Draft Restoration Plan and Environmental Assessment for the Tinker Creek Chemical Spill Natural Resource Damage Assessment and Restoration

Botetourt and Roanoke Counties, Commonwealth of Virginia

Prepared by:

Natural Resource Trustees:
U.S. Fish and Wildlife Service
Virginia Department of Environmental Quality

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Executive Summary

On July 29, 2017 an agricultural-use chemical (Termix 5301) leaked from a container on the facility of Nutrien Ag Solutions, Inc. (formerly known as Crop Production Services) located at 218 Simmons Drive in Cloverdale, Virginia ("Nutrien Site") and entered Tinker Creek. The resultant release of approximately 165 gallons caused the death of approximately 51,000 fish within an 11-mile reach of Tinker Creek in Botetourt and Roanoke counties and closed the area to public fishing ("Tinker Creek Chemical Spill") for 14 days.

This Draft Restoration Plan and Environmental Assessment (RP/EA) has been prepared jointly by natural resource trustees to address natural resources and resource services injured or lost due to the release of a hazardous substance from the Nutrien Site. The Draft RP/EA is intended to inform the public about the natural resource injuries caused by the Tinker Creek Chemical Spill and identifies and evaluates potential restoration projects that could compensate for those injuries. The Draft RP/EA was prepared in accordance with Section 111(i) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and its implementing regulations (43 C.F.R. § 11.93); the Federal Water Pollution Control Act of 1972 as amended by the Clean Water Act of 1977 (33 U.S.C. § 1251 *et seq.*); and Subpart G of the National Oil and Hazardous Substances Contingency Plan (40 C.F.R. §§ 300.600 - 300.615). In addition, a federal trustee must comply with the National Environmental Policy Act (NEPA) (42 U.S.C. § 4321 *et seq.*) and its regulations (40 C.F.R. 1500 *et seq*.) when planning restoration projects. NEPA requires a federal agency to consider the potential environmental impacts of a planned federal action(s) to determine if the proposed action(s) may significantly affect the environment and to inform and involve the public in the decision-making process. In compliance with NEPA, this Draft RP/EA summarizes the current environmental setting where the proposed restoration actions would take place, describes the purpose and need for restoration actions, and identifies alternatives and their potential environmental consequences.

Governmental agencies with trusteeship over natural resources and their services adversely affected by the Tinker Creek Chemical Spill are the U.S Department of the Interior, acting through the U.S. Fish and Wildlife Service, and the Commonwealth of Virginia, acting through the Virginia Department of Environmental Quality on behalf of the Virginia Secretary of Natural Resources (collectively referred to as the "Trustees").

This Draft RP/EA presents information about the Tinker Creek Chemical Spill natural resource damage assessment and proposes restoration alternatives. Using existing information and applicable literature sources, the Trustees evaluated the nature and extent of impacts to natural resources and their services from exposure to Termix 5301. Resources likely impacted include, but are not limited to, fish communities and temporary lost human use of natural resources because of a fishing closure along Tinker Creek (*e.g.*, lost recreational use). The Trustees identified and evaluated potential alternatives that would restore or replace the injured natural resources and/or their services to

compensate for the losses from the Tinker Creek Chemical Spill. The Trustees have identified comprehensive instream habitat improvement and recreational fishing improvement in Tinker Creek as the preferred restoration alternatives using the CERCLA Natural Resource Damage Assessment and Restoration criteria [43 C.F.R. Sec. 11.82(d)]. Consistent with federal laws, the Trustees are continuing to evaluate the preferred restoration alternatives for compliance with other applicable laws. All necessary environmental compliance will be completed before any restoration projects are implemented.

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Abbreviations and Acronyms

CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CWA	Clean Water Act, Federal Water Pollution Control Act
DFY	Discounted Fish-Years
DOI	U.S. Department of the Interior
EA	Environmental Assessment
NEPA	National Environmental Policy Act
NRDA	Natural Resource Damage Assessment
NRDAR	Natural Resource Damage Assessment and Restoration
PCB	Polychlorinated Biphenyl
PV	Present Value
REA	Resource Equivalency Analysis
RP/EA	Restoration Plan and Environmental Assessment
RIM	Restoration Planning, Implementation and Monitoring
SDS	Safety Data Sheet
TMDL	Total Maximum Daily Load
USFWS	United States Fish and Wildlife Service
VDEQ	Virginia Department of Environmental Quality
VDH	Virginia Department of Health
VDHR	Virginia Department of Historic Resources

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1.0 Introduction

The U. S. Department of the Interior (DOI), acting through the U.S. Fish and Wildlife Service (USFWS), and the Commonwealth of Virginia, acting through the Virginia Department of Environmental Quality (VDEQ) on behalf of the Virginia Secretary of Natural Resources, (collectively referred to as the "Trustees") acting under each of their authorities as a natural resource trustee, initiated a natural resource damage assessment and restoration (NRDAR) process to determine and quantify natural resources and resource services injured or lost as a result of the release of chemicals at and from the Nutrien Ag Solutions, Inc. (formerly known as Crop Production Services) facility located at 218 Simmons Drive in Cloverdale, Virginia on July 29, 2017 (herein, Tinker Creek Chemical Spill). As part of the NRDAR process, the Trustees must also identify and select restoration actions that will compensate for the injured resources and services and seek to recover compensation from the entity responsible for the injuries to natural resources and lost services.

This draft document is part of the restoration planning and environmental compliance process under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the National Environmental Policy Act (NEPA). It provides details to the public regarding the natural resource injuries, proposed restoration projects to compensate the public for the injuries and lost recreational use, and the environmental consequences of the proposed projects on the affected environment. The purpose of restoration is to return injured natural resources and services to the condition they would have been in had the Tinker Creek Chemical Spill not occurred.

1.1 Purpose and Need for Restoration

The purpose of this Draft Restoration Plan/Environmental Assessment (RP/EA) is to address natural resources injured and ecological and recreational services lost due to the Tinker Creek Chemical Spill. The Trustees need to implement restoration to restore, rehabilitate, and/or replace the equivalent of the injured natural resources, including fish and their habitat, and the services those resources provided.

1.2 Natural Resource Trustees and Authorities

Pursuant to the authority of Section 107(f) of CERCLA, as amended, 42 U.S.C. § 9607(f); Federal Water Pollution Control Act of 1972 (commonly known as the Clean Water Act) (CWA), as amended, (33 U.S.C. § 1321(f)(4) and (5)); Subpart G of the National Oil and Hazardous Substances Contingency Plan (40 C.F.R. §§ 300.600, 300.605); and other applicable Federal and State laws, designated Federal and State agencies may act on behalf of the public as natural resource trustees to pursue natural resource damages for injury to, destruction of, or loss of natural resources and their services resulting from the release of hazardous substances to the environment.

This Draft RP/EA was prepared jointly by the Trustees in accordance with § 111(i) of CERCLA and its implementing regulations (43 C.F.R. § 11.93). In addition, a federal trustee must comply

with NEPA (42 U.S.C. § 4321 *et seq*.) and its implementing regulations (40 C.F.R. § 1500 *et seq*.) when planning restoration projects. NEPA requires a federal agency to consider the potential environmental impacts of a planned federal action to determine if the proposed action(s) may significantly affect the environment and to inform and involve the public in the decision-making process. In compliance with NEPA, this Draft RP/EA summarizes the current environmental setting where the proposed restoration actions would take place, describes the purpose and need for restoration actions, and identifies alternatives and their potential environmental consequences. Consistent with federal laws, the DOI is continuing to evaluate the preferred restoration alternatives identified in this Draft RP/EA for compliance with other applicable laws. All necessary environmental compliance will be completed before any restoration projects are implemented. For the Draft RP/EA, other potentially applicable laws and regulations include:

- The Endangered Species Act, 16 U.S.C. § 1531, *et seq.*
- National Historic Preservation Act of 1966, 16 U.S.C. § 470 *et seq.*

1.3 Public Participation

Public participation and review is an integral part of the restoration planning process, and is specifically required in the CERCLA NRDAR regulations (43 C.F.R. § 11.81(d)(2)). In addition, NEPA and its implementing regulations require that federal agencies fully consider the environmental impacts of their proposed decisions and that such information is made available to the public.

The Draft RP/EA will be open for public comment for 30 days from the date of publication of the Notice of Availability in the Federal Register. A notice of availability will also be published in The Roanoke Times. Interested individuals, organizations, and agencies may submit comments by writing or emailing:

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The Trustees will review and consider the comments received during the public comment period prior to finalizing the RP/EA. The Final RP/EA will address public comments received and will document responses to those comments as an appendix in the Final RP/EA. As restoration progresses, the Trustees may amend the RP/EA if significant changes are made to the type, scope, or impact of the projects. In the event of a significant modification to the RP/EA, the Trustees will provide the public with an opportunity to comment on that particular amendment.

Trustees have maintained records documenting the information considered and actions taken during this NRDAR process and these records are available on the Tinker Creek Chemical Spill NRDAR website (http://www.cerc.usgs.gov/orda_docs/DocHandler.ashx?task=get&ID=5859). Physical copies of the records are also available for review by interested members of the public at the USFWS Virginia Field Office, 6669 Short Lane, Gloucester, Virginia 23061. However, arrangements must be made in advance to review or obtain copies of these records by contacting the USFWS representative listed above. Access to and copying of these records is subject to all

applicable laws and policies, including laws and policies relating to copying fees and the reproduction or use of any material that is copyrighted.

1.4 Overview of the Tinker Creek Chemical Spill

On July 29, 2017 an agricultural-use chemical leaked from a container on the facility of Nutrien Ag Solutions, Inc. (Nutrien) located at 218 Simmons Drive in Cloverdale, Virginia (Nutrien Site). Runoff from recent rain mobilized between 165-169 gallons of the chemical into an adjacent stormwater pond and runoff conveyance that ultimately emptied into Tinker Creek. The chemical, Termix 5301, is a surfactant that is added to herbicide and pesticide products before application. The resultant spill and exposure to the chemical caused the death of more than 51,000 fish and resulted in a creek closure for an 11-mile reach of Tinker Creek in Botetourt and Roanoke counties (Figure 1; Pinder 2018; VDH 2017). As a result of the spill, the creek was closed for fishing for 14 days.

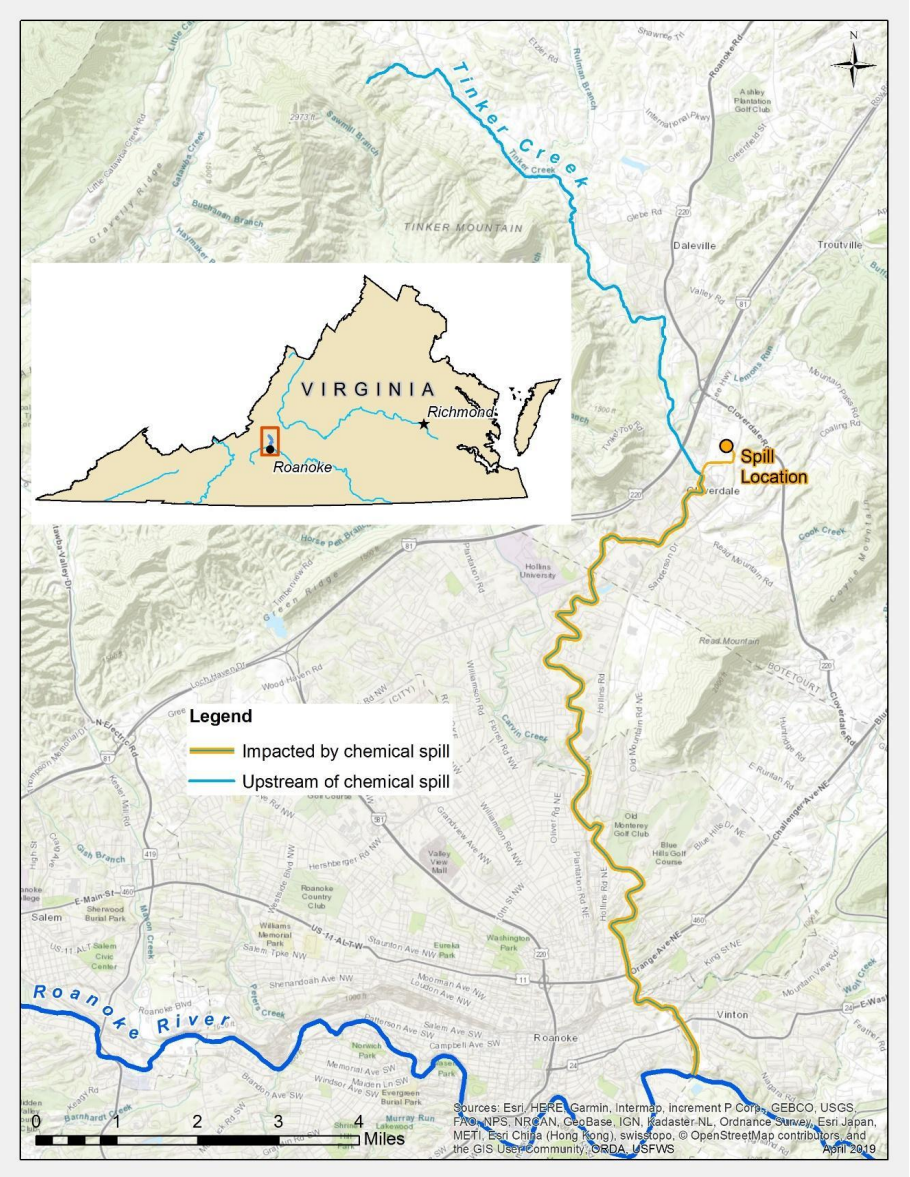

Figure 1. Location of the Tinker Creek Spill. Botetourt and Roanoke counties, Virginia.

1.5 Summary of the Proposed Settlement Agreement

A proposed settlement agreement was documented in a draft Settlement Agreement, notice of which was published in the Federal Register for public review and comment simultaneously with the release of this Draft RP/EA. Under the proposed settlement, Nutrien agrees to pay $425,000.00 to resolve its potential natural resource damages liabilities arising from the Tinker Creek Chemical Spill. Of this amount, the Trustees propose to use $385,000.00 to fund the preferred restoration alternatives identified in Section 3.4. The remaining funds will be used by the Trustees for administrative costs associated with restoration planning, implementation, and monitoring. As part of the cooperative assessment process for the Tinker Creek Chemical Spill NRDAR, Nutrien has previously reimbursed incurred assessment costs of the Trustees.

1.6 Organization of the Tinker Creek Chemical Spill RP/EA

The sections that follow describe the injury to natural resources and lost recreational services as a result of the Tinker Creek Chemical Spill (Section 2); restoration alternatives and evaluation under Restoration Evaluation Criteria (Section 3); the affected environment and the probable consequences on the human environment that may result from the implementation of the alternatives (Section 4); the potential cumulative impacts from the proposed activities, including past, current, and foreseeable future projects (Section 4); and a general monitoring framework for the Preferred Alternatives (Section 5).

2.0 Injury to Natural Resources, Restoration Scaling, and Damages Determination

2.1 Termix 5301 Toxicity Profile

Termix 5301 is a highly viscous surfactant used in herbicide products and agricultural applications. The Safety Data Sheet (SDS) for this product states that it is "very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment." The SDS also states that the material is classified for U.S. Department of Transportation shipping purposes as a corrosive material that must be placarded as corrosive and toxic to aquatic life (VDEQ Consent Order 2018).

2.1.2 Assessment Strategy

The goal of the injury assessment was to determine the nature and extent of injuries to natural resources and to quantify the resulting resource and service losses, providing a basis for evaluating the need for, type of, and scale of restoration actions. The Trustees conducted inspections of the areas affected by the spill and reviewed data collected from spill response agencies to document natural resource injuries and recovery. The Trustees also identified and developed restoration alternatives. The scale (or size) of the restoration action should be that which provides the value to adequately offset the natural resource losses. The process of determining the size of restoration is called restoration scaling. Restoration scaling requires a framework for quantifying the value of losses and for quantifying the benefits of restoration so the losses and benefits can be compared.

2.1.3 Quantification of Injury

The Tinker Creek Chemical Spill resulted in a loss of recreational fishing and ecological injuries to Tinker Creek. To support the injury determination, the Trustees may assess injury based on adverse physical, chemical, or biological changes in a resource resulting from exposure to toxic chemicals

(43 C.F.R. § 11.62). Examples of these injuries include changes in an organism's reproductive success or death. For the Tinker Creek Chemical Spill NRDAR, the Trustees identified fish as the representative resource for the ecological injury due to the amount of data available showing evidence of injury (death) and the overlapping restoration needs of the impacted resources. For example, restoration projects designed to compensate for the injury to fish, (*e.g.*, sunfish, darters, catfish, suckers, and shiners) will most likely provide benefits to other aquatic species that also may have been impacted (*e.g.*, invertebrates, waterfowl, reptiles and amphibians) but for which data is not readily available.

Ecological

Spill response personnel documented 51,512 fish, representing 33 species, killed in Tinker Creek after the release (Table 2-1). Experts organized the impacted fish species into five taxonomic families for use in a Resource Equivalency Analysis (REA), which is commonly used in NRDAR cases to quantify injuries and scale restoration (Table 2-2). As identified in 43 C.F.R. § 11.83, REA is a resource-to-resource approach that assumes services lost and restored are comparable.

The population size of species over time is used as an indicator of service losses, expressed in units of measure such as discounted fish-years (DFYs). In the Tinker Creek Chemical Spill NRDAR, experts identified a representative species based on the largest number of individuals killed for each taxonomic family and utilized the life history for each representative species, including age distribution and lifespan, to calculate DFYs. Standard growth function calculation methods were used to estimate the survival rate for a stable population. The REA debit was estimated using a Leslie matrix and the life history for each representative species to determine how many fish should have been present over time but for the chemical release. The result is a direct loss in present value (PV or discounted) of the representative species in each family affected by the spill. The REA debit calculations resulted in a total direct loss of 91,504 DFYs from 51,512 individuals, as shown in Table 2-2.

Table 2-1. List of fish species killed in the Tinker Creek Chemical Spill.

Taxonomic Family	Species – Common Name	Species - Scientific Name
Centrarchidae (Bass and Sunfish)	Black Crappie	*Pomoxis nigromaculatus*
	Bluegill	*Lepomis macrochirus*
	Largemouth Bass	*Micropterus salmoides*
	Redbreast Sunfish	*Lepomis auritus*
	Rockbass	*Ambloplites rupestris*
	Smallmouth Bass	*Micropterus dolomieu*
Cyprinidae (Minnows and Dace)	Blacknose Dace	*Rhinichthys atratulus*
	Bluehead Chub	*Nocomis leptocephalus*
	Bluntnose Minnow	*Pimephales notatus*
	Central Stoneroller	*Campostoma anomalum*
	Crescent Shiner	*Luxilus cerasinus*
	Cutlip Minnow	*Exoglossum maxillingua*
	Longnose Dace	*Rhinichthys cataractae*
	Mountain Redbelly Dace	*Chrosomus funduloides*
	Rosefin Shiner	*Lythrurus ardens*
	Rosyside Dace	*Clinostomus funduloides*
	Satinfin Shiner	*Cyprinella analostana*
	Spottail Shiner	*Notropis hudsonius*
	White Shiner	*Luxilus albeolus*

Percidae (Darters)	Chainback Darter Fantail Darter Johnny Darter Riverweed Darter Roanoke Darter Roanoke Logperch	*Percina nevisense* *Etheostoma flabellare* *Etheostoma nigrum* *Etheostoma podostemone* *Percina roanoka* *Percina rex*
Catostomidae (Suckers)	Bigeye Jumprock Blacktip Jumprock Golden Redhorse Northern Hogsucker Torrent Sucker White Sucker	*Moxostoma ariommum* *Moxostoma cervinum* *Moxostoma erythrurum* *Hypentelium nigricans* *Thoburnia rhothoeca* *Catostomus commersonii*
Ictaluridae (Catfish and Madtoms)	Margined Madtom Yellow Bullhead	*Noturus insignis* *Ameiurus natalis*

Table 2-2. Resource Equivalency Analysis debit by taxonomic family for the Tinker Creek Chemical Spill NRDAR.

Taxonomic Family	Representative Species	# of Individuals Killed	Density (Fish Per Mile)	PV Lost Fish-Years (DFYs)
Cyprinids	Crescent Shiner	35,298	5515	51,952
Percids	Fantail Darter	8,545	1335	21,524
Catostomids	White Sucker	4,287	670	10,425
Centrarchids	Smallmouth Bass	2,430	380	6,012
Ictalurids	Margined Madtom	952	145	1,591
Total		51,512		**91,504**

Recreational Fishing

The Trustees quantified recreational lost use using the following inputs:

- Tinker Creek was closed from July 29 through August 11, 2017, for a total of 14 days;
- The closure included 10.5 miles; and
- There are an estimated 1,120 annual fishing trips per mile (Shenandoah-based data).[1]

Because of the closure (14/365 days = 3.84% of the year), an estimated 451 recreational fishing trips were lost (3.84% x 10.5 miles x 1,120 trips per mile).

[1] Adapted from: Bowman, Darrell W. (1997). Shenandoah River and South Fork of the Shenandoah River. Angler Creel Survey, 1997. Federal Aid in Sport Fish Restoration Project F-111-R-6. Virginia Department of Game and Inland Fisheries. Bugas Jr., Paul E. (2005). Anger Survey South River – Upper South Fork Shenandoah River. Augusta and Rockingham Counties, VA. April–October 2005. Virginia Department of Game and Inland Fisheries. Bugas Jr., Paul E. (2011). Anger Survey South River–August County and Waynesboro, VA. May–September 2005. F-111-R. Virginia Department of Game and Inland Fisheries. Reeser, Stephen J. (2011). South Fork Shenandoah River Angler Creel Survey. Sport Fish Restoration. Virginia Department of Game and Inland Fisheries.

2.1.4 Restoration Scaling and Damages Determination

Ecological

The Trustees focused on fish reintroduction and/or instream habitat and fish passage improvement projects to offset the loss of resident fish. Additionally, because all fish species were co-located throughout Tinker Creek, Trustees concluded that restoration of aquatic habitat sufficient to restore the Cyprinids injury resulting from the Tinker Creek Chemical Spill would offset the losses of other fish species. Using the change in the Index of Biotic Integrity from the Woolen Mill Dam removal study (Doyle et al. 2005) to determine uplift in fish habitat quality applied to the crescent shiner baseline density of 5,515 fish per mile, the Trustees calculated 28,228 DFYs per river-mile of new fish habitat and 13,360 DFYs per river-mile of increased fish access would be achieved from removal of 1-2 (depending on the size) instream impediments to fish passage and habitat improvement.

Recreational Fishing

Recreational fishing damages were calculated by multiplying the total number of lost trips (451) by the estimated average value per trip ($61.25; regional value[2]). The result is $27,628[3] for recreational fishing losses in Tinker Creek.

3.0 Restoration Alternatives

This section describes the restoration alternatives the Trustees developed and analyzed to return the natural resources and services injured by the Tinker Creek Chemical Spill to their baseline condition and to compensate the public for the interim losses. As part of the effort to develop restoration alternatives, the Trustees consulted with Federal and State natural resource personnel and scientists to assess the benefits and feasibility of various types of restoration actions. These efforts were important in assisting the Trustees in identifying projects that are potentially feasible, have net environmental benefits, and meet requirements to compensate for injuries resulting from the spill. Since the primary injury associated with the Tinker Creek Chemical Spill was to resident fish, the Trustees determined that instream habitat and fish passage restoration projects would best offset the losses by providing breeding, rearing, sheltering and foraging habitat.

3.1 Restoration Evaluation Criteria

To ensure the appropriateness and acceptability of restoration options addressing ecological and recreational losses, the Trustees evaluated each option against restoration evaluation criteria. Below are the criteria used to evaluate potential restoration projects as part of the Tinker Creek Chemical Spill. The Restoration Evaluation Criteria reflect the "factors to consider when selecting the alternative to pursue" as described in 43 C.F.R. § 11.82(d)(1-10) and site-specific criterion:

(1) Technical feasibility.
(2) The relationship of the expected costs of the proposed actions to the expected benefits from the restoration, rehabilitation, replacement, and/or acquisition of equivalent resources.
(3) Cost-effectiveness. The expected benefits are obtained for the least cost in comparison to other alternatives.
(4) The results of any actual or planned response actions.

[2] https://my.usgs.gov/benefit-transfer/activity/display/9008#averageValues

[3] Calculations of numbers provided do not sum to total due to rounding.

(5) Potential for additional injury resulting from the proposed actions, including long-term and indirect impacts, to the injured resources or other resources.
(6) The natural recovery period determined in 43 CFR § 11.73(a)(1) of this part.
(7) Ability of the resources to recover with or without alternative actions.
(8) Potential effects of the action on human health and safety.
(9) Consistency with relevant Federal, State, and Tribal policies.
(10) Compliance with applicable Federal, State, and Tribal laws.
(11) Geographic proximity.

For the Tinker Creek Chemical Spill, the Trustees' evaluation prioritized the extent to which an alternative would compensate for the same type of injuries and losses, cost-effectiveness, the time required for the resource to recover, and geographic proximity of the restoration to the location of the injuries.

3.2 Alternatives Considered, But Not Further Evaluated

Alternatives considered and eliminated from further study included improving fish communities through the removal or modification of 1-2 small (<4 feet in height) instream impediments to fish passage within the Tinker Creek watershed or sub-basin. There are 4 small (<4 feet in height) impediments to fish passage (Figure 2) on Tinker Creek between Cloverdale and the Roanoke River. These barriers consist of 3 sewer line crossings and 1 sheet pile diversion structure. Site visits in 2018 to the area by Virginia Department of Game and Inland Fisheries (VDGIF) and USFWS indicated that Big Lick Driving Range sewer line is not likely an impediment to fish passage. These types of small (<4 feet in height) barriers can negatively affect population genetics, vigor, and recovery of fish populations because they separate fish communities and obstructs movement of fish. Removal or modification of 1-2 of these barriers would improve recovery of fish populations at a faster rate than natural recovery; however, the Trustees found that removal of these small impediments did not fully compensate for the injuries and no further evaluation was performed.

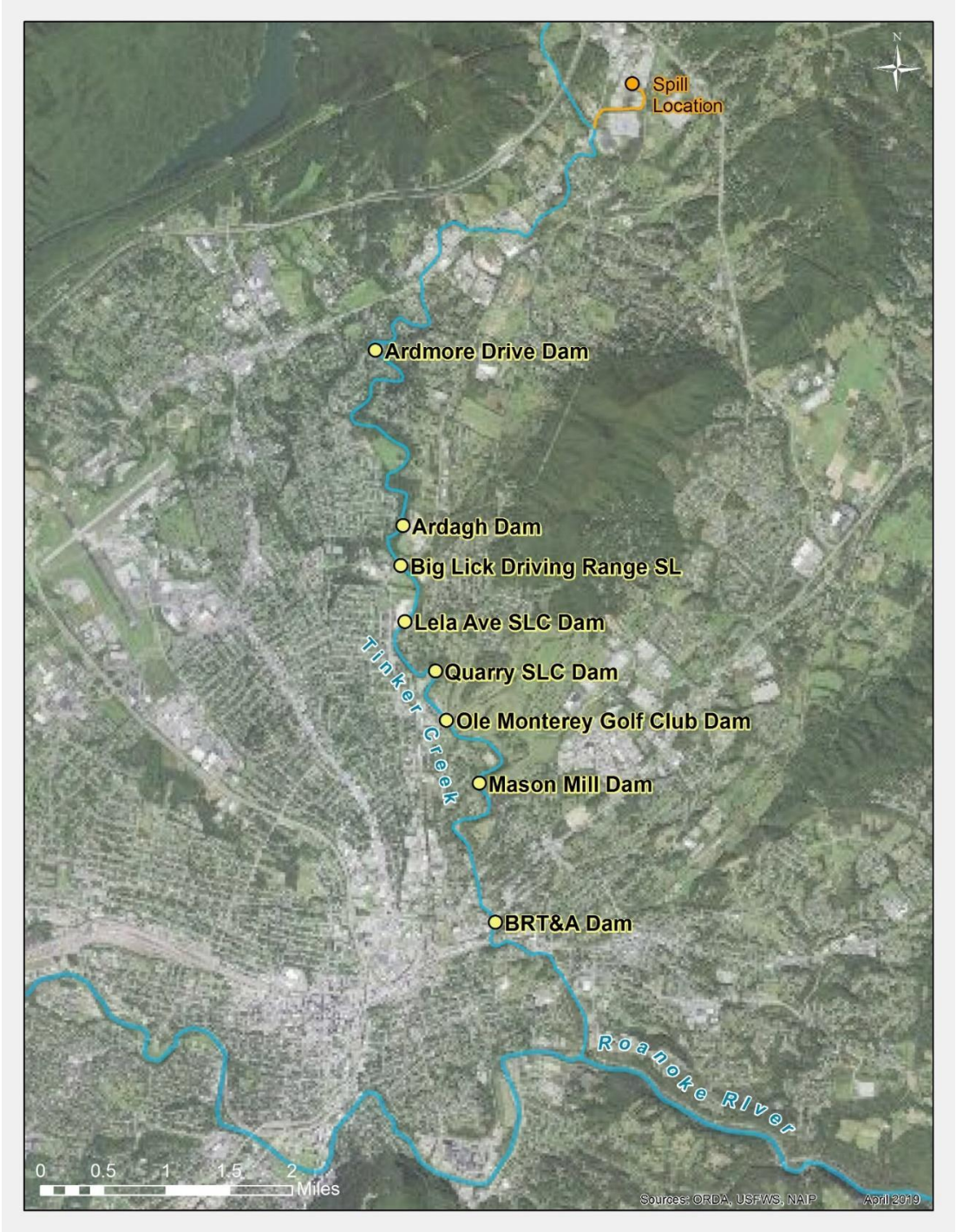

Figure 2. Names and locations of small and mid-size impediments to fish passage in Tinker Creek below the Tinker Creek Chemical Spill. Botetourt and Roanoke counties, Virginia.

3.3 Proposed Restoration Alternatives

The following subsections discuss potential alternatives to restore, rehabilitate, replace, and/or acquire the equivalent of the injured resources and lost recreation as a result of the Tinker Creek Chemical Spill. Trustees evaluated the alternatives to determine if they provide sufficient type, quality, and quantity of ecological and recreational services to compensate for those lost due to contamination in the context of both site-specific and Restoration Evaluation Criteria (43 C.F.R.

§ 11.82 (d)) (Table 3-1). The Trustees also evaluated whether significant effects may be associated with the proposed alternatives to restore the natural resources and services injured or lost due to the release of hazardous substances as required by NEPA (40 C.F.R. § 1508.9(b)).

3.3.1 Alternative 1 - No Action/Natural Recovery

As required under CERCLA and NEPA, the Trustees considered a No Action Alternative. Under this alternative, the Trustees would rely on natural recovery and would take no direct action to restore injured natural resources or compensate for lost recreational opportunities. This alternative would include the continuance of ongoing monitoring programs by Federal and State agencies but would not include additional activities aimed at improving aquatic habitat or enhancing recreation in Tinker Creek. Under this alternative, no compensation would be provided for interim losses in resource services.

The Trustees found that the No Action Alternative would not satisfy the Restoration Evaluation Criteria under CERCLA. This Alternative would not compensate for injured resources or recreational use and technically feasible and cost effective restoration approaches are available to compensate for these losses. Therefore, the No Action Alternative is not a preferred restoration alternative when evaluated against the Restoration Evaluation Criteria.

3.3.2 Alternative 2 – Fish Propagation and Restocking

Alternative 2 involves propagating tens of thousands of native fish in specialized rearing facilities and releasing the young-of-year into Tinker Creek over at least a decade. The effort would include propagating a minimum of 21 species of fish injured during the spill as well as the research and development needed to establish propagation techniques for 13 of those species (Pinder 2018). Over time, this Alternative would replace the fish community lost as a result of the Tinker Creek Chemical Spill.

The Trustees found that this Alternative is not technically feasible at this time given the limited or lack of experience with propagating many of the fish species injured during the Tinker Creek Chemical Spill. Additionally, costs for research and propagation facility development to successfully rear these species would exceed the costs of other alternatives, making this Alternative less cost effective and the benefits less certain relative to the other alternatives. For instance, this Alternative would require multiple years of research to develop propagation techniques. While techniques for some fish species could possibly be grouped, other species would have to be developed separately due to their unique reproductive strategies and life history characteristics. However, there is no guarantee workable propagation techniques will result from the research time and expenditure of funds required for this Alternative. For this Alternative to be successful, it is likely that additional research would need to be funded to update and refine previous propagation research. If successful, a propagation facility and personnel would need to be secured to propagate species for several years. Capacity of existing rearing facilities is limited and may require multiple facilities, both public and private, and an upgrade or increase in capacity that involves hiring of new staff, purchase of new equipment, and expansion of infrastructure.

A further confounding factor is that many of the cyprinids have mutualistic relationships with one another, such that the timing of propagation and release would have to be structured around life history needs for reintroductions to be successful. For example, many minnow species spawn exclusively on the nests of bluehead chubs, so this species would first need to be sufficiently

propagated and established to enable successful reestablishment of those dependent minnow species. The VDGIF currently conducts similar propagation work for a minimum of 10 years before evaluating success (Pinder 2018). Additional years may be necessary to account for propagation and ongoing monitoring. Because of these factors, the time to recovery of this Alternative is longer than other alternatives considered.

3.2.3 Alternative 3 – Fish Passage Improvement (Preferred)

Alternative 3 involves the restoration and enhancement of instream fish habitat within the Tinker Creek watershed or sub-basin. Examples include draining impoundments and removal of sediments by removal or modification of instream obstructions (e.g., dams, sewer crossings, water diversion structures, sheeting, etc.); construction of low slope riffles and/or rock ramps; bank stabilization and revegetation; installation of riparian buffers; and similar habitat and water quality improvement actions. Improvement of fish communities through the removal or modification of mid-size (>4 feet in height) instream impediments would improve recovery of fish populations lost as a result of the Tinker Creek Chemical Spill by providing the feeding, nesting, brooding, rearing, and cover habitat necessary for fish. For many fish species, the ability to move along a free-flowing river allows (1) greater genetic diversity, as populations are able to mix freely, and (2) greater species distribution, as fish are able to move into important areas to feed, breed, grow, or rest that might otherwise be unreachable (Sherman 2013, Higgs 2002, Bednarek 2001). These factors increase a species' chance for long-term survival.

Alternative 3 involves the removal of some of the impediments to fish passage on Tinker Creek between Cloverdale and the Roanoke River (Figure 2). Under this alternative, the following activities may occur: draining impoundments and removal of sediments by removal or modification of 1 mid-size instream obstruction; construction of low slope riffles and/or rock ramps; bank stabilization and revegetation; installation of riparian buffers; and similar habitat and water quality improvement actions. Table 3-2 presents the estimated habitat and fish access created through removal of the different types of fish passage impediments being considered under Alternative 3. Ardagh Dam and Mason Mill Dam are mid-size concrete dams that separate fish populations and bury aquatic habitat in sediment, negatively affecting instream habitat, aquatic food webs, and other natural processes like flood reduction, sediment transport, and water quality. The decision on which projects to implement will be based on cost once further progress on design and environmental compliance has occurred.

Table 3-1 Miles of New Instream Habitat and Fish Access Associated with Potential Fish Passage Improvements in Tinker Creek, Botetourt and Roanoke counties, Virginia.

Project	Instream Habitat Created (miles)	Fish Access Created (miles)
Ardagh Dam	0.30	2.3
Sewer Line Rock Ramps		1.7
Ole Monterey Golf Club Diversion Structure	0.24	1.4
Mason Mill Dam	0.85	See note [4]
Total:	1.39	5.4

[4] Miles of fish access are included with the Ole Monterey Golf Club structure, located just upstream of Mason Mill Dam pool.

The removal of instream barriers expedites the recovery of injured fish communities in several complementary or synergistic ways:

Enhancing instream fish habitat through restoration of the impounded channel upstream of the removed dam and the scoured channel below the removed dam. The restored channels provide more complex habitat supporting the sheltering, feeding, and spawning needs for a greater diversity of native fish species;

Supporting higher fish diversity and density. Fish recolonize areas that were formerly unsuitable once large woody debris and coarse substrate, such as cobble, pebbles, and fine gravel retained behind instream barriers are mobilized and renew channel bottom complexity downstream. For example, deposition of fine gravel provides new spawning habitat for many species of bottom-dwelling fish;

Improving genetic vigor of resident fish populations by reconnecting previously isolated fish communities. Furthermore, the aquatic food web is improved by restoring the downstream

transport of sediment and organic matter. This food web includes the aquatic insects and zooplankton that all life stages of fish consume; and

Restoring access to upstream tributaries that are spawning habitat for fish species like suckers.

The Trustees found this Alternative to be the most cost effective of the proposed Alternatives. In addition, it provides the greatest benefits to fish communities in relation to costs of the restoration. Alternative 3 more comprehensively addresses habitat issues that limit recovery of the injured resources by including fish passage improvement, restoration of natural stream bottom, riparian vegetation establishment, and bank stabilization in areas adjacent to the removed dam, and enhancement of hydrogeological functions compared to other proposed Alternatives.

3.3.4 Alternative 4 – Recreational Fishing Improvement (Preferred)

Alternative 4 involves hosting a single, one-time stocking event to release brook *(Salvelinus fontinalis*) and/or rainbow trout (*Oncorhynchus mykiss*) to provide an increase in public fishing opportunities in Tinker Creek. Trustees would host a children's fishing day that would feature the stocking of 600-700 trout in established fishing access sites along Tinker Creek, from Mason Mill Park to approximately 0.5 miles downstream. Fishing rods and bait would be available and Trustee representatives would be present to assist participants. This Alternative will also either improve upon an existing facility or establish a new public access point in Tinker Creek for fishing that may also allow creek access for non-motorized watercraft (canoes and kayaks).

The Trustees found this alternative to be cost effective and beneficial to the recreational fishing community in Tinker Creek, and the Trustees propose this as a Preferred Alternative.

Table 3-2 Evaluation of restoration alternatives for the Tinker Creek Chemical Spill under Restoration Evaluation Criteria.

Restoration Alternatives 1-4		
Alternative	**Project**	**Restoration Evaluation Criteria**
1	No Action/Natural Recovery	**1. Technical Feasibility:** Not applicable. **2. Cost/Benefit:** Not applicable. **3. Cost Effective:** Not applicable **4. Likelihood of Success:** Interim losses due to chemical spill not restored. **5. Additional Injury:** Additional interim loss would occur. **6. Recovery Period:** Decades. **7. Recovery Ability:** Limited, would require decades. **8. Public Health and Safety:** Not applicable. **9. Policy Consistency:** Fail. Restoration is feasible under CERCLA. **10. Regulatory Compliance:** Not applicable. **11. Geographic proximity:** Not applicable.
2	Fish Propagation and Restocking	**1. Technical Feasibility:** Limited, and for some species, non-existent. Capacity and technical knowledge on propagating many of the injured species would have to be developed. **2. Cost/Benefit:** Moderate. **3. Cost Effective:** Fail. See 1 above. **4. Likelihood of Success:** Uncertainty exists due to unknown and unproven techniques for some species. **5. Additional Injury:** Pass. **6. Recovery Period:** Excessive for many species injured. **7. Recovery Ability:** Limited. Some species have not been propagated in captivity. **8. Public Health and Safety:** Not applicable. **9. Policy Consistency:** Pass. **10. Regulatory Compliance:** Pass. **11. Geographic proximity:** Pass.

3	Fish Passage Improvement	1. **Technical Feasibility:** High. 2. **Cost/Benefit:** Produces multiple benefits to aquatic fauna and injured resources at reasonable costs. 3. **Cost Effective:** High. Proven technique. 4. **Likelihood of Success:** High. 5. **Additional Injury:** Temporary impacts due to sediment releases and instream work 6. **Recovery Period:** Short. 7. **Recovery Ability:** High. 8. **Public Health and Safety:** Improves public safety. 9. **Policy Consistency:** Pass. 10. **Regulatory Compliance:** Pass. 11. **Geographic proximity:** Pass.
4	Recreational Fishing Improvement	1. **Technical Feasibility:** High. 2. **Cost/Benefit:** Satisfactory 3. **Cost Effective:** Yes comparative to similar examples in VA. 4. **Likelihood of Success:** High. Proven technologies. 5. **Additional Injury:** Negligible 6. **Recovery Period:** Immediate. 7. **Recovery Ability:** Not applicable. 8. **Public Health and Safety:** Low concern. 9. **Policy Consistency:** Pass. 10. **Regulatory Compliance:** Pass. 11. **Geographic proximity:** Pass.

3.4 Preferred Restoration Alternatives

Based on the evaluation of the CERCLA criterion above, and the NEPA analysis in section 5, the Trustees propose Alternative 3 - *Fish Passage Improvement* and Alternative 4 - *Recreational Fishing Improvement* as the Preferred Alternatives. These Alternatives meet all the Restoration Evaluation Criteria and most effectively return fish in Tinker Creek to pre-spill baseline conditions and compensating for the loss of recreational fishing use in Tinker Creek.

4.0 Environmental Assessment Under NEPA

This Section presents information about the area which would be affected by implementation of the Preferred Alternatives (Affected Area) and the Trustees' analysis of the environmental consequences of implementing the Preferred Alternatives.

4.1 The Affected Environment

This sub-section presents a brief description of the physical, biological, and cultural environment for the Tinker Creek sub-watershed located in Botetourt and Roanoke counties, Virginia. The Tinker Creek sub-watershed encompasses 53,095.3 acres (83 square miles) in south–central Virginia north of Roanoke (VDEQ Factsheet, NHDPlus) and excludes the tributaries of Lick Run, Laymantown, Glade, and Carvin Creeks. The Affected Area includes the 11.8 miles of instream segments and

those lands immediately adjacent to Tinker Creek from Cloverdale, Virginia to the Roanoke River that would be affected by proposed instream habitat, riparian, public boating, or fishing access improvements. The watershed below Cloverdale is highly developed adjacent to the stream with urban housing, manufacturing, and retail businesses. The watershed above Cloverdale is rural, agricultural, and less developed than the lower watershed.

4.1.1 Physical Environment

The Affected Area is located in the Valley and Ridge Physiographic Province that includes Roanoke Valley. Valley and Ridge geology is characterized by folded sedimentary bedrock that comprise linear mountain ridges and valleys that trend to the northeast. The ridges of the province are formed of hard layers of sandstone or chert, while the valleys are composed of softer shale and carbonate rocks of limestone and dolomite. Roanoke Valley, part of the larger Valley of Virginia, is surrounded by mountain terrain. Soils tend to be moderately to strongly calcareous due to the presence of calcium concretions or calcareous materials in the sediments originating from weathered sandstone, siltstone, metasiltstone, and shale formations from which they were formed (VDCR 2016). At Cloverdale, Virginia, Tinker Creek occupies the larger of 5 physical openings or passes into Roanoke Valley at an elevation of 1,275 feet above sea level, only 100 feet higher than the city of Roanoke.

Climate is humid subtropical characterized by mild winters, long periods of spring and fall, and warm, humid summers. Average annual temperature is 59 degrees, average annual rainfall is 41 inches, and average annual snowfall is 8 inches. Precipitation interacting with carbonate formations forms sinkholes, swallets, caves, and springs, and contributes to the 'hardness' of the groundwater. Aquifer and subsurface recharge occurs where streams often cross fault zones and through surface run-off into limestone sinkholes, bypassing filtration through the soil. Proposed restoration activities, including operation of heavy construction equipment, are not expected to produce air pollutants at levels to exceed state air quality standards.

Tinker Creek begins south of Route 630 and east of Mount Union in Botetourt County, Virginia within an agricultural setting and flows south for 20.1 miles through Botetourt and Roanoke counties before joining the Roanoke River on the east side of Roanoke, Virginia. The Roanoke River continues southeast before entering Albemarle Sound in coastal North Carolina.

The entire 20.1 mile reach of Tinker Creek is classified as impaired by the VDEQ for *Escherichia coli* (*E. coli*). Sources of *E. coli* are attributed to agriculture (65.3%) and human development (31.5%) (Maptech 2004). Tinker Creek was placed on the Commonwealth of Virginia's 1996 Section 303(d) List of Impaired Waters because of violations of the fecal coliform bacteria water quality standard. These Total Maximum Daily Loads (TMDL) focus on fecal coliform impairments. Based on TMDL exceedances of the standard recorded at VDEQ monitoring stations, the stream does not support primary contact recreation (*e.g.*, swimming). VDEQ developed a TMDL for impairments in Tinker Creek and determined that reductions in point and non-point sources of pollution will be necessary to restore supportive water quality conditions to Tinker Creek (Maptech 2004). The lower 5.35 mile reach of Tinker Creek (Deer Branch to Roanoke River confluence) was placed on the 2008 Section 303(d) List of Impaired Waters due to elevated concentrations of polychlorinated biphenyls (PCBs) in fish tissue and sediment. This reach of Tinker Creek was included in the Roanoke River PCB TMDL (TetraTech 2009). The TMDL identified stormwater as the primary source of PCBs to Tinker Creek.

4.1.2 Biological Resources

The Valley and Ridge province in Virginia is biologically diverse and contains multiple habitat types and thousands of native plant and animal species. The Tinker Creek watershed has been influenced by postcolonial human occupation for more than 300 years and the natural environment has been extensively modified due to agricultural, residential, and commercial development associated with the City of Roanoke, Cloverdale, and other settlements. Despite this, Tinker Creek and adjacent tributaries support a diverse fish community of over 30 species and many land based mammals and birds.

Land cover in the Tinker Creek watershed includes a mixed cover of forests (35.4%), grasslands/agriculture (28.3%), wetlands (0.2%), urban/developed (35.8%), and 0.2% other (Fry et al. 2011). Forests are composed of mixed hardwood and conifer (oak and oak-pine) with isolated patches of Northern hardwoods and relict spruce-fir (VDGIF 2015). Forests within this region support water resources like Tinker Creek and provide habitat for migratory and resident birds, small mammals, reptiles, amphibians, and insects among other more common species like white-tailed deer, wild turkey, raccoon, and opossum. Agriculture is mainly pasture-hay and cattle production and provides habitat for insect-consuming grassland bird species like Eastern meadowlark and Eastern bluebird. Open grasslands and shrublands not currently in agricultural use are uncommon and may include abandoned agricultural lands, glades, and barrens. These areas support nesting, feeding, and protected habitats for rare birds and insects. Aquatic and wetland areas include rivers, streams, and creeks provide habitat for aquatic insects and fish, including State priority species such as the Kosztarab's common stonefly (*Acroneuria kosztarabi)*, orangefin madtom (*Noturus gilberti*), bigeye jumprock (*Scartomyzon ariommus*), Roanoke hogsucker (*Hypentelium roanokense*), and Roanoke logperch (*Percina rex*). Riparian areas adjacent to Tinker Creek support raptors, songbirds, deer, and small mammals; open water or pools provide areas for ducks, geese, heron, and small mammals; and riverine areas support shorebirds, small mammals, ducks, geese, heron, and other species.

4.1.2.1 Rare, Threatened, Endangered, and Special Concern Species

The Ridge and Valley Province support one of the highest concentrations of rare species and significant natural communities in the State. Virginia Natural Heritage data list 2,376 occurrences of 503 rare species and significant natural community types. Of these occurrences, 296 represent populations of federally threatened or endangered species and 471 are State listed (Wilson and Tuberville 2003). Tinker Creek includes the federally listed Roanoke logperch and the Virginia Wildlife Action Plan listed bigeye jumprock (VDGIF 2015).

4.1.3 Archeological and Cultural Resources

A search of State historical records produced a total of 8 archaeological and 32 architectural resources within 1/4 mile from each side of Tinker Creek along a 4.6 mile length from the end of pool upstream of Ardagh Dam to 1 mile below Mason Mill Dam. Records indicate a majority of the archaeological sites were either destroyed or partially destroyed by development. Most of the architectural resources are houses. Of those, 21 of the 29 houses occur below Mason Mill Dam and are either not evaluated, recommended not eligible by the surveyor, or determined not eligible by the Virginia Department of Historic Resources (VDHR). All but one are also 200 feet or more from Tinker Creek. A set of houses that might have been built for mill workers has not been evaluated and a bridge below Mason Mill Dam was determined not eligible as historic.

All of the significant architectural resources are located above Mason Mill Dam. Of the 8 houses above the dam, 4 are determined eligible for listing, 2 are determined potential eligible for listing and 1 is listed. The remaining 1 is recommended not eligible for listing. Two cemeteries have not been evaluated for listing. Other architectural resources above the dam include a pump house that has been determined eligible, railroad tracks that have been determined potentially eligible, and a bridge determined not eligible.

Some architectural and archaeological survey work has been completed for Mason Mill and the associated dam but VDHR has not evaluated it for listing. No survey work has been completed on Ardagh Dam.

The Virginia Landmarks Register and National Register of Historic Places includes 19 properties and districts in Botetourt County. Two of the 19 properties are within the Affected Area and include Niningers Mill (Tinker Mill) and Mason Mill. (2011 Botetourt County Comprehensive Plan, VDHR). An additional 16 sites have been evaluated by the VDHR National Register Team and determined eligible for listing on the State and National registers. Niningers Mill was built in 1847, is a private residence, and will be unaffected by the proposed alternatives. The dam or instream portion of Mason Mill may be removed under Preferred Alternative 3.

4.1.4 Recreational Services

Local, State, and national parks and recreation areas existing in or near the Affected Area include the Appalachian Trail crossing Tinker Creek in Botetourt County, East Gate Park and Mason Mill Park in Roanoke, and the Tinker Creek Greenway Trail. The relatively new Tinker Creek Greenway Trail has 2 segments, a 2.5 mile natural surface trail between Plantation Road north of I-81 and Carvins Cove's Fisherman's Trail, and a 1 mile trail segment between Wise Avenue SE and the confluence with the Roanoke River. These areas are presumably utilized for walking, biking, wading, fishing, historical interpretation, personal reflection, team sports, bird watching, boating, and horseback riding among other uses. According to user posts on Paddling.com, boaters in canoes and kayaks launch or put in to Tinker Creek at East Gate Park and float downstream to a suitable parking area. Proposed restoration activities are anticipated to be beneficial at project areas where public access will be allowed.

4.1.5 Socioeconomic Trends

The U.S. Census Bureau lists the population of Botetourt County as 33,148 in 2017 with a 0.1% increase since 2010. Density is 61.2 people per square mile. The largest ethnicity is 94.3% white, 28.3% of the population greater than 25 years of age, have a bachelor's degree or higher, and per capita income is $34,733. The poverty rate is 6.4% and unemployment is 3.6% (U.S. Bureau of Labor Statistics).

The U.S. Census Bureau lists the population of Roanoke County as 99,837 in 2017 with a 3.0% increase since 2010. Density is 2,279.8 people per square mile. The largest ethnicity is 63.6% white, 23.2% of the population greater than 25 years of age have a bachelor's degree or higher, and per capita income is $24,697. The poverty rate is 6.4% and unemployment is 3.4% (U.S. Bureau of Labor Statistics).

No social or economic impacts are expected from the proposed restoration projects because of the remote location and types of projects proposed. There are low-income populations near proposed

project areas but these populations will not be adversely affected due to the intended beneficial environmental outcomes of the projects and use of some of the areas for recreation. The area currently experiences a fairly high truck traffic volume due to mining and milling activities. However, the restoration is not expected to add significantly to the existing traffic patterns and there are no existing traffic congestion issues in the area.

5.0 Environmental Consequences Under NEPA

The purpose of the environmental consequences analysis section is to evaluate the consequences on the environment from implementing any of the Alternatives. This analysis will provide pertinent information to the decision-maker and the public. The analysis for each Alternative will vary depending on the scope, magnitude, and environmental effects of the alternative.

NEPA requires that the potential impacts of the proposed restoration actions are evaluated, including evaluation of the No Action Alternative. This section of the Draft RP/EA includes discussion of the potential impacts of both the No Action Alternative and the two proposed preferred restoration alternatives identified in Chapter 3. The analyses presented here considered the range of potential environmental consequences that may be anticipated to occur as a result of implementation of activities within the scope of the Preferred Alternatives.

The following definitions are used in this section to characterize the nature of the various impacts evaluated in this Draft RP/EA:

- *Short-term or long-term impacts.* These characteristics are determined on a case-by-case basis and do not refer to any rigid time period. In general, short-term impacts are those that would occur only with respect to a particular activity or for a finite period. Long-term impacts are those that are more likely to be persistent and chronic.

- *Direct or indirect impacts.* A direct impact is caused by a proposed action and occurs contemporaneously at or near the location of the action. An indirect impact is caused by a proposed action and might occur later in time or be farther removed in distance but still be a reasonably foreseeable outcome of the action. For example, a direct impact of erosion on a stream might include sediment-laden waters in the vicinity of the action, whereas an indirect impact of the same erosion might lead to lack of spawning and result in lowered reproduction rates of indigenous fish downstream.

- *Minor, moderate, or major impacts.* These relative terms are used to characterize the magnitude of an impact. Minor impacts are generally those that might be perceptible but, in their context, are not amenable to measurement because of their relatively minor character. Moderate impacts are those that are more perceptible and, typically, more amenable to quantification or measurement. Major impacts are those that, in their context and due to their intensity (severity), have the potential to meet the thresholds for significance set forth in the Council on Environmental Quality (CEQ) regulations (40 CFR § 1508.27) and, thus, warrant heightened attention and examination for potential means for mitigation to fulfill the requirements of NEPA.

- *Adverse or beneficial impacts.* An adverse impact is one having adverse, unfavorable, or undesirable outcomes on the man-made or natural environment. A beneficial

impact is one having positive outcomes on the man-made or natural environment. A single act might result in adverse impacts on one environmental resource and beneficial impacts on another resource.

- *Cumulative impacts.* CEQ regulations implementing NEPA define cumulative impacts as the "impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR § 1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time within a geographic area.

5.1 Environmental Consequences of the No Action Alternative

NEPA requires the consideration of a "no action" Alternative. Under this Alternative, the Trustees would take no direct action to restore injured natural resources or compensate for lost services pending natural recovery. Instead, the Trustees would rely on natural processes for recovery of the injured natural resources and their associated services. While natural recovery would occur over varying time scales for the injured resources services, the interim losses would not be compensated under the "no action" Alternative.

The principal advantages of this approach are the ease of implementation and low cost. This approach relies on the capacity of ecosystems to recover without human intervention. CERCLA, however, establishes Trustee authority to seek compensation for interim losses pending recovery of the natural resources, losses which cannot be addressed through a "no action" alternative. The "no action" Alternative is rejected as it does not meet the purpose and need for restoration. Losses occurred and impacts continue during the period of recovery from this release. Technically feasible, cost-effective alternatives exist to compensate for these losses.

5.2 Environmental Consequences of Alternative 2 Fish Propagation and Restocking

Environmental consequences of this Alternative include re-establishment of the natural abundance and variation of native fish in Tinker Creek over a period of time. Due to the gradual nature of the restocking effort, the restoration action contemplated under this Alternative would not create dramatic change in the habitat or prey base for fish and most, if any, adverse impacts associated with implementation of Alternative 2 would be anticipated to be minor and short term. One possible long-term adverse impact may be the degradation of native fish genetics because of mixing with propagated fish, however this science is not well known and it is too speculative to consider further.

5.3 Environmental Consequences of the Preferred Alternatives

A summary of environmental consequences of the Preferred Alternatives appears in Table 5-1. Adverse impacts associated with implementation of Alternatives 3 - *Fish Passage Improvement* and 4 - *Recreational Fishing Improvement* are anticipated to be minor to moderate, short-term, direct, and indirect whereas benefits are moderate to major, long-term, direct, and indirect. Some limited short-term ecological effects are expected from dam removal. However, a comprehensive review of dam removal projects found that the long-term ecological benefits of dam removal, as measured in improved water quality, sediment transport, and native resident and migratory species recovery, outweigh the short-term effects and make dam removal an effective long-term river restoration tool (Bednarek 2001). Adverse impacts are associated primarily with construction activities that will temporarily increase soil disturbance, sedimentation and turbidity within the channel, instream

habitat perturbations, noise, truck traffic, diesel combustion emissions, and restricting public access. However, minimization and avoidance measures, and best management practices associated with the work instream and time-of-year restrictions, will reduce adverse effects.

Sediment currently trapped behind dams will be released downstream upon removal of the dam. This action is anticipated to result in minor to moderate, short-term, direct, and indirect impacts to downstream areas including Tinker Creek, the Roanoke River, and to a much lesser degree, Smith Mountain Lake. Moderate effects would be expected in Tinker Creek with minor adverse effects anticipated in the Roanoke River and Smith Mountain Lake due to existing sediment loads in these water bodies. Furthermore, the Roanoke River possesses a high absorption/dilution capacity due to water volumes and flow relative to Tinker Creek. The 8-mile distance from the projects to Smith Mountain Lake provides sufficient area for sediment deposition and the majority of sediment mobilized from dam removal activities is anticipated to move rapidly through the system by flood flows and ultimately deposit behind Niagara Dam in Roanoke before reaching Smith Mountain Lake. Other sources of sediment and turbidity during construction will be minimized by strict adherence to an approved erosion and sediment control plan.

Mason Mill Dam is located in the reach of Tinker Creek included in the Roanoke River PCB TMDL (TetraTech 2009). Elevated concentrations of PCBs were detected in 1 of 6 samples tested from behind Mason Mill Dam (USFWS 2019). The PCB congener profile indicates weathered material. The source of PCBs in the sediment behind Mason Mill dam is currently unknown, but stormwater is the suspected primary source of PCBs to Tinker Creek (TetraTech 2009). Removal of Mason Mill Dam would mobilize PCBs behind Mason Mill Dam. The quantity of PCBs potentially released through dam removal is unknown; however, more characterization of PCBs would be conducted prior to dam removal. The Ardagh Dam is located outside of the reach of Tinker Creek included in the Roanoke River PCB TMDL and PCBs were not detected in sediment samples collected behind the dam (USFWS 2019).

No adverse impacts are anticipated with economic, recreation, or public health and safety factors. Known archeological sites and resources within the Affected Area include Mason Mill Dam that will be impacted by the Preferred Alternatives. Mason Mill Park alongside Tinker Creek features a 5 x 25 ft. picnic shelter with 2 tables and 1 grill, parking lot with spaces for 6 automobiles, bench seating, an old non-functioning water mill, the dam, and a public fishing area. Alternative 3 would have major, long-term, direct impacts to the dam while leaving the raceway, water wheel, and other features of the dam and park undisturbed. Portions of the dam may be left in place for historical interpretation if sufficient integrity and stability exists to avoid creating a public safety hazard.

Restoration activities will result in major, long-term, direct and indirect benefits by restoring natural instream geologic and hydrologic processes necessary for the maintenance of aquatic habitat. Outside of minor, temporary adverse impacts during construction, implementation of Alternatives 3 and 4 are anticipated to provide multiple benefits, primarily in the form of improved aquatic habitat, recreational activities, and public safety within Tinker Creek below Cloverdale, Virginia.

Table 5-1. Summary of environmental consequences for the No Action and Preferred Restoration Alternatives for the Tinker Creek Chemical Spill under NEPA.

Resource	Alternative 1 – No Action	Environmental Consequences	
		Alternative 3 – Fish Passage Improvement	**Alternative 4 – Recreational Fishing Improvement**
Physical			
Hydrology and Water Quality	Direct, moderate, and long-term adverse effects would continue since no restoration would occur. Ecological benefits that result from Alternative 3 would not be realized and the expectation for recovery of any injured natural resources would remain unchanged.	Moderate, short-term, direct and indirect adverse impacts are expected from the release of sediment and turbidity generated from dam removals, instream placement of stone, and construction equipment. Restoration activities will result in major, long-term, direct and indirect benefits by restoring natural instream hydrologic processes necessary for the maintenance of aquatic habitat.	Minor, short-term, direct and indirect localized impacts to water quality could occur during the fishing event or establishment of a boat launch. Related activities could increase turbidity in the immediate project vicinity, although best management practices (BMPs) would minimize impacts.
Air		Minor, short-term, indirect impacts to local air quality are expected from diesel construction equipment emissions.	Minor, short-term, indirect impacts to local air quality are expected from public vehicles and/or diesel construction equipment emissions.
Geology		Minor, short-term, direct soil disturbance is expected from ingress and egress of construction equipment. Restoration activities will result in major, long-term, direct and indirect benefits by restoring instream geologic processes of channel geometry, flushing, and sediment transport necessary for the maintenance of aquatic habitat.	Minor permanent impacts to bank and shoreline habitat within the boat access footprint would occur. Localized disturbance of sediments during construction and use is anticipated.
Biological			
		Release of sediment and turbidity generated from dam removals, instream placement of stone, and construction equipment will result in moderate, short-term, direct and	Minor, short-term, direct adverse impacts to fish and other aquatic biota during event and access establishment construction due to increased turbidity and sedimentation from

Fish and Wildlife	Direct, moderate, and long-term adverse effects would continue since no restoration would occur. Ecological benefits that result from Alternative 3 would not be realized and the expectation for recovery of any injured natural resources would remain unchanged.	indirect adverse impacts to fish and aquatic insects, including the federally listed Roanoke logperch. Restoration activities will result in major, long term, direct and indirect benefits by restoring and enhancing instream habitat and restoring physical and chemical processes necessary for the maintenance of aquatic habitat.	instream foot traffic and construction. BMPs would be employed during construction to reduce impacts.
Vegetation		Minor, short-term, direct disturbance is expected from ingress and egress of construction equipment and control of noxious weeds. No adverse impacts from any native plant establishment.	Clearing and earth moving activities, if necessary, for parking and stream access would directly impact plants within the boat launch footprint. Affected vegetation adjacent to the construction area may be disturbed, but effects are likely to be short-term. Event impacts to vegetation associated with foot traffic would be minor and short-term.
Special Status Species		Same moderate, short-term, direct and indirect consequences as listed for Fish and Wildlife with no exceptions associated with take or killing of species with State or Federal special status.	Impacts to the Roanoke logperch and State listed species would be minor, short-term, and minimized by BMPs and catch and release regulations. Boat access establishment activities would exclude working instream.
Archeological and Cultural			
Historic	No adverse effects are anticipated.	Moderate, long-term, direct impacts to Mason Mill and Ardagh dams will occur. Impacts will be minimized by avoidance of the mill and landward portions of Mason Mill and completion of a Phase I archaeological survey and possible intensive Phase I architectural survey conducted in coordination with the Virginia State Historic Preservation	No adverse effects are anticipated.

		Office and Section 106 of the National Historic Preservation Act guidelines. Portions of Mason Mill dam will remain for historical interpretation if possible.	
Aesthetics, Noise		Potential moderate, long-term impacts to a listed historic home (DHR ID: 128-0035) situated on a knoll above Mason Mill Dam. No adverse impacts other than minor short-term disturbance during construction.	Minor, short-term, direct adverse impacts due to crowd noise and implementation of boating access. No adverse impacts anticipated to aesthetic values.
Recreational Services			
Team sports, walking, hiking, bicycling, horseback riding, non-motorized boating, hunting, fishing, bird watching, and other outdoor recreational sports.	Moderate, long-term, adverse effects would occur to instream activities like fishing and non-motorized boating because no restoration to fish community and instream habitat. Instream obstructions would remain.	Minor, short-term, adverse impacts anticipated during restrictions on public access to areas of construction work or soil stabilization. Minor, short-term impact on fishing.	No adverse effects are anticipated.
Ancillary activities (facilities, trails, maintenance, economic activity including equipment sales, guide services, health services, etc.)	Minor to moderate long-term adverse effects would occur because of no improvement or restoration of natural resources promoting recreational activities.	Minor, short-term, adverse impacts anticipated during implementation activities.	No adverse effects are anticipated.
Socioeconomic			
Economics		No adverse impacts anticipated. Moderate, short and long term, direct and indirect benefits from construction employment.	No adverse effects are anticipated.

Transportation	No adverse effects would occur.	Minor, short-term, direct increase in truck traffic in the vicinity of the area of work and debris disposal sites during construction.	Minor, short-term, direct increase in vehicular traffic during fishing event and boat access area (pre and post construction).
Public Health and Safety		No adverse impacts anticipated with safety protocols in place during construction. Moderate, long term, direct and indirect benefits by removing human drowning and falling hazards associated with dams.	No adverse effects are anticipated under standard safety protocols for public events and non-motorized boating activities.
Environmental Justice	Project area socio-economic variables would not be affected since no restoration would occur.	The project does not create a disproportionately high or adverse effect on any minority or low-income populations. Economic activity generated by the alternative would be beneficial to local economies.	No adverse effects are anticipated to environmental justice communities.

5.4 Cumulative Impacts

Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 C.F.R. §1508.7). As stated in the CEQ handbook, "Considering Cumulative Effects" (CEQ 1997), cumulative impacts need to be analyzed in terms of the specific resource, ecosystem, and human community being affected and should focus on effects that are truly meaningful.

Sources of cumulative effects analyzed within the Tinker Creek sub-basin and project areas included in Alternatives 3 - *Fish Passage Improvement* and 4 - *Recreational Fishing Improvement* represent past, present and foreseeable future actions, both of an adverse and beneficial nature. Past actions include agricultural and urban development, stream obstructions (dams, diversions, and sewer lines), conversion of forests to open land, increase in impervious surface and runoff, contaminants and hazardous substances, invasive plant and animal species, and other human associated environmental perturbations. Present actions include Alternatives 3 - *Fish Passage Improvement* and 4 - *Recreational Fishing Improvement* and ongoing routine maintenance activities associated with areas currently inhabited by humans as well as new development. Future actions include any reasonably foreseeable additional human development and land use changes as well as any restoration or environmental improvement projects. For the purpose of this analysis, the cumulative impact spatial boundary includes the mainstem of Tinker Creek from the Ardmore Drive Dam downstream to the Roanoke River.

Cumulatively, past actions have had significant impact on Tinker Creek. Examples such as agricultural runoff, PCBs, chemical spills, land clearing, and dams have impacted water quality, interfered with geomorphological and chemical processes, and affected fish passage and health.

Many of these influences on Tinker Creek (agricultural runoff, urban development, impervious surface runoff, and sedimentation) will continue into the foreseeable future. The Preferred Alternatives will moderately improve some of this degradation and have long term, direct and indirect beneficial effects. Activities in the foreseeable future that may be undertaken by other entities, private and public, vary widely. The Tinker Creek sub-basin consists of Botetourt and Roanoke counties, is largely rural except below Cloverdale, and has experienced little growth and development in recent years. Activities on private parcels may include maintenance of utilities, development of housing on nearby or adjacent uplands, and/or agriculture practices on adjacent uplands. These types of activities are expected to continue to result in short and long term potential impacts within Tinker Creek. Maintenance of public utilities, such as power lines, and pipelines in easements within state or federally-owned lands will not be impeded as a result of the Preferred Alternatives. Public entities may undertake land or wildlife management activities on parcels under their control throughout the project area. These activities may include restoration activities similar to those proposed under this Draft RP/EA and others such as maintenance and upkeep. These activities would result in both short and long term adverse and beneficial impacts.

The Preferred Alternatives are anticipated to result in minor direct cumulative impacts from multiple areas of instream work that will be overshadowed by the benefits of restoration. Restoration actions would be performed concurrently outside of fish spawning season and associated time of year restrictions and the impacts of construction access and sediment removal would occur within a single concurrent timespan (verses multiple seasons or years). However, restoration actions implemented under Alternative 3 - *Fish Passage Improvement* will benefit instream physical, chemical, and biological processes, reducing the existing anthropogenic impacts to the creek that cumulatively adversely affect the aquatic ecosystem in Tinker Creek.

Implementing the Preferred Alternatives as proposed and analyzed in this Draft RP/EA would have no major adverse impacts on Tinker Creek habitats, on adjacent lands and waterways, or on the natural resources within each. As described above, the proposed projects may result in minor, short-term adverse impacts and both short and long term beneficial impacts. When considered with other past, present, and reasonably foreseeable future actions within the sub-basin, the preferred alternatives are not anticipated to have adverse cumulative impacts. Direct and indirect adverse impacts, as discussed previously, are likely to be short-term and will occur primarily during periods of active construction activities. Periods of active construction are anticipated to be less than 8 weeks, and individually and cumulatively, would result in only short-term impacts. The Preferred Alternatives are not expected to result in significant cumulative impacts on the human environment since they alone, or in combination with other current and future activities in the vicinity, would not significantly change the larger current hydrological patterns of discharge, recreational use, economic activity or land-use in the Tinker Creek watershed.

6.0 Monitoring and Performance Criteria

Monitoring will assess whether instream habitat is sufficiently restored to meet restoration goals and objectives for fish and if species of interest are occupying habitat enhancement areas. A project-specific monitoring plan may be developed to evaluate the long-term results of planned restoration actions within Tinker Creek. A monitoring plan would include project specific performance standards and criteria, some of which have already been identified (below), appropriate to proposed restoration actions, guidelines for implementing corrective actions, a sampling and analysis plan, and a schedule for the frequency and duration of monitoring. Restoration goals will be guided by

performance criteria, or measures that assess the progress of restoration sites. In this way, the Trustees will be able to determine which project attributes are not on target, and what actions and course corrections are needed to achieve restoration goals. Monitoring information may also be used by the Trustees as an outreach tool to illustrate to the public continued progress (quantitatively and qualitatively) over time. Although the Trustees are currently completing final restoration planning actions, preliminary ideas for monitoring approaches and restoration goals have been developed and are described below.

Annual monitoring will begin within 1 year following completion of the project, and continue for a period of 3 years for physical modification goals and 5 years for biological improvement goals. Monitoring may cease at any time goals have been documented as reasonably achieved. Monitoring will consist of as-built morphological surveys of the channel, bank, and stability structures; and quantitative monitoring of plant survival, presence of invasive plants, and fish species richness and relative abundance. Qualitative photo monitoring will also be conducted regularly at fixed photo station locations pre and post construction. Restoration goals include no significant deviation between approved construction plans and post construction as-builts; and no more than 15% scour loss or movement of constructed instream structures after 3 bankfull events. Channel infill in or near removed/modified instream impediments by sediment in the form of sand or gravel bars, benches, bank building or sloughing, downed trees and woody debris, and natural recruitment of aquatic vegetation and trees is permissible and will be considered expected.

Annually, the Trustees will prepare a brief status report on the implementation and monitoring of the Preferred Alternatives. The annual status report will be made available to the public on the case website upon agreement of all Trustees. The project will be considered complete when all funds allocated for the project are spent.

7.0 Conclusion

The Tinker Creek Chemical Spill injured fish and natural resource services within Tinker Creek and resulted in lost recreational use. The objective of any restoration action under the CERCLA NRDAR process is to restore or replace natural resources and the services such resources provide. To meet that objective, the benefits of a restoration project must be related, or have an appropriate nexus to, the natural resource injuries and losses due to the unpermitted discharge of toxic chemicals from the release. The preferred restoration alternatives proposed by the Trustees in this Draft RP/EA are Alternative 3 - *Fish Passage Improvement* and Alternative 4 - *Recreational Fishing Improvement*. The removal of impediments to fish passage in Tinker Creek will restore instream habitat and lead to a more comprehensive, quicker recovery of native fish communities and the aquatic ecosystem, and restocking game fish, hosting a fish day, and improving public access will compensate for the loss of recreational fishing use in Tinker Creek.

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Tinker Creek Spill
Natural Resource Damage Assessment and Restoration

Draft Restoration Plan/Environmental Assessment

In accordance with U.S. Department of the Interior (Department) policy regarding documentation for natural resource damage assessment and restoration projects (521 DM 3), the Authorized Official for the Department must demonstrate approval of draft and final Restoration Plans and their associated National Environmental Policy Act documentation, with concurrence from the Department's Office of the Solicitor.

The Authorized Official for the Tinker Creek Spill Natural Resource and Damage Assessment is the Regional Director for the U.S. Fish and Wildlife Service's North Atlantic-Appalachian Region.

By the signatures below, the draft Restoration Plan/Environmental Assessment (RP/EA) is hereby approved. This approval does not extend to the final RP/EA. The draft RP/EA shall be released for public review and comment for a minimum of 30 days. After consideration of the public comments received, the RP/EA may be revised to address such comments.

Approved:

NOV 15 2019

Wendi Weber Date

Acting ~~Acting~~ Regional Director
North Atlantic-Appalachian Region
U.S. Fish and Wildlife Service

Concurred:

21 Oct 2019

Amy Horner Hanley
Date
Senior Attorney Advisor
Environmental Restoration Branch
Office of the Solicitor

Tinker Creek Spill
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Concur:

Date: February 6, 2020

Paul Kugelman, Jr.
Senior Assistant Attorney General
Chief, Environmental Section
Counsel for the Trustee of Virginia's Natural Resources