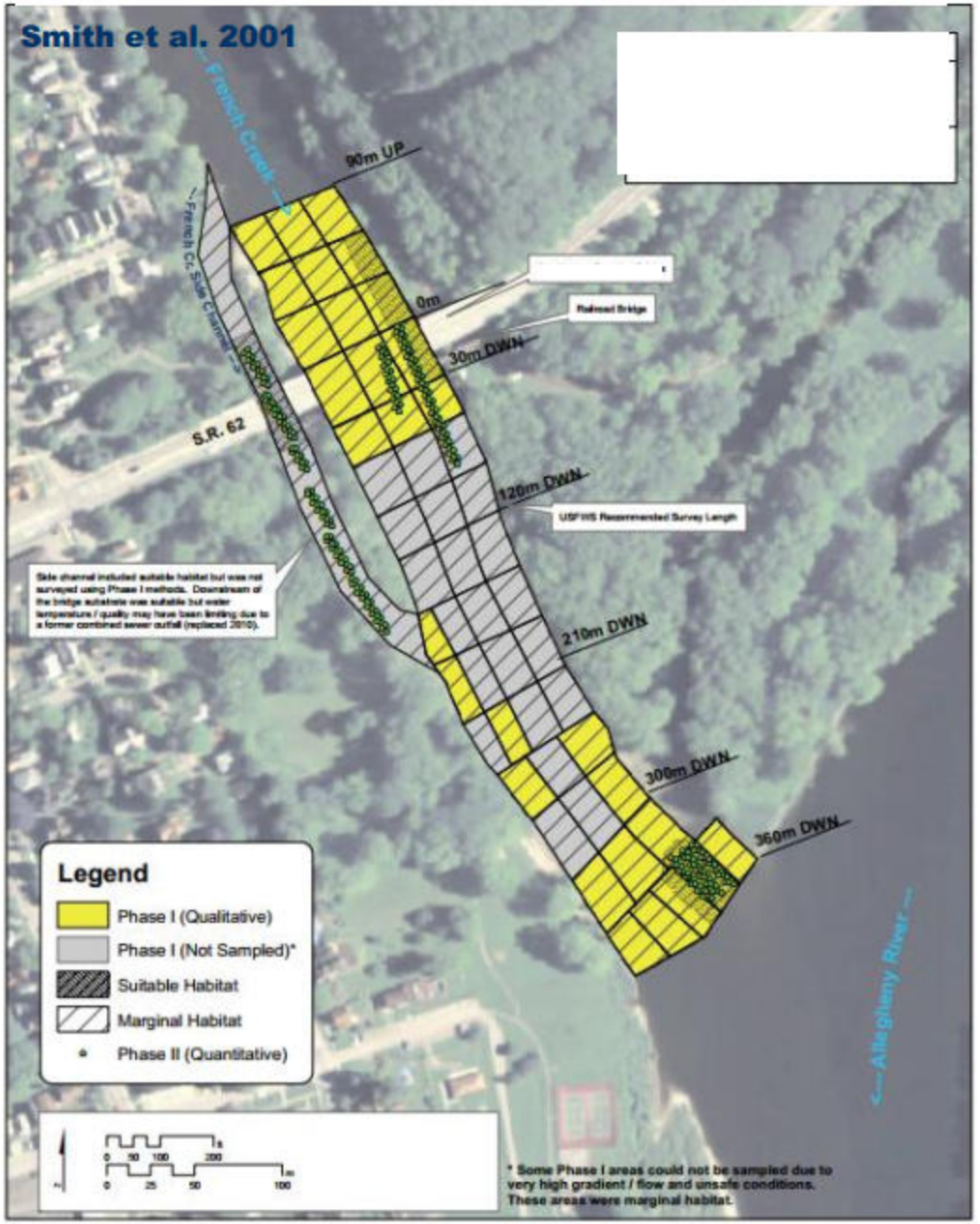
Smith et al. 2001
French Creek
90m UP
0m
30m DWN
120m DWN
210m DWN
300m DWN
360m DWN
S.R. 62
Allegheny River
Legend
Phase I (Qualitative)
Phase I (Not Sampled)*
Suitable Habitat
Marginal Habitat
Phase II (Quantitative)
* Some Phase I areas could not be sampled due to very high gradient / flow and unsafe conditions. These areas were marginal habitat.

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Mussel Distribution
0
1 - 300
301 - 700
701 - 1200
1201 - 1600
1601 - 2229
Bents
New Pier Work Area
Google

Questions?

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