Memorandum Supporting Decision to Extend Registrations for GF-3335 (Enlist One) and Enlist Duo

Approved by: Ed Messina Digitally signed by EDWARD MESSINA Date: 2022.01.11 11:41:36 -05'00'

Ed Messina, Esq.
Director, Office of Pesticide Programs
Office of Chemical Safety & Pollution Prevention

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1 Summary

This memorandum supports and outlines the underlying basis for the decision of the U.S. Environmental Protection Agency (referred to hereafter as EPA or the Agency) to grant an amendment to the time-limited registrations under Section 3(c)(5) of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) for the end-use herbicide products Enlist Duo® (EPA Registration Number 62719-649) containing the active ingredients 2,4-dichlorophenoxyacetic acid (2,4-D) choline salt and glyphosate dimethylammonium salt (glyphosate), and GF-3335, also referred to as Enlist One® (EPA Registration Number 62719-695) containing 2,4-D choline salt. Both products are labeled for use in 34 states for the control of emerged annual and perennial broadleaf weeds as preplant, preemergence, and postemergence (over-the-top) uses on genetically-engineered (GE), herbicide-tolerant corn, cotton, and soybean containing the Enlist trait[1]; preplant, preemergence, and postharvest uses on conventional/non-Enlist corn; preplant use on conventional/non-Enlist soybean; and preplant and preemergence uses in fallow systems to be planted with Enlist and non-Enlist corn, cotton, or soybean. Corteva Agriscience, LLC (Corteva; formerly Dow AgroSciences, LLC) submitted applications to EPA on April 5, 2021 requesting registration amendments for both products to extend registrations for an additional term, as the current 5-year registrations were set to expire on January 12, 2022. No additional uses were requested with these applications beyond those already approved. Supported by the rationale in this memo and the entire administrative record, EPA is granting an additional 7-year term to Enlist One and Enlist Duo registrations with additional label restrictions and amended terms and conditions.

EPA evaluated the benefits and risks to human health and the environment from these products' uses, including potential risk to non-target organisms, and conducted effects determinations for federally listed endangered and threatened species (listed species). EPA formulated mitigation measures to address identified risks and evaluated the impacts of those mitigation measures on users of the products. Risk assessments, endangered species assessments, benefit assessments, impact assessments, risk management considerations (including label changes and changes to the terms and conditions of the registrations), and details on initiating formal consultation under section 7(a)(2) of the Endangered Species Act (ESA) and addressing effects to listed species are summarized in this memorandum. Taken together, these evaluations enabled EPA to conclude that granting the amendments to Enlist One and Enlist Duo registrations meet both the requirements of FIFRA and ESA, including sections 7(a)(2) and 7(d).

2 Background

Enlist Duo (EPA Reg. No. 62719-649) and GF-3335 (EPA Reg. No. 62719-695; alternate brand name "Enlist One") are end-use liquid herbicide products from Corteva Agriscience, LLC

[1] On the Enlist website (https://www.enlist.com/en, last visited on 12/16/2021) the registrant Corteva describes Enlist-branded cotton and soybeans as having "herbicide tolerance to 2,4-D choline, glyphosate and glufosinate." Enlist-branded corn is described elsewhere on the site; the Enlist seed trait website (https://www.enlist.com/en/traits.html, lasted visited in 12/16/2021) states that seed purchasers "get tolerance to 2,4-D choline and glyphosate with all Enlist crops, as well as glufosinate tolerance in Enlist® cotton and Enlist E3® soybeans, and FOP herbicide tolerance in Enlist corn."

registered for control of emerged annual and perennial broadleaf weeds as preplant, preemergence, and postemergence (over-the-top) uses on genetically-engineered (GE), herbicide-tolerant Enlist corn (DAS-40278-9), Enlist cotton (DAS-8191Ø-7), and Enlist soybean (DAS-68416-4)[2]; preplant, preemergence, and postharvest uses on conventional, non-GE/non-Enlist corn; preplant use on conventional, non-GE/non-Enlist soybean; and preplant and preemergence uses in fallow systems to be planted to GE and non-GE corn, cotton, or soybean. Enlist Duo contains 24.4% 2,4-D choline salt and 22.1% glyphosate dimethylammonium salt, and Enlist One contains 55.7% 2,4-D choline salt. For the purposes of this document, the names "GF-3335" and "Enlist One" refer to the same product and are considered interchangeable.

Enlist Duo was first registered under FIFRA 3(c)(5) on October 15, 2014 for new uses of 2,4-D choline salt on herbicide-tolerant Enlist corn and Enlist soybean in six states (IL, IN, IA, OH, SD, and WI). The registration was amended on March 31, 2015 to expand uses on herbicide tolerant Enlist corn and Enlist soybean to nine additional states (AR, KS, LA, MN, MS, MO, NE, ND, and OK). The registration was again amended on January 12, 2017 to extend the expiration date to January 12, 2022 and to add a new use on herbicide tolerant Enlist cotton in the 15 states already registered for use on Enlist corn and Enlist soybean, and expand use on all three Enlist crops to 19 additional states (AL, AZ, CO, DE, FL, GA, KY, MD, MI, NC, NJ, NM, NY, PA, SC, TN, TX, VA, and WV). This amendment also amended the registration to be "conditional" under FIFRA 3(c)(7)(B) in light of then-outstanding data in the context of 2,4-D registration review under FIFRA 3(g), which have since been submitted and the condition is considered satisfied. Documents supporting the 2014 registration and 2015 amendment are located on www.regulations.gov under docket number EPA-HQ-OPP-2014-0195. Documents supporting the 2017 amendment are located under docket number EPA-HQ-OPP-2016-0594.

Enlist One was granted a five-year registration under FIFRA 3(c)(7)(A) on January 31, 2017 with an expiration date of January 12, 2022 for the same uses as Enlist Duo on conventional and herbicide tolerant Enlist corn, cotton, and soybean in the same 34 states where Enlist Duo was already registered.

Following the 2014 registration of Enlist Duo, two separate lawsuits (that were later consolidated) challenged EPA's issuance of the Enlist Duo registration based on both FIFRA and Endangered Species Act (ESA) allegations. On July 22, 2020, the U.S. Court of Appeals for the Ninth Circuit, in *National Family Farm Coalition, et al., v. U.S. EPA, et al.,* 966 F.3d 893 (9th Cir., 2020), issued an opinion denying Petitioners' ESA claims, denying in part Petitioner's FIFRA claims, and remanding the registration decision to EPA without vacating the registration itself. The sole issue on remand was for EPA to consider potential on-field effects to monarch butterflies under FIFRA due to on-field control of milkweed.

Specifically, the Court directed EPA to "address the evidence that monarch butterflies may be harmed by the destruction of milkweed on target fields in determining whether the registration of Enlist Duo will lead to any 'unreasonable adverse effect' on the environment." *Id*. at 930. This memorandum discusses the potential for indirect effects on monarchs through loss of milkweed

[2] https://www.aphis.usda.gov/aphis/ourfocus/biotechnology/permits-notifications-petitions/petitions/petition-status

in determining whether the registrations of Enlist One and Enlist Duo, as herein described, will lead to any unreasonable adverse effect on the environment, as defined by FIFRA section 2(bb), when the herbicides are used in accordance with widespread and commonly recognized practice.

This memorandum summarizes EPA's evaluation of 2,4-D for the registered uses of Enlist One on conventional and herbicide tolerant Enlist corn, cotton, and soybean and fallow land to be planted to corn, cotton, and soybeans. Because Enlist Duo contains a premix of 2,4-D and glyphosate, this memorandum summarizes EPA's evaluation of both 2,4-D and glyphosate on these same uses. No additional uses of either active ingredient were requested by Corteva or considered in this regulatory action. This document addresses whether Enlist One and Enlist Duo continue to meet FIFRA and ESA standards and thus their registrations can be extended beyond the January 12, 2022 expiration date.

Corteva submitted the amendment applications on April 5, 2021. Revised draft labels were provided to EPA on May 18, 2021. EPA conducted risk assessments and effects determinations based upon the May 2021 labeling. Subsequent discussions with Corteva occurred throughout 2021 and early 2022 to discuss preliminary ecological risk findings and potential mitigations to non-target taxa including listed species. Corteva submitted multiple label iterations during 2021 and early 2022 seeking to mitigate risks and address EPA comments. These were reviewed and considered throughout the process. Corteva submitted final revised labeling to include additional mitigations on January 10, 2022. EPA relied upon the January 2022 labeling in its effects determination re-evaluation for certain listed species as discussed in an addendum. On January 10, 2022, EPA initiated formal consultation with the United States Fish and Wildlife Service[3] (FWS).

3 Human Health Risk Assessment Summary: 2,4-D Including Choline Salt

EPA evaluated the available toxicity data for 2,4-D, including its choline salt, and considered its validity, completeness, and reliability as well as what the results of those studies indicate regarding the potential for human health risks from the use of Enlist One and Enlist Duo. EPA has also considered available information concerning the variability of the sensitivities of major identifiable subgroups of the population, including infants and children. The toxicology database for 2,4-D is complete and adequate for hazard characterization.

There are no new uses or use pattern changes in this action that would affect the human health risk conclusions from the previous assessments on Enlist herbicide uses. There have been no new toxicity or metabolism data received since the last human health risk assessment by EPA was conducted for all 2,4-D uses in August 2019 (D446968, 08/21/2019). New minor uses on intermediate wheatgrass and sesame were granted in 2020, which relied upon the 2019 assessment because the uses did not show any increased risk. The dietary, residential, aggregate, and occupational risk conclusions for use of 2,4-D choline salt on 2,4-D tolerant corn, cotton, and soybean from the 2013 and 2016 risk assessments remain unchanged. There were no dietary,

[3] EPA has initiated consultation with only FWS as there are no National Marine Fisheries Service (NMFS) species or designated critical habitats that may be affected by this action.

residential, or aggregate risk concerns identified from 2,4-D uses in EPA's 2019 assessment; however, EPA did identify occupational handler inhalation risks of concern for certain scenarios, which include mixing, loading, or application of granular 2,4-D products for aerial applications and applying sprays using mechanically pressurized handguns on rights-of-way. The Enlist One and Enlist Duo product labels prohibit aerial applications, are liquid formulations, and are not approved for use on rights-of-way; therefore, these occupational handler inhalation risk concerns do not apply to the Enlist registrations.

Potential areas of environmental justice concerns, to the extent possible, were considered in the human health risk assessment, in accordance with U.S. Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," (http://www.archives.gov/federal-register/executive-orders/pdf/12898.pdf). As a part of every pesticide risk assessment, OPP considers a large variety of consumer subgroups according to well-established procedures. In line with OPP policy, HED estimates risks to population subgroups from pesticide exposures that are based on patterns of that subgroup's food and water consumption, and activities in and around the home that involve pesticide use in a residential setting.

EPA considered the following 2,4-D human health risk assessments for this action:

- *Enlist/Enlist Duo. Verification that HED Risk Assessments for 2,4-D Choline Salt for These Products are Current and Require No Updates.* (D463518, D463516, 09/20/2021). EPA-HQ-OPP-2021-0957.
- *2,4-D. Second Revision: Human Health Risk Assessment for Registration Review.* (D446968, 08/21/2019). EPA-HQ-OPP-2012-0330-0109, EPA-HQ-OPP-2019-0233-0013
- *2,4-D. Human Health Risk Assessment for a Proposed Use of 2,4-D Choline on Herbicide-Tolerant Cotton* (D423374, 10/27/2016). EPA-HQ-OPP-2016-0594-0009
- *2,4-D. Human Health Risk Assessment for a Proposed Use of 2,4-D Choline on Herbicide-Tolerant Corn and Soybean* (D389455, 08/08/2013). EPA-HQ-OPP-2014-0195-0007

Documents indicating a docket number at the end of their listing are located on www.regulations.gov under their respective docket and document identification numbers.

4 Human Health Risk Assessment Summary: Glyphosate Including Dimethylammonium Salt

EPA assessed risks to human health from exposure to glyphosate from all registered uses including uses of Enlist One and Enlist Duo in December 2017 (D417700, 12/12/2017). There are no new uses or use pattern changes in this action that would affect the human health risk conclusions from the previous assessments on Enlist herbicide uses. The toxicology database for glyphosate is complete and adequate for hazard characterization. Additionally, there have been no new toxicity or metabolism data identified that would impact the human health risk assessment conclusions. There were no dietary, aggregate, residential, or occupational risk concerns identified for glyphosate in EPA's 2017 assessment. The dietary, residential, aggregate,

and occupational risk conclusions for use of glyphosate on corn, cotton, and soybean remain unchanged from the 2017 assessment.

Potential areas of environmental justice concerns, to the extent possible, were considered in the human health risk assessment, in accordance with U.S. Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," (http://www.archives.gov/federal-register/executive-orders/pdf/12898.pdf). As a part of every pesticide risk assessment, OPP considers a large variety of consumer subgroups according to well-established procedures. In line with OPP policy, HED estimates risks to population subgroups from pesticide exposures that are based on patterns of that subgroup's food and water consumption, and activities in and around the home that involve pesticide use in a residential setting.

EPA considered the following human health risk assessments for this action:

- *Enlist/Enlist Duo. Verification that HED Risk Assessments for Glyphosate for These Products are Current and Require No Updates.* (D463704, 10/07/2021). EPA-HQ-OPP-2021-0957
- *Glyphosate. Draft Human Health Risk Assessment in Support of Registration Review.* (D417700, 12/12/2017). EPA-HQ-OPP-2009-0361-0068

Documents indicating a docket number at the end of their listing are located on www.regulations.gov under their respective docket and document identification numbers.

5 Environmental Risk and Endangered Species Assessment – 2,4-D including Choline Salt

A summary of the environmental fate and ecological effects and risks of 2,4-D choline salt as assessed in the agency document titled, *2022 Ecological Risk and Endangered Species Assessment for Use on Genetically-Modified Herbicide-Tolerant Corn, Soybean, and Cotton in Support of Registration Renewal Decision for Enlist One and Enlist Duo Products* is provided below. The complete assessment that reviewed the May 2021 labels submitted by Corteva and supporting materials are available through docket EPA-HQ-OPP-2021-0957 on regulations.gov. To evaluate the uses of the Enlist products on corn, cotton, and soybean[4], EPA has evaluated the risk of 2,4-D separately from glyphosate. While application of the Enlist Duo product will result in the simultaneous environmental exposure to both 2,4-D and glyphosate at the time of application, the fate and environmental transport of the two active ingredients is driven by their physiochemical properties. Each of these components of the formulation will result in differential risk profiles following application of the product based on the different toxicity and exposure profiles of the two herbicide active ingredients. This section focuses on the ecological assessment conclusions for 2,4-D alone.

[4] This assessment covers the use of Enlist One and Enlist Duo on fallow acres to be planted with corn, cotton, and soybean.

EPA's 2,4-D ecological assessment for non-listed taxa concludes that there are potential on-field (on the site of application[5]) risks to terrestrial vertebrates (mammals, birds, amphibians, and reptiles), terrestrial invertebrates (including bees and monarch butterflies), and terrestrial plants. Risks are considered low for non-listed aquatic animals (fish, amphibians, and invertebrates) and aquatic plants. For non-target plants located off the treated field, EPA's evaluation of the potential for off-field exposure to 2,4-D through spray drift and/or runoff, taking into account the restrictions on the labeling (May 2021), concludes the following about the potential risks:

- The mandatory spray drift mitigation measures on the product labels, including the 30-foot downwind in-field spray drift set back, eliminate level-of-concern (LOC) exceedances due to spray drift for listed and non-listed off-field mammals, birds, reptiles, terrestrial-phase amphibians, and terrestrial invertebrates.
- The same mandatory spray drift mitigation measures eliminate LOC exceedances due to spray drift for listed and non-listed plant effects resulting from spray drift of these products.
- The mandatory runoff mitigation measures on the May 2021 labels reduce exposure; however, more reduction would be needed to alter the "may affect" determination for listed plants in terrestrial or wetland habitats that may receive runoff after application. Additionally, the measures on the May 2021 labels were not sufficient to result in risk quotients (RQs) below the FIFRA LOC for non-listed plants.
- Monitoring data reinforce the risk conclusions indicating that runoff is a relevant off-site transport pathway for 2,4-D.

Furthermore, because plants play an important role in terms of shelter, food, and habitat for animals, there are potential indirect effects to animals, primarily from the runoff exposure to plants. For monarch butterflies, in addition to direct risks on-field, there are potential indirect adverse effects from 2,4-D effects to on-field and off-field milkweed.

Using listed-species levels of concern as a screen (USEPA, 2004;[6]), EPA concluded that there are potential on-field effects to terrestrial animals that utilize corn, soybean and/or cotton fields as well as several listed plant species that are assumed to be on these types of fields based on FWS documentation of the species habitat or distribution. The Agency also found potential effects to terrestrial and wetland plants that are exposed to runoff and listed animal species that depend upon plants in terrestrial and wetland areas receiving runoff from Enlist treated corn, cotton or soybean fields. EPA further considered the potential effects to listed species by accounting for their taxon-specific life history and diets in the Effects Determination (USEPA, 2022a;[7]). For information on EPA's listed species-specific analysis for the potential direct and

[5] Impacts can be from direct spray, consumption of contaminated food items or destruction of dietary items.
[6] USEPA. 2004. Overview of the Ecological Risk Assessment Process in the Office of Pesticide Programs, U.S. Environmental Protection Agency - Endangered and Threatened Species Effects Determinations. https://www.epa.gov/sites/default/files/2014-11/documents/ecorisk-overview.pdf
[7] USEPA. 2022a. 2,4-D Choline Salt and Glyphosate Dimethylammonium Salt:2022 Ecological Risk and Endangered Species Assessment for Use on Genetically-Modified Herbicide-Tolerant Corn, Soybean, and Cotton in Support of Registration Renewal Decision for Enlist One and Enlist Duo Products. Environmental Fate and Effects

indirect effects from the Enlist products[8], see this document's section titled EPA's Effects Determination Under the ESA (Section 11).

Table 1 summarizes EPA's assessment regarding potential risks from 2,4-D to non-target non-listed and potential effects to listed taxa on and off the field from the use of Enlist One and Enlist Duo (based on the May 2021 label). Corteva submitted revised labels to include mitigations that reduce the exposure of listed species to 2,4-D and glyphosate (see Section 10.4 for more details). These mitigations were put in place as a response to EPA's effects determination summarized in Section 11 of this document. An addendum to the effects determination (USEPA, 2022b;[9]) was generated, and new listed species and critical habitat effects determinations were made based on the January 2022 labeling. See Section 11 in this document for further details.

Division. Office of Pesticide Programs. U. S. Environmental Protection Agency (DP Barcodes 462084, 462086). EPA-HQ-OPP-2021-0957.

[8] The term "direct effects" refers to decreases in the survival, growth, or reproduction of individuals of a listed species due to exposure to 2,4-D or glyphosate. The term "indirect effects" refers to impacts on individuals of a listed species that may be the result of the effects of 2,4-D or glyphosate on organisms on which the listed species depends upon for prey, pollination, habitat, and/or dispersal.

[9] USEPA. 2022b. 2,4-D Choline Salt and Glyphosate Dimethylammonium Salt: Evaluation of Mitigations on Enlist One and Enlist Duo Labels to Address Listed Species Risks Identified in the 2022 Ecological Risk and Endangered Species Assessment for Use on Genetically-Modified Herbicide-Tolerant Corn, Soybean, and Cotton in Support of Registration Renewal Decision for Enlist One and Enlist Duo Products. Environmental Fate and Effects Division. Office of Pesticide Programs. U. S. Environmental Protection Agency (DP Barcodes: 464071, 464072). EPA-HQ-OPP-2021-0957.

Table 1. Summary of 2,4-D-Based Risk Quotients and Lines of Evidence Relevant to Potential Effects to Non-listed and Listed Species for (May 2021 labeling) Uses of Enlist One and Enlist Duo

Taxa	Exposure Duration	Risk Quotient (RQ) Range[1]	Potential Risk to Non-listed Species?[3]	Additional Information/Lines of Evidence	Do Direct Risks to Non-Listed Species Extend Beyond the Treated Field?	Potential Effects to Listed Taxa?[4,5]
Aquatic Animals (including fish, invertebrates, and aquatic phase amphibians)	Acute and Chronic	Not Calculated (non-definitive endpoints)	No	Estimated environmental concentrations (EECs) are orders of magnitude below endpoint concentrations where no mortalities were observed.	Not Applicable	Direct: No Indirect: Yes
Mammals	Acute	<0.01 – 0.36	No	Exceedances of acute listed species LOC for small, medium, and large mammals based on shortgrass diet assumption. Listed small and medium size mammal RQs also exceed for all other dietary items except fruits/pods and seeds.	No (risk is limited to the field)	Direct: Yes Indirect: Yes
	Chronic	0.02-2.91 Dose based 0.02 – 0.34 Dietary based	Yes	Exceedances of chronic LOC for listed and non-listed small, medium, and large mammals based on shortgrass diet assumption. Small and medium size mammal RQs also exceed for all other dietary items except fruits/pods and seeds.		
Birds (including terrestrial phase amphibians and reptiles)	Acute	0.01-2.67 Dose based Dietary based Not Calculated	Yes	Exceedances of acute non-listed and listed species LOC for small and medium sized birds feeding on all exposed dietary items except fruits/pods and seeds.	No (risk is limited to the field)	Direct: Yes Indirect: Yes
	Chronic	0.02-0.38	No	--		

Taxa	Exposure Duration	Risk Quotient (RQ) Range[1]	Potential Risk to Non-listed Species?[3]	Additional Information/Lines of Evidence	Do Direct Risks to Non-Listed Species Extend Beyond the Treated Field?	Potential Effects to Listed Taxa?[4,5]
Bees and other terrestrial invertebrates	Acute Adult	<0.01	No	--	No (risk is limited to the field)	Direct: Yes Indirect: Yes
	Chronic Adult	0.2 – 6.3	Yes	Chronic adult endpoint based on mortality. Systemic transport is of low risk concern. Enlist formulation-specific residue data supports risk conclusion for cotton and soybean.	No (risk is limited to the field)	
	Acute Larval	0.02-2.3	Yes	Acute endpoint based on mortality. Systemic transport is of low risk concern. Enlist formulation-specific residue data supports risk conclusion for cotton and soybean.	No (risk is limited to the field)	Direct: Yes Indirect: Yes
	Chronic Larval	>0.9-349	Yes	In the available studies, a NOAEL was not established. The assessment considered two different approaches to characterizing the potential for risk. Each of these approaches resulted in a conclusion of risk. Enlist formulation-specific residue data supports risk conclusion for cotton and soybean.	No (risk is limited to the field)	

Taxa	Exposure Duration	Risk Quotient (RQ) Range[1]	Potential Risk to Non-listed Spectes?[3]	Additional Information/Lines of Evidence	Do Direct Risks to Non-Listed Species Extend Beyond the Treated Field?	Potential Effects to Listed Taxa?[4,5]
Other (non-bee) Terrestrial Invertebrates	Acute	EEC to Endpoint Ratio Adult Not Calculated (non-definitive endpoints) Larval 0.015-2.37	Adult Not calculated Larval[2] Yes	RQs were not calculated; EECs were directly compared to available endpoints. Potential for acute risks based on using honey bee larval endpoint when exposures are based on either insect residue or vegetation residue estimates.	No (risk is limited to the field)	Direct: Yes Indirect: Yes
	Chronic	EEC to Endpoint Ratio Adult 0.08-1.34 Larval 1.94-127	Adult[2] Yes Larval[2] Yes	RQs were not calculated; EECs were directly compared to available endpoints. Potential for chronic risks based on using honey bee adult and larval endpoints when exposures are based on either insect residue or vegetation residue estimates.	No (risk is limited to the field)	

Taxa	Exposure Duration	Risk Quotient (RQ) Range[1]	Potential Risk to Non-listed Species?[3]	Additional Information/Lines of Evidence	Do Direct Risks to Non-Listed Species Extend Beyond the Treated Field?	Potential Effects to Listed Taxa?[4,5]
Vascular and Non-vascular Aquatic Plants	N/A	Wetlands Non-listed: 0.4-1.0 Listed: 2.4-6.3 Non-Wetlands Non-listed: <0.1-0.1 Listed: 0.2-0.8	Wetlands Yes Aquatic habitats No	Several exposure scenarios result in exceedances of the IC_{50} values and NOAECs in the available studies based on EECs in the wetland.	Yes Runoff from treated fields is likely to cause threshold level effects to plant growth, reproduction, or survival in wetlands off the field.	Direct: Yes Indirect: Yes
Terrestrial Plants	Upland or Dry-Land Taxa	Non-Listed Taxa 0.1-9.3 Listed Taxa 0.1-12.3	Yes	A refined assessment was conducted considering all label requirements, various refinements of the model parameters, different application scenarios, and variability in species response in the toxicity data, and Species Sensitivity Distributions. Multiple lines of evidence suggest risk for terrestrial and wetland plants as a result of runoff-based exposure.	Yes Runoff from treated fields is likely to cause threshold level effects to plant growth, reproduction, or survival off the field. Spray drift control measures on the label prevent risk from the spray drift route of exposure.	Direct: Yes Indirect: Yes
Terrestrial Plants	Wetlands, riparian areas and species within the flow-path of agricultural runoff	Non-Listed Taxa 0.4-26.9 Listed Taxa 0.4-35.5	Yes			Direct: Yes Indirect: Yes

[1] RQs reflect exposure estimates for 2,4-D and maximum application rates allowed on labels.
[2] RQs and LOC comparisons were not made for this taxon, potential risk was identified if the EECs exceeded the available endpoint.
[3] Non-Listed Level of Concern (LOC) Definitions: Terrestrial Vertebrates: Acute=0.5; Chronic=1.0; Terrestrial Invertebrates: Acute=0.4; Chronic=1.0; Aquatic Animals: Acute=0.5; Chronic=1.0; Plants: 1.0

[4] Listed Level of Concern (LOC) Definitions: Terrestrial Vertebrates: Acute=0.1; Chronic=1.0; Terrestrial Invertebrates: Acute=0.05; Chronic=1.0; Aquatic Animals: Acute=0.05; Chronic=1.0; Plants: 1.0

[5] All listed taxa with "Yes" indicated potential effects are considered further in the Effects Determination (Section 11 of this document).

6 Environmental Risk and Endangered Species Assessment – Glyphosate Including Dimethylammonium Salt

A summary of the environmental fate and ecological effects and risks of glyphosate dimethylammonium salt as assessed in the agency document titled, *2022 Ecological Risk and Endangered Species Assessment for Use on Genetically-Modified Herbicide-Tolerant Corn, Soybean, and Cotton in Support of Registration Renewal Decision for Enlist One and Enlist Duo Products* is provided below. The complete assessment of the May 2021 draft labels and supporting materials are available through docket EPA-HQ-OPP-2021-0957 on regulations.gov. To evaluate the uses of the Enlist products on corn, cotton, and soybean, EPA has evaluated the risk of 2,4-D separately from glyphosate. While application of the Enlist Duo product will result in the simultaneous environmental exposure to both 2,4-D and glyphosate at the time of application, the fate and environmental transport of the two active ingredients is driven by their physiochemical properties. Each of these components of the formulation will result in differential risk profiles following application of the product based on the different toxicity and exposure profiles of the two herbicide active ingredients. This section focuses on the ecological assessment conclusions for glyphosate alone.

EPA's glyphosate ecological assessment for non-listed taxa concludes that there are potential on-field (on the site of application[10]) risks to birds, reptiles, and terrestrial phase amphibians, and terrestrial plants. Risks are considered low for mammals, terrestrial invertebrates, aquatic plants (vascular and non-vascular) and aquatic animals (fish, amphibians, and invertebrates). For species located off the treated field, EPA's evaluation of the potential for off-field exposure to glyphosate through spray drift and/or runoff, taking into account the restrictions on the May 2021 labels, concludes the following about the potential risks:

- The mandatory spray drift control measures on the product labels, including the 30-foot downwind in-field spray drift set back, eliminate LOC exceedances due to spray drift for listed and non-listed off-field birds, reptiles, and terrestrial phase amphibians.
- The same mandatory spray drift control measures eliminate LOC exceedances due to spray drift for listed and non-listed plant effects resulting from spray drift of these products.
- The mandatory runoff control measures on the May 2021 labels reduced exposure; however, these measures did not provide enough reduction to alter the determination of "may affect" for listed plants in terrestrial or wetland habitats that may receive runoff after application. Additionally, the measures on the May 2021 labels were not sufficient to result in RQs below the FIFRA LOC for non-listed plants.
- Monitoring data reinforce the risk conclusions indicating that runoff is a relevant off-site transport pathway for glyphosate.

Furthermore, because plants play an important role in terms of shelter, food, and habitat for animals, there are potential indirect effects to animals, primarily from the runoff exposure to

[10] Impacts can be from direct spray, consumption of contaminated food items or destruction of dietary items.

plants. For monarch butterflies, in addition to direct risks on-field, there are potential indirect adverse effects from glyphosate effects to on-field and off-field milkweed.

Using listed-species levels of concern as a screen (USEPA, 2004), EPA concluded that there are potential on-field effects to terrestrial animals that utilize corn, soybean and/or cotton fields as well as several listed plant species that are assumed to be on these types of fields based on FWS documentation of the species habitat or distribution. The Agency also found potential effects to terrestrial and wetland plants that are exposed to runoff and listed animal species that depend upon plants in terrestrial and wetland areas receiving runoff from Enlist treated corn, cotton or soybean fields. EPA further considered the potential effects to listed species by accounting for their taxon-specific life history and diets in the Effects Determination (USEPA, 2022a). For information on EPA's listed species-specific analysis for the potential direct and indirect effects from the Enlist products[11], see this document's section titled EPA's Effects Determination Under the ESA (Section 11).

Table 2 summarizes EPA's assessment regarding potential risks from glyphosate to non-target non-listed and potential effects to listed taxa on and off the field from the use of Enlist Duo as described on the May 2021 label. Corteva submitted a revised Enlist Duo label to include mitigations that reduce the exposure of listed species to 2,4-D and glyphosate. These mitigations were put in place as a response to EPA's effects determination summarized in Section 11 of this document. An addendum to the effects determination (USEPA, 2022b) was generated, and new listed species and critical habitat effects determinations were made based on the January 2022 revised label. See Section 11 in this document for further details.

[11] The term "direct effects" refers to decreases in the survival, growth, or reproduction of individuals of a listed species due to exposure to 2,4-D or glyphosate. The term "indirect effects" refers to impacts on individuals of a listed species that may be the result of the effects of 2,4-D or glyphosate on organisms on which the listed species depends upon for prey, pollination, habitat, and/or dispersal.

Table 2. Summary of Glyphosate-Based Risk Quotients and Lines of Evidence Relevant to Potential Effects to Non-listed and Listed Species from (May 2021 labeling) Uses of Enlist One and Enlist Duo.

Taxa	Exposure Duration	Risk Quotient (RQ) Range[1]	Potential Risk to Non-listed Species?[2]	Additional Information/Lines of Evidence	Do Direct Risks to Non-Listed Species Extend Beyond the Treated Field?	Potential Effects to Listed Taxa?[3,4]
Aquatic Animals (fish, invertebrates, aquatic phase amphibians)	Acute	< 0.01	No	--	Not Applicable	Direct: No Indirect: Yes
	Chronic	≤ 0.15				
Mammals	Acute	Not calculated (non-definitive endpoints)	No	Acute RQs not calculated; LOC exceedances not expected due to non-definitive (>) endpoints that are higher than exposures by at least 10x.	Not Applicable	Direct: No Indirect: Yes
	Chronic	0.01 – 0.08	No	--		
Birds (including terrestrial phase amphibians and reptiles)	Acute	<0.01 -0.16 (dose) Dietary based not calculated	No	Acute dietary RQ not calculated; LOC exceedances not expected due to non-definitive (>) toxicity endpoints that are higher than EECs by at least 7x.	Not Applicable	Direct: Yes Indirect: Yes
	Chronic	Not Calculated (non-definitive endpoints)	Yes	Potential for chronic risks to birds; effects on male weight gain in mallards reported at the lowest reliable test level.	Risk is uncertain, due to non-definitive (<) endpoint, but is expected to be low due to low drift as a result of the in-field buffer.	

Taxa	Exposure Duration	Risk Quotient (RQ) Range[1]	Potential Risk to Non-listed Species?[2]	Additional Information/Lines of Evidence	Do Direct Risks to Non-Listed Species Extend Beyond the Treated Field?	Potential Effects to Listed Taxa?[3,4]
Honey Bees and Other Non-Apis Terrestrial Invertebrates	Acute Adult	Not Calculated (non-definitive endpoints)	No	Risk is not expected. Endpoints are non-definitive (>); no mortality reported up to the highest level tested for both contact and oral toxicity. EECs are lower than the highest tested level for both contact and oral exposure.	Not Applicable	Direct: No Indirect: Yes
	Chronic Adult	Not Calculated (non-definitive endpoints)	No	Endpoints are non-definitive (>); no significant mortality reported up to the highest level tested. EECs do not exceed the test levels, so risk is not expected. There is some uncertainty as the study tested a different formulation.	Not Applicable	
	Acute Larval	Not Calculated (non-definitive endpoints)	No	Risk not expected. Acute and chronic laboratory-based toxicity data for larvae are not available. A colony feeding study using higher concentrations than the EEC reported no effects on larvae. There is uncertainty in extrapolating to other terrestrial invertebrates.	Not Applicable	Direct: No Indirect: Yes
	Chronic Larval	Not Calculated (non-definitive endpoints)	No			
Vascular and Non-vascular Aquatic Plants	N/A	<0.01	Wetlands No Aquatic habitats No	--	Not Applicable	Direct: No Indirect: Yes
Terrestrial Plants	Upland or Dry-land Taxa	Non-Listed Taxa 18 – 82 Listed Taxa 23.7 - 108	Yes	A refined assessment was conducted considering all label requirements, various refinements of the model parameters, different application scenarios, and variability in species response in the toxicity data. All evidence suggests potential risk to terrestrial plants and species within the flow-path from agricultural fields through runoff-based exposure.	Yes Runoff from treated fields is likely to cause threshold level effects to plant growth, reproduction, or survival off the field. Spray drift control measures on the label prevent risk from the spray drift route of exposure	Direct: Yes Indirect: Yes
Terrestrial Plants	Wetlands, riparian areas and species within the flow-path of agricultural runoff	Non-Listed Taxa 38.6 - 199 Listed Taxa 50 - 262	Yes			Direct: Yes Indirect: Yes

[1] RQs reflect exposure estimates for glyphosate and maximum application rates allowed on labels.
[2] Non-Listed Level of Concern (LOC) Definitions: Terrestrial Vertebrates: Acute=0.5; Chronic=1.0; Terrestrial Invertebrates: Acute=0.4; Chronic=1.0; Aquatic Animals: Acute=0.5; Chronic=1.0; Plants: 1.0
[3] Listed Level of Concern (LOC) Definitions: Terrestrial Vertebrates: Acute=0.1; Chronic=1.0; Terrestrial Invertebrates: Acute=0.05; Chronic=1.0; Aquatic Animals: Acute=0.05; Chronic=1.0; Plants: 1.0
[4] All listed taxa with "Yes" indicated potential effects are considered further in the Effects Determination (Section 11 of this document).

7 Impact on Milkweed

EPA has assessed the impact of Enlist One and Enlist Duo use on milkweed in the EPA document titled, *Characterization of the Impact of the Use of Enlist One and Enlist Duo in Corn, Soybean, and Cotton on In-Field Milkweed Populations* (Orlowski and Kells, 2022; EPA-HQ-OPP-2021-0957). A summary of EPA's assessment is described below.

Milkweed is a perennial weed that can occur in corn, soybean, and cotton fields. Monarch butterflies only lay their eggs on milkweed, and larvae depend exclusively on the plant as their food source; therefore, milkweed is necessary for the growth and development of monarch butterflies. Enlist herbicides may therefore have indirect effects on monarch butterfly populations where milkweed in corn, soybean, and cotton fields is controlled by the Enlist products. EPA identified potential indirect risks to monarch butterflies from the use of Enlist herbicides (USEPA, 2022a).

Due to the importance of fully controlling weeds in crop fields, growers of corn, soybean, and cotton generally remove all weeds, including milkweed, prior to the planting of the crops, and, after planting, weeds are prevented from emerging or are removed with herbicides until the crop achieves canopy closure.

EPA examined market research data as well as state agricultural Extension weed control guides to determine how frequently milkweed is targeted by herbicide programs in corn, soybean, and cotton. EPA also considered how frequently Enlist herbicides are used and recommended for control of milkweed in corn, soybean, and cotton crops. Based on market research data and Extension recommendations, EPA concludes that corn, cotton, and soybean growers rarely specifically target milkweed for control in their fields. When growers do target milkweed, they frequently use glyphosate and other herbicides both prior to and after crop emergence for milkweed control. Market research data suggests that Enlist One and Enlist Duo are not frequently used to target milkweed in corn, soybean, and cotton.

While it is rare for milkweed to be directly targeted with herbicide applications in cotton, soybean, and corn, milkweed may still be exposed to herbicides if it happens to be present in the field at the time of herbicide application. EPA acknowledges that applications of Enlist herbicides, especially Enlist Duo, have the potential to control milkweed when present in the field being treated, even when the milkweed is not directly targeted. Despite this, EPA does not expect the continued registration of Enlist One and Enlist Duo to substantially impact the presence of milkweed in corn, cotton, and soybean fields as Enlist One and Enlist Duo are rarely the only herbicides being used in weed management programs for these crops, and therefore are not likely to be uniquely responsible for control of milkweed present in corn, cotton, or soybean fields. Furthermore, if Enlist One or Enlist Duo were not available for use, growers would adopt other tools to achieve complete weed control, including control of milkweeds present on fields. Growers would likely replace Enlist One and Enlist Duo with other alternative weed control systems or herbicides such as dicamba or glufosinate, for management of herbicide-resistant weeds (e.g. glyphosate-resistant weeds). Growers could also utilize increased tillage and

cultivation in order to remove undesirable weeds in their crops. Therefore, EPA concludes that continued availability of Enlist One and Enlist Duo will have a negligible impact on milkweed species populations on-field relative to the alternative weed management strategies which growers would use in the absence of Enlist One and Enlist Duo.

8 Benefits

The current and future benefits of the Enlist products assessed in the EPA document "*Use, Usage, and Current and Future Benefits of the Enlist One and Enlist Duo Herbicides in Corn, Soybean, and Cotton,"* (Orlowski and Kells, 2022; EPA-HQ-OPP-2021-0957) are summarized below.

The major benefits of the Enlist products remain largely similar to those identified in previous EPA assessments of Enlist (USEPA, 2016;[12]). The 2,4-D component of Enlist products is one of the extremely limited herbicide chemistries and herbicide modes-of-action available for postemergence control of problematic, multiple-herbicide-resistance broadleaf weeds in cotton and soybean. In cases where glyphosate-resistant weeds are not present, Enlist Duo will provide two effective modes of action for weed control as it contains 2,4-D choline salt and glyphosate. Where glyphosate-resistant weeds are present, the 2,4-D component of Enlist Duo will provide an effective mode of action for control of glyphosate-resistant weeds, and glyphosate will control a broad spectrum of non-glyphosate-resistant weeds. Enlist One (which only contains the 2,4-D choline salt) provides control of problematic multiple herbicide-resistant broadleaf weeds. Enlist One also provides greater flexibility for users as it can be tank-mixed with other herbicides, especially glufosinate, which is not an approved tank mix partner for Enlist Duo. Multiple state agricultural Extension agencies consider the combination of Enlist One, which contains 2,4-D alone, tank mixed with glufosinate to be the best combination to control Palmer amaranth; however, data suggests this combination is currently rarely utilized. Enlist One is also commonly tank mixed with glyphosate, allowing greater flexibility in glyphosate rates being applied as compared to Enlist Duo. The use of 2,4-D choline salt for control of these multiple herbicide-resistant broadleaf weeds allows for integrated pest management (IPM) approaches in these crops, and in some cases provides the only effective postemergence herbicide option to manage these problematic weeds. EPA concludes that the benefits of the 2,4-D-containing Enlist herbicides are high in soybean and cotton. While the benefits of Enlist herbicides in corn are lower than in cotton and soybean, due to the existence of alternative generic 2,4-D products labeled for use in corn, users of the Enlist weed management system[13] have additional benefits as compared to producers using non-Enlist corn and generic 2,4-D products. These benefits include a longer application window and increased crop safety.

[12] USEPA. 2016. Review of Benefits as Described by the Registrant of Enlist Duo 2,4-D choline on Herbicide Resistant Enlist Cotton to Improve the Performance of Current Weed Control Systems and Provide New Weed Resistance Management Options. EPA-HQ-OPP-2016-0594-0010.

[13] EPA is referring to the Enlist weed management system as the combination of crops with the Enlist traits plus the use of Enlist herbicides.

The major change in the benefits of 2,4-D choline salt-containing Enlist herbicides as compared to EPA's previous assessments relates to the increases in populations of multiple-herbicide resistant weeds since those older assessments were completed. While EPA's analysis of annual reports from Corteva did not indicate that the Enlist products were specifically associated with reports of herbicide-resistant weeds during the reporting period, academic extension reports of 2,4-D-resistant Palmer amaranth in Tennessee are indicators that resistance cases associated with Enlist product use have already occurred, and EPA expects that incidents of 2,4-D resistance related to Enlist products will increase in the future. EPA also notes resistance to dicamba also appears to confer resistance to 2,4-D in Palmer amaranth, and research indicates that other problematic weed species, such as waterhemp, can also show frequent instances of cross-resistance between similar herbicides. Because of these incidents, EPA concludes that the benefits to the use of Enlist One and Enlist Duo products have decreased compared to previous EPA benefits assessments. Despite this change in benefits, Enlist One and Enlist Duo continue to provide high benefits for soybean and cotton, and are highly important products for control of problematic herbicide resistant broadleaf weeds, generally.

9 Herbicide Resistance

The current picture of synthetic auxin herbicide resistance assessed in the EPA document "*Use, Usage, and Current and Future Benefits of the Enlist One and Enlist Duo Herbicides in Corn, Soybean, and Cotton,"* (Orlowski and Kells, 2022; EPA-HQ-OPP-2021-0957) is summarized below.

Extension reports from the 2020 and 2021 growing seasons suggest Palmer amaranth is developing resistance to synthetic auxin herbicides, particularly dicamba and 2,4-D. In 2020, Extension weed scientists have reported decreased Palmer amaranth sensitivity to dicamba in at least five states, with dicamba-resistant Palmer amaranth being confirmed in Tennessee. State Extension weed scientists in two of these states, Tennessee and Arkansas, report that decreased sensitivity to dicamba also confers resistance to 2,4-D and state Extension weed scientists in Tennessee have already issued multiple reports of Palmer amaranth in Tennessee that is resistant to 2,4-D. However, excluding the most recently confirmed instances of 2,4-D resistance in Palmer amaranth due to cross-resistance, other instances of weed resistance to 2,4-D occurred before registration of Enlist herbicides or in use sites where Enlist herbicides are not registered (ie. sorghum). Furthermore, there were no reports of instances of lack of herbicide efficacy for Enlist herbicides between 2015 and 2020 in annual reports submitted by Corteva or through open literature searches suggesting that weed resistance directly related to the use Enlist herbicides is currently rare.

Although currently confirmed cases of 2,4-D resistance may not necessarily be related to Enlist One and Enlist Duo applications, the application of dicamba and 2,4-D associated with the Xtend and Enlist weed management systems, respectively, across millions of acres coupled with the reported cross resistance in Palmer amaranth to dicamba and 2,4-D poses threat to the potential benefits of Enlist One and Enlist Duo in the future and the situation should be monitored closely. However, the use of herbicide-tolerant systems that allow for the use of multiple effective modes of action, including the Enlist weed control system, coupled with best management practices for

herbicide resistance management can significantly help limit the further development of weed resistance.

10 Registration Decision

In accordance with FIFRA section 3(c)(5), EPA must register a pesticide when it finds that the use will not generally cause unreasonable adverse effects[14] on human health or the environment, taking into account the economic, social, and environmental costs and benefits of the use of the pesticide. FIFRA section 3(c)(5) specifically requires EPA to register a pesticide if the Agency determines:

> (A) its composition is such as to warrant the proposed claims for it;
> (B) its labeling and other material required to be submitted comply with the requirements of FIFRA;
> (C) it will perform its intended function without unreasonable adverse effects on the environment; and
> (D) when used in accordance with widespread and commonly recognized practice it will not generally cause unreasonable adverse effects on the environment.

EPA reviewed the compositions of both products and determined that the claims made are warranted and the information supports the approval of the registrations. EPA, under the authority of Congress, has waived by regulation, data requirements as to efficacy issues for all agricultural pesticides; therefore, no efficacy data were reviewed in support of this registration decision. This regulation is further explained in Pesticide Registration Notice 96-4. The final labeling, which has been revised to include additional mitigation measures to address ecological risks and reduce potential exposures to listed species as described more fully below (Section 10.4), contains all the necessary requirements and restrictions and complies with the requirements of FIFRA. To determine whether the products will cause unreasonable adverse effects, EPA is charged with considering the economic, social, and environmental costs and benefits of the use of the pesticide. To determine the risks and benefits, the Agency reviewed a large body of information to determine how these products have been and may be used according to the final labeling. EPA determines whether a product will generally cause unreasonable adverse effects by considering whether the benefits of the product outweigh any potential risks of concern or adverse impacts from its use. EPA has determined that these products will perform their intended function without unreasonable adverse effects on the environment and that registering the products will not generally cause unreasonable adverse effects on the environment when used in accordance with widespread and commonly recognized practice, with the implementation of specific mitigation measures and updated terms of registrations as outlined below in Section 10.4 and Section 10.5.

The database submitted to support the assessment of human health risk is sufficient for a full hazard evaluation and is considered complete and adequate to evaluate risks to the general

[14] FIFRA section 2(bb) defines, in pertinent part, "unreasonable adverse effects" as "any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide…."

population including infants and children. The Agency has not identified any risks of concern for human health, including all population subgroups, or for occupational handlers. EPA also considered the potential for risks to plants and wildlife and identified mitigation measures appropriate to address those risks and considered the benefits and impacts of the use, as discussed in the next section (Section 10.1). All registration review data call-in requirements have been satisfied.

Based on these considerations, consistent with the requirements of FIFRA section 3(c)(5), EPA concludes that granting these amendments as set forth below will not cause any unreasonable adverse effect on the environment when the herbicides are used in accordance with the labels and widespread and commonly recognized practice. Additionally, EPA completed ESA effects determinations for these actions for listed species and designated critical habitat (Section 11). EPA made may affect likely to adversely affect determinations, therefore the Agency initiated consultation under ESA section 7(a)(2). EPA determined that granting these actions while in consultation is consistent with ESA section 7(d). This determination is in a standalone supporting document on www.regulations.gov under docket number EPA-HQ-OPP-2021-0957. Accordingly, the Agency has accepted these amendments for expiration date extensions and will extend the registrations by a period of seven years, ending on January 11, 2029, with certain terms and label mitigations necessary to meet the FIFRA standard and comply with ESA sections 7(a)(2) and 7(d).

10.1 Addressing Ecological Risk under FIFRA

EPA's ecological risk assessment on 2,4-D concluded that there are potential on-field risks to the following non-listed taxa prior to the submission of the revised Enlist One and Enlist Duo labels: terrestrial vertebrates (mammals, birds, amphibians, and reptiles), terrestrial invertebrates (including but not limited to bees and the monarch butterfly), and terrestrial and wetland plants. The ecological risk assessment on glyphosate concludes that there is potential on-field chronic risk to non-listed animals (birds, terrestrial-phase amphibians, and reptiles) and potential risk to non-listed terrestrial and wetland plants. In addition, there are potential indirect effects to monarch butterflies due to the effects to or removal of milkweed from fields or in adjacent off-field areas following 2,4-D or glyphosate exposure. For more specific information on risk, see the Environmental Risk Assessment sections in this decision document for each active ingredient (Sections 5 and 6). The spray drift reduction measures included on the May 2021 labels reduce spray drift to the point that off-field risks from spray drift for non-target plants and animals are not expected; however, the May 2021 label did not have adequate measures to address the l potential off-field risk to terrestrial and wetland plants from runoff.

While models indicate the potential for on-field risk to non-listed birds, reptiles, terrestrial phase amphibians, and mammals from either 2,4-D or glyphosate, the assessments include several conservative assumptions about diet, including that animal diet comes exclusively from treated areas. Spray drift mitigations on the labels (30 foot in-field buffer for areas downwind of the application) are sufficient to reduce off-field exposures so that spray drift does not pose a risk to non-target organisms. For animals with a wide range of habitat and varied diets, some portion of

their diet is expected to come from areas not treated with Enlist One or Enlist Duo. Therefore, EPA expects that actual exposures to these pesticides will be lower than estimated for these animals and that risk to these animals would be less than for animals with primarily on-field feeding habits. For on-field listed species, the Effects Determination included exposure refinements based on the species-specific diets. In consideration of these refinements, county-level prohibitions are included on the January 2022 final labels to protect threatened and endangered animal species that may be located on use sites as described in Section 11.

To minimize the risk from 2,4-D to honey bees and other pollinators on-field, EPA determined that timing restrictions were necessary to prohibit applications during blooming periods when bees are likely to be foraging. Specifically, revised labels include growth-stage-based timing restrictions specifying that applications may only be made through the R1[15] stage of soybeans and up to the first white bloom of cotton crops. These restrictions will minimize applications during flowering periods of these crops and will result in reduced exposure of bees and other pollinators that could be actively visiting the field during flowering. Enlist corn crops did not require an addition of a similar prohibition because the current labels only allow applications up to the V8[16] growth stage and therefore already restrict applications to the period before tasseling and before pollen would be present for potential consumption by pollinators. EPA also determined that updated environmental hazard and non-target organism language is necessary to clearly communicate the acute and chronic risk from 2,4-D to invertebrate pollinators (including monarch larvae located on milkweed) from direct applications of 2,4-D.

In general, terrestrial invertebrate risk from glyphosate is low. However, as discussed above, monarch butterflies use milkweed for obligate habitat, and therefore there is potential for indirect risk to monarchs through impacts to on-field milkweed plants, due to Enlist Duo applications, and off-field milkweed plants due to runoff of 2,4-D and glyphosate from the treated field. This indirect risk also applies to Enlist One, but the level of effects expected for on-field milkweed from 2,4-D alone are uncertain and application of 2,4-D may suppress, but may or may not control, on-field milkweed. While Enlist One and Enlist Duo may be applied to fields where milkweeds are present, EPA does not expect the use of these products to substantially impact the presence of milkweed in corn, cotton, and soybean fields when considering other methods of weed control that will also be used. Most fields are treated with multiple applications of stand-alone glyphosate or other products besides Enlist One or Enlist Duo, and fewer than 10% of growers report applying only Enlist herbicide products during the growing season. In addition, weed control is one of the primary land management goals within agricultural fields, so if growers choose not to control weeds through the use of herbicides, milkweeds would likely still be controlled through mechanical weed control methods such as cultivation. Therefore, EPA concludes that registration of Enlist herbicides will have a negligible impact to on field milkweed availability to monarchs relative to the alternative weed management strategies which growers would use in the absence of Enlist herbicide products (USEPA, 2022c;[17]), and while adverse effects to on-field and off-field milkweed from the use of Enlist herbicides may occur, the

[15] R1 growth stage in soybeans refers to the first reproductive stage or the "beginning flowering" stage.
[16] V8 growth stage in corn refers to the vegetative stage at which eight leaf collars are present.
[17] USEPA. 2022d. *Characterization of the Impact of the Use of Enlist One and Enlist Duo in Corn, Soybean, and Cotton on In-Field Milkweed Populations*. (Orlowski and Kells, 2021). EPA-HQ-OPP-2021-0957

likelihood of those effects are not unreasonable given the weed management goals within agricultural fields are to remove all weed pests that could take resources from the crop. In addition, these weed management goals minimize potential for direct adverse effects from Enlist One or Enlist Duo to monarch larvae, since few milkweed plants are expected to be present in fields during Enlist One or Enlist Duo applications where monarch larvae could be feeding.

Despite this conclusion, EPA acknowledges that any removal of milkweed from fields treated with Enlist herbicides, no matter how negligible, may still result in a decrease in available habitat for monarch butterflies. Therefore, EPA has determined that Corteva must develop, implement, maintain, and annually update a pollinator protection stewardship plan. The purpose of this plan is to address potential impacts from the products' use to insect pollinators, including bees and butterflies. This plan must include education materials that describe the importance of pollinator protection in agriculture and best management practices to reduce potential pesticide exposure to pollinators including, but not exclusive, to monarch butterflies. Education materials must also describe label provisions intended to minimize the potential for product exposure to pollinators, including updated environmental hazard and non-target organism advisory statements, and new application timing restrictions. Additionally, the pollinator protection stewardship plan must include conservation activities that result in meaningful restoration of habitat used by monarch butterflies and other insect pollinators to address potential impacts from the products' use, taking into account species' range and habitat requirements.

To mitigate risk to non-listed off-target terrestrial and wetland plants, EPA determined that appropriate runoff mitigation measures are necessary to minimize off-site exposures. Specific measures include: prohibition of use when rainfall is predicted within 48 hours; prohibition of irrigation within 48 hours of application; prohibition of use to soils that are saturated or at field capacity; and required implementation of a subset of mitigation measures as described in a "pick-list". Applicators must select measures from the pick list that combine to a minimum number of "credits" (4 or 6 depending on soil type), which will result in a significant reduction in runoff transport of 2,4-D and glyphosate to terrestrial and wetland habitats (further details describing the runoff mitigations are outlined in Section 10.4). The pick list is designed to allow Enlist applicators flexibility in the measures that will be used in their fields while also ensuring that the combined mitigations result in a significant reduction of pesticide movement into non-target areas. Additionally, EPA determined certain education and training components were necessary for these registrations. Corteva agreed to develop and implement education and training components relevant to runoff mitigation requirements, which are summarized in the Registration Terms section below (Section 10.5).

As stated in Section 8., EPA has determined that the benefits of Enlist One and Enlist Duo are high in soybean and cotton but lower in corn due the availability of alternative 2,4-D herbicides labeled for use in corn (USEPA, 2022c). Although the benefits associated with the corn use are lower than in soybean and cotton due to the availability of early post-emergence applications of generic 2,4-D products in corn, users of the Enlist weed management system have additional benefits as compared to producers using non-Enlist corn and generic 2,4-D products. These benefits include a longer application window and increased crop safety. At the same time Enlist One and Enlist Duo will carry less ecological risk than the generic alternative products due to

stricter limitations included on the revised labels that are not currently included on generic 2,4-D labels containing uses in corn. After weighing the risks of concern to non-listed species against the benefits of these uses, EPA finds that with the required mitigation measures for these uses as described above and applied on the revised labels, the benefits of the use of Enlist One and Enlist Duo outweigh the risks associated with Enlist One and Enlist Duo use in corn, cotton and soybean fields. As noted in Section 9, the development of herbicide resistant weeds continues to be a threat to the benefits of the Enlist weed control system. EPA will continue to monitor the development of herbicide resistance, and per EPA's determination that pre- and post-application scouting was necessary, the January 2022 final labels for Enlist One and Enlist Duo include these requirements. Additionally, EPA has made changes to the annual reporting and testing requirements associated with the herbicide resistance management plan, to help facilitate active monitoring of the continued development of herbicide resistance that may change the associated benefits of Enlist One and Enlist Duo. These changes are explained in more detail in Section 10.5.

10.2 Impacts of Mitigations to Growers

Prior to finalizing the mitigations described in Section 10.1, EPA considered the impacts of requiring the mitigation for these registrations. These impacts are assessed in the EPA document "*Registration Renewal of Enlist 2,4-D on Genetically Modified 2,4-D-Tolerant Corn, Cotton and Soybean: Incidents and Impacts of Potential Mitigation. (Orlowski and Kells 2022)*" are summarized below.

10.2.1 County-Level Prohibition of Enlist One and Enlist Duo

For cotton and soybean growers currently using Enlist herbicides in counties where use of Enlist One and Enlist Duo herbicides will be prohibited, growers would have no choice but to seek alternative seed varieties and herbicides to replace the Enlist weed control system. These prohibitions would affect approximately 4% of cotton, 1% of corn, and a negligible percent of soybean acres nationally. For counties where only Enlist Duo will be prohibited, EPA does not expect substantial impacts as growers will still be able to use Enlist One in these prohibited counties.

10.2.2 Impact on Growers from the Growth Stage Cutoff

A restriction on post-emergence applications after the end of the R1 growth stage in soybean or after the first white bloom in cotton would limit grower ability to make multiple postemergence applications. As cotton growers use two postemergence Enlist applications more frequently than soybean producers, more cotton growers may be impacted by a cutoff that is more restrictive than the currently registered label. EPA expects that restrictions before the start of the first white bloom growth in cotton and restrictions at or before the start of the R1 growth stage in soybeans would likely make the product unusable for producers and force them to switch to alternative weed control systems.

10.2.3 Impact on Growers Implementing Runoff Mitigations

Prohibition of applications within 48 hours of forecasted rainfall

Prohibiting applications of Enlist One and Enlist Duo when rain is forecasted within 48 hours of the application could delay time-sensitive herbicide applications and may limit the number of available hours applicators are able to apply Enlist One and Enlist Duo. The impact from this mitigation will vary based on the prevailing frequency of rainfall in the area where the Enlist herbicides are being applied. If rainfall is frequent enough, it could prevent growers from applying Enlist herbicides in a timely manner for effective weed control, possibly resulting in poor weed control or necessitating the use of alternative herbicides that do not have the 48-hour rainfall restriction. The previous Enlist labels already contained a prohibition of applications within 24 hours of predicted rainfall. The new label requirement of a 48-hour rainfall prohibition doubles the time period of the prohibition but does not add an entirely new category of burden on applicators.

Prohibition of irrigation within 48 hours of applications

Because irrigation is controlled by the user, this prohibition may impact growers less than the prohibition of applications within 48 hours of forecasted rainfall. However, impacts aren't negligible as timely applications of Enlist herbicides are necessary to achieve control of target weeds. If applications must be made during a period where water is also necessary, growers could be forced to choose between delaying their applications of Enlist One and Enlist Duo to water the crop or delaying their irrigation in favor of controlling the weeds. Delaying their herbicide applications could decrease the efficacy of the Enlist One and Enlist Duo against target weeds, resulting in poor weed control and subsequent decrease in crop yield in addition to potentially accelerating the development of herbicide resistance. If a grower forgoes a necessary irrigation for 48 hours in order to apply Enlist herbicides, crop yield and quality could also be reduced. The previous Enlist labels associated with the expiring registration already contained an irrigation prohibition for 24 hours after applications of either Enlist One or Enlist Duo. The new label requirement of a 48-hour prohibition doubles the time period of the prohibition but does not add an entirely new category of burden on applicators.

Prohibition of applications to soils which are saturated or at field capacity

Because the Enlist One and Enlist Duo labels prohibit aerial applications, ground equipment must be used to apply the herbicides. Generally, growers aim to avoid driving equipment in fields when the soils are saturated because operating in muddy conditions can lead to risks of equipment getting stuck, as well as other consequences such as increased soil compaction. As such, impacts from this mitigation are expected to be minimal. While ground applications to saturated soils are unlikely, the application window for weed species targeted with Enlist herbicides is narrow and growers may need to apply herbicides when soil conditions are saturated. Therefore, the soil saturation restriction could reduce the ability of growers to apply Enlist herbicides, potentially resulting in reduced control of problematic weeds. The impact to

users will also vary by soil textural class, as some soils will retain water longer than others, possibly affecting the potential application window for Enlist herbicides.

Implementation of a runoff mitigation practice "pick-list"

The difficulty of adopting runoff mitigations from the pick-list will vary by grower based on their experience with each practice and on the characteristics of their land. Some land may be more adaptable to a particular conservation practice while others may be more challenging. In situations where land characteristics pose a challenge to implementation of runoff mitigations identified in the pick-list, growers will face higher costs (in terms of adoption time, land management, and knowledge of conservation practices) to comply with the runoff mitigation credit requirement.

EPA expects that growers will select the least burdensome method to achieve the points necessary to use Enlist herbicides. Growers will choose to adopt management practices that are appropriate to their production system, the physical characteristics of each piece of land that they own, or area of the country. However, if the grower is not familiar with the management practices, they will have to become acquainted with the requirement(s) and the specific practices they choose to pursue.

In many cases, EPA expects that growers may already be utilizing some of these practices in their current production practices. For example, growers may already be utilizing cover crops as part of their production system, and for these growers, the impact of achieving the necessary credits for runoff reduction via cover crops will be negligible. Growers already utilizing multiple practices intended to reduce runoff as part of their production systems may achieve the required number of credits with their current practices. The impact of adopting the labeled practices will impose negligible burden on these growers.

For some growers the cost of achieving runoff reduction equivalent to the required credits could be substantial. The process may take more than one growing season to implement – and these growers would be unable to use Enlist One or Enlist Duo during this period. If the cost of achieving sufficient points of conservation practices is greater than the value growers expect to receive from being able to use Enlist herbicides, these growers will likely choose to utilize alternative weed control systems.

10.3 Data Requirements

All data requirements associated with any registration review data call-ins have been satisfied for 2,4-D and glyphosate.

10.4 Labeling Requirements

This section reflects mitigations that have been included on the revised labels. The final stamped labels are available in docket EPA-HQ-OPP-2021-0957 on regulations.gov.

10.4.1 Environmental Hazard Statements

Revised environmental hazard language has been added to alert users of the products to the risks to pollinators and off-target plants due to runoff and to provide information on how to mitigate those risks. Additional ground and surface water statements are also included. These Environmental Hazards statements provide the precautionary language informing users of the potential hazards to the environment from use of the product and associated restrictions of use. Additional restrictions protecting the environment are included in the Directions for Use. The language as updated is as follows:

10.4.1.1 Enlist Duo (EPA Reg. No. 62719-649)

> "This pesticide is toxic to fish and aquatic invertebrates. Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high-water mark. Do not contaminate water when disposing of equipment washwaters or rinsate. Drift or runoff may adversely affect aquatic invertebrates, sensitive wetland environments, and non-target plants. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas.
>
> This product is toxic to plants and may adversely impact the forage and habitat of non-target organisms, including pollinators, in areas adjacent to the treated site. Protect the forage and habitat of non-target organisms by following label directions intended to minimize spray drift and runoff.
>
> This product is moderately toxic to bees on an acute basis, and may cause chronic risk to pollinators or other terrestrial invertebrates. Do not apply this product to blooming vegetation or if bees or other pollinating insects are visiting the treatment area
>
> This product may impact surface water quality due to runoff of rainwater. This is especially true for poorly draining soils and soils with shallow ground water. This product is classified as having high potential for reaching surface water via runoff for several days to months after application.
>
> A level, well-maintained vegetative buffer strip between areas to which this product is applied and surface water features such as ponds, streams, and springs will reduce the potential loading of 2,4-D and glyphosate from runoff water and sediment. Runoff of this product will be reduced by avoiding applications when rainfall or irrigation is expected to occur within 48 hours. Sound erosion control practices will reduce this product's potential to reach aquatic sediment via runoff.
>
> 2,4-D and glyphosate are known to leach through soil into groundwater under certain conditions as a result of label use. This chemical may leach into groundwater if used in areas where soils are permeable, particularly where the water table is shallow. Application around a cistern or well may result in contamination of drinking water or ground water."

10.4.1.2 Enlist One® (EPA Reg. No. 62719-695)

> "This pesticide is toxic to fish and aquatic invertebrates. Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high-water mark. Do not contaminate water when disposing of equipment washwaters or rinsate. Drift or runoff may adversely affect aquatic invertebrates, sensitive wetland environments, and non-target plants. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas."
>
> "This product is toxic to plants and may adversely impact the forage and habitat of non-target organisms, including pollinators, in areas adjacent to the treated site. Protect the forage and habitat of non-target organisms by following label directions intended to minimize spray drift and runoff."
>
> "This product is moderately toxic to bees on an acute basis, and may cause chronic risk to pollinators or other terrestrial invertebrates. Do not apply this product to blooming vegetation or if bees or other pollinating insects are visiting the treatment area."
>
> "This product may impact surface water quality due to runoff of rainwater. This is especially true for poorly draining soils and soils with shallow ground water. This product is classified as having high potential for reaching surface water via runoff for several days to weeks after application."
>
> "A level, well-maintained vegetative buffer strip between areas to which this product is applied and surface water features such as ponds, streams, and springs will reduce the potential loading of 2,4-D from runoff water and sediment. Runoff of this product will be reduced by avoiding applications when rainfall or irrigation is expected to occur within 48 hours."
>
> "2,4-D is known to leach through soil into groundwater under certain conditions as a result of label use. This chemical may leach into groundwater if used in areas where soils are permeable, particularly where the water table is shallow. Application around a cistern or well may result in contamination of drinking water or groundwater."

10.4.2 Directions for Use

Endangered and Threatened Species (listed species):

The labels prohibit use of Enlist One and/or Enlist Duo in counties where potential effects to listed species on-field (on the application site) were identified in the ecological risk assessment and effects determination (see Section 11 for details). All counties with use prohibition are listed on the labels.

EPA is aware that Enlist One may be tank mixed with other products that may include glyphosate. EPA has determined that restricting the use of Enlist One to prohibit mixing with glyphosate products is not necessary during the pendency of consultation. As discussed above, the Enlist One label includes runoff mitigation that includes a prohibition of applications within 48 hours of when rainfall is predicted or irrigation occurs, and to saturated soils. When tank mixing, users must follow the most restrictive directions for use from any of the mixed products. Therefore, for tank mixes that include Enlist One, this mitigation would provide corresponding exposure reduction for all products included in the tank mix (e.g., including products containing glyphosate).

For example, as noted above, Enlist One users must select runoff mitigation measures that involve reduced chemical loading, runoff reduction or runoff capture. Applicators using Enlist One are required to implement certain measures from a "pick list" of options that combine to a minimum number of "credits" (four or six, depending on soil type), which have been determined to significantly reduce runoff transport of 2,4-D (and would provide the same reduction for any pesticide that is tank mixed with Enlist One) to off-field habitats. Enlist One users with A/B soils[18] could choose to only make one Enlist One application and not need any additional mitigations. In this case, the 48-hour prohibition of applications after rainfall and irrigation and prohibition to saturated soil would still serve to reduce runoff of other pesticides in the tank mix. Growers with A/B soils who apply 2 or 3 applications at the maximum label rate are required to implement other runoff mitigation measures (i.e., runoff reduction or capture). In addition, for Enlist One users with C/D soils to achieve the minimum number of points, some runoff reduction or capture measures are needed even if chemical loading is addressed.

EPA expects that the mitigation measures for runoff reduction and capture of runoff on the Enlist One label will help reduce potential impacts of other pesticide products, including glyphosate, when tank mixed and applied on the same fields where Enlist One is used. This will likely serve to reduce pesticide exposures in off-field terrestrial and wetland habitats, including Enlist One applications that involve tank mixing with glyphosate products. Therefore, these restrictions, in turn, would reduce the runoff exposures from glyphosate in contrast to exposure from glyphosate used separately were Enlist One not available.

In the transition time between the extension of the Enlist One registration and the implementation of necessary mitigations on all glyphosate products resulting from consultation on the active ingredient glyphosate, runoff mitigations on Enlist One should provide some protection for listed species adjacent to fields where Enlist One is applied (because on-field and off-field mitigation practices serve to reduce runoff concentrations of other pesticides applied to the same fields).

[18] Hydrologic Soil Group (HSG) definitions: A = Sand, loamy sand, or sandy loam; B = Sandy clay loam; C = Silt loam or loam; D = Clay loam, silty clay loam, sandy clay, silty clay or clay. For land with Hydrologic Soil Groups A & B, the land manager/applicator must effectively implement measures in the following tables to equal a minimum of four credits. For land with Hydrologic Soil Groups C & D the land manager/applicator must effectively implement the measures in the following tables to equal a minimum of six credits.

If EPA took a similar approach as it did for Enlist Duo to avoid exposure to on-field animals additionally exposed to glyphosate in tank mixes by off-labeling of specific counties that include the ranges of those animal species, it would prohibit tank mixes of Enlist One with glyphosate in the 39 counties. EPA has not done so because EPA expects that growers would forego the use of Enlist One and instead use glyphosate alone or with other companion herbicides for resistance management. Since glyphosate labels do not currently include mitigations to avoid exposure to these listed animals nor do they contain mitigations to address potential run-off to the same extent, restricting the Enlist One product would potentially lead to increased likelihood of jeopardy and adverse modification where other glyphosate end use products are used in lieu of Enlist One. EPA also acknowledges that through the consultation process, FWS could determine additional restrictions are necessary to further protect listed species and designated critical habitats.

EPA is not developing Endangered Species Protection Bulletins for the Enlist products because the county prohibitions are on the labels. Additionally, EPA is currently in formal consultation with U.S. Fish and Wildlife Service (FWS). To enable expedient implementation of any necessary changes to the registration following completion of consultation, the labels include the following necessary language, which will allow EPA to further restrict use of these products in specific geographic areas through "Bulletins Live Two", if appropriate:

> "It is a Federal offense to use any pesticide in a manner that results in an unauthorized "take" (e.g., kill or otherwise harm) of an endangered species and certain threatened species, under the Endangered Species Act section 9. When using this product, you must follow the measures contained in the Endangered Species Protection Bulletin for the area in which you are applying the product. You must obtain a Bulletin no earlier than six months before using this product. To obtain Bulletins, consult http://www.epa.gov/espp/, call 1-844-447-3813, or email ESPP@epa.gov. You must use the Bulletin valid for the month in which you will apply the product."

10.4.2.1 Herbicide Resistance Management

To maintain Enlist herbicides as a useful tool in the face of the increasing development of herbicide resistance in problematic weeds, additional scouting requirements have been added to the herbicide resistance requirements labeling. The scouting requirements are aimed at prolonging the lifetime of 2,4-D choline over-the-top use by targeting applications to field conditions and identifying escapes in an attempt to find resistant populations before they become widespread. The revised label includes the following:

> "To aid in the prevention of developing weeds resistant to this product, the following steps must be followed:

- Scout fields before application to ensure herbicides and rates will be appropriate for the weed species and weed sizes present."
- "Scout fields after application to detect weed escapes or shifts in weed species."

10.4.2.2 Runoff Mitigation

As stated previously, a concern identified in the ecological assessments was off-field movement of 2,4-D and glyphosate in runoff resulting in potential adverse effects to non-target plants. Runoff of 2,4-D and glyphosate results in direct risk concerns for plants in terrestrial and wetland areas receiving runoff and indirect risk concerns to animals that rely upon terrestrial or wetland plants for food or habitat. These concerns include potential direct and indirect effects to listed species. To support EPA's determination that this action is not likely to jeopardize listed species or adversely modify[19] designated critical habitat and reduce the potential for take for listed species and critical habitats, measures to minimize 2,4-D and glyphosate concentrations in runoff through management of pesticide loading to the treated field, improving retention of pesticide on the field, and capturing runoff adjacent to the field were necessary. To address needed reductions in exposure, EPA and Corteva agreed upon a set of mitigations that are included on the revised Enlist One and Enlist Duo product labels. Some of these mitigations are required for all uses and others are available as a pick-list from which the applicator and land manager/grower could identify as appropriate for their fields. Applicators must select measures from the pick-list that combine to a minimum number of "credits" (4 or 6 depending on soil type), which will result in a significant reduction in runoff transport of 2,4-D and glyphosate to terrestrial and wetland habitats. The pick list is designed to allow Enlist applicators flexibility in the mitigations that will be used in their fields while also ensuring that the combined mitigations result in a significant reduction of pesticide movement into non-target areas.

Measures required for all uses include restrictions of application timing relative to rainfall and irrigation, as well as restrictions on applications to saturated soils or soils at field capacity. These measures provide additional time for 2,4-D and glyphosate to move into the soil and reduce their potential for runoff.

> "Do not apply this product when soil is saturated or at field capacity, or when a storm event likely to produce runoff from the treated area is forecasted (by NOAA/National Weather Service, or other similar forecasting service) to occur within 48 hours following application."
>
> "Do not irrigate treated fields within 48 hours of application."

The mitigations required for all uses result in a substantial reduction in runoff exposure; however, additional runoff concentration reduction is still needed. The following hydraulic soil group statements and accompanying pick-list of mitigation measures have been added to the Enlist One and Enlist Duo labels in order to further minimize runoff:

> "For land with Hydrologic Soil Groups* A & B: The land manager/applicator must effectively implement the practices in the following tables to equal a minimum of 4

[19] "Adversely modify" is used in this document to represent both destruction and adverse modification of designated critical habitat.

credits."

"For land with Hydrologic Soil Groups* C & D: The land manager/applicator must effectively implement the practices in the following tables to equal a minimum of 6 credits."

Mitigation Measures	Credits
Reduced Chemical Loading Reduced number of applications of the products per year. Applications may be made at any time during crop development, but must maintain a minimum 12-day retreatment interval	3 applications = 0 2 applications = 2 1 application = 4
Residue and Tillage Management: no-till, strip-till, ridge-till, and mulch-till.	4
Vegetative Filter Strips • 30 foot off-field vegetative buffer on down slope • 100 foot off-field vegetative buffer on down slope	30ft: Hydrologic Group A or B soils = 2 100ft: Hydrologic Group A or B soils = 4 Hydrologic Group C or D soils = 1
Cover Crop	2
Contour Buffer Strips or Terracing or Vegetative Barrier	2
Field Border or Grassed Waterways	2
Water and Sediment Basins	1
Contour Farming or Contour Strip cropping	1

"*Hydrologic Soil Group (HSG) definitions: A = Sand, loamy sand, or sandy loam; B = Sandy clay loam; C= Silt loam or loam; D = Clay loam, silty clay loam, sandy clay, silty clay or clay."

"Applicators must meet minimum criteria described for each mitigation measure as outlined on Enlist.com/mitigationmeasures to receive credits."

EPA has required that Corteva maintains a website as www.Enlist.com/mitigationmeasures that serves as collateral labelling outlining minimum criteria that must be met to receive credits. The purpose of this collateral labelling is to briefly describe and specify the minimum requirements associated with each mitigation measure. If an Enlist user selects a given mitigation measure but does not meet the minimum requirements described in the collateral labeling for that measure, the application of Enlist will not be compliant with the legal requirements of the label.

Each of the mitigation measures function by reducing potential for runoff and/or catching runoff and allowing time for infiltration into the soil, degradation, or plant uptake (USEPA, 2022b). Ultimately, this results in a reduction of sediment bound and dissolved pesticide concentrations reaching terrestrial, wetland and aquatic habitats. Based on the reductions in 2,4-D and glyphosate concentrations as a result of these combined measures, EPA determined that listed

species will not likely be jeopardized and no designated critical habitats will be adversely modified from the use of the Enlist products. EPA also determined that the added mitigation measures will minimize the potential for take. See Section 11 of this document for more discussion.

10.4.2.3 Pollinator Protection

EPA identified RQs exceeding the LOC for acute and chronic exposure to honey bees. EPA also identified risks to other species of terrestrial invertebrates. To protect pollinating insects present on the field, the labels include prohibitions that minimize applications during times periods where pollinator-attractive flowers may be expected in the field.

For Enlist soybean, the restriction prohibits application after the R1 stage. The revised Enlist soybean use instructions and accompanying restriction reads as follows:

> "Apply when weeds are no larger than 6 inches and any time after soybean emergence through the R1 growth stage."
>
> "Do not apply after the R1 growth stage."

The pollinator-protection restriction for Enlist cotton prohibits any application after the appearance of the first white bloom at the application site. The revised Enlist cotton use instructions and accompanying restriction reads as follows:

> "Apply when weeds are no larger than 6 inches and any time after cotton emergence up to first white bloom."
>
> "Do not apply after first white bloom."

EPA is not requiring corn restrictions beyond what is already on the label. The current labels do not allow applications after the V8 stage in Enlist corn. Therefore, during application, no corn tassels are expected to be present, no pollen is expected to be present to attract pollinators, and exposure to potentially contaminated corn pollen is not expected.

10.5 Registration Terms

10.5.1 7-year Time-Limitation

EPA has determined that a seven-year time-limitation is appropriate for the registration amendments. Each registration will automatically expire, unless EPA takes further action, at the end of the 7-year period. Extending the Enlist registrations for an additional seven years will enable corn, cotton, and soybean growers to have continued access for at least a limited time to a tool that is important to control glyphosate-resistant weeds, while simultaneously allowing EPA and states to monitor the impacts of the new mitigation measures and positioning the Agency to

be responsive to any unexpected impacts. The length of registration will not be the only mechanism allowing for this decision to be revisited as the Enlist registration terms require registrations to be updated depending on the outcome of the ESA consultations with FWS (Section 10.5.3). This time-limited registration also allows EPA to monitor incidents of herbicide resistance.

10.5.2 Endangered Species Protection and Formal Consultation

EPA concluded that the mitigation measures on these registrations and labeling will reduce pesticide exposure to an extent that use of the Enlist products will not jeopardize any listed species or adversely modify their designated critical habitats. If FWS adopts these conclusions, they will provide this determination in their biological opinion. However, if consultation with FWS results in a jeopardy or adverse modification determination for any listed species or critical habitat or additional mitigations needed to minimize take, then EPA will require Corteva to submit registration amendments to include any necessary changes, including amended labels. Additionally, FWS may issue a no jeopardy opinion based on changes outside of any RPAs. To address the possibility that additional measures may be necessary, Corteva has agreed to the following language in the registration decision letter:

> "If, after formal consultation with FWS, additional modifications are identified in the Service's Biological Opinion, EPA will notify Corteva in writing within 45 calendar days of the issuance of the Biological Opinion of any necessary required changes. Within 30 calendar days of receiving EPA's notice, Corteva must submit an amendment application incorporating any required changes, including amended labels. Alternatively, Corteva may respond by submitting a request for voluntary cancellation of this product. If Corteva fails to comply with this term, Corteva has agreed in prior written acceptance of these terms that EPA may cancel the registration under an expedited process under FIFRA 6(e)."

10.5.3 Immediate Use of Revised Labeling and Supplemental Labeling

EPA determined that the label requirements described in Section 10.4 need to be implemented for the 2022 growing season. Therefore, after 1/11/2022, all production of new product must bear the revised label.

Corteva has released for shipment Enlist One and Enlist Duo products with previously approved labeling for use during the 2022 growing season with a registration that was set to expire on January 12, 2022. Product labeling approved prior to the approval date of this action will be superseded by the revised labeling described in this decision document, except for product being returned to Corteva or disposed of as described below. Therefore, to ensure that products are not misbranded or misused, and appropriate labeling is in the possession of users for the 2022 growing season, EPA is requiring the following terms and conditions:

> Any sale or distribution of this product that is not labeled with the revised label or is not accompanied by the supplemental label described below will be considered a violation of

FIFRA and may be subject to EPA enforcement. Some of these enforcement measures may include, but are not limited to, the issuance of Stop Sale, Use or Removal Orders (SSUROs) and/or the assessment of penalties.

Along with the new labeling approved herein, EPA has approved supplemental labeling that supersedes the labeling on all products sold on or prior to 1/11/2022.

To ensure that EPA can track the relabeling and distribution of the supplemental labeling, after 1/11/2022, for all products that were released for shipment and are in the channels of trade prior to 1/11/2022, Corteva must make the supplemental label available as described below.

By 1/25/2022, copies of the revised Section 3 labels and supplemental labels must be announced and posted in a prominent location on all Corteva websites that advertise or provide information about this product, including, Enlist main page (www.enlist.com), Enlist Herbicides page (www.enlist.com/en/herbicides.html), Enlist One Herbicide page (www.enlist.com/en/herbicides/enlist-one.html), Enlist Duo Herbicide page (www.enlist.com/en/herbicides/enlist-duo.html) and Enlist Ahead page (www.enlist.com/en/enlist-ahead.html), and retained until the expiration date of this registrations unless superseded by subsequent approved labeling.

By 1/25/2022, a banner containing the following must be prominently displayed at the top of all Corteva websites that advertise or provide information about this product, including the URLs listed above.

1. **"ATTENTION: ENLIST ONE MUST HAVE THIS NEW LABELING TO BE LAWFULLY APPLIED, DISTRIBUTED, OR SOLD AFTER 1/11/2022."**
2. A copy or link to a copy of the supplemental labeling with approval date.
3. After 1/11/2022, Corteva has provided supplemental labeling for this product and users are under legal obligation to follow the supplemental labeling or the revised Section 3 labeling.
4. After 1/11/2022, all sellers and distributors of this product must ensure either the supplemental labeling accompanies products sold or distributed, or that the products are labeled with the revised Section 3 labeling.
5. It is a violation of FIFRA Section 12 to use a registered pesticide in a manner inconsistent with its labeling.
6. It is a violation of FIFRA Section 12 to sell or distribute a misbranded pesticide.
7. Civil penalties may be assessed in an amount up to $20,528 for each unlawful sale or distribution under FIFRA.

As soon as possible, but no later than 2/28/2022, Corteva must notify and send a copy of the supplemental labeling to all sellers, distributors, and purchasers of this product from 1/1/2017 through 1/11/2022, except for those described in paragraph d, either electronically to a valid and appropriate e-mail address, or via mail, or both. With the labeling, Corteva must also provide all of the information specified above for the banner-linked web page. A sample of this correspondence must be sent to EPA by 1/28/2022. Corteva must maintain copies of each correspondence it sends to all sellers, distributors, and purchasers for a minimum of 5 years and provide copies to EPA, if requested, within 10 business days.

Corteva must maintain a record of when, to whom, and method of mailing of this correspondence. Corteva must track the receipt of this correspondence via return receipts or requesting confirmation of receipt. Corteva must submit this record to EPA by 3/14/2022.

As of 1/11/2022, these products cannot be used in certain geographic areas identified by the supplemental labeling. Corteva must inform all sellers, distributors, and purchasers in those geographic areas by 2/28/2022 that it is a misuse and a violation under federal law to apply this product in these prohibited areas. Corteva must coordinate with these parties to return or properly dispose of this product. If returned, Corteva must relabel before any further distribution with either the new labeling or the supplemental labeling. Such relabeling of products must be completed in an EPA-registered establishment. Corteva must send a report to EPA by 3/14/2022 detailing its efforts to accomplish all of the above. Corteva must maintain copies of any correspondence it sends to all sellers, distributors, and purchasers in these areas and make them available to EPA upon request.

Corteva must communicate the availability and requirement for purchasers to follow the supplemental labeling when using products that were sold or distributed prior to 1/11/2022 in the Enlist education and training program, including in written educational communications. Materials must emphasize that:

Users must have a copy of the supplemental labeling. The supplemental labeling supersedes the labeling on all products sold on or prior to 1/11/2022.

After 1/11/2022, users of this product are under legal obligation to follow the supplemental labeling or it will be considered a misuse under federal law.

10.5.4 Pollinator Protection Stewardship Plan

EPA has determined that Corteva must develop, implement, maintain, and annually update a pollinator protection stewardship plan. The purpose of this plan is to address potential impacts from the products use to insect pollinators, including bees and butterflies. This plan must include education materials that describe the importance of pollinator protection in agriculture and best management practices to reduce potential pesticide exposure to pollinators including, but not exclusive, to monarch butterflies. Education materials must also describe label provisions

intended to minimize the potential for product exposure to pollinators, including updated environmental hazard and non-target organism advisory statements, and new application timing restrictions. Additionally, the pollinator protection stewardship plan must include conservation activities that result in meaningful restoration of habitat used by monarch butterflies and other insect pollinators to address potential impacts from this product's use, taking into account species' range and habitat requirements.

10.5.5 Herbicide Resistance Management Plan

EPA has determined that the registrations must contain a term that requires Corteva to have herbicide resistance management plans for both Enlist One and Enlist Duo. Corteva's current educational program is focused on educating and training retailers, farmers, and applicators on the appropriate use of the Enlist products. The current herbicide resistance management plan within this existing program outlined in the EPA decision memorandum titled "Final Registration Decision of Enlist Duo Herbicide" (USEPA, 2017; [20]) will be amended for both Enlist One and Enlist Duo with the following changes:

Suspected Resistance Testing

The EPA has determined the currently required suspected resistance testing components of the Herbicide Resistance Management Plan be amended so testing is conducted for 2,4-D and dicamba, to provide the EPA with information on the frequency of cross-resistance, and so that results must be submitted to the EPA in the annual reports for Enlist One and Enlist Duo that the registrant is required to submit each year.

Grower Surveys

The EPA has determined that the grower surveys (as described below is Section 10.5.8) conducted as part of the ongoing annual reporting requirements for Enlist One and Enlist Duo must be amended to include questions about how Enlist products are used, including use site/crop, application timing, whether they are tank mixed with other herbicide(s), and, if so, identification of the active ingredient(s) used in the tank mixture.

10.5.6 Spray Drift Testing of Tank Mix Products

EPA has determined that Corteva must continue to maintain a website at www.enlist.com/tankmix, to maintain the integrity of the mitigations that prevent spray drift risks. This website must include a list of products that have been tested pursuant EPA testing protocol and found, based upon such testing, that the tank mix will not result in drift that is statistically greater than the mean estimate for the combination of Enlist Duo reference formulation and nozzle. The website must state that any requestor seeking to have a product added to the list must perform a study pursuant either to the testing protocol identified on the website that is consistent with EPA protocol or another protocol that has been approved for such

[20] USEPA, 2017. Final Registration Decision of Enlist Duo Herbicide. Docket ID# EPA-HQ-OPP-2016-0594

purpose by EPA. The requestor must submit the test data and results to Corteva, along with a certification that the study was performed either pursuant to the testing protocol identified on the website or pursuant to another protocol approved by EPA, and that the test results support adding the product to the list of products tested and found not to adversely affect the spray drift properties of this product. Corteva will determine whether the testing and results conform to the conditions prescribed in the protocol. Corteva must review and respond to all third-party requests within 90 days of receipt by either adding the product to the list of approved tank mix partners on the Enlist website or notifying the requestor that the product did not meet the requirements for inclusion.

Corteva must retain records of all spray drift test data generated by Corteva, someone working for Corteva, or submitted to Corteva by a third-party along with a certification indicating whether the study was performed either pursuant to the testing protocol identified on the website or pursuant to another protocol approved by EPA, and whether the test results support adding the product to the list of products tested and found not to adversely affect the spray drift properties of this product. All such records must be submitted to EPA upon request within 10 business days.

10.5.7 Education, Training, and Outreach

In addition to the education, training, and outreach required for the herbicide resistance management plan and pollinator protection stewardship plan, EPA has determined a further requirement is necessary. Corteva has agreed to develop, implement, and annually update an education and training program that includes information on product use restrictions and mitigation measures to protect endangered species and their designated critical habitats, including geographical use limitations; consulting with the Endangered Species Protection Bulletin (Bulletins Live! Two) within 6 months prior to application; spray drift, nozzle selection, and tank mix restrictions related to spray drift testing; 48-hour rainfall and irrigation restrictions; runoff mitigation measures including selection of practices and determination of soil types; and reporting ecological incidents to Corteva. Education, training, and outreach must also provide a component on the availability of, and requirement to use, revised supplemental labeling.

Corteva must ensure annually, including the 2022 use season, that growers of Enlist crops and Enlist product users receive training and educational materials that convey the current information on the Enlist program and have copies of the current approved labeling.

Corteva must provide a copy of all Enlist educational and training materials, and examples of written communication materials to EPA by February 28, 2022, and at any time upon EPA's request. At the initiative of either EPA or Corteva, EPA and Corteva will meet to discuss possible modifications to the educational program as needed.

Corteva must provide access to educational materials for distribution by sales representatives or others to growers, users, extension agents, neighboring landowners, and any other interested stakeholders by February 1st of each year and must also provide access to all educational materials to state pesticide authorities and state agricultural extension services upon request.

10.5.8 Annual Survey and Evaluation

Corteva must conduct annual surveys of growers of Enlist crops and product users and provide final results to EPA by January 15th of each year. These surveys must be based on a statistically representative sample of growers and users. The sample size and geographical resolution should be adequate to allow analysis of responses within regions, between regions, and across the United States. These surveys must evaluate, at a minimum, planning and adoption of runoff mitigation measures, including, which practices were already in place prior to deciding to use this product; which practices were newly selected in order to use this product; and which practices are planned for future use of this product as well as information required as part of the herbicide resistance management plan.

10.5.9 Annual Reporting

EPA has determined that Corteva must continue to submit annual reports to EPA by January 15th. These annual reports must contain results from annual survey on planning and adoption of runoff mitigation measures and information required as part of the herbicide resistance management plan. The annual report for implementation of the pollinator protection stewardship plan, including activities on conservation and habitat restoration, and education, training, and outreach will be submitted separately and is due on July 15th of each year beginning July 15, 2022.

Subsequent annual reports after the first year shall include updates of any aspect of the education and training program and associated materials that have materially changed since submission of the previous annual report. Following submission of the annual report, Corteva shall meet with the EPA at EPA's request to evaluate and consider the information contained in the report.

11 EPA's Effects Determination Under the ESA

11.1 Effects Determinations Based on Draft Labels (May 2021)

ESA section 7(a)(2) provides that "[e]ach Federal agency shall, in consultation with [FWS] insure that any action authorized, funded, or carried out by such agency. . . is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species. . . ." ESA section 7(d) requires that "[a]fter initiation of consultation required under [ESA section 7(a)(2)], the Federal agency and the permit or license applicant shall not make any irreversible or irretrievable commitments of resources with respect to the agency action which has the effect of foreclosing the formulation or implementation of reasonable and prudent alternative measures which would not violate [ESA section 7(a)(2)]."

Based on the May 2021 label, EPA completed effects determinations for federally listed threatened and endangered species (listed species) for Enlist One (GF-3335) and Enlist Duo in the 34 states representing the areas where Enlist products may be applied (USEPA, 2022a). EPA evaluated whether the registration of Enlist One and Enlist Duo poses any reasonable expectation of discernible effects to listed species and designated critical habitats within the action area in the listed species effects determination. The ESA effects determination makes use of the best available scientific information and considered both direct and indirect effects. The term "direct effects" refers to decreases in the survival, growth, or reproduction of individuals of a listed species due to exposure to 2,4-D or glyphosate. The term "indirect effects" refers to impacts on individuals of a listed species that may be the result of the effects of 2,4-D or glyphosate on organisms on which the listed species depends upon for prey, pollination, habitat, and/or dispersal.

In the effects determination (USEPA, 2022a), EPA preliminarily concluded that the uses of the two Enlist herbicide products as described on the May 2021 labels may affect, and are Likely to Adversely Affect (LAA), multiple listed species and designated critical habitats. An LAA determination means that there is a reasonable likelihood of discernible adverse effect to one or more individuals of a listed species or their designated critical habitats. When considering an action (such as the registration of a pesticide product), the ESA directs federal agencies to avoid jeopardizing listed species or adversely modifying their designated critical habitats. An LAA determination is not equivalent to a jeopardy determination; however, EPA can assess the potential for jeopardy or adverse modification (J/AM)[21] to help inform the formal consultation with FWS and the National Marine Fisheries Service (NMFS) ("the Services") and resulting Biological Opinion developed by the Services.[22] The purpose of the EPA evaluation of the likelihood of J/AM is to inform mitigations to avoid and minimize exposures to listed species earlier in the consultation process. Therefore, for those species and critical habitats with preliminary LAA determinations, EPA further assessed the likelihood that the Enlist products (based on the May 2021 labels) would lead to J/AM (USEPA, 2022a).

In the effects determination, EPA made LAA determinations for 5 on-field animal and plant species and 1 designated critical habitat based on 2,4-D exposure (Enlist One and Enlist Duo). Since glyphosate has additional effects (compared to 2,4-D) to birds, terrestrial-phase amphibians and reptiles, EPA also made LAA determinations for Enlist Duo for an additional 8 animal species that may use corn, cotton, or soybean fields. As a result of runoff of 2,4-D and glyphosate (Enlist One and Enlist Duo), EPA made LAA determinations for 49 listed plants, 64 listed animal species (5 with obligate relationships to specific species of non-listed plants and 59 that generally depend upon plants for habitat and/or diet), and 38 designated critical habitats (3 for listed plants and 35 for listed animals that generally depend upon plants for habitat and/or diet). LAA determinations indicate that an individual of a listed species is likely to be affected by

[21] "Adverse modification" is used in this document to represent both destruction and adverse modification of designated critical habitat.
[22] *See* 50 C.F.R. § 402.40(b).

Enlist products (either through direct or indirect effects[23]). For the species with LAA determinations, EPA concluded that the draft Enlist Duo and One labels were likely to jeopardize 88 and 83 species, respectively (USEPA, 2022a). In addition, 33 designated critical habitats are likely to be adversely modified by the two products (USEPA, 2022a).

11.2 Mitigation Measures and Revised Effects Determinations

Following the effects determinations, EPA determined what mitigation measures were needed so that the action would not be likely to jeopardize listed species or adversely modify designated critical habitats. The EPA document titled, "*2,4-D Choline Salt and Glyphosate Dimethylammonium Salt: Evaluation of Mitigations on Enlist One and Enlist Duo Labels to Address Listed Species Risks Identified in the 2022 Ecological Risk and Endangered Species Assessment for Use on Genetically-Modified Herbicide-Tolerant Corn, Soybean, and Cotton in Support of Registration Renewal Decision for Enlist One and Enlist Duo Products*," (USEPA, 2022b) identifies and describes the mitigations that EPA determined were necessary. These mitigation measures, when implemented through measures on the revised labels (see section 10.4 for details), result in reductions of exposure sufficient for EPA to determine the actions would not result in a likelihood of J/AM for any listed species or designated critical habitat following the use of the Enlist products. In addition, these mitigations avoid or minimize exposure for all listed species and reduce the potential for take across areas where Enlist products may be used. The Services prefer that EPA first limit potential pesticide effects by avoiding use of pesticides where they might impact listed species and designated critical habitats. Where avoidance is not reasonably feasible, then the Services prefer EPA implement mitigations, to minimize exposure to and impacts from pesticides. For the Enlist products, a combination of avoidance and minimization measures were used to avoid J/AM.

In this case, EPA implemented mitigations to 1) avoid exposure to on-field animals through off-labeling of specific counties for which listed species' ranges may be impacted, and 2) minimize 2,4-D and glyphosate concentrations in runoff through management of pesticide loading to the treated field, improving retention of pesticide on the field, and capturing runoff adjacent to the field[24]. Mitigations for runoff were organized into a list of options (referred to as a "pick list") that growers can select from to minimize 2,4-D and glyphosate exposures within terrestrial and wetland habitats receiving runoff from corn, cotton, or soybean fields treated with Enlist herbicide products. These mitigations have been outlined in the Labeling Requirements section of this document (Section 10.4). Corteva agreed to these mitigations and submitted revised Enlist One and Enlist Duo labels. Therefore, the mitigations are included as part of this action and are part of the description of the action.

[23] A direct effect involves toxicity of 2,4-D or glyphosate to an assessed species. An indirect effect involves impacts to a listed species from effects on species upon which a listed species depends for prey, pollination, habitat and/or dispersal.

[24] EPA also considered off-labeling counties to avoid exposure due to runoff, but determined this was not a feasible option because of the geographic extent of the runoff concern.

11.3 Formal Consultation with FWS

On January 10, 2022, EPA initiated formal consultation with FWS for Enlist One and Enlist Duo because the Agency made LAA determinations for certain listed species and designated critical habitats. With the mitigations that were added to the revised Enlist One and Enlist Duo labels, EPA determined that uses of Enlist One and Enlist Duo are not likely to jeopardize listed species or adversely modify designated critical habitats. EPA also determined that these mitigations will minimize the potential for take. Additional mitigation, including additional geographic prohibitions, may be required after completion of consultation with FWS.

EPA has complied with ESA section 7(a)(2) by initiating formal consultation with FWS and, consistent with ESA section 7(d), determining that the granting of these amendments for Enlist One and Enlist Duo will not result in "irreversible or irretrievable commitment of resources" because it would not foreclose the formulation or implementation of RPAs during the consultation period. For further information on EPA's ESA section 7(d) determination, see the documents titled "*Endangered Species Act Section 7(d) Consistency Determination with Respect to a Request to Amend the Enlist One Registration,*" and "*Endangered Species Act Section 7(d) Consistency Determination with Respect to a Request to Amend the Enlist Duo Registration"* located in docket EPA-HQ-OPP-2021-0957 on regulations.gov. As mentioned above, the time-limited registration period for these products will be extended by seven years, ending on January 11, 2029. EPA expects that the ESA consultation with FWS will be completed as expeditiously as possible.