In January 2018, minor revisions were made to the following document:

BIOLOGICAL ASSESSMENT

AN ASSESSMENT OF POTENTIAL EFFECTS TO FEDERALLY LISTED SPECIES

For Complete 540 –
Triangle Expressway Southeast Extension
Wake, Johnston, & Harnett Counties

(December 2017)

The revisions occur on Pages 42, 43, 44, 45, 49, and 50. For convenience, this document first contains the aforementioned pages denoting the changes that were made, followed by the same pages without the edits shown.

If the reader would like a copy of the complete document with the revised pages inserted, please make such request through an email to:

complete540@ncdot.gov

Revisions to Pages 42, 43, 44, 45, 49, and 50
with the edits shown follow this page.

NCDOT is committing to installing one to two HSB(s) within the immediate vicinity/floodplain of the crossing of Swift Creek, the ultimate location(s) to be determined during final design.

4.3 Induced Land Development

Roadway construction can influence land use and result in development that would not occur without the road (induced development). While land development itself does not affect freshwater mussels and their habitat, increases in sediment loads and various pollutants, alterations in flow regime (base flow and peak discharge), and loss of riparian buffers are consequences of development that lead to water quality degradation. How these consequences of land development affect water quality and ultimately freshwater mussels is discussed in Section 3.5.4 of this report.

Baker Engineering (2017) completed a Quantitative Indirect and Cumulative Effects (ICE) Report of the Complete 540 Project using a methodology to forecast land use changes between the base year of 2011 and design year 2040. This Quantitative ICE report utilized much of the information in the Qualitative ICE Report (H.W. Lochner 2014). As was projected in the Qualitative ICE Report and confirmed and quantified in the Quantitative ICE Report, the introduction of a high-speed, controlled-access roadway into the FLUSA would provide a faster and more direct route to employment and commercial centers in the region. Further, the primary changes in land development from the No-Build to Build are higher land use densities, more commercial and industrial development, and a greater mix of uses in the areas surrounding the interchanges. Though this pattern is captured in the model results, it is noted~~: "Without~~ that without the project, there would be both less development overall and lower densities of development in the FLUSA. However, there does not appear to be a more sprawled development pattern in the FLUSA in the Build scenario, and the relative increase in development in the Swift Creek water supply watershed is ~~miniscule," (Baker Engineering 2017d).~~very small.

The predictive watershed model utilized in the analysis and documented in the Quantitative ICE Report (Baker Engineering 2017c) was run twice for each land use scenario to estimate a range of potential induced and cumulative effects to the water quality study area. For both model runs, the process described in Quantitative ICE Memo #2 (Baker Engineering, 2017b) was used to calculate land cover in the water quality study area. The first, more-conservative model run, produced an "upper limit" of percent impervious coverage for each HUC in the study area. The second model run used the observed percent impervious coverage by land cover type in the Baseline condition to estimate the "lower limit" of impervious coverage for the 2010, 2040 No-Build, and 2040 Build scenarios. This approach could produce some under-estimation of impervious surface percentages; therefore, Model Run 2 provides a low-end-of-range estimate, and Model Run 1 provides a high-end-of-range estimate. These results are provided as ranges in Table 11.

Table 11. Percent Increases from 2010 Baseline to 2040 No-Build and from 2040 No-Build to 2040 Build

Watershed	Impervious Surface (%)			TSS (MT/yr/ac)			Copper (g/yr/ac)		
	Baseline	Baseline to No-Build % increase	No-Build to Build % increase	Baseline	Baseline to No-Build % increase	No-Build to Build % increase	Baseline	Baseline to No-Build % increase	No-Build to Build % increase
White Oak Creek	4-10	5-18	≤1	0.08	26-38	≤1	0.69-0.70	26-38	≤1
Piney Grove Cemetery-Swift Creek	4-7	1-5~~-12~~	<1	0.20	18-20	3-4	1.36-1.40	18-20	3-4
Little Creek (Lower)	4-9	~~7-22~~3-13	<1	0.11	21-27	<1	0.74	21-27	<1
Mahlers-Swift Creek	5-14	~~10-29~~5-15	<1-6	0.26	88-94	<1-2	2.27-2.29	88-94	<1-2
Reed Branch	4-12	~~7-22~~2-10	<1	0.17	34-38~~18-20~~	2	1.17	34-38	2
Middle Creek (Lower)	3-8	1-5~~-14~~	≤1	0.33-0.34	29-30~~34-38~~	3	2.26-2.34	29-30	3

The Quantitative ICE Assessment Memo #4 (Baker Engineering 2017d) addressed a more detailed NEPA-based analysis of induced effects to the six subwatersheds in which DWM and Yellow Lance are currently extent; White Oak Creek (Lower), Piney Grove Cemetery-Swift Creek, Mahlers-Swift Creek, Reed Branch, Little Creek (Lower), and Middle Creek (Lower) (Figures 8 and 9). Three factors were chosen to quantify induced land use effects for this BA; impervious surface, total suspended solids (TSS), and copper. These factors were chosen as they either directly or indirectly can be correlated with, or serve as surrogates for, threats to mussel species discussed in Section 3.5.3.

Stream flow and nitrogen were also evaluated in the Quantitative ICE memos (Baker Engineering 2017a, 2017b, 2017c, and 2017d). For stream flow, any changes will be a direct correlation to impervious surface effects. As there are opportunities to temper this correlation via various stormwater control measures, it was decided that impervious surface effects would be the most appropriate parameter to consider. Nitrogen was not included directly in this evaluation because of the difficulty of using this parameter as an indicator of stream health. Nitrogen toxicity on mussels is related to a multitude of factors, and the amount of nitrogen in and of itself does not necessarily equate to an effect.

As discussed in the DWM Viability Study (Three Oaks 2016) and the ICE Memoranda and Water Quality Assessment (Baker Engineering 2017a, 2017b, 2017c, and 2017d), there are a number of development restrictions in place within the Action Area, such as Neuse Buffer Rules and designated Environmentally Sensitive Areas (ESAs), that would lessen some of the potential for project induced development. However, the DWM Viability Study (Three Oaks 2016) notes there are several areas that drain into Swift Creek that are exempt from the current ESA, such as some properties in the I-40/NC-42 interchange area. For example, the Golden Corral property

was exempt as it was approved prior to the adoption of the ESA regulations. However, the Wal-Mart property was not exempt, and various stormwater BMPs were incorporated into site development.

4.3.1 Induced Impervious Surface Effects

Impervious surface was chosen as one of the three factors since it directly relates to loss of pervious surfaces and indirectly to water flow in receiving surface waters, and is used as a proxy to represent anticipated indirect physical habitat effects (channel instability, channel scour, etc.), indirect water quality effects (thermal pollution) and indirect water quantity effects (changes in peak and base flows). The percentage increase in five of the six watersheds from the 2040 No-Build to Build is less than or equal to 1 percent, with the exception being the Mahlers-Swift Creek watershed, where the range is less than ~~or equal to~~ 1 to 6 percent. In the least impactful scenario, there would be a ~~10~~5 percent increase from the Baseline to the No-Build. In accordance with this scenario, then the percent increase from No-Build to Build would also be the least impactful scenario, with an increase of less than ~~or equal to~~ 1 percent over the Baseline to No-Build total. Accordingly, in the most impactful scenario, construction of the Complete 540 project (2040 Build Scenario) would increase the percent impervious by up to 6 percent above the ~~29~~15 percent increase (No-Build) that would be expected without the project. In all the other watersheds, similar scenarios are forecast with regard to increasing amounts of imperviousness from the baseline conditions to 2040; however, in those instances, the increases in impervious surface attributable to Complete 540 would be less than or equal to 1 percent.

4.3.2 Induced TSS Effects

TSS was chosen as one of the three factors as a proxy to represent anticipated indirect water quality and physical habitat effects since it directly relates to sedimentation, which degrades water quality and habitat suitability. As shown in Table 11, the percentage increase in ~~three~~two of the six watersheds from the 2040 No-Build to Build is less than or equal to 1 percent. In the other ~~three~~four, the highest potential increase is the Piney Grove Cemetery-Swift Creek watershed, where there is a 3 to 4 percent increase attributable to Complete 540, followed by 3 percent in Middle Creek ~~and~~, 2 percent in Reed Branch~~.~~, and <1-2 percent in Mahlers-Swift Creek. However, Piney Grove Cemetery-Swift Creek watershed~~, along with the Reed Branch watershed,~~ is where the least amount of percent increase from Baseline to No-Build (18-20% for each) is anticipated.

4.3.3 Induced Copper Effects

Copper was chosen as one of the three factors as a proxy to represent anticipated indirect water quality effects since it is generally considered to be the most toxic of the contaminants to freshwater mussels, is found in runoff directly relatable to increased development, and has been addressed in the Lower Swift Creek Water Quality Report (Three Oaks 2015). Because the

transport method for copper is directly related to TSS, the same percent increases in the six watersheds that were noted for TSS are also reflected for copper. The percentage increase in ~~three~~two of the six watersheds from the 2040 No-Build to Build is less than or equal to 1 percent, with the highest potential increase being the Piney Grove Cemetery-Swift Creek watershed. In this watershed, there is a 3 to 4 percent increase attributable to Complete 540, followed by 3 percent in Middle Creek ~~and~~, 2 percent in Reed Branch, and <1-2 percent in Mahlers-Swift Creek.

4.3.4 Induced Roadway Runoff Effects

Induced changes in land use also has the potential to affect traffic patterns on the existing road network within the action area of roadway construction projects, which in turn result in changes of pollutant concentration of roadway runoff exposure within occupied habitats. Increased traffic volumes on the road networks traversing the watersheds could potentially affect the associated aquatic communities, including freshwater mussels, by causing water quality degradation via an increase in runoff contaminants attributable to the additional traffic. Increased traffic volumes may also result in the need for widening and improvements to existing roads that occur within the Swift and Lower Middle Creek watersheds, further increasing runoff from both construction and increased stormwater flows from the additional impervious surface. Widening of existing roadways could also result in increased exposure to thermal pollutants due to a larger impervious footprint of the respective roadways. Decreases in traffic volume could have a potential localized beneficial effect by decreasing concentrations of toxicants originating from roadway runoff, and/or toxic spills along roadways.

Induced effects from roadway runoff fall into two categories; 1) increases/decreases in roadway runoff due to changes in traffic patterns on the existing roadway network within occupied watersheds, and 2) roadway runoff originating from project crossings of waters within occupied watersheds.

The forecasted traffic levels indicate that the induced growth effects of the proposed project will likely add to the total volume of traffic in Wake and Johnston Counties and to the total vehicle miles traveled and vehicle hours traveled. Roads that connect to Complete 540 will likely see some increases in traffic, mostly in the immediate vicinity of interchanges. The traffic analysis (HNTB 2017) of FLUSA-Level traffic conditions showed that while total Daily and PM Peak Vehicle Miles Traveled (VMT)/Vehicle Hours Traveled (VHT) slightly increased with Complete 540 in place, the congested Daily and PM Peak VMT/VHT, average Daily and PM Peak speeds, and Daily and PM Peak congested roadway mileage all improved in the Build condition. Additionally, the volume-to-capacity comparisons showed that all areas with a Level of Service of “E” or worse had Triangle Regional Model daily volume-to-capacity ratios within the same threshold in the model runs both Future-Year Build conditions (No-Build and Build). This indicates that these issues would exist with or without the project.

that building Complete 540 will actually result in fewer roadways that would have otherwise been constructed. As such, indirect effects to DWM and Yellow Lance from the alteration of flow/channel stability are likely immeasurable.

4.4.2.2 Roadway Runoff

There are multiple streams that will be impacted due to the project that drain to occupied portions of Swift Creek and/or Lower Middle Creek. These new sources of roadway runoff coupled with increased traffic volumes on some of the existing roads within the respective watersheds may result in a localized increase of the respective DWM and Yellow Lance population's exposure to roadway derived pollutants. However, there may also be localized reductions in exposure to toxicants in other areas within the respective populations as a result of decreased traffic volumes along other roads within the Action Area that drain to occupied habitat. As such, while it is likely that construction of the Complete 540 will likely lead to slightly more exposure of freshwater mussels to roadway runoff than the No-Build scenario, there isn't existing data to determine if this potential increase would pass a threshold to which would adversely impact the mussels.

4.4.2.3 Toxic Spills

As discussed in Section 4.2.3 there is the potential for adverse effects to occur to the DWM and Yellow Lance as a result of toxic spills once the facility is in operation, with the potential for impacts increasing the closer they occur to Swift Creek. There is no way to accurately predict where and when toxic spills associated with the facility will occur; however, such an event is likely to occur during the lifetime of the facility. According to the US Department of Transportation (USDOT), there were 639 reported transportation related incidents involving hazardous materials in North Carolina in 1996 (USDOT 1996). It is even harder to predict the magnitude of the impacts to DWM and Yellow Lance if such a spill were to occur along the facility. The construction of a HSB(s) at the crossing of Swift Creek will help to minimize the potential for this type of adverse impact to occur in the future.

4.4.3 Induced Land Development Effects

As discussed in Section 4.3, both the ICE Memoranda and Water Quality Assessment (Baker Engineering 2017a, 2017b, 2017c, and 2017d) analyses, as well as the Qualitative ICE Report (H.W. Lochner 2014), forecast continued increases in developed land and associated water quality degradation in the Swift Creek and Middle Creek watersheds in both the 2040 No-Build and Build scenarios. Except for the Mahlers-Swift Creek subwatershed, all the subwatersheds occupied by or draining to habitat occupied by DWM and Yellow Lance increased in percentage of imperviousness, which is attributable to the 2040 Build Scenario, by less than or equal to 1 percent. In the Mahlers-Swift Creek subwatershed, the percent increase of imperviousness may be as high as 6 percent. Additionally, maximum increases of ~~3 to~~ 4 percent of TSS and copper

associated with the 2040 Build Scenario are projected in the Piney Grove Cemetery-Swift Creek subwatershed; followed by 3 percent in the Lower Middle Creek; 2 percent in Reedy Creek and Mahlers-Swift Creek; and less than or equal to 1 percent in White Oak Creek, and Little Creek Lower and Mahlers-Swift Creek subwatersheds, respectively.

Induced changes in land use may also result in changes of roadway runoff exposure within occupied habitats. Increased traffic volumes on the road networks traversing the watersheds could potentially affect the associated aquatic communities, including freshwater mussels, by causing water quality degradation via an increase in runoff contaminants attributable to the additional traffic. Decreases in traffic volume could have a potential localized beneficial effect by decreasing concentrations of toxicants originating from roadway runoff, and/or toxic spills along roadways.

4.4.4 Cumulative Effects

As detailed above, the proposed Complete 540 is expected to directly and indirectly result in adverse effects to the DWM and Yellow Lance through the construction and operation of the proposed facility, as well as through induced land use effects. Cumulative effects under the ESA are those effects of future state or private activities not involving federal activities that are reasonably certain to occur within the action area of an action subject to consultation. Under NEPA, cumulative effects are the incremental environmental impact or effect of the proposed action, together with impacts of past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. As noted, the cumulative analysis for the DEIS was performed using the NEPA definition. We used the broader, more conservative, NEPA cumulative assessment as the biases for this ESA cumulative analysis. The reasoning for this is due to the difficulty predicting which of the future development will require federal authorization, such as a CWA 404 permit, and would not be considered a cumulative effect under the ESA for this action. Therefore, the potential cumulative effects discussed in this BA, as defined per ESA, are overestimated since the ICE Report (Baker Engineering 2017a-d) included the effects of future federal actions as well as non-federal actions. We are making the assumption that some of the future activities discussed would have a Federal nexus and/or are already considered as induced development for the project (interrelated/interdependent activities).

Future state and private activities, including federal actions, are reasonably certain to occur within the Swift Creek and Middle Creek watersheds (Baker Engineering 2017d) and will continue to impact the DWM and Yellow Lance. However, as indicated above, most all of which are expected to occur with or without (Build vs. No-Build) the proposed action. The projected growth in the project Action Area is anticipated to result in additional (cumulative) effects to the DWM and Yellow Lance.

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As discussed in the DWM Viability Study (Three Oaks 2016) and the ICE Memoranda and Water Quality Assessment (Baker Engineering 2017a, 2017b, 2017c, and 2017d), there are a number of development restrictions in place within the Action Area, such as Neuse Buffer Rules and designated Environmentally Sensitive Areas (ESAs), that would lessen some of the potential for project induced development. However, the DWM Viability Study (Three Oaks 2016) notes there are several areas that drain into Swift Creek that are exempt from the current ESA, such as some properties in the I-40/NC-42 interchange area. For example, the Golden Corral property was exempt as it was approved prior to the adoption of the ESA regulations. However, the Wal-

Mart property was not exempt, and various stormwater BMPs were incorporated into site development.

4.3.1 Induced Impervious Surface Effects

Impervious surface was chosen as one of the three factors since it directly relates to loss of pervious surfaces and indirectly to water flow in receiving surface waters, and is used as a proxy to represent anticipated indirect physical habitat effects (channel instability, channel scour, etc.), indirect water quality effects (thermal pollution) and indirect water quantity effects (changes in peak and base flows). The percentage increase in five of the six watersheds from the 2040 No-Build to Build is less than or equal to 1 percent, with the exception being the Mahlers-Swift Creek watershed, where the range is less than 1 to 6 percent. In the least impactful scenario, there would be a 5 percent increase from the Baseline to the No-Build. In accordance with this scenario, then the percent increase from No-Build to Build would also be the least impactful scenario, with an increase of less than 1 percent over the Baseline to No-Build total. Accordingly, in the most impactful scenario, construction of the Complete 540 project (2040 Build Scenario) would increase the percent impervious by up to 6 percent above the 15 percent increase (No-Build) that would be expected without the project. In all the other watersheds, similar scenarios are forecast with regard to increasing amounts of imperviousness from the baseline conditions to 2040; however, in those instances, the increases in impervious surface attributable to Complete 540 would be less than or equal to 1 percent.

4.3.2 Induced TSS Effects

TSS was chosen as one of the three factors as a proxy to represent anticipated indirect water quality and physical habitat effects since it directly relates to sedimentation, which degrades water quality and habitat suitability. As shown in Table 11, the percentage increase in two of the six watersheds from the 2040 No-Build to Build is less than or equal to 1 percent. In the other four, the highest potential increase is the Piney Grove Cemetery-Swift Creek watershed, where there is a 3 to 4 percent increase attributable to Complete 540, followed by 3 percent in Middle Creek, 2 percent in Reed Branch, and <1-2 percent in Mahlers-Swift Creek. However, Piney Grove Cemetery-Swift Creek watershed is where the least amount of percent increase from Baseline to No-Build (18-20% for each) is anticipated.

4.3.3 Induced Copper Effects

Copper was chosen as one of the three factors as a proxy to represent anticipated indirect water quality effects since it is generally considered to be the most toxic of the contaminants to freshwater mussels, is found in runoff directly relatable to increased development, and has been addressed in the Lower Swift Creek Water Quality Report (Three Oaks 2015). Because the transport method for copper is directly related to TSS, the same percent increases in the six watersheds that were noted for TSS are also reflected for copper. The percentage increase in two

of the six watersheds from the 2040 No-Build to Build is less than or equal to 1 percent, with the highest potential increase being the Piney Grove Cemetery-Swift Creek watershed. In this watershed, there is a 3 to 4 percent increase attributable to Complete 540, followed by 3 percent in Middle Creek, 2 percent in Reed Branch, and <1-2 percent in Mahlers-Swift Creek.

4.3.4 Induced Roadway Runoff Effects

Induced changes in land use also has the potential to affect traffic patterns on the existing road network within the action area of roadway construction projects, which in turn result in changes of pollutant concentration of roadway runoff exposure within occupied habitats. Increased traffic volumes on the road networks traversing the watersheds could potentially affect the associated aquatic communities, including freshwater mussels, by causing water quality degradation via an increase in runoff contaminants attributable to the additional traffic. Increased traffic volumes may also result in the need for widening and improvements to existing roads that occur within the Swift and Lower Middle Creek watersheds, further increasing runoff from both construction and increased stormwater flows from the additional impervious surface. Widening of existing roadways could also result in increased exposure to thermal pollutants due to a larger impervious footprint of the respective roadways. Decreases in traffic volume could have a potential localized beneficial effect by decreasing concentrations of toxicants originating from roadway runoff, and/or toxic spills along roadways.

Induced effects from roadway runoff fall into two categories; 1) increases/decreases in roadway runoff due to changes in traffic patterns on the existing roadway network within occupied watersheds, and 2) roadway runoff originating from project crossings of waters within occupied watersheds.

The forecasted traffic levels indicate that the induced growth effects of the proposed project will likely add to the total volume of traffic in Wake and Johnston Counties and to the total vehicle miles traveled and vehicle hours traveled. Roads that connect to Complete 540 will likely see some increases in traffic, mostly in the immediate vicinity of interchanges. The traffic analysis (HNTB 2017) of FLUSA-Level traffic conditions showed that while total Daily and PM Peak Vehicle Miles Traveled (VMT)/Vehicle Hours Traveled (VHT) slightly increased with Complete 540 in place, the congested Daily and PM Peak VMT/VHT, average Daily and PM Peak speeds, and Daily and PM Peak congested roadway mileage all improved in the Build condition. Additionally, the volume-to-capacity comparisons showed that all areas with a Level of Service of “E” or worse had Triangle Regional Model daily volume-to-capacity ratios within the same threshold in the model runs both Future-Year Build conditions (No-Build and Build). This indicates that these issues would exist with or without the project.

There are multiple crossings of water bodies within the Swift and Middle Creek watersheds all of which eventually drain to habitat occupied by DWM and/or Yellow Lance; thus, there is

4.4.2.2 Roadway Runoff

There are multiple streams that will be impacted due to the project that drain to occupied portions of Swift Creek and/or Lower Middle Creek. These new sources of roadway runoff coupled with increased traffic volumes on some of the existing roads within the respective watersheds may result in a localized increase of the respective DWM and Yellow Lance population's exposure to roadway derived pollutants. However, there may also be localized reductions in exposure to toxicants in other areas within the respective populations as a result of decreased traffic volumes along other roads within the Action Area that drain to occupied habitat. As such, while it is likely that construction of the Complete 540 will likely lead to slightly more exposure of freshwater mussels to roadway runoff than the No-Build scenario, there isn't existing data to determine if this potential increase would pass a threshold to which would adversely impact the mussels.

4.4.2.3 Toxic Spills

As discussed in Section 4.2.3 there is the potential for adverse effects to occur to the DWM and Yellow Lance as a result of toxic spills once the facility is in operation, with the potential for impacts increasing the closer they occur to Swift Creek. There is no way to accurately predict where and when toxic spills associated with the facility will occur; however, such an event is likely to occur during the lifetime of the facility. According to the US Department of Transportation (USDOT), there were 639 reported transportation related incidents involving hazardous materials in North Carolina in 1996 (USDOT 1996). It is even harder to predict the magnitude of the impacts to DWM and Yellow Lance if such a spill were to occur along the facility. The construction of a HSB(s) at the crossing of Swift Creek will help to minimize the potential for this type of adverse impact to occur in the future.

4.4.3 Induced Land Development Effects

As discussed in Section 4.3, both the ICE Memoranda and Water Quality Assessment (Baker Engineering 2017a, 2017b, 2017c, and 2017d) analyses, as well as the Qualitative ICE Report (H.W. Lochner 2014), forecast continued increases in developed land and associated water quality degradation in the Swift Creek and Middle Creek watersheds in both the 2040 No-Build and Build scenarios. Except for the Mahlers-Swift Creek subwatershed, all the subwatersheds occupied by or draining to habitat occupied by DWM and Yellow Lance increased in percentage of imperviousness, which is attributable to the 2040 Build Scenario, by less than or equal to 1 percent. In the Mahlers-Swift Creek subwatershed, the percent increase of imperviousness may be as high as 6 percent. Additionally, maximum increases of 4 percent of TSS and copper associated with the 2040 Build Scenario are projected in the Piney Grove Cemetery-Swift Creek subwatershed; followed by 3 percent in the Lower Middle Creek; 2 percent in Reedy Creek and

Mahlers-Swift Creek; and less than or equal to 1 percent in White Oak Creek and Little Creek Lower.

Induced changes in land use may also result in changes of roadway runoff exposure within occupied habitats. Increased traffic volumes on the road networks traversing the watersheds could potentially affect the associated aquatic communities, including freshwater mussels, by causing water quality degradation via an increase in runoff contaminants attributable to the additional traffic. Decreases in traffic volume could have a potential localized beneficial effect by decreasing concentrations of toxicants originating from roadway runoff, and/or toxic spills along roadways.

4.4.4 Cumulative Effects

As detailed above, the proposed Complete 540 is expected to directly and indirectly result in adverse effects to the DWM and Yellow Lance through the construction and operation of the proposed facility, as well as through induced land use effects. Cumulative effects under the ESA are those effects of future state or private activities not involving federal activities that are reasonably certain to occur within the action area of an action subject to consultation. Under NEPA, cumulative effects are the incremental environmental impact or effect of the proposed action, together with impacts of past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. As noted, the cumulative analysis for the DEIS was performed using the NEPA definition. We used the broader, more conservative, NEPA cumulative assessment as the biases for this ESA cumulative analysis. The reasoning for this is due to the difficulty predicting which of the future development will require federal authorization, such as a CWA 404 permit, and would not be considered a cumulative effect under the ESA for this action. Therefore, the potential cumulative effects discussed in this BA, as defined per ESA, are overestimated since the ICE Report (Baker Engineering 2017a-d) included the effects of future federal actions as well as non-federal actions. We are making the assumption that some of the future activities discussed would have a Federal nexus and/or are already considered as induced development for the project (interrelated/interdependent activities).

Future state and private activities, including federal actions, are reasonably certain to occur within the Swift Creek and Middle Creek watersheds (Baker Engineering 2017d) and will continue to impact the DWM and Yellow Lance. However, as indicated above, most all of which are expected to occur with or without (Build vs. No-Build) the proposed action. The projected growth in the project Action Area is anticipated to result in additional (cumulative) effects to the DWM and Yellow Lance.

State and local regulations in the Swift and Middle Creek watersheds aim to reduce the cumulative effect of development on water quality in these sensitive watersheds. These