Third-Party Consultant Environmental Review of the TransCanada Keystone XL Pipeline Risk Assessment

Exponent®

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Prepared for

TransCanada Keystone Pipeline, LP
and
U.S. Department of State

Prepared by

Exponent
1800 Diagonal Road, Suite 500
Alexandria, VA 22314

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Disclaimer

This final report summarizes the results of work performed by Exponent representing the "Environmental Review" of the Keystone XL Project Risk Assessment (Appendix P of FEIS) and related sections in the Final Environmental Impact Statement (FEIS). This work represents a limited and directed scope of review focused specifically on the Risk Assessment (Appendix P of FEIS) and on specific questions addressed to Exponent as detailed in Section 1 of our report. The findings presented herein are made to a reasonable degree of scientific certainty based on information and data provided by the U.S. Government (i.e., DOS/PHMSA/EPA), through the U.S. Department of State (DOS) and by TransCanada Keystone Pipeline, LP (Keystone). Limited data gathering was involved. Exponent reserves the right to supplement this report and to expand or modify findings and opinions based on our review of additional material as it becomes available through ongoing correspondence with DOS/PHMSA/EPA and Keystone and/or through any additional work or review of additional work performed by Battelle and others. Also, due to the limited and directed scope of this review, this report shall not be considered to have identified or analyzed all scenarios and all sensitive resources that could potentially be impacted by the Keystone XL Project. In our review we point out the limitations of work conducted previously by others. To the extent that we have conducted analyses to address the questions posed to us, these analyses represent very limited and time-constrained analyses, and therefore cannot and should not be construed as filling gaps or inadequacies. In particular we recognize that Keystone will undertake a more detailed analysis to address questions related to the final design of the Keystone XL Project and the potential for environmental impacts. Determining the adequacy of the Biological Assessment performed as part of the FEIS in regard to threatened and endangered species and other special status species is outside Exponent's scope of work as determined by DOS. Rather Exponent used the information in the FEIS on special status species in support of our review. The report addresses comments on Exponent's draft report. Exponent's review was based on the initial route for the pipeline; the modifications of that route have not been specifically evaluated. However, the general recommendations made in this report are broadly applicable.

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Acronyms and Abbreviations

BGEPA	Bald and Golden Eagle Protection Act
BLM	U.S. Bureau of Land Management
BTEX	benzene, toluene, ethylbenzene, and xylenes
CPS	contributory pipeline segment
DOS	U.S. Department of State
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ERP	Emergency Response Plan
ESA	Endangered Species Act
ESA	ecologically sensitive area
FEIS	Final Environmental Impact Statement
FWCA	Fish and Wildlife Coordination Act
HDD	horizontal directional drilling
HSSM	Hydrocarbon Spill Screening Model
LNAPL	light, nonaqueous-phase liquid
MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant level
NAPL	nonaqueous-phase liquid
NEPA	National Environmental Policy Act
PAH	polycyclic aromatic hydrocarbon
PHMSA	Pipeline and Hazardous Materials Safety Administration
Project	Keystone XL Project
Risk Assessment	Keystone XL Project risk assessment
RBWMD	Rainwater Basin Wildlife Management District
SARA	saturates, aromatic, resins, and asphaltenes
SCO	synthetic crude oil
T&E	threatened and endangered
TAN	total acid number
TransCanada	TransCanada Keystone Pipeline, LP
USA	unusually sensitive area
USDOT	U.S. Department of Transportation
USFWS	U.S. Fish and Wildlife Service
WCSP	Western Canadian Sedimentary Basis
WPA	Waterfowl Production Area

Executive Summary

This report provides Exponent's third-party independent environmental review of a specific set of issues identified by the U.S. Department of State (DOS) in consultation with the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA) and the U.S. Environmental Protection Agency (the agencies) that relate to the Keystone XL Project (Project) preliminary risk assessment (Risk Assessment) prepared by AECOM and Dynamic Risk Assessment Systems, Inc., on behalf of TransCanada Keystone Pipeline, LP (Keystone). These issues are described in Section 1 of our environmental review. The Risk Assessment document is presented in Appendix P–*Pipeline Risk Assessment and Environmental Consequence Analysis* dated July 2009 contained within the Final Environmental Impact Statement (FEIS) prepared for DOS by Cardno ENTRIX, contractor for DOS. The agencies thought it advisable to have an additional environmental review of the Risk Assessment because of the highly technical nature of the issues involved, and the desire to ensure that the Project-specific Special Conditions are properly implemented in the event that a Presidential Permit is issued. To address the issues identified by the agencies, we relied on information in the Risk Assessment and FEIS as well as information we obtained that related to the issues identified by the agencies. The report addresses comments on Exponent's draft report. Exponent's review was based on the initial route for the pipeline; the modifications of that route have not been specifically evaluated. However, the general recommendations made in this report are broadly applicable.

The agencies determined that Keystone should commission an engineering analysis that would, at a minimum, assess the advisability of additional valves and/or the deployment of external leak detection systems in areas of particularly sensitive environmental resources. Battelle was chosen by the agencies to provide that ***engineering review***. Exponent was tasked by the agencies to provide the ***environmental review***, part of which was to consider the presence of other sensitive environmental resources along the Project that may warrant additional environmental protection. These potentially sensitive environmental resources were in addition to those that had been the focus of the Risk Assessment. Based on the Scope of Work described in Section 1 of this environmental review, Exponent performed the following tasks:

1. Provided an overview of the overall Keystone Risk Assessment methodology
2. Examined the characteristics of the crude oil being transported
3. Evaluated transport and fate characteristics of spilled crude oil
4. Addressed sensitive issue Area 1: Shallow groundwater
5. Addressed sensitive issue Area 2: Small stream crossings less than 100 ft in width and associated ecological concerns.

This executive summary provides a brief overview of each of these tasks, along with our key findings and recommendations. Exponent's findings will be used, in part, by Battelle to make recommendations related to engineering considerations that could be used to address environmental safety issues related to the Project.

Review of Crude Oil Composition

Exponent reviewed Keystone's consideration of the chemical and physical characteristics of the oil blends to be transported in the pipeline, and compiled crude oil compositional data required in the subsequent sections of our report. Exponent compared the characteristics of diluted bitumen (dilbit) and synthetic crude oil (SCO) to typical crude oil using data from a number of publically available sources.

Key Findings/Conclusions

- The physical and chemical characteristics of dilbit are consistent with a heavy crude oil
- The physical and chemical characteristic of SCO are consistent with a medium gravity crude oil
- The benzene concentrations of both oils are within the range of typical crude oils
- The chemical compositions of the oils are within the range of typical crude oils, although there are some significant gaps in our knowledge about all the constituents
- For the factors considered by Keystone in the Risk Assessment, we agree with their conclusion that dilbit and SCO are sufficiently similar to crude oil and that they should not result in an excess risk in case of a release.

Recommendations

- While not required at this stage in the process, Keystone should consider obtaining additional information on the chemistry of the oils as this information will be needed for developing clean-up and remediation plans
- Knowledge on the chemistry of dilbit continues to increase, and that new information should be incorporated into planning and operations as appropriate (e.g., to improve spill response planning).

Transport and Fate of Spilled Oil

To address questions about potential environmental consequences of oil spills raised by the agencies, Exponent conducted additional transport and fate analyses to better describe the behavior of potential spills. Our review relied on information provided in the Risk Assessment and FEIS as well as on information and data in the scientific literature such as the viscosity of the oil and distance that oil spills have been known to travel in surface water. We conducted screening-level calculations to quantitatively check statements made in the Risk Assessment about the behavior of oil spills, and to support other aspects of our evaluation.

Our evaluation of possible risks to sensitive areas of groundwater and surface waters depends in part on how the spilled oil will behave when released from a buried pipeline. Therefore, we evaluated how quickly large and small spills might reach aquifers and the behavior of dissolved constituents in these aquifers. Our screening calculations are not an exhaustive transport and fate analysis. The detailed analyses that are required by Special Condition 14 and PHMSA regulations, as part of the Integrity Management Program, will be conducted after the final route is selected as part of the final design of the project. The rate of migration of an oil spill to and in groundwater is an important consideration in the development of the Environmental Response Plan (ERP). It bears directly on response time and the ability to contain and clean up spills that might occur. Similarly, the distance that oil spilled into surface waters of small streams could travel is important for identifying ecologically sensitive areas or other high consequence areas (HCAs) that might be impacted.

Quantitative screening-level estimates of the potential transport of oil to groundwater are provided for two scenarios: a large volume spill or rupture, and a small leak. We also provide a discussion on the potential transport of oil overland. Exponent's analyses are based on the general range of conservative conditions and are intended to provide a sense of scale of potential oil impact. Thus, findings are expected to be a conservative characterization of what could happen along the pipeline. Based on these analyses, Exponent considered the ramifications of the findings in light of the implications they would have on the final Project design and ERP. The following are Exponent's key findings/ conclusions, followed by our recommendations.

Key Findings/Conclusions

- The flow of oil overland is affected by many variables including spill rate, topography, soil type, and vegetation. To provide a sense of scale, a highly simplified case of a sudden spill of 25,000 bbl to a flat surface is presented. If the spill flows in a radial pattern, is 1 ft deep, and there is no spill response, it would spread with a radius of about 200 ft. A pool with a depth of 0.1 ft would spread to a radius of about 700 ft. If a surface spill was influenced by topography and flowed in a channelized manner, the distance traveled could be on the order of thousands of feet, depending on the steepness of the terrain, presence of vegetation, etc. Keystone conservatively assumed in the Risk Assessment that a large spill would be capable of moving overland up to 1 mile. Therefore, considering our analyses, the 1 mile distance criterion used in the Risk Assessment is considered adequate. Where HCAs are located within 1 mile of the pipeline, Keystone is required to perform a site-specific evaluation of overland flow (spreading analysis).

- Exponent applied a numerical screening model, the hydrocarbon spill screening model or HSSM, to estimate the behavior of a large spill of dilbit from the pipeline in an area with a high permeability shallow aquifer. The HSSM modeling simulation showed that groundwater impacts from a large spill would likely occur first from infiltration from the trench near the rupture and not from oil spread across the ground surface. Oil in the potentially filled trench near the rupture could begin forming a non-aqueous phase liquid lens at the water table in less than 1 day if the water table is 1 ft below the trench (8 ft below ground surface), in 7 days if the water table is 3 ft below the trench (10 ft below ground surface), and in 50 days if the water table is 10 ft below the trench (17 ft below ground surface). In contrast, oil infiltrating from the ground surface would reach a water table 8 ft below ground surface after approximately 240 days.

- Results from HSSM simulations of a large spill (25,000 bbl) illustrate that plume lengths for dissolved hydrocarbons (i.e., benzene at or above the under typical groundwater gradients could be between 100 and 900 ft in length. This range is consistent with those reported in the literature; most reported plumes are less than 200–300 ft and a very small number of plumes exceed 1,000 ft. HSSM simulations were also performed to explore an elevated groundwater gradient, representing the potential influence of groundwater extraction (irrigation wells) near the pipeline. When coupled with a simulated low degradation rate (representing an upper bound condition), the higher groundwater gradient could extend the plume length to as much as 2,600 ft.

- Modeling results agree with the conclusions in the Risk Assessment that a small leak going undetected indefinitely is unlikely. More likely, oil from a small "pin hole" leak (28 bbl/day) would reach the ground surface on a time scale of a few months. Based on the screening-level modeling, a benzene plume that may form because of a small leak was estimated to travel downgradient by as much as 600 ft.

- Many private wells located near the pipeline do not meet the criteria to be classified as HCAs in the Risk Assessment. Exponent considered potential factors that could be used to identify non-HCA groundwater areas for shallow groundwater (< 50 ft) where more extensive spill prevention measures and monitoring may be warranted. Based on our analysis of possible plume dimensions, we selected a downgradient distance of 1,000 ft from the proposed centerline of the pipeline as a reasonable boundary of a plume for identifying shallow groundwater and associated wells that could be within the influence of an oil spill. This distance recognizes that large spills would be readily detected and remediated and that small leaks that could take longer to be detected would have smaller plumes. Based on an independent review of the NEDNR well database in Nebraska, Exponent identified approximately 260 wells (not screened by depth) within 1,000 ft of the proposed centerline of the pipeline. Most of these wells are used for irrigation purposes but domestic wells are also present, several of which draw from shallow groundwater. This list will need to be revised once the final pipeline is determined.

- The relative vulnerability/sensitivity of groundwater resources to a dissolved hydrocarbon plume from an oil spill can be assessed by considering combinations of several factors: 1) proximity to the pipeline (<1,000 ft); 2) depth from point of the oil release to the water table (e.g., release of oil at or below the water table will affect groundwater quality more quickly than releases many feet above the water table); 3) depths of receptor wells (wells that are tens of feet deep are more vulnerable than wells that are hundreds of feet deep); and 4) the pumping of receptor wells (wells with higher pumping rates are more likely to draw plumes further downgradient than wells with lower pumping rates). This combination of factors could be used to identify groundwater resources that do not meet the listing criteria for HCAs but may be more vulnerable to a dissolved benzene plume emanating from an oil spill. An example of this would be a cluster of irrigation wells and domestic wells located within 1,000 ft of a pipeline segment where a release of oil occurred in or within a few feet of the water table.

- The assessment in the FEIS conservatively assumes that in the event of a worst-case spill in which all of the benzene partitions from the oil into water in streams with a range of flow rates. The assessment is useful for comparison of worst-case benzene concentrations to human health and ecological concentration benchmarks and is discussed further in Section 5 of our review. However, the FEIS does not provide an evaluation of possible transport distances of oil via surface water. This appears to be a gap that needs to be addressed.

- The primarily qualitative assessment of the transport and fate of oil in the event of a spill presented in the Risk Assessment is consistent with our analysis and review of the literature. Ultimately, quantitative analysis of transport and fate in surface waters is required by Special Condition 14 and PHMSA regulations as part of the Integrity Management Program during the final design of the project after the final route is selected. These evaluations should take into account the lessons learned from the pipeline rupture in Enbridge, Michigan, in 2010.

Recommendations

- Keystone, as part of the final Project design, should perform further evaluation of overland flow (spreading analysis) of spilled oil, and further evaluation of the transport of spilled oil in small streams (e.g., the downstream distance crude oil could travel from the proposed centerline of the pipeline) for purposes of ERP. These analyses should take into account potential density and viscosity increases associated with the loss of volatiles from heavy crudes and diluted bitumen.

- Keystone should use the screening criteria (e.g., well depth, depth of release compared to water table, lithology between pipeline and aquifer) suggested in our report for identifying vulnerable/sensitive groundwater resources adjacent to the pipeline that do not classify as HCAs but that may be more vulnerable to exposure to a benzene plume in the event of a an oil spill. For example, these could be defined as clusters of both domestic and irrigation wells within 1,000 ft of a pipeline segment where an oil spill could occur in or within a few feet of the water table. Exponent recommends that additional modeling be performed as part of the final design of the Project to further refine the appropriate downgradient distance criteria to be used for identifying sensitive clusters of wells. Exponent recommends that these non-HCA groundwater resources be afforded a degree of protection from the occurrence of an oil spill and from the consequences of a spill similar to what is currently afforded to groundwater resources that are defined HCAs.

- Considering the above-mentioned screening analysis, Exponent recommends that Keystone consider how to improve upon external leak detection through more frequent inspections and education of property owners for wells within these areas of sensitive groundwater resources.

Analysis of Risks Related to Small Stream Crossings

Exponent was asked to evaluate whether there are sensitive environments associated with stream crossings that are less than 100 ft wide that may warrant additional analyses and perhaps mitigation or control measures. Exponent used a set of ecologically-relevant criteria to identify such areas. This part of the environmental review also included an examination of information in the FEIS related to special status species, in particular, the presence of these species and their habitats relative to small stream crossings.

As part of our small stream crossing evaluation Exponent performed the following tasks:

- Reviewed the adequacy of the risk characterization of PHMSA-defined HCAs in the Risk Assessment with a specific focus on ecologically sensitive areas (ESAs)

- Evaluated whether there were other sensitive environmental resources downstream of small stream crossings not already identified by the PHMSA-defined ESAs

- Evaluated the adequacy of relying on benzene as a surrogate chemical to address the magnitude of aquatic toxicity of crude oil spilled into small streams

- Evaluated whether the Risk Assessment process adequately considered the presence of special status species (e.g., threatened and endangered species) when defining sensitive ecological resources.

Exponent considered the implications of our findings with respect to the final Project design and ERP. The following are Exponent's key findings/conclusions, followed by our recommendations.

Key Findings/Conclusions

- The Risk Assessment appropriately followed standard PHMSA guidelines for identifying contributory pipeline segments (CPSs) associated with small stream crossings and the HCAs potentially affected.
- Based on our assessment of transport and fate of oil into surface waters, we used a downstream distance of 10 miles as a basis for identifying locations of sensitive areas around small stream crossings. Using a set of ecologically-relevant criteria, Exponent identified at least ten small stream crossings areas that should be considered for additional protection. An additional four small stream crossings were identified as having special water bodies within 10 miles downstream of the proposed centerline of the pipeline that likely have high wildlife habitat value which should also be given further consideration.
- Exponent agrees with the assessment of the potential magnitude of risk of an oil spill on aquatic life in the water column associated with the toxicity of dissolved oil as represented by benzene. While the toxicity assessment based on benzene is not rigorous, it appears to be sufficiently conservative for assessing short-term effects to aquatic biota residing in the water column. However, depending upon the characteristics of the water body into which a spill occurs, some portion of the spilled oil could come into contact with sediments along shorelines or the bottom of the water body. The oil and associated chemicals that may be present within sediments could exert longer-term chronic effects on aquatic biota that are not captured by considering benzene alone.
- Exponent determined that the list of special status species identified in the FEIS is comprehensive and complete. Exponent also found that the preliminary findings of which species are likely to be adversely affected (one species, the American burying beetle) were arrived at through a sufficiently rigorous review of the distribution, abundance, and biological use of the Project area by special status species.
- Exponent believes that there could be habitat utilized now or in the future by special status species that is not specifically identified as PHMSA-designated ESAs.
- Exponent believes ongoing natural shifts in resources underpinning the distribution and abundance of special status species and the species they rely upon will likely result in a shifting of locations where special status species occur during the lifetime of the Project. These changes will necessitate that

the environmental protection of the areas which these species use as habitat along the pipeline corridor be updated over time.

Recommendations

- A distance of at least 10 miles downstream from the proposed centerline of the pipeline should be used for the identification of sensitive areas and for identifying CPSs during the final design phase of the Project.
- Based on location-specific analyses of fate and effects of spills that Keystone will undertake prior to construction, Keystone should consider the use of additional valves and/or noninvasive boring technologies at the small stream crossings that Exponent identified as associated with additional potentially sensitive ecological areas, and where Keystone's release analysis shows the potential exists for medium to very large spills.
- Keystone should rely upon stream-specific scour analyses for small stream crossings to identify where the pipeline should be buried deeper than 5 ft or where horizontal directional drilling may be warranted. The particular small stream crossings identified by Exponent should be given attention in this regard.
- Exponent recommends that the ERP consider the possibility that spilled oil may be entrained into sediments and that these types of conditions be anticipated as part of spill response and clean-up.
- Exponent recommends that the ERP also take into account the additional ecologically sensitive resources identified in our review. For example, wildlife habitat for special status species, within close proximity of the pipeline could be designated as "special and/or unique areas" for purposes of the ERP.
- Exponent recommends that Keystone develop explicit plans for updating the status and presence of special status species and their habitat every 2 years, and that identified changes be incorporated into the ERP.

1 Introduction

This report provides Exponent's third-party independent environmental review[1] of a specific set of issues identified by the U.S. Department of State (DOS) in consultation with the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA) and the U.S. Environmental Protection Agency (EPA) (the agencies) that relate to the Keystone XL Project (Project) preliminary risk assessment (Risk Assessment) prepared by AECOM and Dynamic Risk Assessment Systems, Inc., on behalf of TransCanada Keystone Pipeline, LP (Keystone). This Risk Assessment document is presented in Appendix P–*Pipeline Risk Assessment and Environmental Consequence Analysis* dated July 2009 contained within the Final Environmental Impact Statement (FEIS) prepared for DOS by Cardno ENTRIX, contractor for DOS. The agencies thought it advisable to have an additional environmental review of the Risk Assessment because of the highly technical nature of the issues involved, and the desire to ensure that the Project-specific Special Conditions are properly implemented in the event that a Presidential Permit is issued. To address the issues identified by the agencies, we relied on information in the Risk Assessment and FEIS as well as information we obtained that related to the issues identified by the agencies. The report addresses comments on Exponent's draft report. Exponent's review was based on the initial route for the pipeline; the modifications of that route have not been specifically evaluated. However, the general recommendations made in this report are broadly applicable.

The agencies determined that Keystone should commission an engineering analysis that would, at a minimum, assess the advisability of additional valves and/or the deployment of external leak detection systems in areas of particularly sensitive environmental resources. Battelle was chosen by the agencies to provide that ***engineering review***. Exponent was tasked by the agencies to provide the ***environmental review***, part of which was to consider the presence of other sensitive environmental resources along the Project that may warrant additional environmental protection via mitigation methods such as the use of valves to control spills. These potentially sensitive environmental resources were in addition to those that had been the focus of the Risk Assessment. The Scope of Work provided to Exponent[2] described our tasks as follows:

> *Potentially Sensitive Environmental Resources*
>
> With respect to the identification of particularly sensitive environmental resources, the risk assessment (Note: we refer to our work as an environmental review) should draw from the information included in the final Environmental Impact Statement regarding the potentially affected environment.

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[1] Because many assessment terms are used throughout this document, we refer to the Exponent work as an ***environmental review*** to distinguish our work from the Risk Assessment and from the FEIS.

[2] Keystone Project (US) Supply Agreement – Consulting Services Agreement No. 9646 for Keystone –Phase 3&4 Environmental Review dated September 6, 2001 between TransCanada Keystone Pipeline, LP by its agent TC Oil Pipeline Operations Inc., and Exponent, Inc. Schedule A Scope of Work.

The risk assessment (i.e., environmental review) should take into consideration the fact that the focus of 49 CFR 195.6(2) and (3) is to protect particularly sensitive drinking water resources; especially sensitive drinking water resources that have no adequate alternative water supply and whose intakes lie within highly vulnerable aquifers. The identification of sensitive environmental resources, however, should not be limited by those existing code requirements. Rather it should also be informed by the information, analysis, and federal, state, and public input developed through the EIS process.

In light of the information, analysis, and public input received, the examination of sensitive environmental resources should focus on areas of shallow groundwater (defined as a depth to water of less than 50 feet below ground surface), and river crossings less than 100 feet with the presence of sensitive resources. These areas can be identified based on information in the final EIS.

The analysis of potentially sensitive environmental resources should also take account of the particular characteristics of the crude oil likely to be released into the environment in the event of a spill, particularly into an aquatic environment. This should include any specific characteristics that may affect the fate and transport of potential contaminants in the aquatic environment and/or affecting the difficulty of emergency response operations, containment, oil recovery, and remediation efforts. This information would be used to enhance and inform decisions on the DOT response plan(s) for the pipeline if a Presidential Permit were granted.

Exponent's scope does not involve an environmental review of the overall National Environmental Policy Act (NEPA) process as it was carried out for the Project, nor does it provide an independent review of the selected route for the pipeline. The main aspect considered in our environmental review was the potential for the pipeline to impact sensitive environmental resources that border the Project route described in the FEIS and in the Risk Assessment. To carry out our assessment we undertook several tasks, which are described below along with the rationale for undertaking them to meet the objectives of our scope.

1. **Provide Overview of the Overall Keystone Risk Assessment Methodology.** This task was carried out so Exponent would have the necessary understanding of how risks were evaluated and to provide the foundation for identifying other environments that may be sensitive, in addition to those that were explicitly considered in the Risk Assessment and FEIS, as performed by others. The Risk Assessment method used for the Project has been utilized in other pipeline risk assessments and has evolved over the last decade. However, there is no "standard" risk assessment method prescribed by PHMSA. Therefore, in line with Exponent's specific scope of work, our environmental review specifically evaluates the thoroughness of the methodology used in the Risk Assessment to identify potentially sensitive environmental resources (e.g., drinking water aquifer, sensitive ecological resources such as special status species [federal or state-listed as threatened, endangered, proposed or candidate species, BLM

sensitive species, or species of conservation concern]) that have been designated to be considered for additional protection in the event of a spill.

2. **Examine the Characteristics of the Crude Oil Being Transported.** An understanding of the characteristics of the crude oil is essential for evaluating the transport, fate, and effects of this crude in the event of a spill. Therefore, Exponent reviewed these characteristics, as utilized in the Risk Assessment and FEIS and supplemented those evaluations with information from our independent evaluation of the literature. This information was used to support other tasks.

3. **Evaluate Transport and Fate Characteristics**. We examined transport and fate characteristics of spilled crude to evaluate how these spills might affect sensitive environmental resources (e.g., drinking water aquifers and ecological sensitive resources). We focused on larger spills as well as smaller spills that may be below the capability of the Project system for leak detection[3]. We relied upon information provided in the Risk Assessment as well as empirical data reported in the literature. To check certain presumptions about transport, screening-level modeling was carried out to assess the behavior of the spilled oil with respect to transport to and within groundwater, expression at the ground surface, spreading upon the ground surface, and transport in surface water.

4. **Address Sensitive Issue Area 1: Shallow Groundwater.** This task involved an environmental review of the methodology used in the Risk Assessment to evaluate risk to shallow groundwater resources. The agencies raised questions concerning whether there are non-HCA areas that could be particularly sensitive to groundwater contamination and that might warrant additional protection beyond that being planned.

   This task included an evaluation of the spill and transport and fate components of the Risk Assessment with respect to consequences of spills along the pipeline overlying the aquifers. We understand that the context for this particular task is that the Risk Assessment focused mainly on defined HCAs. However, the agencies also expressed a concern about: a) water withdrawal locations that are not defined HCAs (e.g., water withdrawals for agricultural purposes from areas that are not HCAs); b) the possibility that a spill at distance from an HCA or other sensitive area could spread quickly through the aquifer and contaminate the identified HCA or other sensitive area; and c) the issue of future groundwater resources.

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[3] Larger spills were considered as 25,000 bbl spills, which is the maximum estimated spill volume according to the Updated Analysis of Incident Frequencies and Spill Volumes for Environmental Consequence Estimation for the Keystone XL Project, October 2011; p. A-12, Figure A-2. Smaller spills were estimated based on simulations of infiltration of diluted bitumen in permeable sand, which provided estimates for detection times and potential spill volumes (see Section 4).

5. **Address Sensitive Issue Area 2: Stream Crossings Less Than 100 Ft in Width and Associated Ecological Concerns.** While there are regulatory requirements and specified mitigation and control measures specified in the FEIS for river crossings in excess of 100 ft, we were asked to examine the environmental risk and need for any additional mitigation measures for small stream crossings that are less than 100 ft. For these smaller stream crossings, the pipe will be buried to at least 5 ft, but would not necessarily include valves for limiting spillage into the stream. We evaluated the available information to assess whether there were sensitive environments associated with small stream crossings that are less than 100 ft wide that may warrant additional protection. Related to this issues, we also reviewed information on the aquatic toxicity of constituents in the crude as a check on the assessment made in the Risk Assessment of the potential effects of an oil spill to a surface water body. This part of the environmental review also included an examination of information in the FEIS related to special status species, in particular, the presence of these species and their habitats relative to small stream crossings.

   We also commented on how special status species and their habitats might change over the operational history of the pipeline, and how those changes might alter their risk of exposure to potential spills. We provided suggestions for how these changes could be addressed during the lifetime of the pipeline.

To carry out these five tasks, Exponent scientists were organized into teams that addressed each specific topic. The teams shared their evaluation results throughout the process. Our scientists relied mainly on information provided in the Risk Assessment, the FEIS, and on supplemental information provided directly by Keystone. However, we also searched for and accessed relevant publically available information and utilized that information in our evaluation. Numerous questions arose during the course of our evaluation and we relied upon daily calls with Keystone, the agencies, and Battelle to identify additional information and provide the information necessary to help answer these questions. We also held a series of calls with Battelle to coordinate our effort with theirs and to obtain and share information from our respective assessments.

The Exponent environmental review team is described below.

1.1 Exponent Environmental Review Team Roles and Members

The Exponent environmental review team is presented below by role. Brief resumes for the environmental review team members can be found in Appendix A. Specific technical environmental review teams were formed to review the following in more detail:
1) characteristics of crude oil including physical, chemical, and toxicology properties;
2) transport and fate of crude oil as it relates to impacts to groundwater and surface water;

3) small stream crossings in regard to the presence of ecologically sensitive areas (ESAs) associated with them, and 4) special status species considerations related to the Project.

Overall Management

Charles Menzie, Ph.D. (Project Manager)
Michael Kierski, Ph.D.

Technical Review of Document and Quality Control

Paul Boehm, Ph.D.
Walter Shields, Ph.D.

Risk Assessment Methodology

Randall Wentsel, Ph.D. (Team Leader)
Charles Menzie, Ph.D.
Anne Fairbrother, D.V.M., Ph.D.

Crude Oil Characterization Team

Kirk O'Reilly, Ph.D. (Team Leader)
Sungwoo Ahn, Ph.D.
Anne Fairbrother, DVM, Ph.D.
Sheryl Law, M.S.

Transport and Fate Team

Gary Bigham. (Team Leader)
Ronald Breitmeyer, Ph.D.
Farrukh Mohsen, Ph.D., P.E.
Scott Shock, P.E.

Small Stream Crossing Evaluation Team

Anne Fairbrother, DVM, Ph.D. (Team Leader)
Ashley Kaiser, M.S.
Michael Kierski, Ph.D.
Sheryl Law, M.S.
Jane Ma, Ph.D.

Special Status Species Evaluations Team

Richard Podolsky, Ph.D. (Team Leader)
Jane Ma, Ph.D.
Ashley Kaiser, M.S.

2 Risk Assessment Methodology Description

This section presents a description, not a critique, of the Risk Assessment methodology and provides a road map for what portions of the Risk Assessment Exponent and Battelle are reviewing in detail. Areas where Exponent is performing additional evaluations in support of our environmental review are discussed briefly in this section. The detailed evaluations used to support our environmental review are provided in subsequent sections of this report.

In general, the risk assessment approach used by others (AECOM and Dynamic Risk 2009) combines information on the potential for oil spills of particular sizes with information on the proximity of that spill to sensitive areas. From a spill mitigation standpoint those sensitive areas include HCAs. HCAs are collectively identified by PHMSA and include input from multiple federal and state agencies, environmental groups, and the public; they are listed in a national database maintained by PHMSA and are updated periodically. For the pipeline route presented in the FEIS, the locations of HCAs were obtained from PHMSA by Keystone and were mapped in relation to the pipeline.[4] The definition of PHMSA-defined HCAs is discussed later in this report. The distances in miles from the proposed centerline of the pipeline to the HCAs were then calculated and compared to specific distance criteria provided in Table B-1 in Appendix B of the Risk Assessment to assess whether the HCAs could potentially be affected in the event an oil spill were to occur.

For each segment of the pipeline a combination of factors, including potential spill volumes, proximity to HCAs, and numbers of potential HCAs that may be impacted, were used as criteria for ranking the risks of a spill at each pipe segment. As part of the Risk Assessment and FEIS process, Keystone sought input from state agencies and natural resource trustees concerning locations referred to as operator-defined HCAs, which include other sensitive areas such as groundwater protection areas and USFWS-defined critical habitat for threatened and endangered (T&E) species. While no operator-defined HCAs were identified, Keystone conservatively classified all groundwater source water protection areas (SWPA) and wellhead protection areas (WHPAs) as HCAs for the Risk Assessment, regardless of whether they met regulatory criteria as PHMSA-defined HCAs. In Section 5of this report, we describe the methods we used as part of our own evaluation of whether there may be other particularly sensitive resources along the proposed route that are not specifically defined as HCAs, but where additional protection may be warranted.

The Risk Assessment states that a more detailed analysis of the risk to HCAs will be conducted by Keystone prior to commencing Project operations to support the development of an Emergency Response Plan (ERP) in compliance with the U.S. Department of Transportation's (USDOT) Integrity Management Rule (49 CFR Part 195). The final detailed analysis will reflect the final pipeline route selected after completion of the route alternative evaluations in the FEIS. Exponent was informed that the detailed analysis will evaluate worst case discharge volumes released at any location along the pipe, identifying potential spill flow paths, potential

4 The locations of certain types of HCAs, including ecological and drinking water HCAs, are confidential due to Homeland Security issues.

for downstream transport under maximum stream flow velocities (over 20 miles), transport and fate of the released oil, and intersection with HCAs. We would suggest that a final detailed analysis incorporate lessons learned from the Enbridge spill in Marshall, Michigan, concerning fate, toxicity, and response actions. Keystone should also recognize that additional studies on the characterization of dilbit may be necessary. Keystone provided the preliminary HCA evaluation (Appendix B[5] of the Risk Assessment) to assist DOS in its preparation of the FEIS.

The following five sections summarize the *Structure* of the Risk Assessment (Section 2.1), *Purpose* of the Risk Assessment (Section 2.2), an overview of the *Risk Assessment Process* (Section 2.3), the approach for *Assessing Risks to Human Populations* and HCAs (Section 2.4), and the *Delineation of Pipeline Segments Potentially Affecting HCAs and the Risk Ranking Process* (Section 2.5). This section provides the reader with a summary of the methods used for the Risk Assessment. In addition, a brief description of the additional evaluations performed by Exponent and Battelle are provided to put the evaluations provided in Sections 3 through 6 of this report into context.

2.1 Structure

The Risk Assessment includes a brief Project overview and introduction, a section on incident frequency and spill volumes, a discussion on the consequences of a spill, a section on the pipeline safety program, conclusions, and two confidential appendices (Appendices A and B) addressing incident frequencies and spill volumes for environmental consequence estimation and risk ranking.

The sections on the pipeline safety program and mitigations measures in Appendix A of the Risk Assessment (Appendix P of the FEIS) discuss leak detection measures, quality control, a pipeline maintenance program, third-party issues, and threat mitigation measures (e.g., corrosion prevention and emergency response).

2.2 Purpose

The purpose of the Risk Assessment is to provide decision makers with sufficient information to understand the potential hazards associated with the transportation of crude oil through the Keystone XL Pipeline. Specifically, the Risk Assessment identified the predicted spill frequency, relative magnitude of potential risk along the pipeline (i.e., the pipe) using a relative risk modeling approach, pipeline segments most susceptible to spills, and environmental consequences of a spill from the pipe. Because the preliminary Risk Assessment was developed early in the design and NEPA permitting process, the Risk Assessment was not intended as a predictive modeling effort that evaluated site-specific risk associated with an oil spill from the pipeline nor was the Risk Assessment intended to be an exhaustive transport and fate analysis conducted for operational and emergency response purposes. Those detailed analyses are required by Special Condition 14 and PHMSA regulations (as part of the Integrity Management

[5] Appendices A and B of the Risk Assessment are confidential due to site-specific information related to HCAs. These appendices were available to reviewing agencies, but not to the general public.

Program) and will be conducted after the final route is selected as part of the final design of the Project. As stated in the Risk Assessment, its purpose is threefold:

1. To provide a conservative range of anticipated effects from the operation
2. To provide a preliminary evaluation of potential risk during the pipeline's design phase
3. To provide Keystone with an initial basis for the development of emergency response planning and Keystone's Integrity Management Program.

2.3 Risk Assessment Process

2.3.1 Exposure Pathways Identified

Keystone conducted a threat assessment, which identified five primary threats that could result in a release:

- Corrosion (external, internal, and stress corrosion cracking)
- Materials and construction (e.g., pipe steel flaws, defective welds)
- Accidental damage from third-party excavation
- Incorrect pipeline operations
- Facility damage from natural hazards (e.g., landslides, floods).

The Battelle report, that is a companion to our environmental review, evaluates pipe design characteristics and the potential for leaks.

2.3.2 Estimated Frequency of Spills

The Risk Assessment utilized the PHMSA incident database (2008) and stated that the spill frequency analysis produced a conservative incident frequency of 0.000135 incidents per mile per year, equivalent to no more than 2.2 spills in 10 years for the 1,672 miles of the Project, including the Keystone Cushing Extension. An initial spill frequency of 1.38 spills per year was calculated and Keystone incorporated several factors such as technological advances, strength of material, increased regulatory control, and depth of cover to reduce the spill estimate about six fold to 0.22 spills per year. The number of 2.2 spills in 10 years was used throughout the report to calculate risks and impacts.

These estimates are reviewed and discussed in Battelle's companion report and an evaluation of the adequacy is not discussed further in Exponent's report.

2.3.3 Spill Volume Estimates

PHMSA's incident database (2008) was the source of the spill volume data used for comparison to the spill volumes estimated in the Risk Assessment. The Risk Assessment reported that the PHMSA data set (2002 to present) indicated that the majority of actual pipeline spills are relatively small; with 50 percent of the spills consisting of 3.0 barrels or less. In 85 percent of the cases, the spill volume was 100 barrels or less. In over 95 percent of the incidents, spill volumes were less than 1,000 barrels. Oil spills of 10,000 barrels or larger occurred in only 0.5 percent of cases. In Table 3-2 of the Risk Assessment, the frequencies of oil spills of different volumes that are predicted to occur over a 10-year interval were presented. Maximum spill volumes were discussed in the Executive Summary of the Risk Assessment.

These estimates are reviewed and discussed in Battelle's companion report and an evaluation of the adequacy is not discussed further in Exponent's report.

2.3.4 Transport and Fate of Spilled Oil

Section 4.2.2 of the Risk Assessment discusses transport and fate issues and contains a generic description of physical, chemical, and biological parameters, and the processes of oil degradation in soil and aquatic systems. Much of the discussion concerned crude oil in general and was not developed for the specific crude oil blends planned to be utilized in the pipeline: diluted bitumen and synthetic crude oil. Additional studies on the specific crude oil blends are needed.

Exponent has carried out an independent assessment of transport, fate, and the aquatic toxicity of the transported crude. This assessment is provided later in this report.

2.3.5 Effects/Consequences

Consequences of oil spills were evaluated in the Risk Assessment and FEIS using information on estimated spill probabilities and spill volumes together with proximity to sensitive areas. Impacts of spills were evaluated with respect to soils, vegetation and soil ecosystems, wildlife, water resources (groundwater and surface water), aquatic organisms, and wetlands/reservoirs/lakes. For soils, plants and soil ecosystems, and wildlife, a general description of impacts was presented. The chemical benzene, one of the more toxic yet volatile and hence ephemeral constituents in crude, was used to judge the implications of exposure, risks, and the required clean-up in the event of a spill. When a more detailed analysis is conducted, a comparative study between the aquatic toxicity observed in the Enbridge spill in Marshall, Michigan, and benzene would be beneficial.

Consequences of a spill to groundwater were considered with respect to the following location characteristics where migration to groundwater would be more probable:

- Relatively shallow water table is present (as opposed to locations where a deeper, confined aquifer system is present)

- Soils with high permeability are present throughout the unsaturated zone
- Proximity to specific groundwater resources designated as HCAs.

The Risk Assessment relied on transport, fate, and potential risks associated with benzene to judge relative risks to groundwater resources. *Exponent evaluates the methodology and considers vulnerable groundwater areas later in this report.*

The Risk Assessment evaluated impacts to downstream surface water sources by comparing projected surface water benzene concentrations with the national maximum contaminant level (MCL) for benzene (5 parts per billion [ppb]) to evaluate drinking water safety and with aquatic toxicity thresholds to evaluate environmental safety. Because the pipeline will cross hundreds of perennial, intermittent, and ephemeral streams, the Risk Assessment evaluated categories of streams, based on the magnitude of stream flow and stream width. For surface waters, the assessment utilized the following three conservative assumptions to estimate potential spill effects for planning purposes:

- The entire volume of a spill was released directly into a waterbody
- Complete, instantaneous mixing occurred
- The entire benzene content was solubilized into the water column.

Exponent performed an independent evaluation of the effects and consequences analysis in the Risk Assessment, and performed additional independent evaluations to put the results in the Risk Assessment into perspective.

2.3.6 Wetlands, Reservoirs, and Lakes

The Risk Assessment included a discussion of potential impacts to wetlands, reservoirs, and lakes, and stated that the predicted effects of a spill reaching standing water (e.g., reservoirs, lakes) would depend largely upon the volume of crude oil entering the waterbody and the volume of water within the waterbody. Estimates were made of the amount of water necessary to dilute spill volumes below aquatic toxicity and drinking water thresholds. The Risk Assessment acknowledged that while this approach does not account for transport and fate mechanisms, mixing zones, environmental factors, and emergency response capabilities, it provides an initial screening benchmark for identifying areas of potential concern.

Exponent performed an independent evaluation using the information in the FEIS on these types of sensitive ecological habitats (wetland, reservoirs, and lakes) to determine if they were located along the pipeline in close proximity (i.e., 10 miles) of small stream crossings.

2.4 Risk to Human Populations and HCAs

Pipeline safety regulations use the concept of HCAs to identify specific locales and areas where a release could have the most significant adverse consequences. HCAs are defined within the Integrity Management Rule (49 CFR Section 195.450) and include:

- Populated areas (e.g., city, town, village, or other designated residential areas)
- Commercially navigable waterways
- Designated zones around public drinking water intakes using PHMSA-defined drinking water unusually sensitive areas (USAs)
- Unusually sensitive ecological resource areas that could be damaged by a hazardous liquid pipeline release, including:
  - An area containing critically imperiled species or ecological community
  - Multi-species assemblage areas
  - A migratory waterbird concentration area
  - Areas containing imperiled special status species or imperiled ecological communities where the species is aquatic, aquatic dependent, or terrestrial with a limited range
  - An area containing special status species where the species or community occurrence is one of the most viable, highest quality, or best condition, as identified by an element occurrence ranking (EORANK) of A or B.

The Risk Assessment identified a total of 141.2 miles of pipeline associated with HCAs, with 84.3 miles associated with drinking water source HCAs, 63.9 miles associated with ecologically sensitive area HCAs, and 17.2 miles associated with populated area HCAs. Keystone consulted with USFWS on special status species and identified appropriate conservation measures as necessary.[6] The probability of a spill occurring in a pipeline segment associated with a particular type of HCA was predicted based on the number of miles of pipeline associated with each type of HCA and the base number of average spills predicted to occur (e.g., 1 spill in 53 years for all HCAs crossed by the pipeline).

The Risk Assessment states that the portions of the pipeline that could potentially affect HCAs will be subject to higher levels of inspection and repair criteria (per 49 CFR Part 195), and identifies additional valve locations beyond the original design and regulatory requirements, as a

[6] Exponent was informed that DOS prepared a biological assessment that evaluated the impacts of construction and operation impacts on T&E and candidate species for the entire pipeline. USFWS issued the biological opinion on September 23, 2011, that concurred with the biological assessment findings.

measure to reduce potential risk to HCAs. As a result of the preliminary HCA evaluation, some proposed valve locations were moved and additional valves were added to protect HCAs. In addition, a yearly survey of HCA locations is planned to update the Integrity Management Program.

Exponent used information on the locations of HCAs provided by Keystone to assess the number of HCAs within 10 miles of the proposed center line of the pipeline along specific segments of the pipeline.

2.5 Pipeline Segments Potentially Affecting HCAs and the Risk Ranking Process

The Risk Assessment discussed specific portions of the Project referred to as contributory pipeline segments (CPSs) where, if a spill were to occur, crude oil has the potential to reach HCAs (i.e., "could affect" segments). The authors then developed a process to rank, in risk levels from 1 to 4, the degree of the potential risk for specific pipeline segments by assessing the spill volume and physical transport pathway factors.

The Integrity Management Rule requires that the pipeline be evaluated to identify pipeline segments in which the released crude oil from a failure occurring anywhere between the two endpoints of the value segments could migrate to and affect a HCA. To identify the segments of the pipeline that could potentially affect HCAs, a three-step process was used:

- In the first step, HCAs were screened to determine which areas were within a reasonable proximity to the Project's proposed centerline of the pipeline and also had a viable physical pathway to transport a spill to the HCA.
- The second step of the process was to review those specific segments of the pipeline where, if a spill were to occur, crude oil could potentially reach areas of a HCA or HCA buffer area that contribute to the purpose of the HCA. CPSs were eliminated if the intersection of HCA buffer with the pipeline did not interfere with the purpose of the HCA (e.g., the drinking water HCA buffer area intersects with pipeline below the drinking water intake).
- The third step ranked the relative risk of each pipeline segment capable of affecting a HCA.

Most of the pipeline was removed from consideration in Step 1 and Step 2 of the process. The risk ranking step utilized five factors to categorize the identified CPSs into one of four levels, with level 1 being of the highest concern and level 4 being of lower concern for potential impacts to impact HCAs. The proximity and number of HCAs and maximum spill volume within the CPS were key factors in the ranking of a CPS. The evaluation conservatively assumed 900,000 bpd throughput to calculate maximum spill volume.

The ranking process identified 196.5 miles of the pipeline where the CPSs were ranked from 1 to 4. For risk category 1 (the highest concern), 63.7 miles of the pipeline consisting of nine CPSs, were identified. The higher risk ranking was associated with major river crossings.

The CPS locations are a particular focus for Exponent's review because they are identified in relation to HCAs and because Exponent was tasked with identifying environmental characteristics that may indicate where other sensitive areas are located along the proposed route that are not specifically defines as HCAs. To the extent that such areas are identified in our review, the pipeline segments near these locations may be considered CPSs for the purpose of considering the advisability of additional oil spill controls (e.g., valves) or countermeasure plans.

3 Review of Crude Oil Composition

3.1 Introduction

The purpose of this section is to assess Keystone's characterization of the chemical and physical properties of the oil blends to be transported in the pipeline, and to compile crude oil compositional data used in the subsequent sections of this report. Exponent compared the characteristics of diluted bitumen (dilbit) and synthetic crude oil (SCO) to typical crude oil using data from a number of sources. The following are Exponent's key findings/conclusions, followed by our recommendations. The remainder of this section provides the documentation to support these findings/conclusions and recommendations.

3.1.1 Key Findings/Conclusions

- The physical and chemical characteristics of dilbit are consistent with a heavy crude oil
- The physical and chemical characteristic of SCO are consistent with a medium gravity crude oil
- The benzene concentrations of both oils are within the range of typical crude oils
- The concentrations of PAHs are within the range of typical crude oils.
- While the total acid number of dilbit is within the range of acidic crude oils, the fraction of the acids consisting of naphthenic acids is unknown
- For the factors considered by Keystone in the Risk Assessment, we agree with their conclusion that dilbit and SCO are sufficiently similar to crude oil so that they should not result in an excess risk in case of a release.

3.1.2 Recommendations

- Although PAH concentrations in petroleum are low compared to some environmental sources, this class of compounds can be a long-term driver for remediation and risk management following an oil spill. While not required at this stage in the process, Keystone should consider obtaining addition information on the PAH chemistry of the oils to be transported.
- Given the perceived link between tar sands processing and aquatic toxicity due to naphthenic acids, Keystone should consider obtaining addition information on the naphthenic acid content of the oils to be transported.

- Knowledge on the chemistry of dilbit continues to increase. This new information should be incorporated into planning and operations as appropriate (e.g., to improve the spill response planning).

3.2 Chemical Characteristics and Physical Properties

The FEIS and Risk Assessment focused on the two oils, dilbit and SCO, that will be primarily shipped from Alberta. As noted in the FEIS, the precise composition of these will vary by production location and as the result of upgrading processes. Data on the nature and chemical composition of these oils are available from the online database crudemonitor.ca. This database contains the results of regularly conducted analyses of western Canadian crudes including six heavy sour Canadian crude oils, eight types of dilbit, and seven SCOs. Using this information, Keystone concluded that the oil to be shipped by the pipeline is consistent with crude oils commonly shipped by pipeline and processed in the United States.

To evaluate this conclusion, we compiled data on Alberta dilbit and SCO from a number of published sources and compared their chemistry to that of typical crude oils. As summarized in Table 1 and on Figure 1, diluted heavy bitumen (dilbit) is generally similar in its physical characteristics to the heavy sour crudes. Distillation curves reveal the mass of the oil present in specific boiling ranges and indicate the relative distribution of lighter and heavier compounds. Lighter crudes are typically more mobile under environmental conditions, but are also more susceptible to weathering (e.g., evaporation) and biodegradation. Crudes with more heavy ends are less mobile, and while also subject to various weathering processes, can be more persistent in the environment. Because of the processing used to generate SCO, its characteristics are generally similar to a light crude. For these bulk characteristics, our findings are consistent with Keystone's conclusions.

In the National Transportation Safety Board's Pipeline Accident Report (NTSB 2012) on the Enbridge release in Marshall, Michigan, material similar to what will be transported in the XL pipeline was described as:

> Cold Lake Blend and Western Canadian Select crude oil condensate mixtures are regulated by the U.S. Department of Transportation (DOT) as class 3 flammable hazardous materials. Heavy crude typically is a mixture of crude oil (from 50 to 70 percent) and hydrocarbon diluent (from 30 to 50 percent). The material contains 20 to 30 percent volatiles by volume. The mixture is used as raw material in the production of fuels and lubricants. It is a brown or black liquid with a hydrocarbon odor; it is lighter than water with a specific gravity of 0.65 to 0.75. It exhibits a flashpoint of -31° F. The vapor is heavier than air, with a lower explosive limit of 0.8 percent and an upper explosive limit of 8 percent vapor concentration in air.

While slightly more detailed, this is consistent with the description used in TransCanada's risk assessment. If more chemical or oil characteristic data become available from the Enbridge incident, it should be incorporated as appropriate in spill response planning documents.

Table 1. Summary of crude characteristics data from crudemonitor.ca.

	Density (kg/m^3)	Gravity (deg. API)	Sulphur (wt%)	TAN (mgKOH/g)	Salt (ptb)	Nickel (mg/L)	Vanadium (mg/L)	Benzene (vol%)	Toluene (vol%)	Ethyl Benzene (vol%)	Xylenes (vol%)
Heavy Sour Conventional Blend											
Average	929.40	20.61	3.05	0.67	59.05	44.44	93.11	0.09	0.15	0.06	0.24
SD	4.64	0.76	0.12	0.12	38.62	5.05	10.78	0.03	0.05	0.01	0.05
Max	937.50	21.80	3.39	1.10	136.50	64.20	127.30	0.15	0.32	0.11	0.52
Heavy Sour Dilbit Blend											
Average	922.30	21.80	3.94	1.70	6.81	72.02	193.52	0.29	0.50	0.06	0.39
SD	5.66	0.94	0.10	0.12	1.38	5.01	12.27	0.03	0.07	0.01	0.08
Max	932.60	23.50	4.15	1.94	10.00	83.00	227.00	0.37	0.74	0.11	0.57
Sweet Syncrude Blend											
Average	862.08	32.49	0.10	--	--	0.44	0.93	0.04	0.14	0.10	0.32
SD	3.65	0.69	0.02	--	--	0.27	0.46	0.02	0.04	0.02	0.05
Max	870.10	35.50	0.19	--	--	0.88	1.50	0.11	0.26	0.19	0.49

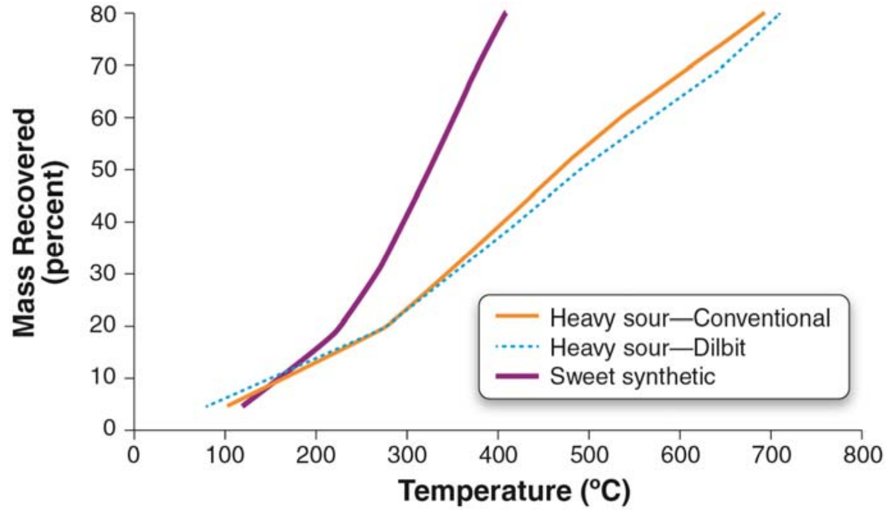

Figure 1. Simulated distillation curves based on 5-year average data from crudemonitor.ca.

Certain physical characteristics are important factors in predicting the transport and fate of petroleum in the environment. These are density, viscosity, and surface tension. Density information is available in the crudemonitor.ca database. Both the dilbit and SCO have densities below one, with the dilbit (929 kg/m^3) being heavier than the SCOs (857 kg/m^3). This means these oils are less dense than water when shipped, but the density can increase following a release due to the loss of the lighter hydrocarbon fractions. As with the transport of other heavy crudes, response plans should consider both floating and sinking oil. The viscosity of both dilbit and SCO can be changed by varying the relative mixture of heavier and lighter cuts. Keystone requires that material shipped in the Keystone XL Pipeline have a viscosity of 350 cST (Kothari 2010). The range of surface tension of crude oils is typically around 30 dynes/cm, and the interfacial oil/water tension varies with API gravity and is near 20 dynes/cm for heavy crudes (Lyons 1996).

Additional information on the chemical characteristics of dilbit may be available from entities involved in the response to the July 2010 Enbridge oil spill in Marshall, Michigan. Chemical fingerprinting of the source oil was conducted by the U.S. Coast Guard’s (USCG) Marine Safety Laboratory. While one page summaries are available through the EPA Region 5 website, details were not provided. The full data reports including chromatograms can be requested from the USCG laboratory.

3.3 Potential Risk Drivers

To evaluate potential impacts of a release, it is important to have information on the concentrations of compounds that can drive risk to human health or ecological receptors. Benzene is a typical petroleum compound of concern and a focus of much of the evaluation of potential impacts to surface water and groundwater. The concentration of benzene in some dilbit is twice as high as the mean but well below the maximum benzene concentration of

69 crude oils (Rixey 2001; Table 2). The benzene concentration of SCO is less than the mean concentration for crude oil. These findings suggest that the risk due to benzene for either dilbit or SCO should not be greater than that due to a typical crude.

Table 2. Mean, standard deviation, and maximum benzene concentrations (mg/kg crude) from crudemonitor.ca compared to a screen of 69 crude oils (Rixey 2001)

	Mean	Standard Deviation	Maximum
Benzene (mg/kg)			
Sixty-nine crudes	1,340	-	5,900
Heavy sour conventional blend	857	280	1,501
Heavy sour dilbit blend	2,773	299	3,515
Sweet syncrude blend	374	163	1,122

Although PAH concentrations in petroleum are low compared to some environmental sources, this class of compounds can be a long-term driver for remediation and risk management following an oil spill. While not required at this stage in the process, Keystone should consider obtaining addition information on the PAH chemistry of the oils to be transported. The FEIS contains little discussion about the concentrations or potential environmental impacts of PAHs. While PAHs are considered to be among the most toxic of the nonvolatile compounds in petroleum, their concentrations are typically low (less than 1 percent to about 3 percent by weight) compared to their concentrations in materials such as coal tars. Oil contains both the unalkylated PAHs that are typically measured as part of environmental assessments and a number of alkyl-substituted forms. Recently published data on the PAH chemistry of dilbit and SCO (Yang et al. 2011) indicate the total concentration is in the low range (<0.5 percent) of crude oils. Table 3 compares the concentration of individual PAHs for a typical crude oil (Boehm 2006), dilbit, and SCO. The lower total PAH concentration is due primarily to depletion of the two- and three-ringed compounds such as the naphthalenes and fluorenes. Because of the ubiquitous nature of these compounds and the multiple sources other than oil, they are often present in sediments, unrelated to crude oil or petroleum. An understanding of the PAH profiles of pipeline oils would allow for differentiation between baseline and spill impacts.

Table 3. PAH concentrations (µg/kg) in a typical crude oil (Boehm 2006), dilbit, and SCO (Yang et al. 2011)

PAH	Crude Oil	Dilbit	SCO
Naphthalene	1,268	25	31
C1-Naphthalenes	3,886	112	155
C2-Naphthalenes	4,511	376	333
C3-Naphthalenes	2,988	682	406
C4-Naphthalenes	1,000	741	354
Biphenyl	233	ND	9
Acenaphthylene	--	3	2
Acenaphthene	47	7	5
Fluorene	267	20	14
C1-Fluorenes	521	70	54
C2-Fluorenes	682	171	124
C3-Fluorenes	420	251	188
Anthracene	ND	10	6
Phenanthrene	370	31	55
C1-Phenanthrenes/Anthracenes	718	101	195
C2-Phenanthrenes/Anthracenes	716	166	321
C3-Phenanthrenes/Anthracenes	460	200	374
C4-Phenanthrenes/Anthracenes	154	146	357
Fluoranthene	14	6	19
Pyrene	18	18	206
Benz[a]anthracene	2	4	38
Chrysene	32	8	53
C1-Chrysenes	51	48	359
C2-Chrysenes	67	89	502
C3-Chrysenes	38	83	379
Benzo[b]fluoranthene	9	5	25
Benzo[k]fluoranthene	--	1	6
Benzo[e]pyrene	12	7	75
Benzo[a]pyrene	--	4	50
Perylene	--	9	28
Indeno[1,2,3-cd]pyrene	--	2	21
Dibenz[a,h]anthracene	--	2	22
Benzo[ghi]perylene	4	5	109

Given the perceived link between tar sands processing and aquatic toxicity due to naphthenic acids, Keystone should consider obtaining additional information on the potential range of naphthenic acid content of the oils to be transported in the future. Naphthenic acids are a class of compounds found in Canadian oil sands that can potentially result in aquatic toxicity if released into the environment and have been the subject of significant research (Clemente and Fedorak 2005). While questions about the link between these compounds and corrosion are discussed in the Section 3-13 of the FEIS, the FEIS does not discuss the potential environmental implications of this class of compounds. Exponent was informed that the majority of naphthenic acids are removed from Alberta crude upon extraction but that data are lacking on concentrations. The total acid number (TAN) is used as a surrogate. Although the toxicity associated with raw tar sand and tar sand process waters has been well studied, less is known about the acids found in dilbit. Because of the caustic soda washing process used to separate bitumen from oil sands, the acids remaining in dilbit should be depleted more than in water soluble compounds. TAN is an indicator, but not a direct measurement of, naphthenic acids found in crude. TAN values for heavy WCSB and dilbit are consistent with data from 18 international crudes (Aske et al. 2001; Table 4). With a TAN of > 1.0, dilbit would be considered to be an acidic crude, while the heavy WCSB crude is moderately acidic (APEC 2005). Naphthenic acids are not present in SCO.

Table 4. Total acid number (mg KOH/g) compared to a screen of 18 crude oils (Aske et al. 2001)

Mean of 18 Crudes	Median of 18 Crudes	Heavy Sour–Conventional	Heavy Sour–Dilbit	Sweet Synthetic
1.20	0.60	0.64	1.46	0.00

4 Transport and Fate of Spilled Oil

4.1 Introduction

This section presents Exponent's independent assessment of the potential transport and fate of oil in the event of a spill from the Keystone XL pipeline as discussed in the Risk Assessment (Appendix P of the FEIS). Exponent conducted additional transport and fate analyses and a review of the empirical literature related to crude oil spills to provide additional detail on the behavior of potential spills beyond that provided in the Risk Assessment. This information was needed to address questions that DOS and other agencies have posed to Exponent concerning identification of sensitive environmental resources and potential impacts not addressed in the Risk Assessment.

The FEIS provides extensive discussion of groundwater and surface water resources along the path of the pipeline. An evaluation of the potential magnitude of spills and the consequences of a spill to these resources is presented in the Risk Assessment. The PHMSA spill information and the methods used by Keystone to predict the magnitude of potential crude oil spills from the Keystone XL Project presented in the Risk Assessment are reviewed in detail as part of Battelle's third-party review, and are not discussed in Exponent's evaluation.

The Keystone transport and fate evaluation in the Risk Assessment related to spilled oil is primarily a qualitative description of the physical and chemical processes that act upon oil in the environment and influence the distance that the oil may travel. The extent of transport of a particular spill depends on the leak rate and duration, properties of the oil released (presented in Section 3), as well as specific site conditions. The Risk Assessment provides limited quantitative evaluation to estimate the potential extent of a spill. Our review of transport and fate takes into account the characteristics of the oil as described in Section 3 of the Risk Assessment. Our assessment relies on information provided in the Risk Assessment and FEIS, on empirical and literature data (e.g., viscosity of the oil and distance that oil spills have been known to travel in surface water), and on screening calculations made to quantitatively check statements in the Risk Assessment and to help support other aspects of our evaluation.

Our evaluation of sensitive groundwater and surface waters depends in part on how the spilled oil will behave in these environments. Therefore, we were interested in considering how quickly large and small spills might reach aquifers and the behavior of dissolved constituents in these aquifers. Our screening calculations are not an exhaustive transport and fate analysis. The detailed analyses that are required by Special Condition 14 and PHMSA regulations, as part of the Integrity Management Program, will be conducted after the final route is selected as part of the final design of the project. As noted, our evaluation in this regard is essentially a check on the work that has been conducted for the Risk Assessment, but also supports our examination of locations of shallow groundwater receptors that may be impacted by a spill. The rate of migration of an oil spill to and in groundwater is an important consideration because the relative speed of these processes is an important consideration for ERP development and bears directly on response time planning and the ability to contain and clean up spills that might occur.

Similarly, the distance that a spill to surface waters could travel is important for identification of HCAs and for spill response planning.

The following sections provide quantitative estimates of the potential transport of oil to groundwater for two scenarios: a large volume spill or rupture, and a small leak. A discussion of the potential transport of oil overland is also provided. The analyses are based on a general range of conservative conditions and are intended to provide a sense of scale of potential oil impact. Thus, findings are expected to be a conservative characterization of what could happen along the pipeline. For each of the quantitative evaluations described above, we considered the ramifications of the findings of our evaluation in light of the effects they would have on the final Project design and ERP. The following are Exponent's key findings/conclusions, followed by our recommendations. The remainder of this section provides the documentation to support these findings/conclusions and recommendations.

4.1.1 Key Findings/Conclusions

- The flow of oil overland is affected by many variables including spill rate, topography, soil type, and vegetation. To provide a sense of scale, a highly simplified case of a sudden spill of 25,000 bbl to a flat surface is presented. If the spill flows in a radial pattern, is 1 ft deep, and there is no spill response, it would spread with a radius of about 200 ft. A pool with a depth of 0.1 ft would spread to a radius of about 700 ft. If a surface spill was influenced by topography and flowed in a channelized manner, the distance traveled could be on the order of thousands of feet, depending on the steepness of the terrain, presence of vegetation, etc. Keystone conservatively assumed in the Risk Assessment that a large spill would be capable of moving overland up to 1 mile. Therefore, considering our analyses, the 1 mile distance criterion used in the Risk Assessment is considered adequate. Where HCAs are located within 1 mile of the pipeline, Keystone is required to perform a site-specific evaluation of overland flow (spreading analysis).

- Exponent applied a numerical screening model, the hydrocarbon spill screening model or HSSM, to estimate the behavior of a large spill of dilbit from the pipeline in an area with a high permeability shallow aquifer. The HSSM modeling simulation showed that groundwater impacts from a large spill would likely occur first from infiltration from the trench near the rupture and not from oil spread across the ground surface. Oil in the potentially filled trench near the rupture could begin forming a non-aqueous phase liquid (NAPL) lens at the water table in less than 1 day if the water table is 1 ft below the trench (8 ft below ground surface), in 7 days if the water table is 3 ft below the trench (10 ft below ground surface), and in 50 days if the water table is 10 ft below the trench (17 ft below ground surface). In contrast, oil infiltrating from the ground surface would reach a water table 8 ft below ground surface after approximately 240 days.

- Results from HSSM simulations of a large spill (25,000 bbl) illustrate that plume lengths for dissolved hydrocarbons (i.e., benzene at or above the

MCL) under typical groundwater gradients could be between 100 and 900 ft in length. This range is consistent with those reported in the literature; most reported plumes are less than 200-300 ft and a very small number of plumes exceed 1,000 ft. HSSM simulations were also performed to explore an elevated groundwater gradient, representing the potential influence of groundwater extraction (irrigation wells) near the pipeline. When coupled with a simulated low degradation rate (representing an upper bound condition), the higher groundwater gradient could extend the plume length to as much as 2,600 ft.

- Modeling results agree with the conclusions in the Risk Assessment that a small leak going undetected indefinitely is unlikely. More likely, oil from a small “pin hole” leak (28 bbl/day) would reach the ground surface on a time scale of a few months. Based on the screening level modeling, a benzene plume that may form because of a small leak was estimated to travel downgradient by as much as 600 ft.

- Many private wells located near the pipeline do not meet the criteria to be classified as HCAs in the Risk Assessment. Exponent considered potential factors that could be used to identify non-HCA groundwater areas for shallow groundwater (< 50 ft) where more extensive spill prevention measures and monitoring may be warranted. Based on our analysis of possible plume dimensions, we selected a downgradient distance of 1,000 ft from the proposed centerline of the pipeline as a reasonable boundary of a plume for identifying shallow groundwater and associated wells that could be within the influence of an oil spill. This distance recognizes that large spills would be readily detected and remediated and that small leaks that could take longer to be detected would have smaller plumes. Based on an independent review of the NEDNR well database in Nebraska, Exponent identified approximately 260 wells (not screened by depth) within 1,000 ft of the proposed centerline of the pipeline. Most of these wells are used for irrigation purposes but domestic wells are also present, several of which draw from shallow groundwater. This list will need to be revised once the final pipeline is determined.

- The relative vulnerability/sensitivity of groundwater resources to a dissolved hydrocarbon plume from an oil spill can be assessed by considering combinations of several factors: 1) proximity to the pipeline (<1,000 ft); 2) depth from point of the oil release to the water table (e.g., release of oil at or below the water table will affect groundwater quality more quickly than releases many feet above the water table); 3) depths of receptor wells (wells that are 10s of feet deep are more vulnerable than wells that are 100s of feet deep); and 4) the pumping of receptor wells (wells with higher pumping rates are more likely to draw plumes further downgradient than wells with lower pumping rates). The following combination of factors could be used to identify groundwater resources that do not meet the listing criteria for HCAs but may be more vulnerable to a dissolved benzene plume emanating from an oil spill. An example of this would be a cluster of irrigation wells and domestic wells located within 1,000 ft of a pipeline segment where a release of oil occurred in or within a few feet of the water table.

- The assessment in the FEIS conservatively assumes that in the event of a worst-case spill in which all of the benzene partitions from the oil into water in streams with a range of flow rates. The assessment is useful for comparison of worst-case benzene concentrations to human health and ecological concentration benchmarks and is discussed further in Section 5 of our review. However, the FEIS does not provide an evaluation of possible transport distances of oil via surface water. This appears to be a gap that needs to be addressed.

- The primarily qualitative assessment of the transport and fate of oil in the event of a spill presented in the Risk Assessment is consistent with our analysis and review of the literature. Ultimately, quantitative analysis of transport and fate in surface waters is required by Special Condition 14 and PHMSA regulations as part of the Integrity Management Program during the final design of the project after the final route is selected. These evaluations should take into account the lessons learned from the pipeline rupture in Enbridge, Michigan in 2010.

4.1.2 Recommendations

- Keystone, as part of the final Project design, should perform further evaluation of overland flow (spreading analysis) of spilled oil, and further evaluation of the transport of spilled oil in small streams (e.g., the downstream distance crude oil could travel from the proposed centerline of the pipeline) for purposes of ERP. These analyses should take into account potential density and viscosity increases associated with the loss of volatiles from heavy crudes and diluted bitumen.

- Keystone should use the screening criteria (e.g., well depth, depth of release compared to water table, lithology between pipeline and aquifer) suggested in our report for identifying vulnerable/sensitive groundwater resources adjacent to the pipeline that do not classify as HCAs but that may be more vulnerable to exposure to a benzene plume in the event of a an oil spill. For example, these could be defined as clusters of both domestic and irrigation wells within 1,000 ft of a pipeline segment where an oil spill could occur in or within a few feet of the water table. Exponent recommends that additional modeling be performed as part of the final design of the Project to further refine the appropriate downgradient distance criteria to be used for identifying sensitive clusters of wells. Exponent recommends that these non-HCA groundwater resources should be afforded a degree of protection from the occurrence of an oil spill and from the consequences of a spill similar to what is currently afforded to groundwater resources that are defined HCAs.

- Considering the above-mentioned screening analysis, Exponent recommends that Keystone consider how to improve upon external leak detection through more frequent inspections and education of property owners for wells within these areas of sensitive groundwater resources.

4.2 Transport and Fate on Land (Overland Flow)

An assessment of overland flow provides insight into the vulnerability of sensitive areas with respect to distance from the pipeline. Overland flow of a large spill will depend on many factors, including topography, ground cover, soil type, product characteristics (e.g., dilbit versus more traditional crudes), meteorological conditions, and other factors that affect infiltration, evaporation, and flow of spilled product, as discussed in FEIS Section 3.13.5.1. However, the FEIS does not appear to include a quantitative evaluation of how far spilled oil might move over land.

Keystone updated the analysis of spill frequencies and volumes (TransCanada 2011) that had been presented in the Risk Assessment. The updated analysis evaluates the worst-case volume of a spill at specific points along the pipeline based on topography, valve location, and other factors. This analysis reflects a major pipe leak or rupture, which results in complete draining of oil from a section of the pipeline. The calculation was performed at varying intervals based on where the most accurate elevation data were available. Fifty percent of all spills modeled by Keystone were less than 6,375 bbl and the maximum was approximately 25,000 bbl (TransCanada 2011, p. A-12, Figure A-2).

For the purposes of conducting a simple screening calculation to evaluate how far oil might travel, upper bound values (i.e., maximum values for travel distance) can be calculated using simplifying assumptions. For example, using a spill size of 25,000 bbl, if uniform radial flow from a spill source is assumed on a flat landscape, the product could spread hundreds of feet, depending on the pool depth assumption. Only accounting for the geometry of the pool, a 25,000 bbl pool of 1 ft depth would spread with a radius of about 200 ft; a pool with a depth of 0.1 ft would spread to a radius of about 700 ft.

If a surface spill occurs in a situation where topography causes the product to flow in a channelized manner, the distance traveled could be on the order of thousands of feet, depending on the steepness of the terrain, presence of vegetation, etc. This projected distance is less than that used for the Risk Assessment, which conservatively assumed a large spill would be capable of moving overland for 1 mile. Using this distance, Keystone evaluated whether a spill that travels 1 mile would intersect with the buffer zone surrounding HCAs. HCAs included sensitive drinking water resources that were identified during the EIS process. Any pipeline segment that could contact an HCA buffer was considered a "could affect" segment. Future detailed analysis of overland flow that accounts for such factors as topography, transport channels, and the presence of water is required by Special Condition 14 and PHMSA regulations as part of the Integrity Management Program during the final design of the Project. So, the initial 1-mile criteria will be expanded as appropriate during the final design phase of the Project.

4.3 Transport and Fate in Groundwater

In support of Exponent's review of the Risk Assessment, and to address specific issues from DOS, the following sections discuss transport and fate processes in groundwater; evaluate large spill and small spill scenarios and their potential impacts on groundwater; and provide an evaluation of sensitive groundwater areas near the pipeline.

4.3.1 Transport and Fate Processes in Groundwater

The FEIS (Section 3.13) points to the Bemidji, Minnesota, crude oil spill site as a basis for predicting the potential impacts to groundwater of an oil release. Exponent agrees with this approach because of the consistency in dissolved hydrocarbon behavior at Bemidji and other petroleum impacted sites (Newell and Conner 1998; U.S. EPA 2002; Essaid et al. 2011). These studies indicate microorganisms that can consume hydrocarbons are ubiquitous in shallow groundwater. Biodegradation of dissolved petroleum constituents result in a reduction of mass and limits plume lengths. This process, called natural attenuation, is recognized as a valid remedial technology by EPA and other regulatory agencies (ITRC 1998; U.S. EPA 2002, 2004).

Exponent agrees with the FEIS finding that even if oil reaches groundwater, dissolved hydrocarbon plume lengths are unlikely to be more than a few hundred feet. The FEIS cites an American Petroleum Institute report (Newell and Conner 1998) that presented the results of four studies (a total of 600 plumes evaluated) that found the median dissolved hydrocarbon plume length ranged from about 100 to 200 ft. Seventy percent of the 600 plumes considered in the studies were less than 200 ft and 90 percent were less than 320 ft. Our review of more recent studies (Ruiz-Aguilar et al 2003; Shih et al. 2004; Kamath et al., 2012) confirms the finding that most benzene plumes are less than 200 ft and very few plumes exceed 1,000 ft. Dissolved BTEX plumes were observed at the Bemidji site approximately 20 years after the spill and extended from 300 ft to 600 ft downgradient (in the direction of groundwater flow) (Essaid et al. 2011), which further supports the length scales for potential dissolved groundwater plumes discussed in the FEIS.

Most of the hydrocarbon plumes studied were in shallow groundwater and at sites not under the influence of large volume groundwater extraction (irrigation) systems. Large volume groundwater production wells have the potential to locally increase hydraulic gradients resulting in more rapid transport of groundwater contaminants. Site-specific modeling is required to determine whether such systems may influence local plume lengths.

In the following sections, we apply screening models to evaluate the potential range of downgradient migration distances for dissolved hydrocarbons. These analyses are intended as a crosscheck against the empirical data found in the literature, based on potential spill and migration scenarios in the pipeline context.

4.3.2 Large Spill

We used a screening model to examine the behavior of a large spill from the pipeline. The purpose of the analysis was to gain insight into the rate of transport and spreading and the distances and areas that may be impacted. This information is used elsewhere in this report to assist in evaluating the vulnerability of potentially sensitive groundwater areas. A key consideration in this regard is the ability to respond to and control a spill before it spreads to sensitive areas or before it results in a dissolved hydrocarbon plume that may affect such areas. Our assessment has been incorporated into recommendations concerning mitigation that are provided in the Fate and Transport from an Engineering Perspective section of the Battelle report.

4.3.2.1 Infiltration and Potential Groundwater Contamination

The potential scale of infiltration of oil and dissolved constituents and subsequent contamination of groundwater from a large, rapid release, such as the pipeline spill in Bemidji, Minnesota, in 1979 was evaluated using the Hydrocarbon Spill Screening Model (HSSM) developed for EPA (Weaver et al. 1994). HSSM is a screening model that includes a variety of chemical and hydrologic processes and is based on a simple conceptualization of a LNAPL release. The model simulates vertical LNAPL flow and transport from the ground surface to the water table due to gravity and capillary forces. The LNAPL is then simulated to float and spread radially in the capillary fringe forming a LNAPL lens. Additionally, HSSM simulates dissolution of chemical constituents of the LNAPL into the aquifer and migration in the direction of groundwater flow creating contaminant plumes. Simulations with HSSM are an illustrative and simplified screening-level calculation and should not be relied upon for final risk determinations, emergency, and/or environmental planning/response actions.

HSSM was used to estimate the potential for groundwater contamination from oil spilled on highly permeable soil (i.e., sand) and the downgradient groundwater transport of dissolved contaminants (i.e., benzene) from the spill in an area with a highly permeable, shallow aquifer. These conditions represent a potential worst-case scenario that may occur along the pipeline. The objective for these simulations is to evaluate if the Risk Assessment made realistic statements about the potential impacts of a large spill to shallow groundwater.

A simple conceptual model of a large spill is used for HSSM simulations. A large release is defined as 25,000 bbl (1,050,000 gallons) which is consistent with the large spill volume considered for the over-land flow calculations (see Section 4.2). The spilled oil is assumed to be released rapidly and quickly move from the pipe up to the ground surface and spread over an area of 4.5 acres[7] (in circular area with a radius of 250 ft)[8]. Surface spreading of the oil reduces the rate of oil infiltration as the thickness of the oil on the surface (and therefore the pressure driving flow) decreases. High-pressure oil is assumed to move to the ground surface because of the low vertical pressure applied by the overlying trench backfill relative to the anticipated pipeline operating pressure (the FEIS specified the maximum pipeline operating pressure to be

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[7] 4.5 acres was the approximate aerial extent of the Bemidji, MN spill and was assumed as the surface area for large spill modeling. This assumption is conservative in that the modeled large release is more than double the volume of the Bemidji, MN spill (25,000 bbl versus 10,700 bbl) (Essaid et al. (2011)) but is being applied over the same area.

[8] This was an assumed area for calculations using HSSM. The spill footprint would likely vary depending on local topographic conditions. Smaller footprints would tend to lead to higher infiltration as oil would pond deeper and have more head to induce flow. Larger areas would have an opposite effect.

1,600 psig). Oil released at high pressure is anticipated to move in the direction of the lowest principle stress (i.e., upward) and away from lateral and underlying soil confinement. Based on an assumed area of 4.5 acres, and a volume of 25,000 bbl, oil is simulated to initially pond at a depth of 0.75 ft (i.e., all oil is assumed to move to the ground surface). The spill is assumed to occur instantaneously over the 4.5-acre area, and exist at a constant depth of 0.75 ft for one hour[9] followed by a gradual decrease to zero surface depth as the ponded oil infiltrates. This model simulates the vertical infiltration of oil spread on a uniform ground surface.

In addition to oil infiltrating from the ground surface, if a large rapid release occurred from the buried pipeline, localized filling of the trench with oil might result. This zone of filled trench will have a greater depth of oil to drive infiltration than oil spread on the ground surface, and will originate from an elevation closer to the water table than the ground surface. Based on this conceptual model of infiltration from a large spill, a second scenario was developed for HSSM simulations in which oil was simulated to infiltrate from the bottom of the filled trench. The trench was assumed to be 7-ft deep[10], and was modeled to be filled with 7 ft of oil[11] atop the trench bottom for one hour (during the release) followed by a gradual decrease to zero ponded depth as the oil infiltrated. Although the maximum operating pressure in the pipeline is specified in the FEIS to be 1,600 psig, oil released at high pressure is assumed to rapidly lose pressure as oil spreads outward into the trench backfill and to the ground surface. Thus, our trench simulation assumes that only gravity and capillary forces drove flow.

For both scenarios, i.e., infiltration from ground surface over a large area and infiltration from the filled trench, the water table was assumed to be at least 0.3 ft below the base of the trench[12] to evaluate behavior where groundwater is shallow but spills do not occur directly in groundwater.

Hydrologic parameters were defined for permeable sand, a worst case soil condition in terms of maximized transport, based on data in U.S. EPA (1985a,b), and Carsel and Parrish (1988). Soil porosity and vertical hydraulic conductivity (to water)[13] were assumed to be 0.35 and 23ft/day, respectively. Horizontal hydraulic conductivity was assumed to be 10 times the vertical hydraulic conductivity or 230 ft/day. Of note, less permeable soil conditions, i.e., less conservative soil conditions, are present for the majority of the proposed pipeline route (FEIS, Section 3.2). These materials are likely to be orders-of-magnitude less permeable and would likely result in longer times for infiltrating oil to reach groundwater and shorter plume lengths than those described in our simplified and conservative simulations.

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9 One-hour release duration was used to be consistent with Section 4.2.3.4 of the RA.

10 PHMSA Special Condition 19 requires the pipeline soil cover be at minimum forty-eight inches plus the thirty-six inch pipeline diameter.

11 The soil in the trench immediately adjacent to the rupture was neglected due to the unknown effects of a large and rapid release on the porosity of this soil.

12 Since HSSM cannot simulate a spill below the water table, the spill is assumed at least 0.3 ft below the trench; 0.3 ft is the minimum soil thickness that can be accurately simulated by HSSM.

13 Hydraulic conductivity is a fluid specific parameter. HSSM corrects the water hydraulic conductivity for oil hydraulic conductivity.

The viscosity of the oil was assumed to be 350 cSt (325 cP at a specific gravity of 0.93) consistent with viscosity reported for diluted bitumen (Kothari 2010). The viscosity assumed for diluted bitumen is considered to be a conservative assumption, once volatile components of the oil evaporate, because viscosity has been shown to rapidly increase, which will slow transport (Belore 2010). Increases in the viscosity of diluted bitumen after release from the pipeline will be greater than for synthetic crude (Kothari 2010), but to be conservative, this is not taken into account in this analysis[14].

Modeling attenuation requires inclusion of a first order decay rate (λ). Based on a review of published results, EPA suggests a rate λ between 0.001 and 0.01 per day (U.S. EPA 2002) for benzene and other petroleum hydrocarbons. All other model parameters were within typical value ranges proposed by Weaver et al. (1994) for use in HSSM.

Figure 2 shows the time for LNAPL to reach the water table and begin forming a groundwater plume as a function of the depth from the ground surface to the water table. Figure 2 does not show depths to water table less than seven feet, i.e. the pipeline at or below the water table, because groundwater plume formation would be immediate. LNAPL simulated to infiltrate from the bottom of the initially filled trench reaches groundwater and begins forming a plume far before LNAPL infiltrating from the surface due to both the reduced depth to the water table and the greater pressure of the deeper ponded oil filling the trench (initially 7 ft versus 0.75 ft). For the assumed conditions, these results illustrate that oil from the filled trench could reach a water table 1 ft below the trench (8 ft below ground surface) within 1 day of release, or a water table 3 ft below the trench (10 ft below ground surface) within 7 days of release. However, a water table 10 ft below the trench (17 ft below ground surface) would take approximately 50 days. In contrast, oil infiltrating from the ground surface would reach a water table 8 ft below ground surface only after approximately 240 days. Because a large spill would likely be detected and appropriate responses taken, infiltration from the simulated trench is likely to govern potential plume generation.

The period between the spill event and the development of a groundwater plume is an important consideration for judging the efficacy of spill control. For the situation described here for infiltration from the filled trench, rapid clean-up would be required to minimize groundwater impacts.

[14] Note that the pipeline may carry synthetic crude, which would have a lower viscosity. The significance of this is discussed further below.

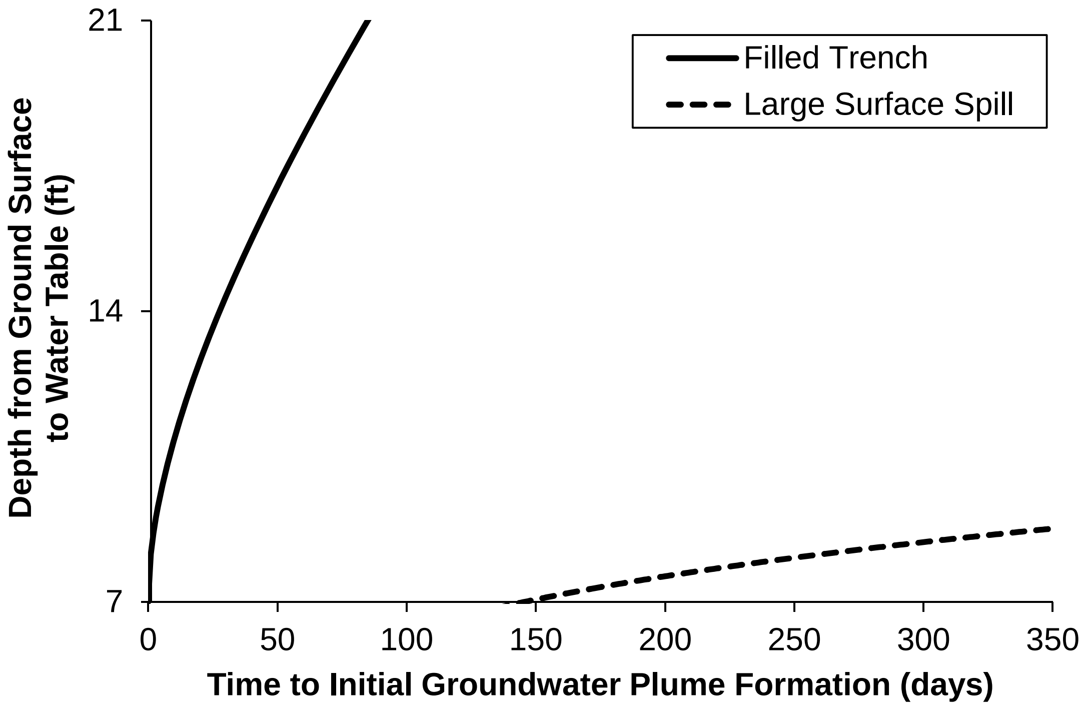

Figure 2. Time for spilled oil to reach the water table and initiate formation of a groundwater plume versus the depth from the ground surface to the water table.

HSSM was used to simulate dissolved benzene transport from the NAPL plume[15] associated with infiltration from the filled trench simulation described previously. Plume simulations were conducted for water table depths of 0.3, 1, and 10 ft below the trench bottom (i.e., 7.3, 8, and 17 ft below the ground surface). These depths were chosen to provide a sense of scale associated with different potential water table depths. For these simulations, the groundwater hydraulic gradient was assumed to range from 0.001 to 0.01. This range represents a reasonably low natural gradient (0.001)[16] to an increased gradient (0.01). Gradients occurring due to groundwater extraction depend on the local aquifer characteristics, the distance from the extraction well, and pumping rates. Since HSSM does not directly simulate pumping wells, a gradient of 0.01 was used to approximate an elevated gradient possibly associated with groundwater extraction. However, hydraulic gradients induced by pumping wells could be higher under certain local conditions. A range of half-lives ($t_{1/2}$) from 639 to 63.9 days[17] was used to account for the degradation of benzene. The hydraulic gradient and benzene concentrations were varied due to the high variability associated with these parameters.

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15 Partitioning and transport parameters for benzene were determined from Weaver et al. (1994) and McMillen et al. (2001). Partitioning coefficients for benzene for crude oil were assumed.

16 Based on the FEIS (Section 3.3; p. 3.3-9); a groundwater velocity of 1 ft/day is reported with a hydraulic conductivity of 60 ft/day for the High Plains Aquifer. Considering that natural porosities generally range between 0.3 and 0.4, the corresponding groundwater gradient is between 0.005 and 0.007, which is within the range simulated. Gradients are probably locally variable, thus assumed values provide a reasonable range for evaluation.

17 Half-lives for benzene were calculated based on first order decay rates of $\lambda = 0.001$/day to $\lambda = 0.01$/day using the equation $t_{1/2} = \text{Ln}(2)/\lambda$.

The HSSM simulation conservatively assumes that no action is taken to remove the oil from the trench after the spill, although such actions are anticipated in the FEIS (Section 4). Oil recovery would reduce the impacts of infiltrating oil. A large, rapid spill would likely be more of a concern to surface water and sensitive areas, which could be impacted more quickly by overland flow or direct release to a water body and this is discussed subsequently. The HSSM simulations indicate that dissolved plumes (defined as groundwater benzene concentrations exceeding the MCL of 5 ppb) may develop from a large spill. LNAPL was assumed to vertically infiltrate over a 6-ft diameter circle, equal to half the average width of typical trench described in Section 2.3.2.3 of the FEIS. Table 5 summarizes the simulated plume lengths resulting from each water table depth, hydraulic gradient, and benzene half-life considered.

Table 5. Benzene plume lengths estimated by HSSM for a large (25,000 bbl) rapid release of diluted bitumen for different depths from trench bottom to water table, hydraulic gradients, and half-lives ($t_{1/2}$).

Depth from Trench to Water Table	Hydraulic Gradient	Plume Length	
		$t_{1/2}$ = 69.3 days	$t_{1/2}$ = 693 days
0.3 ft[a]	0.001	100 ft	200 ft
0.3 ft[a]	0.01	300 ft	500 ft
1.0 ft	0.001	200 ft	400 ft
1.0 ft	0.01	700 ft	2,300 ft
10 ft	0.001	300 ft	900 ft
10 ft	0.01	700 ft	2,600 ft

[a] Minimum depth that can be modeled accurately with HSSM.

The HSSM simulation results indicate that plume lengths resulting from a large release may be between 100 and 2,600 ft in length. For the more conservative longer half-life simulations, plume lengths were increasingly sensitive to the applied hydraulic gradient.

For the large-spill scenarios considered, the plume lengths estimated using HSSM are generally consistent with the literature compilations of field studies described previously in this section and in the FEIS[18]. Our review of literature on observed dissolved plumes related to hydrocarbon releases (see Section 4.3.1) indicates that a very small number of plumes exceed 1,000 ft with most plumes less than 200–300 ft. Thus, the plume lengths associated with groundwater gradients typical of the natural conditions (e.g., 0.001) reported in Table 5 are consistent with what has been observed in the field. Plume lengths of up to 2,600 ft in Table 5 are associated with the higher groundwater gradient of 0.01 which is intended to represent the potential influence of groundwater extraction near the pipeline (conditions not necessarily accounted for in the case studies discussed in Section 4.3.1). Although pumping wells increase hydraulic gradients, this increase is typically limited to a finite zone surrounding the well, the extent of which is dependent on pumping rate and aquifer characteristics. Analyses that include these site-specific conditions are required by Special Condition 14 and PHMSA regulations as

[18] Assumes no action is taken for 1–2 years which allows NAPL to reach water table and for a plume to develop.

part of the Integrity Management Program during the final design of the project. These analyses should include the potential for longer plume lengths, i.e., > 1,000 ft, in fractured or karst terrains discussed in Section 3.1 (Geology) of the FEIS.

The HSSM simulations do not account for a release below the water table. This type of release could occur in locations where the pipe may be seasonally or permanently submerged below the water table. In the event of a leak below the water table, because of buoyancy the oil would tend to float to the water table surface and form a NAPL lens. This type of release would also result in immediate contact between the NAPL and groundwater resulting in immediate development of a dissolved NAPL plume. Because other factors controlling the size of the plume (e.g., degradation and groundwater gradient) would be similar, plume sizes would be expected to be similar.

4.3.3 Small Leak

Large leaks, as evaluated above, are easier to detect because they will likely trigger alarms from components of the leak detection system described in the Risk Assessment. However, very small leaks could potentially go undetected for longer periods of time. The Risk Assessment provides a description of four pipeline leak detection methods that are based on measured flow rates, pressures, and other measured and calculated values. Each of the four methods has different minimum leak sizes (flows) that can be detected, down to 1.5−2.0 percent of the pipeline flow rate[19]. One method is capable of identifying low rate releases below the 1.5−2.0 percent; however, how much below 1.5–2 percent is not stated in the Risk Assessment.

Because small leaks may go undetected for longer periods of time, there is a potential for transport of oil spilled from the pipeline (i.e., diluted bitumen or synthetic crude oil) and the development of a dissolved constituent (i.e., benzene) plume that could ultimately result in impacts to groundwater resources downgradient from the pipeline. The potential extent of downgradient impacts in not quantitatively evaluated in the FEIS and discussed here.

Under shallow groundwater conditions, leaking oil will infiltrate downward through the vadose zone (soil not saturated with water between the ground surface and the water table) until the water table is intersected. Once the oil reaches the water table, vertical migration of the oil slows and oil begins to accumulate in the vadose zone above the water table. For a buried pipe in relatively flat terrain, this could result in filling of the pipe trench and ultimately surface expression of the oil. Lateral (sideways) migration of the oil along the length of the pipeline could occur within the trench, which could extend the time until surface expression of the leaking oil occurs. For buried pipe in sloping terrain, lateral migration of oil could be greater, but also may result in surface expression sooner, when a barrier to oil flow (e.g., trench blocker) is encountered.

[19] 1.5−2% of daily flow rate = 13,500−18,000 bbl (assuming a pipeline flow of 900,000 bbl/day).

As part of the screening analysis, HSSM was used to estimate the following:

- Rates of slow oil leaks that may go undetected below the surface for extended periods of time for a flat terrain condition (assuming detection is only possible through direct inspection or survey of the pipeline because the leak rate is below the limit of other leak detection methods)
- Possible volume of a crude oil spill resulting from a slow and undetected leak
- Possible downgradient extent of dissolved contaminant plume in groundwater (defined as groundwater benzene concentrations exceeding the MCL of 5 ppb).

As in the case of the large spill simulations discussed previously, the small leak calculations are intended to provide insights into the potential transport and fate of oil spilled from the pipeline. This information is used to provide insights into which sensitive groundwater resources may be vulnerable if a spill of oil would occur, which in turn will help provide a check of the distances used in the Risk Assessment to evaluate whether a groundwater resource should be considered vulnerable during preliminary project design. For the slow-leak HSSM simulations, the leak rate is assumed to be below the detection limits for any of the pipeline remote leak detection systems. Thus, leak detection is assumed to be limited to visual or aerial inspection which would be conducted at least every 3 weeks (FEIS; Appendix U)[20].

Estimation of Undetected Rate of Leakage. HSSM was used to estimate the maximum steady-state leak rate (i.e., where infiltration is equal to leak rate out of the pipeline) per area of trench floor. A constant head of 7 ft was assumed based on the distance between the bottom of the trench and ground surface as discussed in Section 2.3.2.3 of the FEIS, see conceptual model shown in Figure 3). A head of 7 ft is a conservative assumption in that this head would only be attained as the oil reached ground surface. Leak rates higher than the maximum steady-state infiltration rate would eventually fill the pore-space in the trench backfill at a rate equal to the difference between the infiltration rate and the leak rate. This method results in an estimate of the approximate time for the surfacing of leaking oil for an assumed area of trench floor. Lateral spreading is not included in this simplified evaluation.

The results from HSSM simulations show that the maximum leakage rate of diluted bitumen that can be vertically infiltrated through permeable sand is approximately 0.005 bbl/d/ft^2 (0.2 gallons/day/ft^2) meaning that for every 1 ft^2 of trench floor, 0.005 bbl/day may infiltrate through that single square foot in 1 day. The area of the spill footprint on the bottom of the trench (i.e., infiltration site) affects the total rate of infiltration. For instance, a circular footprint of trench floor with a diameter of 3 ft (shown in the conceptual model shown in Figure 3) has an area of 7 ft^2, which would correspond to a total infiltration rate of 0.035 bbl/day (0.035bbl/day = 0.005 bbl/d/ft^2 × 7 ft^2). Thus, a leakage rate over the 3-ft diameter circle of 0.035 bbl/day could

[20] This is the statutory requirement for inspection intervals per the FEIS Appendix U. However, if the leak is located near residents or stakeholders who have been educated on identifying leakage signs, a more rapid identification of a leak is possible than considered for this analysis. This analysis assumes no such alternative detection.

theoretically infiltrate indefinitely without surfacing because the infiltration rate is equal to the leak rate.

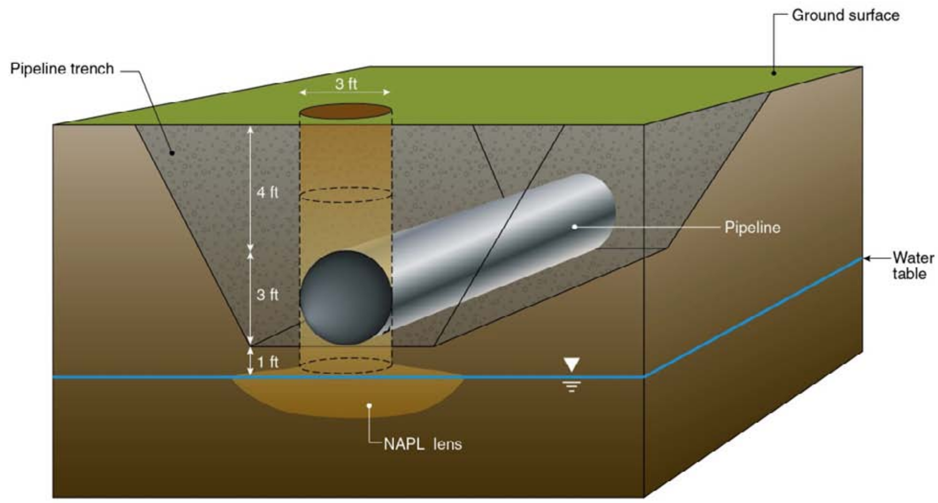

Figure 3. Conceptual model of slow leak. HSSM simulates LNAPL infiltration from trench bottom to water table and subsiquent formation of the NAPL lens.

To provide a sense of scale for a small leak that could go undetected, further analyses were conducted assuming infiltration occurs over a 3-ft diameter circle of trench floor; 3 ft was selected to coincide with the diameter of the pipe. However, the geometry and area of the spill footprint could be highly variable. If lateral movement of the oil through the trench backfill occurred, the area of the infiltration zone would increase, which would increase the volume of oil that could be infiltrated. These factors could result in higher leak volumes that may not express at the surface and therefore not be detected by inspection. Conversely, the vertical case considered for this analysis, rather than the lateral flow scenario, is also conservative in that the infiltration rate would be greater for a given area due to the larger head, which shortens the time to contamination of groundwater.

Figure 4 shows potential leak rates and the associated estimated time to detection. The time to detection was calculated by determining the flow exceeding the 0.035 bbl/day that can be infiltrated through the 3-ft diameter circular area shown in Figure 3. Flow in excess of this rate was assumed to fill pore spaces within a cylindrical volume of the backfill trench directly above the infiltration zone (shown in Figure 3). The total volume spilled was calculated as the product of the leak rate and the time to detection and is shown in Figure 4 as a function of time to detection.

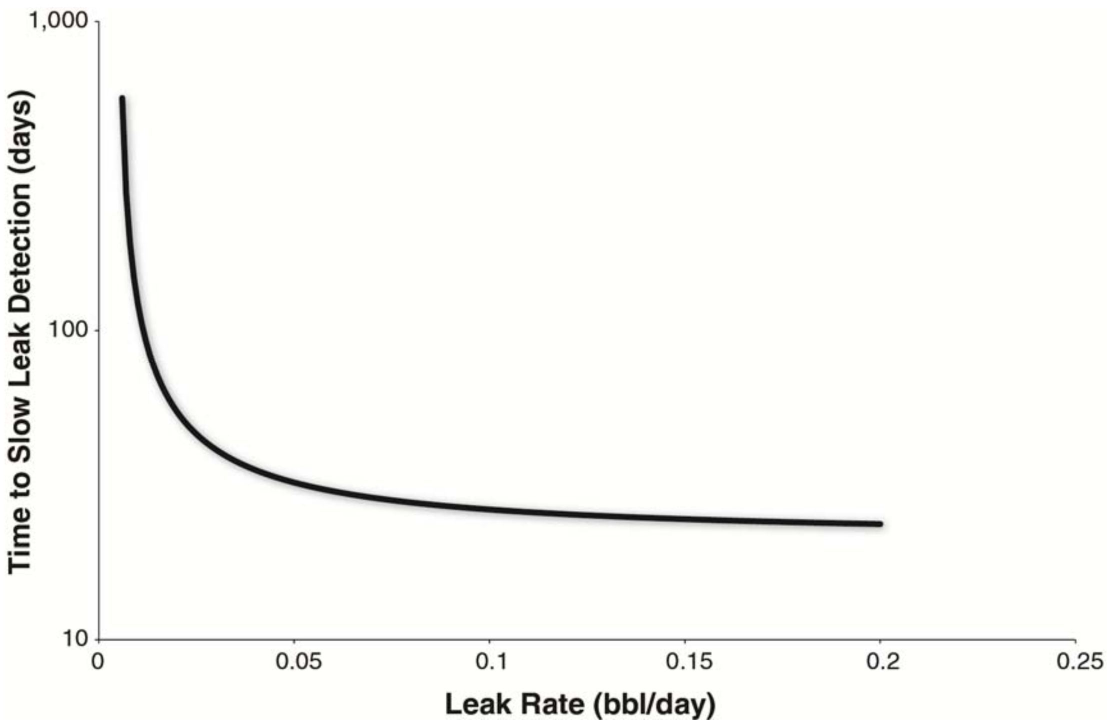

Figure 4. Time to slow leak detection as a function of leak rate for various slow leak rates based on a 3-ft diameter circular infiltration footprint and previously stated assumptions.

As an example, Figure 4 indicates that a leak rate of 0.05 bbl/day of diluted bitumen could be detected (by surfacing oil) within approximately 32 days (providing the underlying assumptions discussed above are met). This corresponds to a release of 1.6 bbl (67 gallons) of oil.

According to the report prepared by Battelle (2011), a leak rate of 28 bbl/day is expected from a "pin-hole" leak defined as a leak through a 1/32-in. diameter hole. The duration or time to surfacing would be dependent on the area over which oil infiltration occurs. If the oil spreads to a larger footprint, surfacing and potential detection will take longer than if the oil spreads to a smaller footprint. The size of the spill footprint will depend on several site-specific factors including but not limited to the permeability of trench backfill, and the permeability of soil surrounding the pipe trench. However, it is likely that a spill of 28 bbl/day would result in oil surfacing and being detected on the time scale of a few months. The "pin-hole" leak rate, 28 bbl/day, is almost three orders-of-magnitude greater than the maximum infiltration rate into permeable sand over the assumed area described previously under the small leak scenario. Therefore, a small leak that goes undetected indefinitely along the pipeline is unlikely.

Evaluation of Dissolved Plume Migration. The potential for development of a dissolved benzene plume was also considered for the constant 7-ft head condition used to estimate the steady-state infiltration rate under the small leak scenario. This results in a constant leak rate of 0.035 bbl/day over a 3-ft diameter circular infiltration area. This represents a hypothetical condition where the oil is near the ground surface but is not detected at the surface for a long period of time. The same transport and degradation conditions were used for these simulations as used in the large-spill evaluation above. A plume was assumed to reach a downgradient location when simulated benzene concentrations reached 5 ppb. A leak duration of 2,000 days (5.5 years) was assumed, although this duration is likely longer than would be expected prior to detection[21]. The objective was to determine whether natural attenuation (i.e., degradation) mechanisms would limit plume size in the event of a release occurring over an extended time period.

Table 6 summarizes the simulated plume extent for dissolved benzene[22]. The plume sizes range from between 200 ft and 600 ft depending on transport and degradation conditions. These plume lengths are consistent with those in the literature discussed previously in this section and in the FEIS. Our assessment of consequence presumes that a small leak occurs at a location that is upgradient of an extraction well; such that is could be affect by the spill. However, if a small leak does occur, the likelihood that the leak would occur upgradient of a well or group of wells is low.

Table 6. Length of plume developing downgradient from pipeline and the time for this plume length to develop. Downgradient plume extent, time required to reach plume extent

	$t_{1/2}$ = 693 days		$t_{1/2}$ = 69.3 days	
Gradient	0.001	0.01	0.001	0.01
Plume length (ft)	200	600	100	200
Time to plume length (days)	411	324	218	100

In areas where groundwater is deeper, there is less likelihood of oil accumulating above the water table and therefore a small oil leak (less than the infiltration rate of the soil) may never appear at the surface unless the infiltration rate of the soil is exceeded by the leak rate. Although the oil may never surface, when groundwater is deeper, the oil may also not reach the aquifer for extended periods of time, or, more likely, much of it would be degraded before it reaches the aquifer. Leaks of this nature were not simulated directly, but would be assumed to be slow enough as to not exceed the maximum infiltration rate of the soil and therefore would likely only result in large release volumes if not detected for very long time periods (on the order of years). However, based on the small leak rates stated by Battelle (2011), 28 bbl/day, relative to the calculated maximum infiltration rates, 0.005 bbl/d/ft^2, an indefinitely undetected leak, while theoretically possible, is not likely to occur.

Along some stretches of the pipeline, the water table will be at or above the pipeline. In these instances, because the leaking oil would tend to float on the water table, a leak would likely be detected sooner than in the scenario described above because the thickness of the soil layer, and thus the volume available for oil to fill before surfacing, would be smaller. A leak below groundwater would result in earlier development of a dissolved plume and arrival of the plume

21 Based on information provided in Battelle's report, the actual duration is more likely to be on the scale of months rather than years.

22 Plume extent was determined by determining the maximum distance to which benzene exceeded 5 ppb in HSSM during the simulation.

at downgradient locations sooner after the leak occurs. The change in time for transport to receptor wells would be dependent on the area over which a leak occurs.

4.3.4 Evaluation of Sensitive Groundwater Areas

There are many wells that are near the pipeline corridor but are not within a defined HCA. For example, the FEIS in Section 3.3.1.1 identifies 29 private wells within approximately 100 ft of the proposed centerline of the pipeline[23]. In addition, Appendix X of the FEIS enumerates all wells, HCA and non-HCA, in Montana, South Dakota, and Nebraska that are within 1 mile of the pipeline. The FEIS also identifies a number of groundwater protection related HCAs in the Appendix P HCA and CPS maps.

Exponent was tasked to consider whether there may be sensitive groundwater resources that do not classify as HCAs but that might warrant additional protection beyond that being planned. Our approach to considering this involved identifying a distance within which wells might be at risk in the event of a spill, by considering characteristics of wells that would make them more or less vulnerable, and by reviewing aspects of planned spill prevention, control, and countermeasures. Based on our screening model analysis and a review of the literature, presented in Section 4.3.2.1, a distance of 1,000 ft is reasonable for identifying wells that might be within the influence of a plume of dissolved hydrocarbons such as benzene. The wells within 1,000 ft of the pipeline are those that, based on our preliminary analysis of dissolved plume migration, could potentially be affected in the event of a release from the pipeline[24]. To provide an example of how this distance criterion could be applied for wells not included within defined HCAs, Exponent conducted an independent review of the NEDNR well database in Nebraska. According to our screening of the database, approximately 260 wells occur within 1,000 ft of the proposed centerline of the pipeline[25]. For the most part, these wells would not be captured by the HCA analysis performed as part of the Risk Assessment. A table enumerating these wells and select data from the NEDNR database is shown as Appendix C. This table provides characteristics that are useful for considering the vulnerability of a well in the event of an oil spill and the potential human health or environmental implications of a plume reaching a well. This screening methodology may be applied to alternative routes as they are developed during the final design of the pipeline.

In earlier sections, we described how an oil spill would behave. Our analysis of the behavior of the oil itself indicated that the oil would remain in the soil or would reside near the surface of the water table and therefore would be unlikely to be entrained into a well. The spill components that could reach a well are those associated with hydrocarbons that dissolve into the groundwater. Our analysis showed that depth to groundwater is an important factor for plume development. Plumes are more likely to develop when the spilled oil is in close proximity or within the groundwater. For these reasons, wells adjacent to locations where the pipeline is

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[23] Exponent's analysis of the NEDNR website indicates that 17 wells are less than or equal to 100 ft. Considering wells up to 160 ft from the pipeline results in 29 wells.

[24] 1,000 ft was selected based on the review of literature presented in Section 4.3.1 and our analysis results in Sections 4.3.2 and 4.4.3. This is meant to be a conservative distance (further than expected plume travel).

[25] Note that wells may only be located, at best, within ¼-¼ section areas.

within a few feet of the groundwater or within the groundwater would be more vulnerable than wells located elsewhere along the pipeline.

Well depth and pumping rate are other factors that can influence vulnerability to impacts from a dissolved hydrocarbon plume. Generally, shallower wells will be more vulnerable than deeper wells because of their proximity to the dissolved plume. Wells with higher pumping rates will also tend to be more vulnerable than wells with lower pumping rates, because they will have a larger impact on groundwater flow and thus a higher potential of drawing the dissolved plume towards them.

Based on the above, the following factors can be used to classify groundwater and associated wells with respect to vulnerability to a spill and to identify areas where additional protective measures may be warranted for sensitive groundwater resources (i.e., shallow aquifers and the wells constructed within these aquifers) that do not meet the listing criteria for HCAs:

- Proximity to the pipeline (<1,000 ft)
- Depth to groundwater (groundwater resources adjacent to pipeline segments that are within a few feet of groundwater or within groundwater are more vulnerable than groundwater resources that are located deeper)
- Depth of well (wells that are 10s of feet deep are more vulnerable than wells that are 100s of feet deep)
- Pumping of wells (wells with higher pumping rates are more likely to draw plumes than wells with lower pumping rates)
- Clusters of wells (clusters of wells would more likely draw plumes than individual wells).

The characteristics of wells in Appendix C provide some insight into the relative vulnerability to a dissolved hydrocarbon plume. Approximately 260 wells are identified. Appendix C does not include the depth to the upper water table and this information could be used to further differentiate groundwater with respect to vulnerability to the formation of a dissolve hydrocarbon plume resulting from an oil spill. The risk factors we have identified can be used to classify areas as being more or less vulnerable to a dissolved hydrocarbon plume in the event of an oil spill. In our view, the most vulnerable areas are locations with the following combinations of factors: areas that have a cluster of wells within 1,000 ft of a segment of pipeline that is in or within few feet of water table.

4.4 Transport and Fate in Surface Waters

Impacts to flowing surface waters are addressed in the FEIS by estimating the impact of benzene from a dilbit spill and a synthetic crude oil (SCO) spill. The assessment in the FEIS conservatively assumes that in a worst-case spill with a duration of 1 hour all of the benzene partitions from the oil into the water in streams with a range of flow rates. The assessment is useful for comparison of worst-case benzene concentrations to human health and ecological concentration benchmarks and is discussed further in Section 3 of our review. The FEIS does not provide an evaluation of possible transport distances of oil via surface water. This appears to be a gap that needs to be addressed, considering that the Enbridge spill to the Kalamazoo River involved surface water transport of oil to distances greater than 10 miles from the spill location (U.S. EPA 2010). Surface water transport and fate analyses should take into account potential density increases associated with the loss of volatiles from heavy crudes and diluted bitumen, the effects of which were illustrated at Enbridge (NTSBA 2012). Ultimately, an analysis of transport and fate in surface waters is required by Special Condition 14 and PHMSA regulations as part of the Integrity Management Program as part of the final design of the project after the final route is selected. These evaluations should take into account the lessons learned from the pipeline rupture in Enbridge, Michigan in 2010.

5 Analysis of Risks Related to Small Stream Crossings

5.1 Introduction

While there are PHMSA-related regulatory requirements and mitigation and control measures specified in the Risk Assessment and FEIS for river crossings greater than 100 ft in width, Exponent was asked to evaluate whether there were sensitive environments associated with stream crossings that are less than 100 ft wide that may warrant additional analyses and perhaps mitigation measures. As described in this section, Exponent used a set of ecologically-relevant criteria to identify such areas. This part of the environmental review also included an examination of information in the FEIS related to special status species, in particular, the presence of these species and their habitats relative to small stream crossings.

As part of our small stream crossing evaluation Exponent performed the following tasks:

- Reviewed the adequacy of the risk characterization of PHMSA-defined HCAs (i.e., specifically focused on ESAs) in the Risk Assessment
- Evaluated whether there were other sensitive environmental resources downstream of small stream crossings not already identified by the PHMSA-defined ESAs
- Evaluated the adequacy of relying on benzene as a surrogate chemical to address the magnitude of aquatic toxicity of crude oil spilled into small streams
- Evaluated whether the Risk Assessment process adequately considered the presence of special status species (e.g., threatened and endangered species) when defining sensitive ecological resources.

For each of these tasks, we considered the ramifications of our findings in light of what effects the findings would have on the final Project design and emergency response planning (ERP). The following are Exponent's key findings/conclusions, followed by our recommendations. The remainder of this section provides the documentation to support these findings/conclusions and recommendations.

5.1.1 Key Findings/Conclusions

- The Risk Assessment appropriately followed standard PHMSA guidelines for identifying contributory pipeline segments (CPSs) associated with small stream crossings and the high consequence areas (HCAs) potentially affected.

- Based on transport and fate analyses described in Section 4 of our report, we used a downstream distance of 10 miles as a basis for identifying locations of sensitive areas around small stream crossings. Using a set of ecologically-relevant criteria, Exponent identified at least ten small stream crossings areas that should be considered for additional protection. An additional four small stream crossings were identified as having special water bodies within 10 miles downstream of the proposed centerline of the pipeline that likely have high wildlife habitat value which should also be given further consideration.

- Exponent agrees with the assessment of the potential magnitude of risk of an oil spill on aquatic life in the water column associated with the toxicity of dissolved hydrocarbons (represented by benzene). While the toxicity assessment based on benzene is not rigorous, it appears to be sufficiently conservative for assessing short-term effects to aquatic biota residing in the water column. However, depending upon the characteristics of the water body into which a spill occurs, some portion of the spilled oil could come into contact with shorelines or with the bottom of the water body and be entrained into sediments. The oil and associated chemicals that may be present within sediments could exert longer-term chronic effects on aquatic biota that are not captured by considering benzene alone.

- Exponent determined that the list of special status species identified in the FEIS was a comprehensive and a complete list in the Project area. Exponent also found that the preliminary findings of "May Affect, Not Likely to Adversely Affect (NLAA), No Effect (NE) or Not Applicable (NA)" for 29 of the 30 species and "May Affect, Likely to Adversely Affect (MALAA)" for 1 species (American burying beetle) were arrived at through a sufficiently rigorous review of the distribution, abundance, and biological use of the Project area by special status species.

- Exponent believes that there could be habitat utilized now or in the future by special status species that is not specifically identified as PHMSA-designated ESAs based on our review of information in the FEIS.

- Exponent believes ongoing natural shifts in resources underpinning the distribution and abundance of special status species and the species they rely upon will likely result in a shifting of locations where special status species occur during the lifetime of the Project. Keystone is planning annual updates along the entire pipeline route. This will include new consultations with USFWS to identify critical T&E species that may not be captured within the existing PHMSA database, and may result in the environmental protection of additional areas along the pipeline corridor.

5.1.2 Recommendations

- A distance of at least 10 miles downstream from the proposed centerline of the pipeline should be used for the identification of sensitive areas and for identifying CPSs during the final design phase of the Project.
- Based on location-specific analyses of fate and effects of spills that Keystone will undertake prior to construction, consider the use of additional valves and/or noninvasive boring technologies at the small stream crossings that Exponent identified as associated with additional potentially sensitive ecological areas, and where Keystone's release analysis shows the potential exists for medium to very large spills to occur.
- Keystone should rely upon stream-specific specific scour analyses for small stream crossings to identify where the pipeline should be buried deeper than 5 ft or where HDD may be warranted. The particular small stream crossings identified by Exponent should be given attention in this regard.
- While Exponent is not charged with reviewing the ERP, we recommend that the ERP consider the possibility that spilled oil may be entrained into sediments and that these types of conditions be anticipated as part of response and clean-up.
- The ERP should also take into account the sensitive areas identified in our review (e.g., Rainwater Basin, small stream crossings associated with ESAs, and special downstream water bodies). For example, wildlife habitat for special status species, within close proximity of the pipeline could be designated as "special and/or unique areas" for purposes of the ERP.
- Exponent recommends that Keystone develop explicit plans for updating the status and presence of special status species and the habitat they rely upon every 2 years, and that identified changes be incorporated into the ERP.

5.2 Small Streams

The FEIS defines small streams crossed by the pipeline as streams less than 100 ft in width. For major stream crossings greater than 100 ft, the pipeline design uses horizontal directional drilling (HDD), which places the pipe well below the stream bed (i.e., 25 ft or greater). The HDD method will not disrupt the stream bed because the pipe is placed in a borehole that is drilled beneath the streambed and drilling occurs well back from the stream bank. For small stream crossings there is no requirement to use HDD, so in most places the pipeline will cross small streams using open-cut crossings (dry, flowing, dry flume, or dry dam-and-pump). According to discussions with Keystone, during the final design phase of the pipeline, specific small stream crossings will also use HDD or micro-bore methods to cross the stream if scour analyses indicate that the pipe would have to be placed deeper than 5 ft below the stream bed to protect it from stream bed erosion. According to Keystone, the crossing method for each stream will be identified in the 401 crossing permit applications that will be evaluated by the U.S.

Army Corps of Engineers. For purposes of our review, because this final design is not yet completed, we conservatively assumed that the pipeline would be buried only 5 ft below the streambed for all the small stream crossings. As a consequence of the shallower burial depth, small stream crossings may be at higher risk of a pipeline rupture as a result of scouring or other bed disturbance. All streams (both large and small) crossed by the pipeline are listed in Tables E-1 and E-2 in Appendix E of the FEIS.

5.3 High Consequence Areas

The Risk Assessment used PHMSA-defined HCAs within specified distances of the pipeline to determine CPSs. Several types of HCAs were considered, including populated areas, drinking water protection areas, and ESAs. Depending on the receptors and potentially complete pathways, the various types of HCAs had different buffers from the pipeline. CPSs were defined using the HCA proximity rules listed in the Risk Assessment with site-specific hydrology assessments conducted as needed to evaluate viable downstream pathways.

Exponent reviewed the CPS identification process using the maps and information provided in the Risk Assessment. A review of the maps revealed that several CPSs were not identified where the southern end of the Houston Lateral passes directly through a populated area (MP 36.7–41 and 43.6 to 47.2 [Figure 5]). CPSs should have been identified where the pipeline is within 1 mile of a populated area or within 5 miles of a viable downstream connection to a populated area. Exponent communication with Keystone staff indicates that this was a mapping error, but according to Keystone, the areas were included in the HCA analysis and summary. Given the topographical specificity needed to accurately determine a viable downstream pathway, Exponent did not re-analyze the downstream pathway along the entire 1,375-mile pipeline and instead relied on the accuracy of the original analysis.

While the southern end of the Houston Lateral was the only section of the pipeline that clearly violated the CPS identification rules, the rules themselves (specifically the distances) seemed arbitrary. The explanation provided for the distances selected for each type of HCA was either vague or absent. As the analysis described in Section 4 indicates, evaluating viable downstream pathways to a distance of 10 miles, rather than 5 miles, would be more appropriately protective of HCAs. Exponent has been informed by Keystone that they plan to evaluate downstream transport for more than 20 miles.

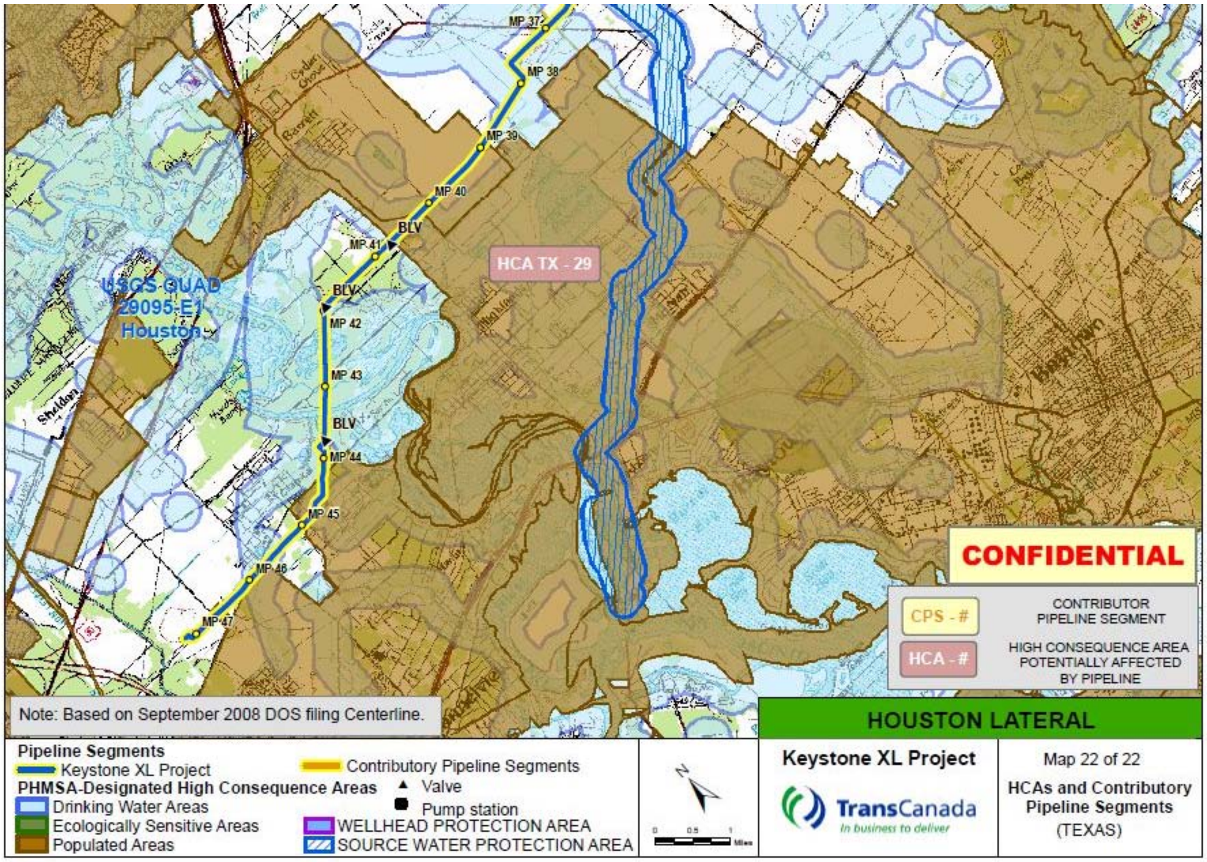

Figure 5. Project passes directly through a populated area and no CPS is identified

While it is very likely that more HCAs will be identified by expanding the downstream search criteria for HCAs from 5 to 10 miles, the purpose of the Risk Assessment was to identify CPS locations, where one or more HCAs could be affected. It is likely that most CPSs are identified using a 5-mile limit for stream and river crossings. However, it is also possible that HCAs may not be encountered within the first 5 miles; thus, extending the search criteria to 10 miles could identify CPSs that may have been missed using the 5 mile criterion. As part of its charge to examine whether sensitive environments are associated with small stream crossings, Exponent carried out several types of analyses, one of which was to examine HCAs located 5–10 miles downstream of stream crossings. Based on discussions with Keystone, it was explained to Exponent that the 5-mile limit was only used for purposes of the FEIS, and that as part of the final design, HCAs located more than 20 miles downstream from the pipeline will be considered if there is a viable flow pathway (e.g., from small stream crossings).

In order to complete our assessment of sensitive environments associated with small stream crossings, Exponent requested information on HCAs within 10 miles of the pipeline in a GIS format that was readily mapped over the pipeline route. Exponent considered what effect such an analysis might have by searching for HCAs located within 10 miles downstream, but more than 5 miles downstream, of the pipeline. This preliminary analysis identified 60 additional HCAs in Nebraska alone (Figure 6). If applied along the entire length of the pipeline, this adjustment in the search criteria distance will likely result in the identification of more HCAs potentially affected by a spill. We recognize that many of these HCAs will have already been captured by the existing CPS analysis since many HCAs are co-located along major river systems. Although each HCA that is identified by such a process will need further evaluation of type (population, groundwater municipal intake, or ecologically sensitive area) and hydrologic connectivity, it is likely that such an analysis will result in the designation of additional CPSs. This detailed analysis is required by Special Condition 14 and by federal regulations. Such a detailed analysis was beyond the scope of Exponent's review because it requires in-field analysis of the conditions near the pipeline.

5.4 Ecologically Sensitive Areas

As described in the Risk Assessment and according to 49 CFR 195, PHMSA identifies ESAs using the following criteria:

- An area containing critically imperiled species or ecological community
- Multi-species assemblage areas
- A migratory water bird concentration area
- Areas containing imperiled special status species or imperiled ecological communities where the species is aquatic, aquatic dependent, or terrestrial with a limited range
- An area containing special status species where the species or community occurrence is one of the most viable, highest quality, or best condition, as identified by an element occurrence ranking (EORANK) of A or B.

The Risk Assessment used PHMSA-identified ESAs to determine CPSs. However, it is possible that the ESA criteria are unnecessarily narrow and may exclude some areas that are very important to sensitive fish and wildlife populations, as identified in the FEIS. Exponent gave consideration to additional areas of special ecological concern other than those identified by PHMSA by considering wetlands of special concern and important wildlife habitats crossed by the pipeline, as identified in the FEIS. Exponent also evaluated where small streams crossed by the pipeline sustained important fisheries within at least 0.5 miles of the pipeline (as identified in Section 3.7 of the FEIS). In addition, Exponent searched for major waterbodies up to 10 miles downstream of the pipeline (as opposed to the 5 miles considered in the Risk Assessment) that were hydrologically connected to small streams crossed by the pipeline.

As an additional check on the comprehensiveness of PHMSA-designated ESAs, Exponent searched for Nature Conservancy sites within 10 miles of the pipeline. Locations from http://my.nature.org/preserves/ were mapped as an overlay on the pipeline route. No Nature Conservancy sites were identified within 10 miles on either side of the pipeline.

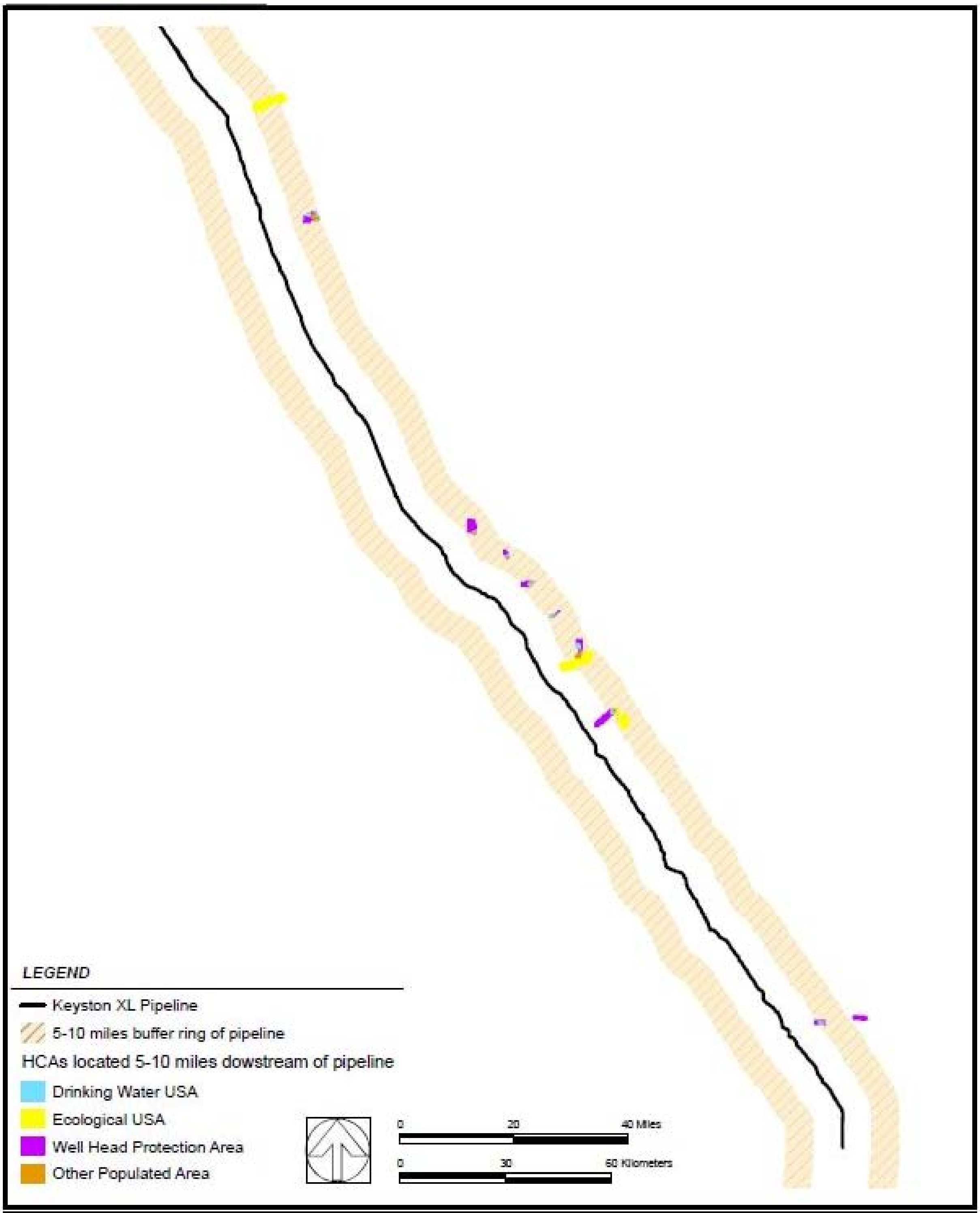

Figure 6. HCAs located between 5 and 10 miles downstream of the Project in Nebraska

5.4.1 Areas of Special Ecological Consideration

Exponent compiled location and pipeline crossing information for additional areas of special ecological concern (as defined above) in Appendix B using information provided in the following documents:

- FEIS Tables
  - Table 2.3.3-1. Waterbodies Crossed Using the Horizontal Directional Drilling Method
  - Table 3.4.2-1. Number and Type of Wetlands Crossed by the Proposed Project within Wetland Areas of Special Concern or Value
  - Table 3.6.2-1. Important Wildlife Habitats within or near the Proposed Project ROW
  - Table 3.7.2-1. Proposed Perennial Stream Crossings at or Upstream of Fisheries Habitat along the Proposed Project Route
- FEIS Appendix P. Pipeline Risk Assessment and Environmental Consequence Analysis
  - Attachment 2 CPS/HCA Risk Ranking Table of Appendix C
- FEIS Appendix E
  - Table E-1. Waterbodies Crossed by the Project – Steele City
  - Table E-2. Waterbodies Crossed by the Project – Gulf Coast
  - Table E-4. Waterbodies within 10 Miles Downstream of Proposed Water Crossings.

After compiling Appendix B, Exponent used the data to identify locations where the pipeline crosses small streams near multiple areas of special ecological consideration (i.e., fisheries, wildlife habitat, wetlands, major waterbodies, or special waterbodies). Pipeline stream crossings in the vicinity of multiple areas of special ecological consideration were identified as posing higher risk to ecological resources if they were not already designated in the FEIS as CPSs or as HDD crossings. Pipelines crossing larger waterways (i.e., stream crossings of greater than 100 ft) using HDD techniques were deemed to have a lower risk of rupture than non-HDD crossings as a result of their substantial depth (≥25 ft) below the stream bed. In addition, crossings identified as posing higher risk to ecological resources had to meet at least one of the following two specific criteria:

1. Stream crossings with at least four of the following five attributes: wetland areas of special concern or value, important wildlife habitats, fisheries within 0.5 miles downstream, waterbodies within 10 miles downstream, and

waterbodies within 10 miles downstream with high quality habitats (defined in Section 5.4.2).

2. Stream crossings with all three of the following FEIS-defined attributes: wetland areas of special concern or value, important wildlife habitats, and fisheries within 0.5 miles downstream.

The following small stream crossings were identified by Exponent as posing higher risk to ecological resources using these two criteria:

- **Keya Paha River, Nebraska (MP 599.9):** As identified in the FEIS, the Project crosses this perennial river at a location with wetlands of special concern (NE Sand Hills Wetlands), with important wildlife habitat (Keya Paha River Valley), and within 0.5 miles of a fishery (Class A WW).

- **Niobrara River, Nebraska (MP 615.38):** As identified in the FEIS, the Project crosses this perennial river at a location with wetlands of special concern (NE Sand Hills Wetlands), with important wildlife habitat (Niobrara River Valley), and within 0.5 miles upstream of a fishery (Class A WW).

- **South Fork Elkhorn River, Nebraska (MP 630.46):** As identified in the FEIS, the Project crosses this perennial river at a location with wetlands of special concern (NE Sand Hills Wetlands), with important wildlife habitat (Sand Hills), and within 0.5 miles of a fishery (Class A WW). The crossing is also within 10 miles upstream of Atkinson Reservoir.

- **Holt Creek, Nebraska (MP 647.31):** As identified in the FEIS, the Project crosses this perennial creek at a location with wetlands of special concern (NE Sand Hills), with important wildlife habitat (Sand Hills), and within 0.5 miles upstream of a fishery (Class A WW).

- **South Fork Elkhorn River, Nebraska (660.22 and 660.23):** As identified in the FEIS, the Project crosses this perennial river at a location with wetlands of special concern (NE Sand Hills Wetlands), with important wildlife habitat (Sand Hills), and within 0.5 miles of a fishery (Class A WW).

- **Big Blue River, Nebraska (MP 765.5):** As identified in the FEIS, the Project crosses this perennial river at a location with wetlands of special concern (Rainwater Basin Wetlands), with important wildlife habitat (Rainwater Basin), and within 0.5 miles upstream of a fishery (Class B WW).

- **Lincoln Creek, Nebraska (MP 774.93):** As identified in the FEIS, the Project crosses this perennial stream at a location with wetlands of special concern (Rainwater Basin Wetlands), with important wildlife habitat (Rainwater Basin), and within 0.5 miles upstream of a fishery (Class B WW).

- **West Fork Big Blue River (MP 789.57):** As identified in the FEIS, the Project crosses this perennial river at a location with wetlands of special concern (Rainwater Basin Wetlands), with important wildlife habitat (Rainwater Basin), and within 0.5 miles upstream of a fishery (Class A WW).

- **Unnamed tributary to Turkey Creek, Nebraska (MP 807.54):** As identified in the FEIS, the Project crosses this perennial stream at a location with wetlands of special concern (Rainwater Basin Wetlands), with important wildlife habitat (Rainwater Basin), and within 0.5 miles upstream of a fishery (Class B WW).
- **Cotton Creek, Texas (MP 457.92 and 457.96):** As identified in the FEIS, the Project crosses this perennial creek at a location with wetlands of special concern (Water Oak–Willow Oak Community) and within 0.5 miles upstream of a fishery (high value). The crossing is also within 10 miles upstream of Big Thicket National Preserve.

These stream crossings warrant additional consideration and may necessitate additional protective measures or special consideration in the ERP. The Risk Assessment acknowledges that spills may be transported downstream up to 5 miles, and Exponent's analysis (see Section 4) indicates that transport distances of 10 or more miles are reasonably likely. Keystone indicated to Exponent during the review process that the detailed transport and fate analysis that will be conducted after the pipeline is constructed, as required by Special Condition 14 and federal regulations, will identify CPSs associated with HCAs located more than 20 miles downstream. Exponent also notes that the 208 fisheries located within 0.5 miles of the pipeline (FEIS Table 3.7.2-1) may be at risk from a spill due to acute toxicity of the oil (see Section 3); however, we considered small streams to be of special ecological concern only if they had three or more critical attributes as described above (e.g., fisheries, wildlife habitat, etc.).

5.4.2 Major Waterbodies

Exponent gave special consideration to Table E-4 in Appendix E of the FEIS to identify waterbodies within 10 miles of the pipeline that may provide high quality wildlife habitat. The 10-mile distance was used as a criterion based on transport and fate considerations that suggested spills of oil to a stream can reasonably move downstream this distance or greater (refer to Section 4). Therefore, the 5-mile criterion used in the FEIS and Risk Assessment (Appendix P) did not appear to be sufficiently protective. Downstream waterbodies include lakes, reservoirs, and proposed reservoirs, most of which are likely to attract migratory water birds at some times of the year. Exponent identified stream crossings with waterbodies within 10 miles downstream of the proposed centerline for the pipeline that are likely to provide high quality habitat to these birds (Appendix B). High quality habitat was subjectively defined for purposes of our evaluation using descriptions of the waterbodies within the "comment" column in Appendix B. Waterbodies that were described as wildlife management areas, year-round bird watching areas, and preserves were designated high quality habitats for purposes of our assessment. We used the spirit of the ESA definition provided earlier to identify those waterbodies that were considered associated with areas of high quality habitat. These waterbodies, all in Texas, included:

- **Pat Mayse Lake:** This lake is situated on the western edge of Pat Mayse Wildlife Management Area. The wildlife management area is an 8,925-acre area managed for recreational uses such as hunting, wildlife viewing, and camping.
- **Lake Bob Sandlin (and Lake Cypress Springs which is contiguous with Lake Bob Sandlin):** This lake is a 9,400-acre reservoir which provides eagle viewing in the winter and other bird watching opportunities year round.
- **Waterbodies Associated with Big Thicket National Preserve:** This preserve is a UNESCO "Biosphere Reserve" noted for the high biodiversity that results from its mix of virgin pine and cypress forest, hardwood forest, meadow, and blackwater swamp.
- **Waterbodies Associated with Trinity River National Wildlife Refuge**: This 25,000-acre wildlife refuge is valued for its high diversity of waterfowl species. Nearly 50 percent of the neotropical bird species listed by USFWS use this wildlife refuge during migration or nesting.

5.5 Toxicity Assessment

Exponent reviewed the aquatic toxicity information presented in Section 4.2.3.4 of the Risk Assessment (Appendix P of FEIS) in light of the information on crude oil (dilbit) chemical content and composition to evaluate whether the conclusions were based on adequately conservative assumptions for small stream crossings. The Risk Assessment's analysis of toxicity in surface water resulting from a release to small streams focused on the toxicity resulting from benzene alone. While benzene is a toxic constituent of crude oil, it is one of many crude oil constituents and forms only a very small proportion of the total volume and potential toxicity. Oil can also result in physical effects as has been described in the FEIS.

Exponent investigated the possibility that other crude oil constituents may pose a greater toxicological risk to aquatic organisms than benzene by evaluating the potential of the following constituents to cause toxicity to aquatic organisms: ethylbenzene, toluene, xylene, nickel, vanadium, chrysene, fluorene, naphthalene, and phenanthrene. Concentrations of the metals and BTEX constituents are shown in Table 1 and PAH concentrations are listed in Table 3. Based on this information, quantitative estimates of water concentrations of these chemicals resulting from a spill could be determined. Using the known water solubility of the different constituents and the same assumptions about water flow rates and sizes of releases as used in Tables 4-7 and 4-8 of the Risk Assessment, Exponent approximated the concentrations of these constituents in surface waters following a release. Although these water concentrations were meant to model an acute event (1 hour of stream flow), we compared them to EPA ecological benchmarks that are protective of aquatic life chronically exposed to these chemicals (EPA Region 6, 7, or 8 benchmarks were given priority; in the absence of any of those, national level criteria were applied [U.S. EPA 2011]).

This evaluation indicated that, of the crude oil constituents evaluated, only nickel and vanadium were likely to exceed chronic water quality thresholds and that these constituents were only likely to exceed for large (10,000 barrels) or moderate (1,000 barrels) spills, but not smaller spills (Tables 7–10). Since these findings show less risk than predicted for benzene, the Risk Assessment's evaluation of toxicity resulting from spills to surface water appears to be sufficient for judging the potential for toxic effects on aquatic organisms. If cleanup was delayed or incomplete, as the oil in a spill ages the concentrations of alkylated PAH compounds will increase on a relative basis as more volatile compounds evaporate, and they will tend to persist for a longer time than their parent non-alkylated forms. The prediction of acute toxicity from most spills into small- to medium-sized streams based on the conservative assessment of benzene toxicity is sufficiently conservative to account for this eventuality. As noted here and in the FEIS, spilled oil can also have physical effects that can adversely affect some wildlife species such as birds and habitats if, for example, the oil comes into contact with soils and sediments.

Exponent recognizes that dilbit also contains additional toxic constituents such as naphthenic acids. While data are lacking on concentrations of these chemicals in the crude oil, it should be noted that these acids are more soluble than similarly size hydrocarbons, and are highly acutely toxic to zooplankton (0.15 mg/L), although less so to fish (25 mg/L) (Clemente and Fedorak 2005). While acid concentrations are reduced by the caustic washing of tar sand to produce dilbit, the FEIS has not discussed the possibility that these chemicals could contribute to the toxicity associated with a spill. However, as our analysis has shown, the selection of benzene within the Risk Assessment to judge the potential for toxicity provides a reasonable basis for assessing the potential for risks to aquatic organisms. Still, because crude oils are complex mixtures, Exponent recognizes there are remaining uncertainties that will be addressed during a response following a spill.

5.6 Special Status Species

DOS submitted a Biological Assessment for the Keystone XL Pipeline that evaluated potential impacts of construction and operation (including spills) to special status species and their habitats. The Biological Assessment was reviewed by USFWS and on September 23, 2011, the USFWS issued a Biological Opinion that concurred with the DOS findings.

Because many of the special status species of concern within the Project area rely on wetlands and other water resources, Exponent reviewed Section 3.8, T&E Species, of the FEIS with special attention to both the large and small stream crossings (also referred to here as wetlands and/or riparian areas collectively). Exponent also reviewed the cumulative impact section of the FEIS (Section 3.14.3.8), with special attention to those cumulative impacts that might impact special status species in wetlands and riparian areas located at or downstream of small stream crossings. Finally, Exponent reviewed Appendix C of 49 CFR 195 to ascertain if the proposed future monitoring of the Project was sufficient to protect special status species from future environmental changes.

5.6.1 General Special Status Species Review

Exponent determined that the list of some 30 threatened, endangered, proposed-for-listing, and candidate-for-listing species covered in Section 3.8 (including 4 mammals, 9 birds, 1 amphibian, 6 reptiles, 4 fish, 2 insects, and 4 plants) was a comprehensive and a complete list of the relevant special status species in the Project area.

Similarly, Exponent determined that the correct federal agencies were consulted during the FEIS process. Specifically, that USFWS provided T&E consultation relative to the Endangered Species Act (ESA), the Fish and Wildlife Coordination Act (FWCA), the Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (BGEPA), and National Environmental Protection Act (NEPA).

Exponent found that the preliminary findings of "May Affect, Not Likely to Adversely Affect (NLAA), No Effect (NE) or Not Applicable (NA)" for 29 of the 30 species and "May Affect, Likely to Adversely Affect (MALAA)" for 1 species (American burying beetle) were arrived at through a sufficiently rigorous review of the distribution, abundance, and biological use of the Project area by T&E Species.

5.6.2 ESAs for Special Status Species

As stated earlier in this section, it is possible that the ESA criteria as specified by PHMSA are narrow with regard to T&E and other special status species. Considering this fact, Exponent used the example of the whooping crane, which is the most imperiled of the T&E species identified in the FEIS, to illustrate that there are other non-ESA defined areas associated with stream crossings that should be considered for additional mitigation during the final design of the Project.

5.6.2.1 Whooping Crane

The Project generally follows much of the migratory corridor of the whooping crane, which runs from Canada to Texas (Figure 7). While the Project is either to the east (in the north) or to the west (in the south) of the migration corridor, the Project does intersect the migration corridor substantially, for nearly 500 miles at the South Dakota/Nebraska line (Figure 7). Furthermore, whooping cranes (Lewis 1995), as well as piping plover (Elliott-Smith and Haig 2004) and least terns (Thompson et al. 1997), are known to use small and large stream areas and other wetlands during migratory stopovers (cranes, plovers, and terns) and as annual breeding habitats (terns and plovers). There are a number of ESAs and CPSs identified along the whooping crane migration corridor.

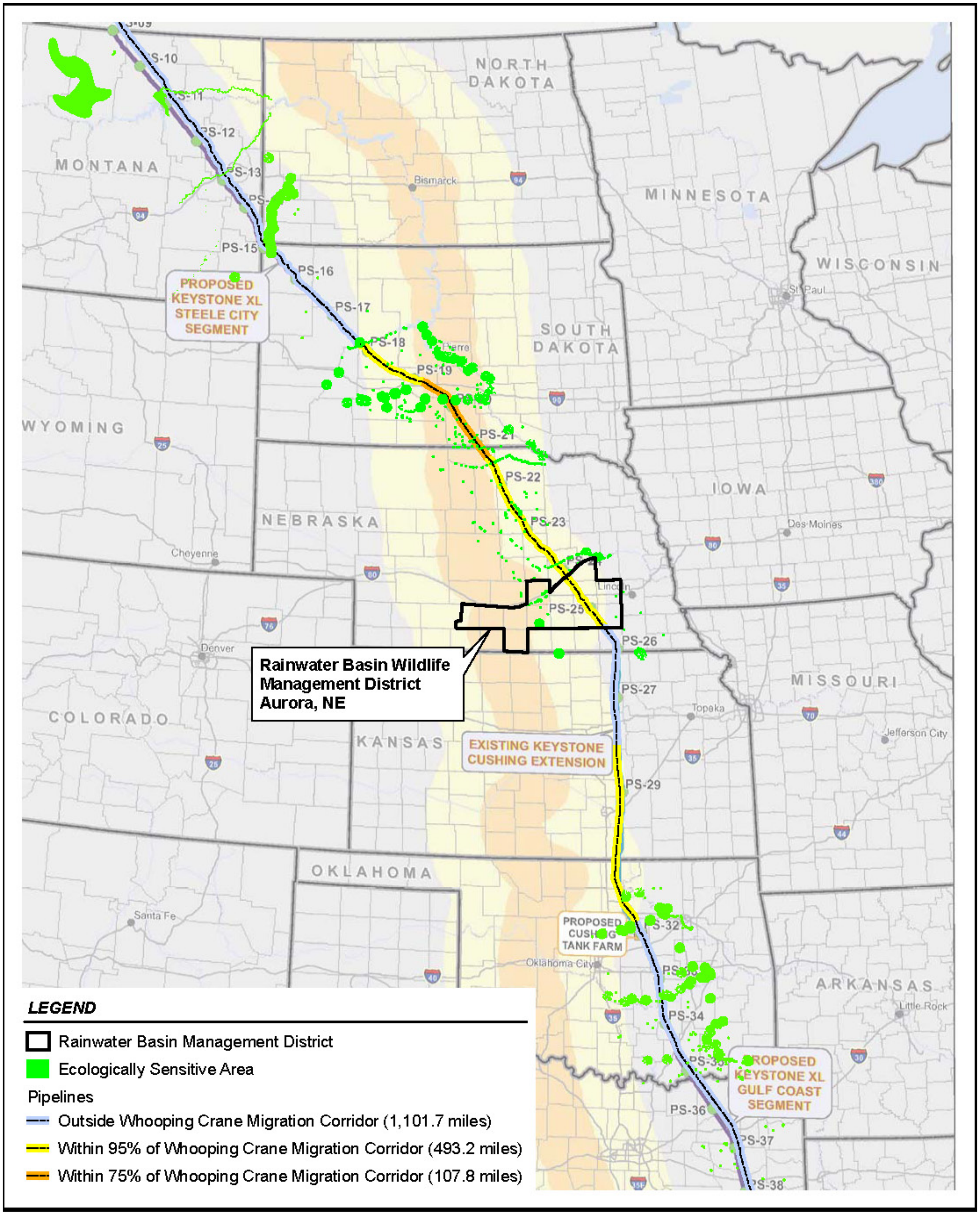

Figure 7. Ecologically sensitive areas (green) are shown within and near the region of the Project that crosses 75% and 95% the whooping crane migration corridor

However, the Project is routed directly through the Rainwater Basin Wildlife Management District (RBWMD) in southeastern Nebraska (Figure 8), and thereby has the potential to impact this important known whooping crane and shorebird migration stopover site (WHSRN 2004). USFWS manages 61 Massie Waterfowl Production Areas (WPAs) in the Rainwater Basin, and the Nebraska Game and Parks Commission manages 35 State Wildlife Management Areas within the Rainwater Basin. The Rainwater Basin Joint Venture, founded in 1992, is a broad coalition of government agencies, non-government organizations, and farmers dedicated to acquisition, restoration, and management of the region's wetlands and surrounding upland habitats. In 2005, the Nebraska Natural Legacy Project (the State's wildlife action plan) identified the Rainwater Basin as a biologically unique landscape. There are also 80 Wetland Reserve Projects within the Rainwater Basin (WHSRN 2004).

There is the possibility that whooping cranes may already be using the RBWMD and/or may relocate into suitable wetlands within the RBWMD during the lifetime of the Project. Some of the potential wetlands within the RBWMD are identified as ESAs. However, many of the wetlands that whooping cranes and other birds could conceivably use or move into near the Project within the RBWMD are not considered ESAs as defined by PHMSA.

Exponent reviewed the information on special status wetlands provided within Table 3.4.2-1 of the FEIS and cross referenced that information to stream crossings within the RBWMD (refer to Appendix B). Removing stream crossings from consideration that are already CPSs or where HDD methods will be used to cross the small stream, there are 59 small stream crossings within the RBWMD that have special status wetlands at the stream crossing that could potentially be used by whooping cranes and other wetland dependent special status species. For this reason, Exponent recommends that these stream crossings should be considered for additional mitigation measures to protect the whooping crane habitat of the RBWMD, because of its importance as a stopover area for feeding and resting by the whooping crane.

Lastly, while most whooping cranes stay within their migration corridor, whooping cranes are seen outside the corridor on a regular basis and may have even begun prospecting new areas (Lewis 1995). Related to this point, many other special status species are capable of utilizing new areas on a yearly basis. A further complication is that according to USGS (2004), many water bird habitats within the RBWMD may be in a state of deterioration, and may already be compelling whooping cranes to utilize unprotected wetlands within the Project. Therefore, Exponent suggests that Keystone should conduct a bi-annual consultation with USFWS to identify areas of high potential for use by special status species and to update the Project ERPs as appropriate.

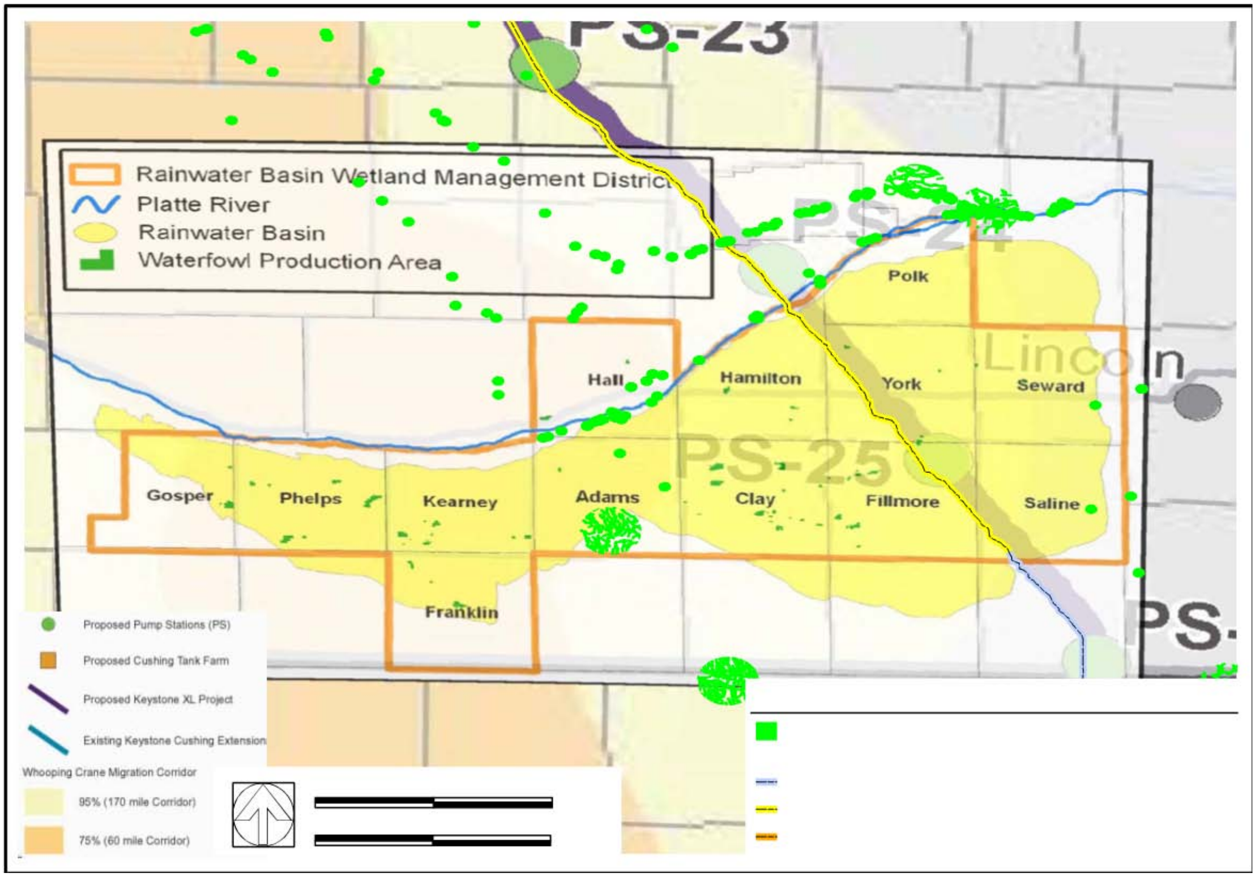

Figure 8. The Project intersects the Rainwater Basin Wetland Management District (shown in yellow), yet few of the wetlands in the RBWMD are identified ESAs.

5.6.3 Recommendations for Special Status Monitoring

Appendix C of CFR 195 (§195.452(d)(3)) states: "An operator is also responsible for periodically evaluating its pipeline segments to look for population or environmental changes that may have occurred around the pipeline and to keep its program current with this information." Yet closer examination of this section of the CFR reveals that it only pertains to physical factors that might impact pipeline integrity and does not explicitly include any biological aspects that might help detect any future impacts to T&E and other special status species. Slightly more relevant to T&E populations is CFR §195.452(d)(3) which states: "An operator must incorporate a new unusually sensitive area into its baseline assessment plan within one year from the date the area is identified. An operator must complete the baseline assessment of any line pipe that could affect the newly-identified high consequence area within five years from the date the area is identified." However, as discussed earlier in this section, these conditions would still not consider additional protection for areas not defined as HCAs (e.g., ESAs), such as the areas identified earlier within this section.

Given the 50-year projected lifespan of the Project and the possibility that one or more special status species may move into the vicinity of the Project during that timeframe, Exponent concludes that the monitoring outlined in CFR 195 may be insufficient to protect special status species over the lifespan of the Project. Specifically, Exponent recommends that in addition to monitoring physical factors that might impact pipeline integrity, Keystone develop a biological monitoring plan for these special and unique special status habitats to periodically determine whether T&E and other special status species are using these habitats within the Project area and whether they are afforded sufficient protection under the ERP.

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Appendix A

Brief Resumes of Review Team Members

Exponent
15375 SE 30th Place
Suite 250
Bellevue, WA 98007

telephone 425-519-8700
facsimile 425-519-8799
www.exponent.com

Sungwoo Ahn, Ph.D.
Senior Scientist

Professional Profile

Dr. Sungwoo Ahn is a Senior Scientist in Exponent's Environmental Sciences practice who specializes in the transport and fate of hydrophobic organic contaminants including PAHs, PCBs, and polybrominated diphenyl ethers (PBDEs), and their bioavailability. Dr. Ahn also has expertise in the environmental behavior of nanomaterials. He is knowledgeable in the use of a variety of laboratory analytical methods including gas chromatography (GC) and mass spectrometry (GC/MS), transmission electron microscopy (TEM), scanning electron microscopy (SEM), x-ray photoelectron spectroscopy (XPS), and x-ray diffraction (XRD).

Before joining Exponent, Dr. Ahn worked as a postdoctoral scholar at Stanford University, where he conducted research on the degradation of flame retardant PBDEs by various forms of nano-scale zerovalent iron (nZVI). Dr. Ahn studied the reaction kinetics and the degradation pathways of PBDEs with positional preference in the debromination. As a part of the research, he synthesized the nanoparticle, as well as its catalyzed and carbon supported particles, in the laboratory and characterized them using analytical tools such as TEM, SEM, XPS, and XRD.

During his Ph.D. work, Dr. Ahn studied the transport and fate of PAHs in contaminated soil and sediment amended with a carbon sorbents for *in situ* contaminant stabilization. The study included physicochemical characterization of contamination at the micro-scale for source identification, assessment of PAH bioavailability and availability to the surroundings, and model simulation of contaminant mass transfer in sediment-sorbent systems, to predict the fate of PAHs and the long-term effect of carbon amendment. In addition, he also has extensive field and laboratory experience in *in situ* stabilization of PCBs in contaminated sediment using carbon amendment.

Academic Credentials and Professional Honors

Ph.D., Civil and Environmental Engineering, Stanford University, 2006
M.S., Civil and Environmental Engineering, Stanford University, 2001
M.S., Chemical Engineering, Yonsei University, South Korea, 1997
B.S., Chemical Engineering, Yonsei University, South Korea, 1995

The Ford Fund Fellowship, 2001–2003

Languages

Korean – native speaker

Exponent
15375 SE 30th Place
Suite 250
Bellevue, WA 98007

telephone 425-519-8700
facsimile 425-519-8799
www.exponent.com

Gary N. Bigham, L.G.
Principal

Professional Profile

Mr. Gary Bigham is a Principal in Exponent's Environmental Sciences practice who specializes in the evaluation of transport, fate, and effects of contaminants in aquatic habitats, soil, sediment, and groundwater. He has managed and been the principal investigator of field, laboratory, and theoretical assessments of a wide variety of contaminants in lakes, rivers, estuarine waters, ocean waters, and groundwater. Mr. Bigham has also directed RI/FSs, human health and ecological risk assessments, cost allocation studies, and NRDAs for sites involving soils, sediments, and waters contaminated with arsenic, chlorinated benzenes, dioxin, mercury, metals, PAHs, PCBs, petroleum hydrocarbons, and solvents. He has also completed several evaluations of mercury in indoor air. Recent examples of contaminant transport and fate analyses include the development of a numerical model of mercury cycling and bioaccumulation for Onondaga Lake; a detailed evaluation and modification of sediment transport and PCB bioaccumulation models for the Fox River and Green Bay, Wisconsin; and an evaluation of the effects of eutrophication on mercury bioaccumulation in the Florida Everglades. Mr. Bigham is the author of numerous publications on the behavior of mercury in the environment.

Mr. Bigham has been designated an expert witness in class action and individual tort claims on the issue of PCB and PAH transport in streams and rivers, and dioxins/furans in a lake; in litigation involving mercury bioaccumulation in the Florida Everglades; and assessments of exposure to mercury vapor, crude oil, and produced water. Mr. Bigham has also completed environmental forensic investigations of mercury-contaminated sediments and soil, groundwater contaminated with chlorinated solvents and petroleum hydrocarbons, and for allocation of remediation costs of a PAH-contaminated sediment site in Boston Harbor. He has also had a lead role in NRDAs related to mercury contamination in surface waters and involving solvents in groundwater. He has also served as a consulting expert on a major NRD claim involving confined animal feeding operations (CAFOs) in Oklahoma and Arkansas.

Mr. Bigham's international experience includes serving as resident manager for a multi-year air quality and marine environmental monitoring program in Saudi Arabia. He led the technical development of a natural resource damage claim for the Kingdom of Jordan to the United Nations Compensation Commission for damages arising from the first Gulf War. He recently completed an environmental assessment for a major oil export facility in Abu Dhabi and evaluated potential human exposure to spilled oil and produced-water discharges in the Amazon basin of Ecuador. He applied a water quality model to predict conditions in and downstream of a proposed reservoir in Bolivia and assessed water quality and greenhouse gas emissions for a proposed reservoir in Guyana. He has also completed an assessment of potential human exposure to mercury vapor from a spill in the Peruvian highlands.

Academic Credentials and Professional Honors

Post-graduate course work in Environmental Engineering, University of Southern California, 1975–1976

M.S., Geophysical Sciences, Georgia Institute of Technology, 1972
B.S., Geology, Oregon State University, 1968

Licenses and Certifications

Licensed Geologist, Washington, #1303
Hazardous Waste Operations Management and Supervisor 8-hour training program

Exponent
One Clock Tower Place
Suite 150
Maynard, MA 01754

telephone 978-461-4600
facsimile 978-461-4699
www.exponent.com

Paul D. Boehm, Ph.D.
Principal Scientist and Group Vice President

Professional Profile

Dr. Paul D. Boehm has overall responsibility for Exponent's Environmental business. He has devoted his 34 years of consulting experience to advising industrial, legal, and government clients on scientific aspects of: contaminated sediments and terrestrial sites; oil spills; and the use of environmental forensic methods to investigate background contamination, to chemically fingerprint contaminants to determine sources, to apportion contamination to allocate liabilities, and to reconstruct historical releases and doses. Dr. Boehm has provided scientific support to clients on natural resource damage assessments, environmental and toxic tort claims, maritime pollution cases, and other litigation matters, including providing expert testimony. His work as an analytical, environmental, and geo-chemist has involved petroleum hydrocarbons, fuel additives, natural gas, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), chlorophenols, chlorinated solvents (TCE, PCE), mercury, lead, and other chemicals and elements. A significant part of Dr. Boehm's work has focused on oil refineries, fuel terminals, and offshore platforms; marine and aquatic oil spills; Superfund sites; manufactured gas plant (MGP); pulp and paper mills, and natural gas storage fields; medical exposures; and transactional disputes. With regards to chemical releases, he specializes in the historical reconstruction of release histories. With regards to petroleum fuels he has focused on petroleum chemistry associated with evolution of refining processes and the use of fuel additives such as alkylated leads, MTBE, TAME, and other compounds.

Dr. Boehm has been engaged in numerous natural resource damage assessments (NRDAs) at oil spill and CERCLA sites where he has provided technical support on sources, divisibility, bioavailability of PAHs, PCBs, petroleum and other chemical sources; exposure and bioavailability; divisibility and apportionment of contamination, and allocation of associated liability. His extensive knowledge of the strategic application and practice of environmental forensics (geo-chemical fingerprinting, transport and fate, source attribution, and allocation) has been applied to numerous cases involving complex environmental liability and litigation matters.

As an oil spill expert, he has studied and published on the fate and effects of most major oil spills in the United States, Europe, and the Middle East. As a natural gas and petroleum chemist and geochemist, he has also investigated geochemical aspects relating to the migration of natural gas from storage fields. His work has also included assessments of the exposure of people to petroleum contaminants in toxic tort cases.

He has been appointed to serve on several national panels on environmental/ marine pollution and has served on several National Research Council panels.

Academic Credentials and Professional Honors

Ph.D., Oceanography, University of Rhode Island, 1977
M.S., Oceanography, University of Rhode Island, 1973
B.S., Chemical Engineering, University of Rochester, 1970

Exponent
15375 SE 30th Place
Suite 250
Bellevue, WA 98007

telephone 425-519-8700
facsimile 425-519-8799
www.exponent.com

Ronald J. Breitmeyer, Ph.D.
Senior Associate

Professional Profile

Dr. Ronald Breitmeyer is a Senior Associate in Exponent's Environmental Sciences practice. Dr. Breitmeyer is a geoenvironmental engineer and hydrogeologist specializing in environmental modeling. Dr. Breitmeyer has expertise in the study and modeling of multi-phase flow and transport in a wide variety of geomaterials. He has experience with numerous environmental modeling tools and software, including HYDRUS, UNSATH, MODFLOW, HSSM, AERMOD, and CALPUFF. Dr. Breitmeyer has conducted research on characterization and modeling of liquid flow in bioreactor landfills and in landfill covers. He has expertise in laboratory testing and field-scale experimentation and instrumentation for characterizing the mechanical and hydraulic properties of geomaterials. He has also designed, fabricated, and operated custom laboratory equipment and instrumentation for geomaterial testing.
Dr. Breitmeyer also has experience performing feasibility-level remediation cost estimates for contaminated sites and accrual purposes and has experience using RACER to develop remedial cost estimates.

Academic Credentials and Professional Honors

Ph.D., Geological Engineering, University of Wisconsin, Madison, 2011
M.S., Hydrogeology, University of Nevada, Reno/Desert Research Institute, 2006
B.S., Hydrogeology, University of Nevada, Reno (*high distinction*), 2004

Exponent
15375 SE 30th Place
Suite 250
Bellevue, WA 98007

telephone 425-519-8700
facsimile 425-519-8799
www.exponent.com

Anne Fairbrother, DVM, Ph.D.
Principal Scientist and Office Director

Professional Profile

Dr. Anne Fairbrother is a Principal Scientist in Exponent's EcoSciences practice, with more than 30 years of experience in Ecotoxicology, wildlife toxicology, contaminated site assessment, and regulatory science for existing and emerging chemicals in the U.S. and Europe. She recently served on a Science Advisory Panel to the state of Utah and as a consultant to the British Columbia (BC) Ministry of Environment to set site-specific water quality standards for selenium that protect fish and wildlife. She has conducted large-area (>100 sq mile) risk assessments at mines in tropical, desert, and mountain ecosystems, determining risk thresholds for plants and wildlife. She provided consultation on future development of mine pit lakes, assessed the risk to livestock from use of wastewater on irrigated pasture during mine closure operations, and conducted an assessment of risk to terrestrial and aquatic organisms from an abandoned mercury mine. Dr. Fairbrother conducted an assessment of the potential ecological risks to aquatic life in San Francisco Bay and coastal southern California posed by use of copper pipes. She also assessed risks to wildlife at sites contaminated with organic chemicals, including DDT, PCBs, dioxins, and petroleum hydrocarbons in Delaware, Texas, Oregon, and California, integrating ecological risks with human health risk assessments.

As a consultant, Dr. Fairbrother has supported various chemical industry groups in compiling and reviewing data from the literature in support of both U.S. and European regulatory processes. Historically, this included preparation of screening information data sets (SIDs) for submission through EPA to the OECD's High Production Volume (HPV) data call-in program. More recently, she also has input the data into the IUCLID database for Europe-wide risk assessments and the REACH chemical registration program.

Dr. Fairbrother has participated in or led the development of guidance documents for ecological risk assessments. For example, she was co-author of the EPA's *Framework for Metals Risk Assessment* and for BC Ministry of Environment guidance for implementing Tier 1 ecological risk assessments of contaminated sites and for setting soil clean-up values, and participated in the development of Ecological Soil Screening Levels (Eco-SSLs) for EPA.

While a scientist at the EPA, Dr. Fairbrother led research into the ecological risks of bioengineered crops, methods for assessing risks of nanomaterials, and some of the early guidance for field assessments of Superfund sites and effects of pesticides on birds. She researched and developed methods for assessment of chemical effects on bird immune and endocrine systems.

Dr. Fairbrother has published more than 80 peer-reviewed articles and book chapters that reflect her expertise in wildlife toxicology, immunotoxicology, endocrine-disrupting chemicals, and ecological risk assessment. She serves on numerous scientific boards, expert panels, and editorial boards in support of scientific and regulator y issues. A veterinarian and Certified Wildlife Biologist, Dr. Fairbrother served as President of the Society of Environmental Toxicology and Chemistry, American Association of Wildlife Veterinarians, and Wildlife Disease Association (WDA). She is the recipient of the WDA Distinguished Service Award (2002), and a gold medal for Commendable Service from EPA. Dr. Fairbrother holds an adjunct professorship at Oregon State University, Department of Environmental and Molecular Toxicology.

Academic Credentials and Professional Honors

Ph.D., Veterinary Science, University of Wisconsin, Madison, 1985
M.S., Veterinary Science, University of Wisconsin, Madison, 1982
D.V.M., Veterinary Medicine, University of California, Davis, 1980
B.S., Wildlife and Fisheries Biology, University of California, Davis, 1976

Distinguished Service Award, Wildlife Disease Association, 2002
Gold Medal for Commendable Service, EPA, 2005
Bronze Medal for Commendable Service, EPA, 2006, 2008

Licenses and Certifications

Certified Wildlife Biologist, The Wildlife Society, 1995
40-hour Hazwoper Training and Certification

Exponent
15375 SE 30th Place
Suite 250
Bellevue, WA 98007

telephone 425-519-8700
facsimile 425-519-8799
www.exponent.com

Ashley Kaiser
Senior Scientist

Professional Profile

Ms. Ashley Kaiser is a Senior Scientist in Exponent's EcoSciences practice. Ms. Kaiser has 10 years of experience as an environmental professional, including more than 7 years in consulting. She works as a risk assessor, assistant project manager, data analyst, researcher, and health and safety coordinator. In these roles, her responsibilities have included human health and ecological risk calculations, project management, statistical analysis, site assessment, research, compliance assurance, sampling method development, and biotic and abiotic fieldwork.

Ms. Kaiser has experience evaluating human health and ecological risks from chemicals in soil, groundwater, surface water, tissue, and air on sites where PCBs, dioxins, PAHs, and/or metals are the primary chemicals of interest. She has provided technical support for multiple projects in Oregon, Washington, and California at a wide range of sites, including retail gasoline stations, bulk petroleum terminals, former gun clubs, abandoned mine sites, electrical substations, lumber mills, and in-water sediment areas. With an interdisciplinary background and a versatile skill set, Ms. Kaiser specializes in projects that do not fit into well-defined categories.

Academic Credentials and Professional Honors

M.S., Environmental Science and Engineering, Oregon Health and Science University, 2003
B.S., Biology, Environmental Science and Policy, Duke University, 2001

Licenses and Certifications

OSHA Hazardous Waste Operations and Emergency Response 40-hour certification

Michael W. Kierski, Ph.D.
Managing Scientist

Professional Profile

Dr. Michael Kierski is an environmental biologist and toxicologist who provides senior-level expertise in human and ecological risk assessment and evaluation of complex environmental problems. Over the past 24 years, Dr. Kierski has evaluated risks associated with chemicals in air, soil, water, sediment, and biota to both people and the environment. He brings specialized expertise on the fate and effects of metals such as lead, hydrocarbons such as benzene and polycyclic aromatic hydrocarbons (PAHs), synthetic organic chemicals such as PCBs, pesticides, chlorinated solvents, and explosives.

Much of Dr. Kierski's work is directed toward the evaluation, remediation, and redevelopment of contaminated properties. This requires not only technical expertise but also an ability to work with regulatory agencies at the state level (e.g., in Indiana, Wisconsin, Iowa, Illinois, Michigan, New York, North Carolina, New Jersey, etc.) and at the federal level (EPA, U.S. Fish and Wildlife Service, and the Department of Defense). Dr. Kierski's primary clients include electric and gas utilities, chemical companies, the Department of Defense, law firms, and other environmental and engineering companies. Dr. Kierski is often called upon to represent these clients in public and regulatory forums.

Dr. Kierski has extensive training and practical experience in the areas of environmental toxicology, environmental biology, and environmental chemistry, which he has used to develop scientifically defensible approaches for the risk evaluations he has performed. He has utilized this experience within a wide variety of risk assessment projects, tailoring each assessment to the particular needs of his clients. He has emphasized practical applications of risk assessment techniques on projects over his career, using innovative techniques as needed to meet his client's specific needs.

Academic Credentials and Professional Honors

Ph.D., Environmental and Occupational Health, University of Minnesota, 1992
B.A., Environmental Biology, St. Mary's College of Minnesota, 1984

Sheryl Law
Managing Scientist

Professional Profile

Ms. Sheryl Law is a Managing Scientist in Exponent's EcoSciences practice. She has a strong background in environmental chemistry including extensive work in aquatic systems, contaminant modeling and analytical instrumentation (ion chromatography, neutron activation, spectrophotometry, atomic absorption spectrometry, high performance liquid chromatography, gas chromatography, and mass spectrometry). She has experience coordinating with chemical laboratories to develop analytical methods and sample preparation techniques for identification of chemicals that cannot be identified with conventional analyses. Her research with chiral analysis of optical isomers has applications in fields of natural attenuation and fate and transport modelling. She is broadly trained in environmental science and chemistry and provides strong technical support on ecological risk assessments, natural resource damage assessments, litigation projects and site remedial investigations. In addition, she is an experienced technical writer and has prepared a variety of data reports and literature reviews.

She received her MBA with a focus on enterprise risk and sustainability or corporate social responsibility issues. She has researched the value of public companies with respect to their "triple bottom line" and has created decision analysis models that derive additional cash flow from ecological assets, mitigation banks, and carbon credits.

Academic Credentials and Professional Honors

M.B.A., Seattle University, 2006
M.S., Environmental Chemistry, University of Toronto, 2000
B.Sc., Environmental Science, University of Toronto *(honors with distinction)*, 1998

University of Toronto Fellowship Award (2000); University of Toronto Open Fellowship Award (1998); Golden Key Honor Society Top 15% Scholar; NSERC Undergraduate Research Award in Industry

Licenses and Certifications

OSHA Hazardous Waste Operations and Emergency Response 40-hour certification

Exponent
15375 SE 30th Place
Suite 250
Bellevue, WA 98007

telephone 425-519-8700
facsimile 425-519-8799
www.exponent.com

Jane Ma, Ph.D.
Senior Scientist

Professional Profile

Dr. Jane Ma is a Senior Scientist in Exponent's EcoSciences practice. She has a strong interdisciplinary background in geosciences and Computer Science including extensive work in geographic information systems (GIS), remote sensing, landscape/watershed analysis, geostatistics, on-line web mapping, environmental/ecological model implementation, and decision support system (DSS) development. Her scientific expertise is principally in the areas of water resources management, with an emphasis on wetland assessment. Her study involves with aquatic habitat evaluation, wetland vulnerability assessment, headwater wetland mitigation, low-impact Best Management Practices (BMPs) design, and watershed-scale ecological restoration study.

Dr. Ma is highly skilled in geospatial analysis and GIS programming. She is experienced in ArcGIS suite, ERDAS, Plone, PostgreSQL and programming languages in Visual Basic, Python, and C++. She has developed numerous desktop and web-based GIS applications customized to meet the requirement of different projects.

Academic Credentials and Professional Honors

Ph.D., Geosciences and Computer Science, University of Missouri, Kansas City, 2006
M.S., GIS and Remote Sensing, Peking University, China 2001
B.S., Geography, Beijing Normal University, China 1998

Licenses and Certifications

Wetland Delineation Training and Field Practicum, Adaptive Ecosystems, Inc., Kansas City, Missouri, April 19–23, 2004, Certified

Languages

Chinese

Exponent
1800 Diagonal Road
Suite 500
Alexandria, VA 22314

telephone 571-227-7200
facsimile 571-227-7299
www.exponent.com

Charles A. Menzie, Ph.D.
Principal Scientist and Practice Director

Professional Profile

Dr. Charles A. Menzie is a Principal Scientist and Director of Exponent's Ecological and Biological Sciences practice. Dr. Menzie's primary area of expertise is the environmental fate and effects of physical, biological, and chemical stressors on terrestrial and aquatic systems. This includes work on chemicals in the environment, oil and gas operations, fossil fuel and nuclear power plants, alternative energy projects, invasive species, and climate change impacts. Dr. Menzie has worked at more than 100 hazardous waste sites, including many high-profile Superfund Sites and NRDA-related cases. He has been called upon to evaluate environmental damage claims related to the use of pesticides, herbicides, and other chemicals. He has provided expertise related to the environmental implications of atmospheric emissions and of point and nonpoint sources of nutrients and toxic chemicals to aquatic and marine environments (through Total Maximum Daily Loads or TMDL programs). Dr. Menzie has worked on a broad range of contaminants, including solvents (TEC, PCE, TCA, and others), persistent chlorinated compounds such as PCBs, dioxins, and pesticides, as well as hydrocarbons including PAHs, cyanides, and metals such as lead, hexavalent chromium, mercury, and cadmium. Employing his deep understanding of risk-based studies and remediation, Dr. Menzie has directed the development of work plans, the implementation of remedial investigations, and the selection of remedial measures, on behalf of individual potentially responsible parties (PRPs), as well as PRP groups. Dr. Menzie has worked in all EPA Regions, including the Midwest and South (Regions 4, 5, and 6), the Northeast and East Coast (Regions 1, 2, and 3), and the West (Regions 8, 9, and 10). He has an active international practice including projects in Ecuador, Uruguay, and Yemen. He has extensive litigation experience and has provided steady and compelling advice and guidance in many controversial and contentious situations. He is the co-inventor of SediMite™, a low-impact method for remediating contaminated sediments.

Dr. Menzie is recognized as one of the leaders in the field of risk assessment and was awarded the Risk Practitioner Award by the Society for Risk Analysis. He has served on the Councils of SRA and SETAC, the two major professional organizations in this field. Dr. Menzie has led numerous peer reviews for industry and for government. He has taken the lead in developing guidance documents for industry and government and has focused on methods that are workable and acceptable to a broad range of parties. He has developed and applied a formal causal-analysis methodology for assessing causation in cases of environmental impairment and contributions of chemical contamination. He was one of the committee members to draft the ASTM Standard for risk-based corrective action (RBCA) for chemical release sites and extended that standard to ecological considerations. He served on the National Research Council's Committee on Bioavailability of Chemicals in Soils and Sediments. In addition to his work on chemical risk-related matters, Dr. Menzie has developed and applied methods for identifying third parties who have contributed to contamination in aquatic and terrestrial environments. These projects have involved meshing historical information with transport-and-fate analyses, risk considerations (remediation drivers), and forensic analyses. He has provided expert advice on historical use and disposal of asbestos products and historical assessments of asbestos in fill.

Academic Credentials and Professional Honors

Ph.D., Biology, City University of New York, 1978
M.A., Biology, City College of New York, 1974
B.S., Biology, Manhattan College, 1971

Licenses and Certifications

OSHA Certified Eight-Hour HAZWOPER Annual Refresher Training in Hazardous Waste Operations and Emergency Response, updated annually; OSHA Certified 40-Hours of Training in Hazardous Waste Operations and Emergency Response

Patents

U.S. Patent # 7,824,129: A Low-Impact Delivery System for In-Situ Treatment of Contaminated Sediment.

Exponent

Exponent
420 Lexington Avenue
Suite 1740
New York, NY 10170

telephone 212-895-8100
facsimile 212-895-8199
www.exponent.com

Farrukh Mohsen, Ph.D., P.E.
Senior Managing Engineer

Professional Profile

Dr. Farrukh Mohsen is a Senior Managing Engineer in Exponent's Environmental Sciences practice. He has 34 years of experience in hydrogeology and groundwater flow and contaminant transport modeling. He has applied his technical strengths in assisting corporate clients nationwide by providing expert opinions in litigation, environmental compliance, and liability allocations. Dr. Mohsen focuses primarily on developing an understanding of the transport and fate of constituents in the subsurface in both groundwater and soil vapor. He has helped his clients by determining the source of groundwater contamination, designing and evaluating remedial options, conducting risk assessments and regulatory negotiations, achieving environmental compliance, delivering public presentations, providing expert opinions, and refuting claims by other experts. He serves as both a testifying and consulting expert.

Prior to joining Exponent, Dr. Mohsen worked as Senior Project Manager at Gannet Fleming and Environ International Corporation. He has been a Visiting Professor at Rutgers University, a Visiting Fellow at Princeton University, an Associate Professor at the University of Petroleum and Minerals, and a lecturer at Bangladesh University of Engineering and Technology.

Academic Credentials and Professional Honors

Ph.D., Environmental Engineering and Water Resources, University of Waterloo, 1975
M.A.Sc., Environmental Engineering and Water Resources, University of Waterloo, 1972
B.Sc., Civil Engineering, Bangladesh University of Engineering and Technology, 1968

Licenses and Certifications

Registered Professional Engineer, New Jersey, #41041
OSHA Hazardous Waste Operations and Emergency Response 40-hour certification

Languages

Bangali

Exponent
15375 SE 30th Place
Suite 250
Bellevue, WA 98007

telephone 425-519-8700
facsimile 425-519-8799
www.exponent.com

Kirk O'Reilly, Ph.D., J.D.
Managing Scientist

Professional Profile

Dr. Kirk O'Reilly is a Managing Scientist in Exponent's Environmental Sciences practice and is based in Bellevue, Washington. He has more than 25 years of experience investigating the interaction between environmental and biological chemistry, and spent 15 years as an in-house consultant for a major oil company. He is a recognized expert in environmental chemistry, petroleum source identification, and bioremediation, and has played a significant role in developing the oil industry's technical response to managing MTBE in the environment. Dr. O'Reilly was a founding member of Chevron's Oil Spill Environmental Functional Team and is trained in aspects of spill management, response, monitoring, and remediation. He has responded to spills of both crude oil and refined products, and served as on-site liaison to environmental regulators. Dr. O'Reilly has provided litigation support in toxic tort and property damage suits, and managed projects focused on the remediation of soils, sediments, and groundwater, as well as on improving industrial wastewater treatment. Specific contaminants studied include crude oil, refined products, chlorinated solvents, wood treatment compounds, pesticides, and fertilizers. He developed innovative methods for monitoring the transformation and assessing the risk of petroleum. He has also conducted toxicity identification evaluations on refinery effluents and managed waste and water issues on offshore platforms. Experienced working within the constraints of the RCRA, CERCLA, and NPDES programs, Dr. O'Reilly promotes the use of strategic site assessments to reduce costs while improving quality. He has participated in collaborative research projects with regulators at the federal, state, and local levels, and taught technical courses sponsored by regulatory agencies, universities, and industrial trade groups. Dr. O'Reilly is a member of the Washington State Bar.

Academic Credentials and Professional Honors

J.D., University of Idaho College of Law (*magna cum laude)*, 2007
Ph.D., Biochemistry, University of Idaho, 1989
M.S., Biology, Portland State University, 1985
B.S., Biology, University of California, Irvine, 1980

Licenses and Certifications

Washington State Bar, #39473

Patents

Patent 6,924,404: Inhibition of Biological Degradation of Fischer-Tropsch Products, 2005 (with M. Moir, and D. O'Rear).

Patent 6,849,664: Process for Disposing Biocidecontaining Cooling Water, 2005 (with M. Moir, D. O'Rear, and R. Moore).

Patent 6,800,101: Deactivatable Biocides for hydrocarbonaceous Products, 2004 (with M. Moir and D. O'Rear).

Patent 6,626,122: Deactivatable biocides in Ballast Water, 2003 (with M. Moir, D. O'Rear, M. Buetzow, M. Dorsch, and V. Brian).

Patent 6,569,909: Inhibition of Biological Degradation in Fischer-Tropsch products, 2003 (with M. Moir, and D. O'Rear).

Patent 5,236,594: Process for removing toxicants from aqueous petroleum waste streams, 1993 (with J. Suzuki).

Exponent

Richard Podolsky, Ph.D.
Senior Managing Scientist

Professional Profile

Dr. Richard Podolsky is a Senior Managing Scientist in Exponent's EcoSciences practice. Dr. Podolsky's training is in ecology and he assists clients with all aspects of environmental compliance, including environmental conservation, natural resource assessments, ecological/environmental restoration, site assessment/site investigations (SA/SI), habitat evaluations, resource conservation and recovery, the Migratory Bird Treaty Act (MBTA), Marine Mammal Protection Act (MMPA), National Environmental Policy Act (NEPA), and Endangered Species Act (ESA), particularly Section 7 Consultations pertaining to ESA.

Dr. Podolsky has 30 years of experience in assisting land developers and oil, gas, and electric generation companies in reducing potentially adverse environmental effects of a wide range of projects and achieving regulatory compliance. He is experienced in researching and successfully applying cost-effective, state-of-the-art environmental techniques, materials, and software to new development and mitigation projects, proactively addressing the environmental concerns of nonprofit organizations and community groups, and troubleshooting with governmental officials to achieve regulatory compliance. Dr. Podolsky has worked on the impact of the built environment on wildlife, especially wind and solar power, artificial lighting big boxes, skyscrapers, and communication and utility towers.

Dr. Podolsky has in-depth experience with the application of computers and modeling to scientific problems, specifically with GIS integration, pattern recognition, data mining, risk assessment, and remote sensing. He regularly designs and develops software and models for environmental scientists, including the Avian Risk of Collision (ARC) Model, which quantifies risk of birds around wind turbines and communication towers; FullPixelSearch, an image mining software tool; GAIA, the first GIS designed for Macintosh OS; Diversidad, a software model for mapping biodiversity hot spots; and FireTower, a software tool for modeling wildfire spread.

Academic Credentials and Professional Honors

Ph.D., Natural Resources, University of Michigan, 1985
M.S., Ecology, Rutgers University, 1980
B.A., Biology, University of Wisconsin, 1976

Licenses and Certifications

Certified Senior Ecologist, Ecological Society of America

Patents

U.S. Patent #7,315,799: Method of and Article of Manufacture for Determining Probability of Avian Collision. Date of Patent: January 2008.

Exponent
15375 SE 30th Place
Suite 250
Bellevue, WA 98007

telephone 425-519-8700
facsimile 425-519-8799
www.exponent.com

Walter J. Shields, Ph.D., C.P.S.S.
Principal Scientist and Practice Director, Environmental and Earth Sciences

Professional Profile

Dr. Walter Shields is the Director of Exponent's Environmental and Earth Sciences practice. A Certified Professional Soil Scientist, he specializes in the study of transport and geochemical fate of toxic pollutants and their environmental effects. He has 34 years of experience conducting and managing environmental studies in more than 30 states and four Canadian provinces. He provides scientific and strategic consultation to industrial clients on the design and implementation of CERCLA and RCRA investigations, cost-effective remediation approaches, and negotiations with state and federal agencies. Dr. Shields manages multidisciplinary investigations, risk assessments, and feasibility studies. He investigates the industrial archeology of sites to understand the history of contaminant sources in a given area. He serves as an expert witness in environmental forensics and has testified on the origin, transport, and fate of chemicals in air, soils, sediments, surface water, groundwater, and biota, and exposure of humans and ecological receptors to those chemicals. He has particular expertise in the environmental chemistry and source identification of dioxins and furans, PCBs, PAHs, and heavy metals and metalloids. Dr. Shields has also testified on the allocation and appropriateness of remediation costs at a variety of sites. He has specialized expertise in the forest products industry and at mining and smelting sites.

Academic Credentials and Professional Honors

Ph.D., Soil Science, University of Wisconsin, 1979
M.S., Forest Management (Soil Science), University of Idaho, 1976
B.S., Forest Science, University of Washington, 1974

Elected to Phi Kappa Phi (honor society for higher education)
Elected to Sigma Xi (honor society for science and engineering)

Hazardous Waste Operations Management and Supervisor training
ISC/AERMOD Air Dispersion Modeling Course

License and Certifications

Certified Professional Soil Scientist, No. 02471, American Registry of Certified Professionals in Agronomy, Crops and Soils

Exponent
15375 SE 30th Place
Suite 250
Bellevue, WA 98007

telephone 425-519-8700
facsimile 425-519-8799
www.exponent.com

Scott S. Shock, P.E.
Managing Engineer

Professional Profile

Mr. Shock is a Managing Engineer in Exponent's Environmental Sciences practice. His diverse project experience includes site investigation and characterization, contaminant transport and fate, human health and ecological risk assessment, soil and groundwater remediation, groundwater modeling, cost analysis, and litigation support. Mr. Shock has planned and implemented numerous field investigations involving a wide variety of contaminants in soil, groundwater, and sediment. He is skilled in data interpretation and evaluation, and development of effective conceptual site models.

One of Mr. Shock's specialties is assessing environmental impacts associated with mining, particularly in sensitive habitats. He is a leader in the development of proactive and preventive risk management strategies designed to minimize the environmental impacts of mining. Mr. Shock is also skilled in risk communication, and in facilitating cooperation among diverse stakeholder groups.

Mr. Shock's cost analysis experience includes feasibility studies under CERCLA and RCRA, and cost allocations associated with cost recovery litigation and insurance coverage. He employs tools such as cost/benefit analysis, Monte Carlo uncertainty analysis, sensitivity analysis, uncertainty reduction (e.g., through targeted supplemental data collection), net environmental benefits analysis, and other decision analysis methods to help clients make more informed and robust remediation and liability management decisions.

Mr. Shock's contaminated-site remediation experience includes evaluating and comparing remedial technologies; costing, planning, and implementing field pilot tests of remediation systems; and designing and supervising the installation, startup, monitoring, and closure of full-scale remediation systems. He has evaluated ongoing remedial actions to improve operational performance, and has assessed the appropriateness of past remedial actions in support of litigation and cost allocation negotiations, particularly with respect to volatile organics in soil and groundwater.

Academic Credentials and Professional Honors

M.S., Civil/Environmental Engineering, University of Washington, 1994
B.S., Civil Engineering, University of Washington, 1992

Licenses and Certifications

Professional Engineer in Washington State, License No. 37417
OSHA Hazardous Waste Operations and Emergency Response 40-hour certification

Exponent
1150 Connecticut Ave, NW
Suite 1100
Washington, DC 20036

telephone 202-772-4900
facsimile 202-772-4979
www.exponent.com

Randall Wentsel, Ph.D.
Senior Managing Scientist

Professional Profile

Dr. Randall Wentsel is a Senior Managing Scientist in Exponent's EcoSciences practice. Dr. Wentsel has over 30 years of experience in environmental sciences in areas including: sediment, aquatic, and terrestrial toxicology; ecological risk assessment; research strategies; and science policy. Dr. Wentsel has authored over 30 open literature publications, 70 government publications, and various book chapters addressing state-of-the-art techniques and environmental toxicology and risk assessment issues.

One of Dr. Wentsel's strengths is the ability to lead multi-disciplinary groups of scientists to address complex issues and to delineate attainable goals; these efforts have resulted in providing guidance to the scientific community. Primary examples (that he has led or co-led) include the Environmental Protection Agency (EPA) Framework for Metals Risk Assessment, the EPA Office of Solid Waste and Emergency Response (OSWER) Guidance on Ecological Soil Screening Levels, a White House Committee for Environment and Natural Resources (CENR) document on Ecological Risk Assessment in the Federal Government, and a DoD Tri-service guidance on Ecological Risk Assessment.

Dr. Wentsel has served in several Federal government positions. He was the National Program Director (NPD) for Contaminated Sites/Resource Conservation in the EPA's Office of Research and Development (ORD), where he provided scientific direction of the program, strategic planning, and documentation of research impacts and applications. In the EPA Office of Water, Dr. Wentsel was a Branch Chief and supervised a staff addressing nutrient criteria, biosolids issues, and sedimentation criteria. He also worked in the ORD National Center for Environmental Assessment and the Office of Science Policy. Working for DoD, Dr. Wentsel managed research activities in ecological risk assessment, aquatic and terrestrial toxicology and biotechnology at the U.S. Army Edgewood Research, Development, and Engineering Center.

Dr. Wentsel has a unique breadth of experience in science policy through completion of the Senior Executive Fellows program at the JFK School of Government, Harvard University, being chosen as the SETAC Science Fellow on the U.S. Senate Environment and Public Works Committee, serving as the DoD member on the White House National Science and Technology Council, Committee on the Environment and Natural Resources, and working with the White House Office of Science and Technology Policy staff on risk and cost benefit issues.

Dr. Wentsel is active in peer review panels, advisory committees, and technical workshops. In the EPA development of ecological risk assessment (ERA) methods, Dr. Wentsel was a peer reviewer on the ERA Framework report, case studies, and guidelines. Technical workshops have included: assessing multiple stressors to ecosystems, ecological risk management, population modeling, soil quality standards, and bioavailability.

Academic Credentials and Professional Honors

Ph.D., Bionuclear, Purdue University, 1977
M.S., Biology, Butler University, 1974
B.S., Zoology, De Pauw University, 1973

EPA Science Achievement Award for Biology/Ecology

Appendix B

Evaluation of Additional Areas of Special Ecological Concern

Appendix B. Evaluation of Additional Areas of Special Ecological Concern

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Steele City	Montana	No	25.4	X			X		2	Frenchman Creek	Perennial	--	--	25.4	Frenchman Creek	--	--
Steele City	Montana	No	25.75			X			1	Unnamed waterbody	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	27.06			X			1	Unnamed tributary to Panhandle Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	27.16			X			1	Unnamed tributary to Panhandle Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	28.8			X			1	Unnamed tributary to Panhandle Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	30.45			X			1	Unnamed tributary to Jordan Coulee	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	32.4			X			1	East Fork Cache Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	34.7			X			1	Unnamed tributary to Pasture Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	35.02			X			1	Pasture Coulee	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	35.34			X			1	Unnamed tributary to Pasture Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	35.51			X			1	Unnamed tributary to Pasture Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	35.54			X			1	Unnamed tributary to Pasture Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	35.81			X			1	Unnamed tributary to Pasture Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	35.84			X			1	Unnamed tributary to Pasture Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	35.95			X			1	Unnamed tributary to Pasture Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	36.01			X			1	Unnamed tributary to Pasture Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	36.12			X			1	Jones Coulee	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	37.97			X			1	Hay Coulee	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	38.59			X			1	Unnamed tributary to Rock Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	39.06			X			1	Unnamed tributary to Rock Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	39.08			X			1	Unnamed tributary to Rock Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	39.09			X			1	Unnamed tributary to Rock Creek	Man-made ditch	--	--	--	--	--	--
Steele City	Montana	No	39.16	X		X			2	Rock Creek	Perennial	--	--	39.2	Rock Creek	--	--
Steele City	Montana	No	40.52	X		X			2	Willow Creek	Perennial	--	--	40.5	Willow Creek	--	--
Steele City	Montana	No	40.92			X			1	Unnamed tributary to Willow Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	41.06			X			1	Unnamed tributary to Willow Creek	Ephmeral	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Steele City	Montana	No	41.72			X			1	Unnamed tributary to Willow Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	42.55			X			1	Unnamed tributary to Willow Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	44.24			X			1	Unnamed tributary to Lime Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	44.58			X			1	Unnamed tributary to Lime Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	45.05			X			1	Lime Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	45.13			X			1	Lime Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	47.95			X			1	Black Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	48.02			X			1	Unnamed tributary to Black Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	48.03			X			1	Unnamed tributary to Black Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	48.26			X			1	Unnamed tributary to Black Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	48.32			X			1	Unnamed tributary to Black Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	48.54			X			1	Unnamed tributary to Black Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	49.9			X			1	Unnamed tributary to Bear Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	49.94			X			1	Unnamed tributary to Bear Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	50.53			X			1	Unnamed tributary to Bear Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	51.3			X			1	Brush Fork	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	51.41			X			1	Unnamed tributary to Brush Fork Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	51.44			X			1	Unnamed tributary to Brush Fork Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	51.53			X			1	Unnamed tributary to Brush Fork Creek	Ephmeral	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Steele City	Montana	No	51.61			X			1	Unnamed tributary to Brush Fork Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	52.47			X	X		2	Bear Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	52.58			X	X		2	Unnamed tributary to Bear Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	53.49			X			1	Unger Coulee	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	53.64			X			1	Unnamed tributary to Unger Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	53.79			X			1	Unnamed tributary to Unger Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	54.14			X			1	Unnamed tributary to Unger Coulee	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	55.03			X			1	Unnamed tributary to Buggy Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	55.22			X			1	Unnamed tributary to Buggy Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	55.46			X			1	Buggy Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	55.67			X			1	Unnamed tributary to Buggy Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	56.03			X			1	Unnamed tributary to Buggy Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	56.04			X			1	Unnamed tributary to Buggy Creek	Ephmeral	--	--	--	--	--	--

Segment	State	CPS?	Approx. Milepost	Special Attributes: Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Stream Crossing (Tables E-1 and E2): Crossing Name	Type	HDD (Table 2.3.3-1): Approx. Milepost	Crossing?	Fisheries (Table 3.7.2-1): Approx. Milepost	Waterbody Name	Wetlands (Table 3.4.2-1): Approx. Milepost	Name
Steele City	Montana	No	56.07			X			1	Unnamed tributary to Buggy Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	56.12			X			1	Unnamed tributary to Buggy Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	56.27			X			1	Unnamed tributary to Buggy Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	56.41			X			1	Unnamed tributary to Buggy Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	56.45			X			1	Unnamed tributary to Buggy Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	56.71			X			1	Unnamed tributary to Buggy Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	56.72			X			1	Unnamed tributary to Buggy Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	57.15			X			1	Alkali Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	57.55			X			1	Unnamed tributary to Alkali Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	57.55			X			1	Unnamed tributary to Alkali Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	57.7			X			1	Unnamed tributary to Alkali Coulee	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	57.74			X			1	Unnamed tributary to Alkali Coulee	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	57.91			X			1	Unnamed tributary to Alkali Coulee	Ephmeral	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Steele City	Montana	No	58.04			X			1	Unnamed tributary to Alkali Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	59.5			X			1	Wire Grass Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	59.55			X			1	Unnamed tributary to Wire Grass Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	60.02			X			1	Spring Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	61.87			X			1	Mooney Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	62.93			X			1	Unnamed tributary to Mooney Coulee	Ephmeral	--	--	--	--	--	--
Steele City	Montana	MT-1	65.97			X			1	Unnamed tributary to Cherry Creek	Ephmeral	--	--	--	--	--	--
Steele City	Montana	MT-1	67.2			X			1	Cherry Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	MT-1	67.25			X			1	Cherry Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	MT-1	67.41			X			1	Unnamed tributary to Cherry Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	MT-1	68.5			X			1	Foss Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	MT-1	68.52			X			1	Foss Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	MT-1	68.64			X			1	Foss Creek	Intermittent	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Steele City	Montana	MT-1	69.41			X			1	Unnamed tributary to East Fork	Ephmeral	--	--	--	--	--	--
Steele City	Montana	No	70.43			X			1	Spring Coulee	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	82.95	X		X	X		3	Milk River	Perennial	82.9	Yes	82.9	Milk River	--	--
Steele City	Montana	No	89.17	X		X			2	Missouri River	Perennial	89.2	Yes	89.2-89.3	Missouri River	--	--
Steele City	Montana	No	89.26	X		X			2	Missouri River	Perennial	89.2	Yes	89.2-89.3	Missouri River	--	--
Steele City	Montana	No	93.88	X					1	Unnamed tributary to Struple Coulee	Perennial	--	--	93.9	Unnamed tributary to Struple Coulee	--	--
Steele City	Montana	No	94.89	X					1	Unnamed tributary to Jorgensen Coulee	Perennial	--	--	94.9	Unnamed tributary to Jorgensen Coulee	--	--
Steele City	Montana	No	102.27				X		1	Unnamed tributary to Bear Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	102.73				X		1	Unnamed tributary to Bear Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	102.78				X		1	Unnamed tributary to Bear Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	103.18				X		1	Unnamed tributary to Bear Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	105.61				X		1	Bear Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	105.62				X		1	Bear Creek	Ephemeral	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Steele City	Montana	No	107.44				X		1	Unnamed tributary to North Prong Shade Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	107.63				X		1	Unnamed tributary to North Prong Shade Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	107.68				X		1	Unnamed tributary to North Prong Shade Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	107.78				X		1	Unnamed tributary to North Prong Shade Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	107.79				X		1	Unnamed tributary to North Prong Shade Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	108.15				X		1	Unnamed tributary to North Prong Shade Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	108.58				X		1	North Prong Shade Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	110.72				X		1	Shade Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	110.74				X		1	Shade Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	110.77				X		1	Shade Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	110.8				X		1	Unnamed tributary to Shade Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	111.71				X		1	Unnamed tributary to Shade Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	111.73				X		1	Unnamed tributary to Shade Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	111.92				X		1	Unnamed tributary to Shade Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	112.14				X		1	Unnamed tributary to Shade Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	112.41				X		1	Unnamed tributary to Shade Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	112.44				X		1	Unnamed tributary to Shade Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	114.55				X		1	South Fork Shade Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	115.81				X		1	Unnamed tributary to South Fork Shade Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	115.9				X		1	Unnamed tributary to South Fork Shade Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	116.25				X		1	Unnamed tributary to South Fork Shade Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	116.41				X		1	Unnamed tributary to South Fork Shade Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	117.17				X		1	Unnamed tributary to South Fork Shade Creek	Ephemeral	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Steele City	Montana	No	127.99	X					1	East Fork Prairie Elk Creek	Perennial	--	--	128	East Fork Prairie Elk Creek	--	--
Steele City	Montana	No	134.78				X		1	Unnamed tributary to Lost Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	136.6				X		1	Unnamed tributary to Lost Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	138.65				X		1	Unnamed tributary to Lost Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	139.19				X		1	Unnamed tributary to Lost Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	139.75				X		1	Unnamed tributary to Lost Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	146.97	X					1	Redwater River	Perennial	--	--	147	Redwater River	--	--
Steele City	Montana	No	153.69	X					1	Buffalo Spings Creek	Perennial	--	--	153.7	Buffalo Spings Creek	--	--
Steele City	Montana	No	159.63	X					1	Berry Creek	Perennial	--	--	159.6	Berry Creek	--	--
Steele City	Montana	No	166.59				X		1	Upper Seven Mile Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	175.6	X					1	Clear Creek	Perennial	--	--	175.6	Clear Creek	--	--
Steele City	Montana	MT-4	196.06	X					1	Side channel of Yellowstone River	Perennial	--	--	196.1	Side channel of Yellowstone River	--	--
Steele City	Montana	No	196.36	X		X			2	Yellowstone River	Perennial	196.4	Yes	196.4	Yellowstone River	--	--
Steele City	Montana	No	234.7	X					1	Pennel Creek	Perennial	--	--	234.7	Pennel Creek	--	--
Steele City	Montana	No	236.02	X					1	Unnamed tributary to Pennel Creek	Perennial	--	--	236	Unnamed tributary to Pennel Creek	--	--
Steele City	Montana	No	246.45				X		1	Unnamed tributary to Red Butte Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	246.51				X		1	Red Butte Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	246.65				X		1	Unnamed tributary to Red Butte Creek	Ephemeral	--	--	--	--	--	--
Steele City	Montana	No	249				X		1	Unnamed tributary to Red Butte Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	250.2				X		1	Red Butte Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	250.22				X		1	Red Butte Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	250.27				X		1	Red Butte Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	250.9				X		1	Red Butte Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	251.11				X		1	Red Butte Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	251.12				X		1	Red Butte Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	251.13				X		1	Red Butte Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	251.2				X		1	Red Butte Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	251.28				X		1	Red Butte Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	251.45				X		1	Unnamed tributary to Red Butte Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	251.91				X		1	Unnamed tributary to Red Butte Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	252.45				X		1	Unnamed tributary to Red Butte Creek	Intermittent	--	--	--	--	--	--
Steele City	Montana	No	262.68	X					1	Little Beaver Creek	Perennial	--	--	262.7	Little Beaver Creek	--	--
Steele City	Montana	MT-7	281.47	X					1	Boxelder Creek	Perennial	--	--	281.5	Boxelder Creek	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Steele City	South Dakota	SD-2	292.08	X					1	Little Missouri River	Perennial	292.1	Yes	292.1	Little Missouri River	--	--
Steele City	South Dakota	No	303.27				X		1	Unnamed tributary to Jones Creek	Intermittent	--	--	--	--	--	--
Steele City	South Dakota	No	303.95				X		1	Unnamed tributary to Jones Creek	Intermittent	--	--	--	--	--	--
Steele City	South Dakota	No	304.22				X		1	Unnamed tributary to Jones Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	No	304.75				X		1	Unnamed tributary to Jones Creek	Intermittent	--	--	--	--	--	--
Steele City	South Dakota	No	306.09				X		1	Unnamed tributary to Jones Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	No	306.65				X		1	Unnamed tributary to Jones Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	No	307.43				X		1	Unnamed tributary to Jones Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	No	308.21				X		1	Unnamed tributary to Rush Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	No	308.28				X		1	Unnamed tributary to Rush Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	No	308.6				X		1	Unnamed tributary to Rush Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	No	308.7				X		1	Unnamed tributary to Rush Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	No	309.13				X		1	Unnamed tributary to Rush Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	No	309.55				X		1	Unnamed tributary to Rush Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	No	311.67				X		1	Unnamed tributary to Rush Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	No	318.09	X					1	South Fork Grand River	Perennial	--	--	318.1	South Fork Grand River	--	--
Steele City	South Dakota	No	322.88	X					1	Clark's Fork Creek	Perennial	--	--	322.9	Clark's Fork Creek	--	--
Steele City	South Dakota	No	328.67				X		1	West Squaw Creek	Intermittent	--	--	--	--	--	--
Steele City	South Dakota	No	328.74				X		1	West Squaw Creek	Intermittent	--	--	--	--	--	--
Steele City	South Dakota	No	328.82				X		1	West Squaw Creek	Intermittent	--	--	--	--	--	--
Steele City	South Dakota	No	328.83				X		1	West Squaw Creek	Intermittent	--	--	--	--	--	--
Steele City	South Dakota	No	328.86	X			X		2	West Squaw Creek	Intermittent	--	--	328.9	West Squaw Creek	--	--
Steele City	South Dakota	No	329.07				X		1	Unnamed tributary to West Squaw Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	No	329.09				X		1	Unnamed tributary to West Squaw Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	No	329.33				X		1	Unnamed tributary to West Squaw Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	No	330.34				X		1	Unnamed tributary to West Squaw Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	No	330.53				X		1	Unnamed tributary to West Squaw Creek	Intermittent	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Steele City	South Dakota	No	330.62				X		1	Unnamed tributary to West Squaw Creek	Intermittent	--	--	--	--	--	--
Steele City	South Dakota	No	331.01				X		1	Unnamed tributary to West Squaw Creek	Intermittent	--	--	--	--	--	--
Steele City	South Dakota	No	331.12				X		1	Unnamed tributary to West Squaw Creek	Intermittent	--	--	--	--	--	--
Steele City	South Dakota	No	331.32				X		1	Unnamed tributary to West Squaw Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	No	331.7				X		1	Unnamed tributary to West Squaw Creek	Intermittent	--	--	--	--	--	--
Steele City	South Dakota	No	331.91				X		1	Unnamed tributary to West Squaw Creek	Intermittent	--	--	--	--	--	--
Steele City	South Dakota	No	331.98				X		1	Unnamed tributary to West Squaw Creek	Intermittent	--	--	--	--	--	--
Steele City	South Dakota	No	353.1	X					1	Unnamed tributary to North Fork Moreau River	Perennial	--	--	353.1	Unnamed tributary to North Fork Moreau River	--	--
Steele City	South Dakota	No	356.94	X					1	North Fork Moreau River	Perennial	--	--	356.9	North Fork Moreau River	--	--
Steele City	South Dakota	No	364.83	X					1	South Fork Moreau River	Perennial	--	--	364.8	South Fork Moreau River	--	--
Steele City	South Dakota	No	383.72	X					1	Pine Creek	Perennial	--	--	383.7	Pine Creek	--	--
Steele City	South Dakota	No	408.94	X					1	Red Owl Creek	Perennial	--	--	408.9	Red Owl Creek	--	--
Steele City	South Dakota	SD-4	425.42	X					1	Narcelle Creek	Perennial	--	--	425.4	Narcelle Creek	--	--
Steele City	South Dakota	SD-4	426.02			X			1	Unnamed tributary to Cheyenne River	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	SD-4	426.07	X		X			2	Cheyenne River	Perennial	426.1	Yes	426.1	Cheyenne River	--	--
Steele City	South Dakota	SD-4	429.11	X					1	Bridger Creek	Perennial	--	--	429.1	Bridger Creek	--	--
Steele City	South Dakota	No	443.84	X					1	West Plum Creek	Perennial	--	--	443.8	West Plum Creek	--	--
Steele City	South Dakota	No	460.92				X		1	Witcher Holes Creek	Intermittent	--	--	--	--	--	--
Steele City	South Dakota	No	460.94				X		1	Witcher Holes Creek	Intermittent	--	--	--	--	--	--
Steele City	South Dakota	No	461.63				X		1	Unnamed tributary to Witcher Holes Creek	Ephemeral	--	--	--	--	--	--
Steele City	South Dakota	SD-5	479.27	X					1	Mitchell Creek	Perennial	--	--	479.3	Mitchell Creek	--	--
Steele City	South Dakota	No	481.54	X					1	Bad River	Perennial	--	--	481.5	Bad River	--	--
Steele City	South Dakota	SD-6	537.09	X		X			2	White River	Ephemeral	--	--	537.1	White River	--	--
Steele City	South Dakota	No	537.13	X		X			2	White River	Perennial	537.2	Yes	537.1	White River	--	--
Steele City	Nebraska	No	599.9	X	X	X			3	Keya Paha River	Perennial	--	--	599.9	Keya Paha River	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	601.12		X				1	Unnamed tributary to Keya Paha River	Intermittent	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	601.46		X				1	Unnamed tributary to Keya Paha River	Intermittent	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	604.19	X	X				2	Spring Creek	Perennial	--	--	604.2	Spring Creek	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	604.53		X				1	Unnamed tributary to Spring Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	615.38	X	X	X			3	Niobrara River	Perennial	--	--	615.4-651.6	Niobrara River	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	615.48	X	X	X			3	Niobrara River	Perennial	615.5	Yes	615.4-651.6	Niobrara River	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	615.61	X	X	X			3	Niobrara River	Perennial	615.5	Yes	615.4-651.6	Niobrara River	600-746	NE Sand Hills Wetlands

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Steele City	Nebraska	No	624.65		X	X			2	Ash Creek	Intermittent	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	628.81		X	X	X		3	Unnamed tributary to North Branch Elkhorn River	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	628.92		X	X	X		3	North Branch Elkhorn River	Intermittent	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	630.16		X	X	X		3	Unnamed tributary to South Branch Elkhorn River	Intermittent	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	630.46	X	X	X	X		4	South Fork Elkhorn River	Perennial	--	--	630.5	South Fork Elkhorn River	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	630.69		X	X	X		3	Unnamed tributary to South Branch Elkhorn River	Intermittent	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	634.18		X	X	X		3	Unnamed tributary to Keegan Creek	Man-made ditch	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	636.33		X	X	X		3	Keegan Creek	Intermittent	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	636.35		X	X	X		3	Keegan Creek	Intermittent	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	636.36		X	X	X		3	Keegan Creek	Intermittent	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	639.88		X	X			2	Unnamed tributary to Dry Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	640.57		X	X			2	Dry Creek	Intermittent	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	647.1		X	X			2	Unnamed tributary to Holt Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	647.31	X	X	X			3	Holt Creek	Perennial	--	--	647.3	Holt Creek	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	648		X	X			2	Unnamed tributary to Holt Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	649.98		X	X			2	Unnamed tributary to Holt Creek	Intermittent	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	654.18		X	X			2	Unnamed tributary to Dry Creek	Intermittent	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	656.17		X	X			2	Unnamed tributary to Dry Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	657.84		X	X			2	Dry Creek	Intermittent	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	658.79		X	X			2	Dry Creek	Intermittent	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	660.22	X	X	X			3	South Fork Elkhorn River	Perennial	--	--	660.2	South Fork Elkhorn River	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	660.23	X	X	X			3	South Fork Elkhorn River	Perennial	--	--	660.2	South Fork Elkhorn River	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	697.3	X	X	X			3	Cedar River	Perennial	697.3	Yes	697.3	Cedar River	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	708.57		X				1	Unnamed tributary to Freeman Creek	Intermittent	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	712.3		X				1	Unnamed tributary to Troy Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Steele City	Nebraska	No	712.63		X				1	Unnamed tributary to Troy Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	712.76		X				1	Unnamed tributary to Troy Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	712.97		X				1	Unnamed tributary to Troy Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	713.52		X				1	Unnamed tributary to Troy Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	714.06		X				1	Troy Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	714.35		X				1	Unnamed tributary to Troy Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	715.56		X				1	Unnamed tributary to Troy Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	715.78		X				1	Unnamed tributary to Troy Creek	Man-made waterbody	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	720.58		X				1	Unnamed tributary to Troy Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	722.21		X				1	Unnamed tributary to Troy Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	722.28		X				1	Unnamed tributary to South Branch Timber Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	722.41		X				1	Unnamed tributary to South Branch Timber Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	722.52		X				1	Unnamed tributary to South Branch Timber Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	722.55		X				1	Unnamed tributary to South Branch Timber Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	722.82		X				1	Unnamed tributary to South Branch Timber Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	722.85		X				1	Unnamed tributary to South Branch Timber Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	722.9		X				1	Unnamed tributary to South Branch Timber Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	727.96		X				1	Unnamed tributary to South Branch Timber Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	728.52	X	X				2	South Branch Timber Creek	Perennial	--	--	728.5	South Branch Timber Creek	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	729.39		X				1	Unnamed tributary to South Branch Timber Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	729.69	X	X				2	Unnamed tributary to South Branch Timber Creek	Perennial	--	--	729.7	Unnamed tributary to South Branch Timber Creek	600-746	NE Sand Hills Wetlands

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Steele City	Nebraska	No	729.77		X				1	Unnamed tributary to South Branch Timber Creek	Perennial	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	730.44		X				1	Unnamed tributary to South Branch Timber Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	731.35		X				1	Unnamed tributary to South Branch Timber Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	732.99		X				1	Unnamed tributary to Timber Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	735.48		X				1	Unnamed tributary to Horse Creek	Open Water	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	735.5		X				1	Unnamed tributary to Horse Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	736.57		X				1	Unnamed tributary to Horse Creek	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	NE-5	738.63	X	X				2	Fullerton Canal	Perennial	--	--	738.6	Fullterton Canal	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	740.72	X	X	X			3	Loup River	Perennial	740.7	Yes	740.7	Loup River	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	741.06		X				1	Unnamed tributary to Loup River	Ephemeral	--	--	--	--	600-746	NE Sand Hills Wetlands
Steele City	Nebraska	No	747.14	X					1	Prairie Creek	Perennial	--	--	747.1	Prairie Creek	--	--
Steele City	Nebraska	No	755.74	X					1	Warm Slough	Perennial	--	--	755.7	Warm Slough	--	--
Steele City	Nebraska	No	756.28	X		X			2	Platte River	Perennial	756.3	Yes	756.3-756.5	Platte River	--	--
Steele City	Nebraska	NE-7	758.13	X	X	X			3	Unnamed tributary to Platte River	Perennial	--	--	758.1-758.2	Unnamed tributary to Platte River	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	NE-7	758.24	X	X	X			3	Unnamed tributary to Platte River	Perennial	--	--	758.1-758.2	Unnamed tributary to Platte River	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	NE-7	759.2		X	X			2	Unnamed tributary to Platte River	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	759.45		X	X			2	Unnamed tributary to Platte River	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	759.72		X	X			2	Unnamed tributary to Platte River	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	759.73		X	X			2	Unnamed tributary to Platte River	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	759.75		X	X			2	Unnamed tributary to Platte River	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	765.5	X	X	X			3	Big Blue River	Perennial	--	--	765.5	Big Blue River	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	767.12		X	X			2	Unnamed tributary to Big Blue River	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	774.93	X	X	X			3	Lincoln Creek	Perennial	--	--	774.9	Lincoln Creek	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	775.2		X	X			2	Unnamed tributary to Lincoln Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	778.02		X	X	X		3	Unnamed tributary to Beaver Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	778.03		X	X	X		3	Unnamed tributary to Beaver Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Steele City	Nebraska	NE-9	780.21	X	X	X	X		4	Beaver Creek	Perennial	--	--	780.21	Beaver Creek	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	NE-9	786.15		X	X			2	Unnamed tributary to West Fork Big Blue River	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	787.31		X	X			2	Unnamed tributary to West Fork Big Blue River	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	788.12		X	X			2	Unnamed tributary to West Fork Big Blue River	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	789.57	X	X	X			3	West Fork Big Blue	Perennial	--	--	789.6	West Fork Big Blue	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	789.84		X	X			2	Unnamed tributary to West Fork Big Blue River	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	790.48		X	X			2	Unnamed tributary to West Fork Big Blue River	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	791.29		X	X			2	Unnamed tributary to West Fork Big Blue River	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	795.05		X	X			2	Indian Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	799.43		X	X			2	Unnamed tributary to Indian Creek	Man-made ditch	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	801.55		X	X			2	Unnamed tributary to Turkey Creek	Man-made ditch	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	806.38		X	X			2	Unnamed tributary to Turkey Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	807.54	X	X	X			3	Unnamed tributary to Turkey Creek	Perennial	--	--	807.54	Unnamed tributary to Turkey Creek	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	NE-12	808.55	X	X	X			3	Turkey Creek	Perennial	--	--	808.6	Turkey Creek	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	808.91		X	X			2	Unnamed tributary to Turkey Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	810.08		X	X			2	Unnamed tributary to Turkey Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	810.1		X	X			2	Unnamed tributary to Turkey Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	813.19		X	X	X		3	Unnamed tributary to North Fork Swan Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	815.14		X	X	X		3	Unnamed tributary to North Fork Swan Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	815.36		X	X	X		3	Unnamed tributary to North Fork Swan Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	816.36		X	X	X		3	Unnamed tributary to North Fork Swan Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	816.41		X	X	X		3	Unnamed tributary to North Fork Swan Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	816.45		X	X	X		3	Unnamed tributary to North Fork Swan Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	817.16		X	X	X		3	Unnamed tributary to North Fork Swan Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	817.55		X	X	X		3	Unnamed tributary to North Fork Swan Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	823.48		X	X	X		3	Unnamed tributary to South Fork Swan Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Steele City	Nebraska	No	823.54		X	X	X		3	Unnamed tributary to South Fork Swan Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	823.61		X	X	X		3	Unnamed tributary to South Fork Swan Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	823.97		X	X	X		3	Unnamed tributary to South Fork Swan Creek	Man-made ditch	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	825.04		X	X	X		3	Unnamed tributary to South Fork Swan Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	825.04		X	X	X		3	Unnamed tributary to South Fork Swan Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	826.27		X	X	X		3	South Fork Swan Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	829.47		X	X	X		3	Unnamed tributary to South Fork Swan Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	829.81		X	X	X		3	Unnamed tributary to South Fork Swan Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	829.88		X	X	X		3	Unnamed tributary to South Fork Swan Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	829.99		X	X	X		3	Unnamed tributary to South Fork Swan Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	830.61		X	X	X		3	Unnamed tributary to South Fork Swan Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	831.33		X	X	X		3	Unnamed tributary to Cub Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	832.18		X	X	X		3	Unnamed tributary to Cub Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	832.71		X	X	X		3	Unnamed tributary to Cub Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	832.73		X	X	X		3	Unnamed tributary to Cub Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	832.74		X	X	X		3	Unnamed tributary to Cub Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	833.9		X	X	X		3	Unnamed tributary to Cub Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	835.29		X	X	X		3	Cub Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	NE-14	836.32		X	X	X		3	Unnamed tributary to Cub Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	NE-14	836.94		X	X	X		3	Unnamed tributary to Cub Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	837.46		X	X	X		3	Unnamed tributary to Cub Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	837.53		X	X	X		3	Unnamed tributary to Cub Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	838.62		X	X	X		3	Unnamed tributary to Cub Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	838.76		X	X	X		3	Unnamed tributary to Cub Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	840.59		X	X	X		3	Unnamed tributary to Cub Creek	Ephemeral	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	843.03		X	X	X		3	Big Indian Creek	Intermittent	--	--	--	--	758-847.4	Rainwater Basin Wetlands

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Steele City	Nebraska	No	847.32		X	X	X		3	Unnamed tributary to Big Indian Creek	Man-made ditch	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	No	847.34		X	X	X		3	Unnamed tributary to Big Indian Creek	Man-made ditch	--	--	--	--	758-847.4	Rainwater Basin Wetlands
Steele City	Nebraska	NE-17	848.66				X		1	Unnamed tributary to Big Indian Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	1.24	X					1	Wildhorse Creek	Perennial	--	--	1.2	Wildhorse Creek	--	--
Gulf Coast	Oklahoma	No	2.45	X					1	Turkey Creek	Perennial	--	--	2.5	Turkey Creek	--	--
Gulf Coast	Oklahoma	No	2.94	X					1	Unnamed tributary to Euchee Creek	Perennial	--	--	2.9	Unnamed tributary to Euchee Creek	--	--
Gulf Coast	Oklahoma	No	3.27	X					1	Unnamed tributary to Euchee Creek	Perennial	--	--	3.3	Unnamed tributary to Euchee Creek	--	--
Gulf Coast	Oklahoma	No	6.98	X			X		2	Unnamed tributary to Camp Creek	Perennial	--	--	7	Unnamed tributary to Camp Creek	--	--
Gulf Coast	Oklahoma	No	7.6				X		1	Unnamed tributary to Camp Creek	Unknown	--	--	--	--	--	--
Gulf Coast	Oklahoma	OK-2	7.83	X			X		2	Unnamed tributary to Camp Creek	Perennial	--	--	7.8	Unnamed tributary to Camp Creek	--	--
Gulf Coast	Oklahoma	OK-2	8.38				X		1	Unnamed tributary to Camp Creek	N/A	--	--	--	--	--	--
Gulf Coast	Oklahoma	OK-2	9.1				X		1	Unnamed tributary to Camp Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	9.37				X		1	Unnamed tributary to Camp Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Oklahoma	OK-3	14.06	X					1	Salt Creek	Perennial	--	--	14.1	Salt Creek	--	--
Gulf Coast	Oklahoma	OK-3	14.84	X					1	Unnamed tributary to Salt Creek	Perennial	--	--	14.8-15.3	Unnamed tributary to Salt Creek	--	--
Gulf Coast	Oklahoma	OK-3	15.23	X					1	Unnamed tributary to Salt Creek	Perennial	--	--	14.8-15.3	Unnamed tributary to Salt Creek	--	--
Gulf Coast	Oklahoma	OK-3	15.25	X					1	Unnamed tributary to Salt Creek	Perennial	--	--	14.8-15.3	Unnamed tributary to Salt Creek	--	--
Gulf Coast	Oklahoma	No	19.52	X					1	Unnamed tributary to Deep Fork River	Perennial	--	--	19.5	Unnamed tributary to Deep Fork River	--	--
Gulf Coast	Oklahoma	No	22.15	X	X	X			3	Deep Fork River	Perennial	22.2	Yes	22.2	Deep Fork River	22.1-23.3	Deep Fork Wildlife Management Area

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Oklahoma	No	22.99		X	X			2	Unnamed tributary to Deep Fork River	Intermittent	--	--	--	--	22.1-23.3	Deep Fork Wildlife Management Area
Gulf Coast	Oklahoma	No	24.03	X					1	Pettiquah Creek	Perennial	--	--	24	Pettiquah Creek	--	--
Gulf Coast	Oklahoma	No	28.3	X					1	Little Hilliby Creek	Perennial	--	--	28.3	Little Hilliby Creek	--	--
Gulf Coast	Oklahoma	No	30.41	X					1	Hilliby	Perennial	--	--	30.4	Hilliby	--	--
Gulf Coast	Oklahoma	No	32.65	X					1	Unnamed tributary to Hilliby Creek	Perennial	--	--	32.7	Unnamed tibutary to Hilliby Creek	--	--
Gulf Coast	Oklahoma	No	38.3	X					1	Unnamed tributary to North Canadian River	Perennial	--	--	38.3	Unnamed tributary to North Canadian River	--	--
Gulf Coast	Oklahoma	No	38.55	X		X			2	North Canadian River	Perennial	38.6	Yes	38.6	North Canadian River	--	--
Gulf Coast	Oklahoma	No	39.9	X					1	Tributary to North Canadian River	Perennial	--	--	39.9	Tributary to North Canadian River	--	--
Gulf Coast	Oklahoma	No	43.53	X					1	Sand Creek	Perennial	--	--	43.5	Sand Creek	--	--
Gulf Coast	Oklahoma	OK-4	46.82	X					1	Unnamed tributary to Little Wewoka Creek	Perennial	--	--	46.8	Unnamed tributary to Little Wewoka Creek	--	--
Gulf Coast	Oklahoma	No	47.29	X					1	Unnamed tributary to Little Wewoka Creek	Perennial	--	--	47.3	Unnamed tributary to Little Wewoka Creek	--	--
Gulf Coast	Oklahoma	No	47.95	X					1	Little Wewoka Creek	Perennial	--	--	48	Little Wewoka Creek	--	--
Gulf Coast	Oklahoma	No	50.01	X					1	Unnamed tributary to Little Wewoka Creek	Perennial	--	--	50	Unnamed tributary to Little Wewoka Creek	--	--
Gulf Coast	Oklahoma	No	52.44	X					1	Unnamed tributary to Long George Creek	Perennial	--	--	52.4	Unnamed tributary to Long George Creek	--	--
Gulf Coast	Oklahoma	No	58.7	X					1	Wewoka Creek	Perennial	--	--	58.7	Wewoka Creek	--	--
Gulf Coast	Oklahoma	No	59.84	X					1	Jacobs Creek	Perennial	--	--	59.8-60.3	Jacobs Creek	--	--
Gulf Coast	Oklahoma	No	59.98	X					1	Unnamed tributary to Jacobs Creek	Ephemeral	--	--	59.8-60.3	Jacobs Creek	--	--
Gulf Coast	Oklahoma	No	60.28	X					1	Jacobs Creek	Perennial	--	--	59.8-60.3	Jacobs Creek	--	--
Gulf Coast	Oklahoma	No	60.33	X					1	Jacobs Creek	Perennial	--	--	59.8-60.3	Jacobs Creek	--	--
Gulf Coast	Oklahoma	OK-6	67.22	X					1	Bird Creek	Perennial	--	--	67.2	Bird Creek	--	--
Gulf Coast	Oklahoma	OK-6	70.38	X					1	Little River	Perennial	70.4	Yes	70.4	Little River	--	--
Gulf Coast	Oklahoma	No	72.95	X					1	Unnamed tributary to Little River	Perennial	--	--	73	Unnamed tributary to Little River	--	--
Gulf Coast	Oklahoma	OK-6	74.05	X		X			2	Canadian River	Perennial	74.1	Yes	74.1	South Canadian River	--	--
Gulf Coast	Oklahoma	OK-6	74.74	X					1	Unnamed tributary to Canadian River	Perennial	--	--	74.7	Unnamed tributary to Canadian River	--	--
Gulf Coast	Oklahoma	OK-7	79.56	X					1	Unnamed tributary to Big Sandy Creek	Perennial	--	--	79.6	Unnamed tributary to Big Sandy Creek	--	--
Gulf Coast	Oklahoma	No	80.17	X					1	Unnamed tributary to Big Sandy Creek	Perennial	--	--	80.2	Unnamed tributary to Big Sandy Creek	--	--
Gulf Coast	Oklahoma	No	87.34	X					1	Muddy Boggy Creek	Perennial	--	--	87.3	Muddy Boggy Creek	--	--
Gulf Coast	Oklahoma	No	95.02	X					1	Unnamed tributary to Turkey Creek	Perennial	--	--	95	Unnamed tributary to Turkey Creek	--	--
Gulf Coast	Oklahoma	No	96.14	X					1	Unnamed tributary to Turkey Creek	Perennial	--	--	96.1	Unnamed tributary to Turkey Creek	--	--
Gulf Coast	Oklahoma	No	102.25	X					1	Unnamed triburaty to Little Caney Boggy Creek	Perennial	--	--	102.3	Unnamed triburaty to Little Caney Boggy Creek	--	--
Gulf Coast	Oklahoma	No	102.69	X					1	Unnamed triburaty to Little Caney Boggy Creek	Perennial	--	--	102.7	Unnamed triburaty to Little Caney Boggy Creek	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Oklahoma	No	111.06	X					1	Unnamed tributary to Coal Creek	Perennial	--	--	111.1	Unnamed tributary to Coal Creek	--	--
Gulf Coast	Oklahoma	No	119.15	X					1	Unnamed tributary to Fronterhouse Creek	Perennial	--	--	119.2	Unnamed tributary to Fronterhouse Creek	--	--
Gulf Coast	Oklahoma	No	122.57	X					1	Fronterhouse Creek	Perennial	122.6	Yes	122.6	Fronterhouse Creek	--	--
Gulf Coast	Oklahoma	No	123.08	X					1	Unnamed tributary to Fronterhouse Creek	Perennial	--	--	123.1	Unnamed tributary to Fronterhouse Creek	--	--
Gulf Coast	Oklahoma	No	124.08	X					1	Unnamed tributary to Fronterhouse Creek	Perennial	--	--	124.1	Unnamed tributary to Fronterhouse Creek	--	--
Gulf Coast	Oklahoma	No	125.62	X					1	Unnamed tributary to Clear Boggy Creek	Perennial	--	--	125.6	Unnamed tributary to Clear Boggy Creek	--	--
Gulf Coast	Oklahoma	No	126.2	X					1	Unnamed tributary to Clear Boggy Creek	Perennial	--	--	126.2	Unnamed tributary to Clear Boggy Creek	--	--
Gulf Coast	Oklahoma	No	126.89	X					1	Clear Boggy Creek	Perennial	--	--	126.9	Clear Boggy Creek	--	--
Gulf Coast	Oklahoma	No	127.09	X					1	Unnamed tributary to Clear Boggy Creek	Perennial	127.1	Yes	127.1-127.3	Unnamed tributary to Clear Boggy Creek	--	--
Gulf Coast	Oklahoma	No	127.26						0	Unnamed tributary to Clear Boggy Creek	Perennial	--	--	127.1-127.3	Unnamed tributary to Clear Boggy Creek	--	--
Gulf Coast	Oklahoma	No	129.45	X					1	Unnamed tributary to Clear Boggy Creek	Perennial	--	--	129.5	Unnamed tributary to Clear Boggy Creek	--	--
Gulf Coast	Oklahoma	No	131.34	X					1	Cowpen Creek	Perennial	--	--	131.3	Cowpen Creek	--	--
Gulf Coast	Oklahoma	No	133.24	X					1	Unnamed tributary to Long Branch Creek	Perennial	--	--	133.2	Unnamed tributary to Long Branch Creek	--	--
Gulf Coast	Oklahoma	No	155.68	X		X			2	Red River	Perennial	155.7	Yes	155.6	Unnamed tributary to Red River	--	--
Gulf Coast	Oklahoma	No	155.73	X		X			2	Red River	Perennial	155.7	Yes	155.7-155.8	Red River	--	--
Gulf Coast	Texas	No	158.53	X					1	Unnamed tributary to Red River	Perennial	--	--	158.5	Unnamed tributary to Red River	--	--
Gulf Coast	Texas	No	162.02	X	X	X			3	Bois D'Arc Creek	Perennial	162	Yes	162	Bois D'Arc Creek	162	WRP Contract Land
Gulf Coast	Texas	No	165.65	X					1	Unnamed tributary to Slough Creek	Perennial	--	--	165.7	Unnamed tributary to Slough Creek	--	--
Gulf Coast	Texas	No	166.16	X					1	Slough Creek	Perennial	--	--	166.2	Slough Creek	--	--
Gulf Coast	Texas	No	168.32				X	X	2	Unnamed tributary to Shooter Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	168.33				X	X	2	Unnamed tributary to Shooter Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	168.33				X	X	2	Unnamed tributary to Shooter Creek	Ephemeral	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	168.84				X	X	2	Unnamed tributary to Shooter Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	169.29	X			X	X	3	Shooter Creek	Perennial	--	--	169.3	Shooter Creek	--	--
Gulf Coast	Texas	No	169.48				X	X	2	Collins Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	170.3				X	X	2	Unnamed tributary to Sanders Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	170.39				X	X	2	Unnamed tributary to Sanders Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	170.9	X			X	X	3	Unnamed tributary to Sanders Creek	Perennial	--	--	170.9	Unnamed tributary to Sanders Creek	--	--
Gulf Coast	Texas	No	171.16	X			X	X	3	Sanders Creek	Perennial	--	--	171.2	Sanders Creek	--	--
Gulf Coast	Texas	No	172.71	X			X	X	3	Cottonwood Creek	Perennial	--	--	172.7	Cottonwood Creek	--	--
Gulf Coast	Texas	No	173.41				X	X	2	Unnamed tributary to Cottonwood Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	174.22	X					1	Unnamed triburaty to Doss Creek	Perennial	--	--	174.2	Unnamed triburaty to Doss Creek	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	184				X		1	Unnamed tributary to Mallory Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	184.08				X		1	Unnamed tributary to Mallory Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	185.09				X		1	Unnamed tributary to Mallory Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	186.41				X		1	Mallory Creek	Perennial	--	--	--	--	--	--
Gulf Coast	Texas	No	187.51				X		1	Mallory Creek	Perennial	--	--	--	--	--	--
Gulf Coast	Texas	No	188.52				X		1	Unnamed tributary to Mallory Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	189.31				X		1	Justiss Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	190.52			X	X		2	Unnamed tributary of North Sulphur River	Intermittent	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	190.52			X	X		2	Unnamed tributary of North Sulphur River	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	190.52			X	X		2	Unnamed tributary of North Sulphur River	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	190.66			X	X		2	Unnamed tributary of North Sulphur River	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	190.67			X	X		2	Unnamed tributary of North Sulphur River	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	190.75			X	X		2	North Sulphur River	Perennial	190.8	Yes	--	--	--	--
Gulf Coast	Texas	No	190.76	X		X	X		3	North Sulphur River	Perennial	190.8	Yes	190.8	North Sulphur River	--	--
Gulf Coast	Texas	No	190.76	X		X	X		3	North Sulphur River	Perennial	190.8	Yes	190.8	North Sulphur River	--	--
Gulf Coast	Texas	No	190.76	X		X	X		3	North Sulphur River	Perennial	190.8	Yes	190.8	North Sulphur River	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	190.82				X		1	Unnamed tributary of North Sulphur River	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	191.05				X		1	Unnamed tributary of North Sulphur River	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	192.85				X		1	Unnamed tributary of North Sulphur River	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	193.67				X		1	Unnamed tributary of North Sulphur River	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	194.24				X		1	Unnamed tributary to Lake Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	194.25				X		1	Unnamed tributary to Lake Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	194.26				X		1	Unnamed tributary to Lake Creek	Ephemeral	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	194.96				X		1	Unnamed tributary to Lake Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	195.87				X		1	Unnamed tributary to Lake Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	195.91				X		1	Unnamed waterbody	Perennial	--	--	--	--	--	--
Gulf Coast	Texas	No	196.37				X		1	Unnamed tributary to Lake Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	199.59				X		1	Evans Branch	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	199.84				X		1	Evans Branch	Seasonal	--	--	--	--	--	--
Gulf Coast	Texas	No	201.77	X			X		2	South Sulphur River	Perennial	201.8	Yes	201.7-201.8	South Sulphur River	--	--
Gulf Coast	Texas	No	201.78	X			X		2	South Sulphur River	Perennial	201.8	Yes	201.7-201.8	South Sulphur River	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	202.95				X		1	Unnamed tributary to South Sulphur River	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	202.95				X		1	Unnamed tributary to South Sulphur River	Perennial	--	--	--	--	--	--
Gulf Coast	Texas	No	203.4				X		1	Unnamed tributary to South Sulphur River	Unknown	--	--	--	--	--	--
Gulf Coast	Texas	No	203.76				X		1	Unnamed tributary to South Sulphur River	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	203.77				X		1	Unnamed tributary to South Sulphur River	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	203.79				X		1	Unnamed tributary to South Sulphur River	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	203.95				X		1	Unnamed tributary to South Sulphur River	Perennial	--	--	--	--	--	--
Gulf Coast	Texas	No	204.09				X		1	Unnamed tributary to South Sulphur River	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	204.14				X		1	Unnamed tributary to South Sulphur River	Ephemeral	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	212.11	X					1	Crosstimber Creek	Perennial	--	--	212.1	Crosstimber Creek	--	--
Gulf Coast	Texas	No	212.82	X					1	White Oak Creek	Perennial	212.8	Yes	212.8	White Oak Creek	--	--
Gulf Coast	Texas	No	217.18	X					1	Unnamed tributary to Stouts Creek	Perennial	--	--	217.2	Unnamed tributary to Stouts Creek	--	--
Gulf Coast	Texas	No	218.23	X					1	Stouts Creek	Perennial	--	--	218.2	Stouts Creek	--	--
Gulf Coast	Texas	No	220.91	X					1	Greenwood Creek	Perennial	--	--	220.9	Greenwood Creek	--	--
Gulf Coast	Texas	TX-1	223.05				X	X	2	Unnamed tributary to Huggings Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	224.15	X			X	X	3	Unnamed tributary to Little Cypress Creek	Perennial	--	--	224.2	Unnamed tributary to Little Cypress Creek	--	--
Gulf Coast	Texas	No	225.03				X	X	2	Unnamed tributary to Little Cypress Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	225.38				X	X	2	Unnamed tributary to Little Cypress Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	225.42				X	X	2	Unnamed tributary to Little Cypress Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	TX-1	226.04				X	X	2	Unnamed tributary to Little Cypress Creek	Unknown	--	--	--	--	--	--
Gulf Coast	Texas	TX-1	226.2				X	X	2	Unnamed tributary to Little Cypress Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	TX-1	226.23				X	X	2	Unnamed tributary to Little Cypress Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	TX-1	226.29				X	X	2	Unnamed tributary to Little Cypress Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	226.68	X			X	X	3	Unnamed tributary to Little Cypress Creek	Perennial	--	--	226.7	Unnamed tributary to Little Cypress Creek	--	--
Gulf Coast	Texas	No	226.76	X			X	X	3	Unnamed tributary to Little Cypress Creek	Perennial	--	--	226.8	Unnamed tributary to Little Cypress Creek	--	--
Gulf Coast	Texas	No	227.52				X	X	2	Unnamed tributary to Big Cypress Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	227.53				X	X	2	Unnamed tributary to Big Cypress Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	227.58				X	X	2	Unnamed tributary to Big Cypress Creek	Perennial	--	--	--	--	--	--
Gulf Coast	Texas	No	227.68				X	X	2	Unnamed tributary to Big Cypress Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	227.91				X	X	2	Unnamed tributary to Big Cypress Creek	Perennial	--	--	--	--	--	--
Gulf Coast	Texas	No	227.95				X	X	2	Unnamed tributary to Big Cypress Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	228.34				X	X	2	Unnamed tributary to Big Cypress Creek	Perennial	228.4	Yes	--	--	--	--
Gulf Coast	Texas	No	228.48	X			X	X	3	Unnamed tributary to Big Cypress Creek	N/A	--	--	228.5	Unnamed tributary to Little Cypress Creek	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	228.86				X	X	2	Unnamed tributary to Big Cypress Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	228.88				X	X	2	Unnamed tributary to Big Cypress Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	230.07				X	X	2	Unnamed tributary to Brushy Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	230.41				X	X	2	Unnamed tributary to Brushy Creek	Unknown	--	--	--	--	--	--
Gulf Coast	Texas	No	230.42				X	X	2	Unnamed tributary to Brushy Creek	Unknown	--	--	--	--	--	--
Gulf Coast	Texas	No	230.89				X	X	2	Unnamed tributary to Brushy Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	231.22				X	X	2	Unnamed tributary to Brushy Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	231.43				X	X	2	Unnamed tributary to Brushy Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	231.6				X	X	2	Unnamed tributary to Brushy Creek	Unknown	--	--	--	--	--	--
Gulf Coast	Texas	No	231.85				X	X	2	Unnamed tributary to Brushy Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	232.65	X			X	X	3	Brushy Creek	Perennial	--	--	232.7	Brushy Creek	--	--
Gulf Coast	Texas	No	232.75	X			X	X	3	Unnamed tributary to Brushy Creek	Perennial	--	--	232.8	Unnamed tributary to Brushy Creek	--	--
Gulf Coast	Texas	No	233.08	X			X	X	3	Unnamed tributary to Brushy Creek	Perennial	--	--	233.1	Unnamed tributary to Brushy Creek	--	--
Gulf Coast	Texas	No	234.13	X			X	X	3	Unnamed tributary to Briary Creek	Perennial	--	--	234.1	Unnamed tributary to Briary Creek	--	--
Gulf Coast	Texas	No	234.21				X	X	2	Briary Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	234.59	X			X	X	3	Sand Branch	Perennial	--	--	234.6	Sand Branch	--	--
Gulf Coast	Texas	No	234.7				X	X	2	Unnamed tributary to Sand Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	235.05	X			X	X	3	Unnamed tributary to Briary Creek	Perennial	--	--	235.1	Unnamed tributary to Briary Creek	--	--
Gulf Coast	Texas	TX-2	235.54	X			X	X	3	Unnamed tributary to Briary Creek	Perennial	--	--	235.5	Unnamed tributary to Briary Creek	--	--
Gulf Coast	Texas	TX-2	236.81				X	X	2	Unnamed tributary to Stout Creek	Intermittent	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	TX-2	238.19				X	X	2	Unnamed tributary to Stout Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	TX-2	239.45				X		1	Unnamed tributary to Caney Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	TX-2	239.67				X		1	Unnamed tributary to Caney Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	241.61				X		1	Unnamed tributary to Little Cypress Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	241.83				X		1	Unnamed tributary to Little Cypress Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	241.86				X		1	Unnamed tributary to Little Cypress Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	242.09				X		1	Unnamed tributary to Little Cypress Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	242.24				X		1	Unnamed tributary to Little Cypress Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	242.71	X			X		2	Unnamed tributary to Little Cypress Creek	Perennial	--	--	242.7	Unnamed tributary to Little Cypress Creek	--	--
Gulf Coast	Texas	No	243.9	X			X		2	Unnamed tributary to Little Cypress Creek	Perennial	--	--	243.9	Unnamed tributary to Little Cypress Creek	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	244.87	X			X		2	Unnamed tributary to Little Cypress Creek	Perennial	--	--	244.9	Unnamed tributary to Little Cypress Creek	--	--
Gulf Coast	Texas	No	245.44	X			X		2	Unnamed tributary to Little Cypress Creek	Perennial	--	--	245.4	Unnamed tributary to Little Cypress Creek	--	--
Gulf Coast	Texas	No	245.53				X		1	Unnamed tributary to Little Cypress Creek	Perennial	--	--	--	--	--	--
Gulf Coast	Texas	No	246.39				X		1	Unnamed tributary to Little Cypress Creek	Unknown	--	--	--	--	--	--
Gulf Coast	Texas	No	246.62	X			X		2	Unnamed tributary to Little Cypress Creek	Perennial	--	--	246.6	Unnamed tributary to Little Cypress Creek	--	--
Gulf Coast	Texas	No	247.51				X		1	Clear Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	248.01	X			X		2	Unnamed tributary to Clear Creek	Perennial	--	--	248	Unnamed tributary to Clear Creek	--	--
Gulf Coast	Texas	TX-4	248.6				X		1	Unnamed tributary to Clear Creek	Perennial	--	--	--	--	--	--
Gulf Coast	Texas	TX-4	249.96				X		1	Honey Creek	Intermittent	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	TX-4	250.28				X		1	Unnamed tributary to Honey Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	TX-5	252.97	X					1	Blue Branch	Perennial	--	--	253	Blue Branch	--	--
Gulf Coast	Texas	No	254.89	X					1	Unnamed waterbody	Unknown	254.8	Yes	254.9	Private Lake	--	--
Gulf Coast	Texas	No	255.17	X					1	Perin Branch	Perennial	--	--	255.2	Perin Branch	--	--
Gulf Coast	Texas	No	256.92	X					1	Big Sandy Creek	Perennial	256.9	Yes	256.9	Big Sandy Creek	--	--
Gulf Coast	Texas	No	258.35		X				1	Unnamed tributary to Big Sandy Creek	Intermittent	--	--	--	--	258-261	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	258.72		X				1	Unnamed tributary to Big Sandy Creek	Intermittent	--	--	--	--	258-261	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	260.05		X				1	Unnamed tributary to Little Cypress Creek	Ephemeral	--	--	--	--	258-261	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	260.94		X				1	Unnamed tributary to Rogers Creek	Seasonal	--	--	--	--	258-261	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	261.24		X				1	Unnamed tributary to Rogers Creek	Intermittent	--	--	--	--	258-261	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	263.5	X					1	Sabine River	Perennial	263.5	Yes	263.5	Sabine River	--	--
Gulf Coast	Texas	TX-6	267.89	X					1	Unnamed tributary to	Perennial	--	--	267.9	Unnamed tributary to Simpson Creek	--	--
Gulf Coast	Texas	TX-6	268.86	X					1	Simpson Creek	Perennial	--	--	268.9	Simpson Creek	--	--
Gulf Coast	Texas	TX-6	270.67	X					1	Unnamed tributary to Simpson Creek	Perennial	--	--	270.7	Unnamed tributary to Simpson Creek	--	--
Gulf Coast	Texas	TX-6	270.84	X					1	Unnamed tributary to Simpson Creek	Perennial	--	--	270.8	Unnamed tributary to Simpson Creek	--	--
Gulf Coast	Texas	No	272.14	X					1	Unnamed tributary to Sunstroke Creek	Perennial	--	--	272.1	Unnamed tributary to Sunstroke Creek	--	--
Gulf Coast	Texas	TX-7	275.08	X			X		2	Unnamed tributary to Prairie Creek	Perennial	--	--	275.1	Unnamed tributary to Prairie Creek	--	--
Gulf Coast	Texas	TX-7	275.48				X		1	Unnamed roadside ditch	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	TX-7	275.53	X			X		2	Prairie Creek	Perennial	--	--	275.5	Prairie Creek	--	--
Gulf Coast	Texas	TX-7	275.55				X		1	Unnamed tributary to Prairie Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	TX-7	277.06				X		1	Unnamed tributary to Mud Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	277.34	X			X		2	Unnamed tributary to Mud Creek	Perennial	--	--	277.3	Unnamed tributary to Mud Creek	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	277.66	X			X		2	Unnamed tributary to Mud Creek	Perennial	--	--	277.7	Unnamed tributary to Mud Creek	--	--
Gulf Coast	Texas	TX-8	279.73	X			X		2	Unnamed tributary to Mud Creek	Perennial	--	--	279.7	Unnamed tributary to Mud Creek	--	--
Gulf Coast	Texas	No	280.12				X		1	Unnamed tributary to Caney Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	280.71	X			X		2	Unnamed tributary to Caney Creek	Perennial	--	--	280.7	Unnamed tributary to Caney Creek	--	--
Gulf Coast	Texas	TX-9	281.84				X		1	Unnamed tributary to Caney Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	TX-9	281.97				X		1	Unnamed tributary to Caney Creek	Seasonal	--	--	--	--	--	--
Gulf Coast	Texas	TX-9	282.02				X		1	Unnamed tributary to Caney Creek	Seasonal	--	--	--	--	--	--
Gulf Coast	Texas	TX-10	283.06	X			X		2	Unnamed tributary to Caney Creek	Perennial	--	--	283.1	Unnamed tributary to Caney Creek	--	--
Gulf Coast	Texas	TX-10	283.45	X			X		2	Unnamed tributary to Caney Creek	Perennial	--	--	283.5	Unnamed tributary to Caney Creek	--	--
Gulf Coast	Texas	TX-10	283.49	X			X		2	Unnamed tributary to Caney Creek	Perennial	--	--	283.5	Caney Creek	--	--
Gulf Coast	Texas	TX-10	283.54				X		1	Caney Creek	Perennial	--	--	--	--	--	--
Gulf Coast	Texas	TX-10	284.62	X			X		2	Unnamed tributary to Caney Creek	Perennial	--	--	284.6	Unnamed tributary to Caney Creek	--	--
Gulf Coast	Texas	TX-10	286.77	X			X		2	Unnamed tributary to Kickapoo Creek	Perennial	--	--	286.8	Unnamed tributary to Kickapoo Creek	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	287.55				X		1	Kickapoo Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	287.84				X		1	Unnamed tributary to Kickapoo Creek	Perennial	--	--	--	--	--	--
Gulf Coast	Texas	No	288.15				X		1	Unnamed tributary to Kickapoo Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	288.24				X		1	Unnamed tributary to Kickapoo Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	297.62	X			X		2	Unnamed tributary to Mills Creek	Perennial	--	--	297.6	Unnamed tributary to Mills Creek	--	--
Gulf Coast	Texas	No	297.67				X		1	Unnamed tributary to Mills Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	297.68				X		1	Mill Creek	Perennial	--	--	--	--	--	--
Gulf Coast	Texas	No	300.74				X		1	Unnamed tributary to Bowles Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	TX-11	301.32	X			X		2	Johnsons Creek	Perennial	--	--	301.3	Johnson Creek	--	--
Gulf Coast	Texas	No	301.74				X		1	Unnamed tributary to Johnsons Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	302.32				X		1	Unnamed tributary to Johnsons Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	302.99				X		1	Unnamed tributary to Boggy Branch	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	303				X		1	Unnamed tributary to Boggy Branch	Ephemeral	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	303.1				X		1	Boggy Branch	Seasonal	--	--	--	--	--	--
Gulf Coast	Texas	No	303.83				X		1	Unnamed tributary to Striker Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	303.88				X		1	Unnamed tributary to Striker Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	304.27				X		1	Unnamed tributary to Striker Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	304.75				X		1	Unnamed tributary to Striker Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	TX-11	308.27	X					1	Wheelus Branch	Perennial	--	--	308.3	Wheelus Branch	--	--
Gulf Coast	Texas	TX-12	313.18		X				1	East Fork Angelina River	Perennial	--	--	--	--	313-315	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-12	313.23		X				1	East Fork Angelina River	Perennial	--	--	--	--	313-315	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-12	313.3	X	X				2	East Fork Angelina River	Perennial	313.3	Yes	313.3	East Fork Angelina River	313-315	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-12	313.55		X				1	East Fork Angelina River	Perennial	--	--	--	--	313-315	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-12	313.68		X				1	Unnamed tributary to East Fork Angelina River	Perennial	--	--	--	--	313-315	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-12	314.5		X				1	Unnamed tributary to East Fork Angelina River	Ephemeral	--	--	--	--	313-315	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-12	314.98		X				1	Unnamed tributary to East Fork Angelina River	Ephemeral	--	--	--	--	313-315	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	315.31		X				1	Unnamed tributary to East Fork Angelina River	Ephemeral	--	--	--	--	313-315	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	316.68	X					1	Indian Creek	Perennial	--	--	316.7	Indian Creek	--	--
Gulf Coast	Texas	TX-13	319.34	X					1	Unnamed tributary to Beech Creek	Perennial	--	--	319.3	Unnamed tributary to Beech Creek	--	--
Gulf Coast	Texas	TX-13	320.25	X					1	Unnamed tributary to Beech Creek	Perennial	--	--	320.3	Unnamed tributary to Beech Creek	--	--
Gulf Coast	Texas	TX-13	320.79	X					1	Beech Creek	Perennial	--	--	320.8	Beech Creek	--	--
Gulf Coast	Texas	No	334.17	X					1	Angelina River	Perennial	334.2	Yes	334.2	Angelina River	--	--
Gulf Coast	Texas	No	337.73		X				1	Unnamed tributary to Stokes Creek	Ephemeral	--	--	--	--	337-340	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	338.31		X				1	Unnamed tributary to Stokes Creek	Intermittent	--	--	--	--	337-340	Water Oak - Willow Oak Community

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	338.48		X				1	Unnamed tributary to Stokes Creek	Ephemeral	--	--	--	--	337-340	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	338.49		X				1	Unnamed tributary to Stokes Creek	Ephemeral	--	--	--	--	337-340	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	338.52		X				1	Stokes Creek	Intermittent	--	--	--	--	337-340	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	338.53		X				1	Unnamed tributary to Stokes Creek	Ephemeral	--	--	--	--	337-340	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-14	338.69		X				1	Unnamed tributary to Stokes Creek	Ephemeral	--	--	--	--	337-340	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-14	338.77		X				1	Unnamed tributary to Stokes Creek	Ephemeral	--	--	--	--	337-340	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	340.17		X				1	Unnamed tributary to Doyle Creek	Intermittent	--	--	--	--	337-340	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	340.18		X				1	Unnamed tributary to Doyle Creek	Intermittent	--	--	--	--	337-340	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	342.53	X					1	Red Bayou	Perennial	--	--	342.5	Red Bayou	--	--
Gulf Coast	Texas	No	344.69				X		1	Unnamed tributary to Watson Branch	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	344.94	X			X		2	Watson Branch	Perennial	--	--	344.9	Watson Branch	--	--
Gulf Coast	Texas	No	345.45				X		1	Unnamed tributary to Watson Branch	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	345.46				X		1	Unnamed tributary to Watson Branch	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	345.52				X		1	Unnamed tributary to Watson Branch	Perennial	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	345.59				X		1	Unnamed tributary to Watson Branch	Perennial	--	--	--	--	--	--
Gulf Coast	Texas	No	345.6	X			X		2	Unnamed tributary to Watson Branch	Perennial	--	--	345.6	Unnamed tributary to Watson Branch	--	--
Gulf Coast	Texas	No	346.52				X		1	Unnamed tributary to Red Bayou	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	346.52				X		1	Unnamed tributary to Red Bayou	Unknown	--	--	--	--	--	--
Gulf Coast	Texas	No	346.59				X		1	Unnamed tributary to Red Bayou	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	346.6				X		1	Unnamed tributary to Red Bayou	Unknown	--	--	--	--	--	--
Gulf Coast	Texas	No	347.76	X			X		2	Red Bayou	Perennial	--	--	347.8	Red Bayou	--	--
Gulf Coast	Texas	No	348.05				X		1	Unnamed tributary to Red Bayou	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	350.01		X		X		2	Unnamed tributary to Neches River	Intermittent	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	350.23		X		X		2	Unnamed tributary to Neches River	N/A	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	351.02	X	X		X		3	Buncombe Creek	Perennial	--	--	351	Buncombe Creek	350-368	Water Oak - Willow Oak Community

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	351.15	X	X		X		3	Unnamed tributary to Buncombe Creek	Perennial	--	--	351.2	Unnamed tributary to Buncombe Creek	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	351.66		X		X		2	Unnamed tributary to Buncombe Creek	Perennial	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	352.18	X	X		X		3	Unnamed tributary to Neches River	Perennial	--	--	352.2	Unnamed tributary to Neches River	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	352.93		X		X		2	Unnamed tributary to Crawford Creek	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	352.94		X		X		2	Unnamed tributary to Crawford Creek	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	352.99		X		X		2	Unnamed tributary to Crawford Creek	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-15	353.12		X		X		2	Unnamed tributary to Crawford Creek	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	353.26	X	X		X		3	Crawford Creek	Perennial	--	--	353.3	Crawford Creek	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	353.28		X		X		2	Stock pond	Unknown	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-16	354.18		X		X		2	Unnamed tributary to Neches River	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-16	354.2		X		X		2	Unnamed tributary to Neches River	Intermittent	--	--	--	--	350-368	Water Oak - Willow Oak Community

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	TX-16	355.01		X		X		2	Unnamed tributary to Neches River	Intermittent	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-16	355.11		X		X		2	Unnamed tributary to Neches River	Intermittent	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-16	355.22		X		X		2	Unnamed tributary to Neches River	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-16	355.27		X		X		2	Unnamed tributary to Neches River	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-16	355.45	X	X		X		3	Unnamed tributary to Neches River	Perennial	--	--	355.5	Unnamed tributary to Neches River	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-16	355.64		X		X		2	Unnamed tributary to Neches River	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	356.08		X		X		2	Unnamed tributary to Neches River	Intermittent	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	356.74		X		X		2	Unnamed tributary to Neches River	Intermittent	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	356.91		X		X		2	Unnamed tributary to Neches River	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	357.41		X		X		2	Unnamed tributary to Neches River	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	357.5		X		X		2	Unnamed tributary to Neches River	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	357.92		X		X		2	Unnamed tributary to Neches River	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	358.17	X	X		X		3	Unnamed tributary to Neches River	Perennial	--	--	358.2	Unnamed tributary to Neches River	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	358.39		X		X		2	Unnamed tributary to Neches River	Intermittent	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	358.83		X				1	Unnamed tributary to Neches River	Intermittent	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	359.08		X				1	Unnamed tributary to Neches River	Intermittent	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	359.25		X				1	Unnamed tributary to Neches River	Intermittent	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	359.66		X				1	Unnamed tributary to Neches River	Intermittent	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	359.71		X				1	Unnamed tributary to Neches River	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	359.81		X				1	Unnamed tributary to Neches River	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	360.54		X				1	Unnamed tributary to Jack Creek	Perennial	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	360.69		X				1	Unnamed tributary to Jack Creek	Perennial	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	360.77		X				1	Unnamed tributary to Jack Creek	Perennial	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	360.81		X				1	Unnamed tributary to Jack Creek	Perennial	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	360.89	X	X				2	Jack Creek	Perennial	--	--	360.9	Jack Creek	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	361.09	X	X				2	Cedar Creek	Perennial	--	--	361.1	Cedar Creek	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	361.12	X	X				2	Cedar Creek	Perennial	--	--	361.1	Cedar Creek	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	361.24		X				1	Unnamed tributarty to Hurricane Creek	Intermittent	--	--	--	--	350-368	Water Oak - Willow Oak Community

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	362.14		X				1	Unnamed tributary to Neches River	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-17	362.79	X	X				2	Unnamed tributary to Neches River	Ephemeral	--	--	362.8	Unnamed tributary to Neches River	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-17	362.81		X				1	Unnamed tributary to Neches River	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-17	362.81		X				1	Unnamed tributary to Neches River	Perennial	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-17	363.17		X				1	Unnamed tributary to Neches River	Perennial	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	366.4		X				1	Unnamed tributary to Fiberboard Lake	Ephemeral	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	366.9		X				1	Fiberboard Lake	Perennial	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	366.94		X	X			2	Fiberboard Lake	Perennial	--	--	--	--	350-368	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	368.6	X					1	Neches River	Perennial	368.6	Yes	368.6	Neches River	--	--
Gulf Coast	Texas	TX-19	376.43	X					1	Piney Creek	Perennial	--	--	376.4	Piney Creek	--	--
Gulf Coast	Texas	TX-19	376.74	X					1	Unnamed tributary to Piney Creek	Perennial	--	--	376.7	Unnamed tributary to Piney Creek	--	--
Gulf Coast	Texas	No	377.66	X					1	Unnamed tributary to Bear Creek	Perennial	--	--	377.7	Unnamed tributary to Bear Creek	--	--
Gulf Coast	Texas	No	377.85	X					1	Bear Creek	Perennial	--	--	377.9	Bear Creek	--	--
Gulf Coast	Texas	No	381.51	X					1	Unnamed tributary to Jones Creek	Perennial	--	--	381.5	Unnamed tributary to Jones Creek	--	--
Gulf Coast	Texas	No	381.9	X					1	Jones Creek	Perennial	--	--	381.9	Jones Creek	--	--
Gulf Coast	Texas	No	382.64	X					1	Brushy Creek	Perennial	--	--	382.6	Brushy Creek	--	--
Gulf Coast	Texas	No	385.56	X					1	Bundix Branch	Perennial	--	--	385.6	Bundix Branch	--	--
Gulf Coast	Texas	No	388.49	X					1	Big Sandy Creek	Perennial	--	--	388.5	Big Sandy Creek	--	--
Gulf Coast	Texas	No	389.69	X					1	Big Sandy Creek	Perennial	--	--	389.7	Big Sandy Creek	--	--
Gulf Coast	Texas	No	391.67	X					1	Big Sandy Creek	Perennial	--	--	391.7	Big Sandy Creek	--	--
Gulf Coast	Texas	TX-20	397.18	X					1	East Menard Creek	Perennial	--	--	397.2	East Menard Creek	--	--
Gulf Coast	Texas	No	400.67				X	X	2	Unnamed tributary to Bluff Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	400.84				X	X	2	Unnamed tributary to Bluff Creek	Ephemeral	--	--	--	--	--	--

Segment	State	CPS?	Approx. Milepost	Special Attributes: Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Stream Crossing (Tables E-1 and E2): Crossing Name	Type	HDD (Table 2.3.3-1): Approx. Milepost	Crossing?	Fisheries (Table 3.7.2-1): Approx. Milepost	Waterbody Name	Wetlands (Table 3.4.2-1): Approx. Milepost	Name
Gulf Coast	Texas	No	401.35	X			X	X	3	Unnamed tributary to Bluff Creek	Perennial	--	--	401.4	Unnamed tributary to Bluff Creek	--	--
Gulf Coast	Texas	No	404.09	X			X	X	3	Menard Creek	Perennial	--	--	404.1	Menard Creek	--	--
Gulf Coast	Texas	No	404.1				X	X	2	Menard Creek	Perennial	--	--	--	--	--	--
Gulf Coast	Texas	No	404.33				X	X	2	Unnamed tributary to Menard Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	404.57				X	X	2	Unnamed tributary to Menard Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	404.74				X	X	2	Unnamed tributary to Menard Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	404.75				X	X	2	Unnamed tributary to Menard Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	405.4				X	X	2	Unnamed tributary to Menard Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	407.13	X			X	X	3	Unnamed tributary to Dry Branch	Perennial	--	--	407.1	Unnamed tributary to Dry Branch	--	--
Gulf Coast	Texas	No	407.15				X	X	2	Unnamed tributary to Dry Branch	Perennial	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	407.22				X	X	2	Unnamed tributary to Dry Branch	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	407.24				X	X	2	Unnamed tributary to Dry Branch	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	407.24				X	X	2	Unnamed tributary to Dry Branch	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	407.26				X	X	2	Unnamed tributary to Dry Branch	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	TX-22	411.68				X	X	2	Unnamed tributary to Williams Creek	Unknown	--	--	--	--	--	--
Gulf Coast	Texas	TX-22	413.66				X	X	2	Unnamed tributary to Williams Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	414.35				X	X	2	Unnamed tributary to Williams Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	414.36				X	X	2	Unnamed tributary to Williams Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	414.7				X	X	2	Unnamed tributary to Bear Foot Lake	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	415.34	X			X	X	3	Unnamed tributary to Bear Foot Lake	Perennial	--	--	415.3	Unnamed tributary to Bear Foot Lake	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	No	415.35				X	X	2	Unnamed tributary to Bear Foot Lake	Perennial	--	--	--	--	--	--
Gulf Coast	Texas	No	415.35				X	X	2	Unnamed tributary to Bear Foot Lake	Perennial	--	--	--	--	--	--
Gulf Coast	Texas	No	416.19				X	X	2	Unnamed tributary to Menard Creek	Unknown	--	--	--	--	--	--
Gulf Coast	Texas	No	416.35	X		X	X	X	4	Menard Creek	Unknown	416.3	Yes	416.4	Menard Creek	--	--
Gulf Coast	Texas	No	422.69				X	X	2	Beef Head Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	431.71				X		1	Unnamed tributary to Batiste Creek	Intermittent	--	--	--	--	--	--
Gulf Coast	Texas	No	432.87				X		1	Unnamed tributary to Batiste Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	433.44				X		1	Unnamed tributary to Batiste Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	433.46				X		1	Unnamed tributary to Batiste Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	434.11				X		1	Unnamed tributary to Batiste Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	434.12				X		1	Unnamed tributary to Batiste Creek	Ephemeral	--	--	--	--	--	--
Gulf Coast	Texas	No	439.5	X					1	Meyhaw Creek	Perennial	--	--	439.5	Meyhaw Creek	--	--
Gulf Coast	Texas	No	449.03	X					1	Pine Island Bayou	Perennial	448.9	Yes	449	Pine Island Bayou	--	--
Gulf Coast	Texas	No	451.56	X					1	Pine Island Bayou	Perennial	--	--	451.6	Pine Island Bayou	--	--

Segment	State	CPS?	Approx. Milepost	Special Attributes: Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Stream Crossing (Tables E-1 and E2): Crossing Name	Type	HDD (Table 2.3.3-1): Approx. Milepost	Crossing?	Fisheries (Table 3.7.2-1): Approx. Milepost	Waterbody Name	Wetlands (Table 3.4.2-1): Approx. Milepost	Name
Gulf Coast	Texas	No	457.92	X	X		X	X	4	Cotton Creek	Perennial	--	--	457.9	Cotton Creek	457-462	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	457.96	X	X		X	X	4	Cotton Creek	Perennial	--	--	457.9	Cotton Creek	457-462	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	459.16		X		X	X	3	Unnamed tributary to Pine Island Bayou	Intermittent	--	--	--	--	457-462	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	459.94		X		X	X	3	Unnamed tributary to Pine Island Bayou	Unknown	--	--	--	--	457-462	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	460.46		X		X	X	3	Unnamed tributary to Pine Island Bayou	Unknown	--	--	--	--	457-462	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-24	461.77	X	X				2	Lower Neches Valley Canal Authority	Perennial	461.8	Yes	461.8	Aggie Rd/Lower Neches River	457-462	Water Oak - Willow Oak Community
Gulf Coast	Texas	No	462.5	X					1	B1 Canal	Perennial	462.5	Yes	462.5	Lower Neches River	457-462	Water Oak - Willow Oak Community
Gulf Coast	Texas	TX-25	469.89	X					1	Jefferson County Canal/Willow Marsh Bayou	Unknown	469.9	Yes	469.9	Willow Marsh Bayou	--	--
Gulf Coast	Texas	TX-25	473.56				X	X	2	Unnamed waterbody	Perennial	--	--	--	--	--	--

				Special Attributes						Stream Crossing (Tables E-1 and E2)		HDD (Table 2.3.3-1)		Fisheries (Table 3.7.2-1)		Wetlands (Table 3.4.2-1)	
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Crossing Name	Type	Approx. Milepost	Crossing?	Approx. Milepost	Waterbody Name	Approx. Milepost	Name
Gulf Coast	Texas	TX-25	473.79				X	X	2	Unnamed tributary to Hillebrant Bayou	Perennial	473.8	Yes	--	--	--	--
Gulf Coast	Texas	TX-25	473.83	X			X	X	3	Hillebrandt Bayou	Perennial	--	--	473.8	Hillebrandt Bayou	--	--
Gulf Coast	Texas	TX-25	474.93				X	X	2	Unnamed tributary to Hillebrant Bayou	Unknown	--	--	--	--	--	--
Houston Lateral	Texas	TX-29	35.6	X					1	Cedar Bayou	Perennial	35.6	Yes	35.6	Cedar Bayou	--	--
Houston Lateral	Texas	No	43.3	X		X			2	San Jacinto River	--	43.3	Yes	43.3	San Jacinto River	--	--
Houston Lateral	Texas	Parts	18-28	X	X	X			3	Various unspecified waterways	--	--	Some	22.8	Trinity River	18-28	Water Oak - Willow Oak Community

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Steele City	Montana	No	25.4	X			X		2	--	--	25.4	Frenchman Reservoir	Pipeline passes approx. 0.5 mile upstream on Frenchman Cr.	The area is clearly surrounded by more lush vegetation than the surrounding hills.
Steele City	Montana	No	25.75			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	27.06			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	27.16			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	28.8			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	30.45			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	32.4			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	34.7			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	35.02			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	35.34			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	35.51			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	35.54			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	35.81			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	35.84			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	35.95			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	36.01			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	36.12			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	37.97			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	38.59			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	39.06			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	39.08			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	39.09			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	39.16	X		X			2	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	40.52	X		X			2	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	40.92			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	41.06			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Steele City	Montana	No	41.72			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	42.55			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	44.24			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	44.58			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	45.05			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	45.13			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	47.95			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	48.02			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	48.03			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	48.26			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	48.32			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	48.54			X			1	25.5-69.7	North Valley Grasslands Important Bird Area (IBA)	--	--	--	--
Steele City	Montana	No	49.9			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	49.94			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	50.53			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	51.3			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	51.41			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	51.44			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	51.53			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Steele City	Montana	No	51.61			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	52.47			X	X		2	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	52.47	Reservoir Number Four	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	52.58			X	X		2	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	52.58	Reservoir Number Four	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	53.49			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	53.64			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	53.79			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	54.14			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	55.03			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	55.22			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	55.46			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	55.67			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	56.03			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	56.04			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Steele City	Montana	No	56.07			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	56.12			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	56.27			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	56.41			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	56.45			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	56.71			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	56.72			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	57.15			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	57.55			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	57.55			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	57.7			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	57.74			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	57.91			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Steele City	Montana	No	58.04			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	59.5			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	59.55			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	60.02			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	61.87			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	62.93			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	MT-1	65.97			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	MT-1	67.2			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	MT-1	67.25			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	MT-1	67.41			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	MT-1	68.5			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	MT-1	68.52			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	MT-1	68.64			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Steele City	Montana	MT-1	69.41			X			1	25.5-69.7 49.4-70.9	North Valley Grasslands Important Bird Area (IBA) Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	70.43			X			1	49.4-70.9	Cornwell Ranch Conservation Easement (proposed)	--	--	--	--
Steele City	Montana	No	82.95	X		X	X		3	82.9	Milk River Valley	82.95	Unnamed reservoir	Pipeline passes within 0.1 mile of oxbow on floodplain	
Steele City	Montana	No	89.17	X		X			2	89.2	Missouri River Valley	--	--	--	--
Steele City	Montana	No	89.26	X		X			2	89.2	Missouri River Valley	--	--	--	--
Steele City	Montana	No	93.88	X					1	--	--	--	--	--	--
Steele City	Montana	No	94.89	X					1	--	--	--	--	--	--
Steele City	Montana	No	102.27				X		1	--	--	102.27	Fort Peck Lake and Charles M. Russell Wildlife Refuge	Highway 24 is located between project and reservoir	1,100,000 acres, the largest refuge in Montana, big game hunting, walleye fishing; Fort Peck lake is a large reservoir up stream of the Missouri River crossing. Otherwise a highway is located between the lake and the pipeline.
Steele City	Montana	No	102.73				X		1	--	--	102.73	Fort Peck Lake and Charles M. Russell Wildlife Refuge	Highway 24 is located between project and reservoir	1,100,000 acres, the largest refuge in Montana, big game hunting, walleye fishing; Fort Peck lake is a large reservoir up stream of the Missouri River crossing. Otherwise a highway is located between the lake and the pipeline.
Steele City	Montana	No	102.78				X		1	--	--	102.78	Fort Peck Lake and Charles M. Russell Wildlife Refuge	Highway 24 is located between project and reservoir	1,100,000 acres, the largest refuge in Montana, big game hunting, walleye fishing; Fort Peck lake is a large reservoir up stream of the Missouri River crossing. Otherwise a highway is located between the lake and the pipeline.
Steele City	Montana	No	103.18				X		1	--	--	103.18	Fort Peck Lake and Charles M. Russell Wildlife Refuge	Highway 24 is located between project and reservoir	1,100,000 acres, the largest refuge in Montana, big game hunting, walleye fishing; Fort Peck lake is a large reservoir up stream of the Missouri River crossing. Otherwise a highway is located between the lake and the pipeline.
Steele City	Montana	No	105.61				X		1	--	--	105.61	Fort Peck Lake and Charles M. Russell Wildlife Refuge	Highway 24 is located between project and reservoir	1,100,000 acres, the largest refuge in Montana, big game hunting, walleye fishing; Fort Peck lake is a large reservoir up stream of the Missouri River crossing. Otherwise a highway is located between the lake and the pipeline.
Steele City	Montana	No	105.62				X		1	--	--	105.62	Fort Peck Lake and Charles M. Russell Wildlife Refuge	Highway 24 is located between project and reservoir	1,100,000 acres, the largest refuge in Montana, big game hunting, walleye fishing; Fort Peck lake is a large reservoir up stream of the Missouri River crossing. Otherwise a highway is located between the lake and the pipeline.

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Steele City	Montana	No	107.44				X		1	--	--	107.44	North Dam	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	107.63				X		1	--	--	107.63	North Dam	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	107.68				X		1	--	--	107.68	North Dam	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	107.78				X		1	--	--	107.78	North Dam	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	107.79				X		1	--	--	107.79	North Dam	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	108.15				X		1	--	--	108.15	North Dam	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	108.58				X		1	--	--	108.58	North Dam	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	110.72				X		1	--	--	110.72	--	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	110.74				X		1	--	--	110.74	--	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	110.77				X		1	--	--	110.77	--	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	110.8				X		1	--	--	110.8	--	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	111.71				X		1	--	--	111.71	--	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	111.73				X		1	--	--	111.73	--	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	111.92				X		1	--	--	111.92	--	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	112.14				X		1	--	--	112.14	--	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	112.41				X		1	--	--	112.41	--	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	112.44				X		1	--	--	112.44	--	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	114.55				X		1	--	--	114.55	Christianson Reservoir	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	115.81				X		1	--	--	115.81	Christianson Reservoir	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	115.9				X		1	--	--	115.9	Christianson Reservoir	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	116.25				X		1	--	--	116.25	Christianson Reservoir	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	116.41				X		1	--	--	116.41	Christianson Reservoir	Pipeline passes within 0.1 mile of reservoir	--
Steele City	Montana	No	117.17				X		1	--	--	117.17	Christianson Reservoir	Pipeline passes within 0.1 mile of reservoir	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Steele City	Montana	No	127.99	X					1	--	--	--	--	--	--
Steele City	Montana	No	134.78				X		1	--	--	134.78	Unnamed reservoir	Downstream from Haynie Reservoir, with additional tribs.	
Steele City	Montana	No	136.6				X		1	--	--	136.6	Unnamed reservoir	Downstream from Haynie Reservoir, with additional tribs.	
Steele City	Montana	No	138.65				X		1	--	--	138.65	Unnamed reservoir	Downstream from Haynie Reservoir, with additional tribs.	
Steele City	Montana	No	139.19				X		1	--	--	139.19	Unnamed reservoir	Downstream from Haynie Reservoir, with additional tribs.	
Steele City	Montana	No	139.75				X		1	--	--	139.75	Unnamed reservoir	Downstream from Haynie Reservoir, with additional tribs.	
Steele City	Montana	No	146.97	X					1	--	--	--	--	--	--
Steele City	Montana	No	153.69	X					1	--	--	--	--	--	--
Steele City	Montana	No	159.63	X					1	--	--	--	--	--	--
Steele City	Montana	No	166.59				X		1	--	--	166.59	Lindsay Reservoir	Approximately 10 river miles downstream	
Steele City	Montana	No	175.6	X					1	--	--	--	--	--	--
Steele City	Montana	MT-4	196.06	X					1	--	--	--	--	--	--
Steele City	Montana	No	196.36	X		X			2	196.4	Yellowstone River Valley	--	--	--	--
Steele City	Montana	No	234.7	X					1	--	--	--	--	--	--
Steele City	Montana	No	236.02	X					1	--	--	--	--	--	--
Steele City	Montana	No	246.45				X		1	--	--	246.45	Red Butte Dam	--	--
Steele City	Montana	No	246.51				X		1	--	--	246.51	Red Butte Dam	--	--
Steele City	Montana	No	246.65				X		1	--	--	246.65	Red Butte Dam	--	--
Steele City	Montana	No	249				X		1	--	--	249	Red Butte Dam	--	--
Steele City	Montana	No	250.2				X		1	--	--	250.2	Red Butte Dam	--	--
Steele City	Montana	No	250.22				X		1	--	--	250.22	Red Butte Dam	--	--
Steele City	Montana	No	250.27				X		1	--	--	250.27	Red Butte Dam	--	--
Steele City	Montana	No	250.9				X		1	--	--	250.9	Red Butte Dam	--	--
Steele City	Montana	No	251.11				X		1	--	--	251.11	Red Butte Dam	--	--
Steele City	Montana	No	251.12				X		1	--	--	251.12	Red Butte Dam	--	--
Steele City	Montana	No	251.13				X		1	--	--	251.13	Red Butte Dam	--	--
Steele City	Montana	No	251.2				X		1	--	--	251.2	Red Butte Dam	--	--
Steele City	Montana	No	251.28				X		1	--	--	251.28	Red Butte Dam	--	--
Steele City	Montana	No	251.45				X		1	--	--	251.45	Red Butte Dam	--	--
Steele City	Montana	No	251.91				X		1	--	--	251.91	Red Butte Dam	--	--
Steele City	Montana	No	252.45				X		1	--	--	252.45	Red Butte Dam	--	--
Steele City	Montana	No	262.68	X					1	--	--	--	--	--	--
Steele City	Montana	MT-7	281.47	X					1	--	--	--	--	--	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Steele City	South Dakota	SD-2	292.08	X					1	--	--	--	--	--	--
Steele City	South Dakota	No	303.27				X		1	--	--	303.27	Unnamed reservoir	Approx. 10 river miles downstream	
Steele City	South Dakota	No	303.95				X		1	--	--	303.95	Unnamed reservoir	Approx. 10 river miles downstream	
Steele City	South Dakota	No	304.22				X		1	--	--	304.22	Unnamed reservoir	Approx. 10 river miles downstream	
Steele City	South Dakota	No	304.75				X		1	--	--	304.75	Unnamed reservoir	Approx. 10 river miles downstream	
Steele City	South Dakota	No	306.09				X		1	--	--	306.09	Unnamed reservoir	Approx. 10 river miles downstream	
Steele City	South Dakota	No	306.65				X		1	--	--	306.65	Unnamed reservoir	Approx. 10 river miles downstream	
Steele City	South Dakota	No	307.43				X		1	--	--	307.43	Unnamed reservoir	Approx. 10 river miles downstream	
Steele City	South Dakota	No	308.21				X		1	--	--	308.21	Gardner Lake	--	Reservoir
Steele City	South Dakota	No	308.28				X		1	--	--	308.28	Gardner Lake	--	Reservoir
Steele City	South Dakota	No	308.6				X		1	--	--	308.6	Gardner Lake	--	Reservoir
Steele City	South Dakota	No	308.7				X		1	--	--	308.7	Gardner Lake	--	Reservoir
Steele City	South Dakota	No	309.13				X		1	--	--	309.13	Gardner Lake	--	Reservoir
Steele City	South Dakota	No	309.55				X		1	--	--	309.55	Gardner Lake	--	Reservoir
Steele City	South Dakota	No	311.67				X		1	--	--	311.67	Gardner Lake	--	Reservoir
Steele City	South Dakota	No	318.09	X					1	--	--	--	--	--	--
Steele City	South Dakota	No	322.88	X					1	--	--	--	--	--	--
Steele City	South Dakota	No	328.67				X		1	--	--	328.67	Unnamed reservoir	State Experiment Farm and Antelope Reserve	
Steele City	South Dakota	No	328.74				X		1	--	--	328.74	Unnamed reservoir	State Experiment Farm and Antelope Reserve	
Steele City	South Dakota	No	328.82				X		1	--	--	328.82	Unnamed reservoir	State Experiment Farm and Antelope Reserve	
Steele City	South Dakota	No	328.83				X		1	--	--	328.83	Unnamed reservoir	State Experiment Farm and Antelope Reserve	
Steele City	South Dakota	No	328.86	X			X		2	--	--	328.86	Unnamed reservoir	State Experiment Farm and Antelope Reserve	
Steele City	South Dakota	No	329.07				X		1	--	--	329.07	Unnamed reservoir	State Experiment Farm and Antelope Reserve	
Steele City	South Dakota	No	329.09				X		1	--	--	329.09	Unnamed reservoir	State Experiment Farm and Antelope Reserve	
Steele City	South Dakota	No	329.33				X		1	--	--	329.33	Unnamed reservoir	State Experiment Farm and Antelope Reserve	
Steele City	South Dakota	No	330.34				X		1	--	--	330.34	Unnamed reservoir	State Experiment Farm and Antelope Reserve	
Steele City	South Dakota	No	330.53				X		1	--	--	330.53	Unnamed reservoir	State Experiment Farm and Antelope Reserve	

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Steele City	South Dakota	No	330.62				X		1	--	--	330.62	Unnamed reservoir	State Experiment Farm and Antelope Reserve	
Steele City	South Dakota	No	331.01				X		1	--	--	331.01	Unnamed reservoir	State Experiment Farm and Antelope Reserve	
Steele City	South Dakota	No	331.12				X		1	--	--	331.12	Unnamed reservoir	State Experiment Farm and Antelope Reserve	
Steele City	South Dakota	No	331.32				X		1	--	--	331.32	Unnamed reservoir	State Experiment Farm and Antelope Reserve	
Steele City	South Dakota	No	331.7				X		1	--	--	331.7	Unnamed reservoir	State Experiment Farm and Antelope Reserve	
Steele City	South Dakota	No	331.91				X		1	--	--	331.91	Unnamed reservoir	State Experiment Farm and Antelope Reserve	
Steele City	South Dakota	No	331.98				X		1	--	--	331.98	Unnamed reservoir	State Experiment Farm and Antelope Reserve	
Steele City	South Dakota	No	353.1	X					1	--	--	--	--	--	--
Steele City	South Dakota	No	356.94	X					1	--	--	--	--	--	--
Steele City	South Dakota	No	364.83	X					1	--	--	--	--	--	--
Steele City	South Dakota	No	383.72	X					1	--	--	--	--	--	--
Steele City	South Dakota	No	408.94	X					1	--	--	--	--	--	--
Steele City	South Dakota	SD-4	425.42	X					1	--	--	--	--	--	--
Steele City	South Dakota	SD-4	426.02			X			1	426	Cheyenne River Valley	--	--	--	--
Steele City	South Dakota	SD-4	426.07	X		X			2	426	Cheyenne River Valley	--	--	--	--
Steele City	South Dakota	SD-4	429.11	X					1	--	--	--	--	--	--
Steele City	South Dakota	No	443.84	X					1	--	--	--	--	--	--
Steele City	South Dakota	No	460.92				X		1	--	--	460.92	Unnamed reservoir	--	--
Steele City	South Dakota	No	460.94				X		1	--	--	460.94	Unnamed reservoir	--	--
Steele City	South Dakota	No	461.63				X		1	--	--	461.63	Unnamed reservoir	--	--
Steele City	South Dakota	SD-5	479.27	X					1	--	--	--	--	--	--
Steele City	South Dakota	No	481.54	X					1	--	--	--	--	--	--
Steele City	South Dakota	SD-6	537.09	X		X			2	537.1	White River Valley	--	--	--	--
Steele City	South Dakota	No	537.13	X		X			2	537.1	White River Valley	--	--	--	--
Steele City	Nebraska	No	599.9	X	X	X			3	599.9	Keya Paha River Valley	--	--	--	--
Steele City	Nebraska	No	601.12		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	601.46		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	604.19	X	X				2	--	--	--	--	--	--
Steele City	Nebraska	No	604.53		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	615.38	X	X	X			3	615.5	Niobrara River Valley	--	--	--	--
Steele City	Nebraska	No	615.48	X	X	X			3	615.5	Niobrara River Valley	--	--	--	--
Steele City	Nebraska	No	615.61	X	X	X			3	615.5	Niobrara River Valley	--	--	--	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Steele City	Nebraska	No	624.65		X	X			2	617.1-663.9	Sand Hills	--	--	--	--
Steele City	Nebraska	No	628.81		X	X	X		3	617.1-663.9	Sand Hills	628.81	Atkinson Reservoir	Atkinson Lake Recreation Area	Picnic, camping, parkland
Steele City	Nebraska	No	628.92		X	X	X		3	617.1-663.9	Sand Hills	628.92	Atkinson Reservoir	Atkinson Lake Recreation Area	Picnic, camping, parkland
Steele City	Nebraska	No	630.16		X	X	X		3	617.1-663.9	Sand Hills	630.16	Atkinson Reservoir	Atkinson Lake Recreation Area	Picnic, camping, parkland
Steele City	Nebraska	No	630.46	X	X	X	X		4	617.1-663.9	Sand Hills	630.46	Atkinson Reservoir	Atkinson Lake Recreation Area	Picnic, camping, parkland
Steele City	Nebraska	No	630.69		X	X	X		3	617.1-663.9	Sand Hills	630.69	Atkinson Reservoir	Atkinson Lake Recreation Area	Picnic, camping, parkland
Steele City	Nebraska	No	634.18		X	X	X		3	617.1-663.9	Sand Hills	634.18	Atkinson Reservoir	Atkinson Lake Recreation Area	Picnic, camping, parkland
Steele City	Nebraska	No	636.33		X	X	X		3	617.1-663.9	Sand Hills	636.33	Atkinson Reservoir	Atkinson Lake Recreation Area	Picnic, camping, parkland
Steele City	Nebraska	No	636.35		X	X	X		3	617.1-663.9	Sand Hills	636.35	Atkinson Reservoir	Atkinson Lake Recreation Area	Picnic, camping, parkland
Steele City	Nebraska	No	636.36		X	X	X		3	617.1-663.9	Sand Hills	636.36	Atkinson Reservoir	Atkinson Lake Recreation Area	Picnic, camping, parkland
Steele City	Nebraska	No	639.88		X	X			2	617.1-663.9	Sand Hills	--	--	--	--
Steele City	Nebraska	No	640.57		X	X			2	617.1-663.9	Sand Hills	--	--	--	--
Steele City	Nebraska	No	647.1		X	X			2	617.1-663.9	Sand Hills	--	--	--	--
Steele City	Nebraska	No	647.31	X	X	X			3	617.1-663.9	Sand Hills	--	--	--	--
Steele City	Nebraska	No	648		X	X			2	617.1-663.9	Sand Hills	--	--	--	--
Steele City	Nebraska	No	649.98		X	X			2	617.1-663.9	Sand Hills	--	--	--	--
Steele City	Nebraska	No	654.18		X	X			2	617.1-663.9	Sand Hills	--	--	--	--
Steele City	Nebraska	No	656.17		X	X			2	617.1-663.9	Sand Hills	--	--	--	--
Steele City	Nebraska	No	657.84		X	X			2	617.1-663.9	Sand Hills	--	--	--	--
Steele City	Nebraska	No	658.79		X	X			2	617.1-663.9	Sand Hills	--	--	--	--
Steele City	Nebraska	No	660.22	X	X	X			3	617.1-663.9	Sand Hills	--	--	--	--
Steele City	Nebraska	No	660.23	X	X	X			3	617.1-663.9	Sand Hills	--	--	--	--
Steele City	Nebraska	No	697.3	X	X	X			3	697.3	Cedar River Valley	--	--	--	--
Steele City	Nebraska	No	708.57		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	712.3		X				1	--	--	--	--	--	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Steele City	Nebraska	No	712.63		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	712.76		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	712.97		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	713.52		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	714.06		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	714.35		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	715.56		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	715.78		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	720.58		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	722.21		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	722.28		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	722.41		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	722.52		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	722.55		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	722.82		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	722.85		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	722.9		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	727.96		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	728.52	X	X				2	--	--	--	--	--	--
Steele City	Nebraska	No	729.39		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	729.69	X	X				2	--	--	--	--	--	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Steele City	Nebraska	No	729.77		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	730.44		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	731.35		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	732.99		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	735.48		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	735.5		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	736.57		X				1	--	--	--	--	--	--
Steele City	Nebraska	NE-5	738.63	X	X				2	--	--	--	--	--	--
Steele City	Nebraska	No	740.72	X	X	X			3	740.7	Loup River Valley	--	--	--	--
Steele City	Nebraska	No	741.06		X				1	--	--	--	--	--	--
Steele City	Nebraska	No	747.14	X					1	--	--	--	--	--	--
Steele City	Nebraska	No	755.74	X					1	--	--	--	--	--	--
Steele City	Nebraska	No	756.28	X		X			2	756.3	Platte River Valley	--	--	--	--
Steele City	Nebraska	NE-7	758.13	X	X	X			3	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	NE-7	758.24	X	X	X			3	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	NE-7	759.2		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	759.45		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	759.72		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	759.73		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	759.75		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	765.5	X	X	X			3	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	767.12		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	774.93	X	X	X			3	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	775.2		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	778.02		X	X	X		3	758-847.4	Rainwater Basin	778.02	Unnamed reservoir	--	--
Steele City	Nebraska	No	778.03		X	X	X		3	758-847.4	Rainwater Basin	778.03	Unnamed reservoir	--	--

Segment	State	CPS?	Approx. Milepost	Special Attributes: Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Wildlife (Table 3.6.2-1): Approx. Milepost	Name	Downstream Waterbody within 10 Miles (Table E-4): Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Steele City	Nebraska	NE-9	780.21	X	X	X	X		4	758-847.4	Rainwater Basin	780.21	Unnamed reservoir	--	--
Steele City	Nebraska	NE-9	786.15		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	787.31		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	788.12		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	789.57	X	X	X			3	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	789.84		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	790.48		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	791.29		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	795.05		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	799.43		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	801.55		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	806.38		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	807.54	X	X	X			3	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	NE-12	808.55	X	X	X			3	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	808.91		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	810.08		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	810.1		X	X			2	758-847.4	Rainwater Basin	--	--	--	--
Steele City	Nebraska	No	813.19		X	X	X		3	758-847.4	Rainwater Basin	813.19	Unnamed reservoir	--	--
Steele City	Nebraska	No	815.14		X	X	X		3	758-847.4	Rainwater Basin	815.14	Unnamed reservoir	--	--
Steele City	Nebraska	No	815.36		X	X	X		3	758-847.4	Rainwater Basin	815.36	Unnamed reservoir	--	--
Steele City	Nebraska	No	816.36		X	X	X		3	758-847.4	Rainwater Basin	816.36	Unnamed reservoir	--	--
Steele City	Nebraska	No	816.41		X	X	X		3	758-847.4	Rainwater Basin	816.41	Unnamed reservoir	--	--
Steele City	Nebraska	No	816.45		X	X	X		3	758-847.4	Rainwater Basin	816.45	Unnamed tributary to North Fork Swan Creek	--	--
Steele City	Nebraska	No	817.16		X	X	X		3	758-847.4	Rainwater Basin	817.16	Unnamed reservoir	--	--
Steele City	Nebraska	No	817.55		X	X	X		3	758-847.4	Rainwater Basin	817.55	Unnamed reservoir	--	--
Steele City	Nebraska	No	823.48		X	X	X		3	758-847.4	Rainwater Basin	823.48	Unnamed reservoir	--	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Steele City	Nebraska	No	823.54		X	X	X		3	758-847.4	Rainwater Basin	823.54	Unnamed reservoir	--	--
Steele City	Nebraska	No	823.61		X	X	X		3	758-847.4	Rainwater Basin	823.61	Unnamed reservoir	--	--
Steele City	Nebraska	No	823.97		X	X	X		3	758-847.4	Rainwater Basin	823.97	Unnamed reservoir	--	--
Steele City	Nebraska	No	825.04		X	X	X		3	758-847.4	Rainwater Basin	825.04	Unnamed reservoir	--	--
Steele City	Nebraska	No	825.04		X	X	X		3	758-847.4	Rainwater Basin	825.04	Unnamed reservoir	--	--
Steele City	Nebraska	No	826.27		X	X	X		3	758-847.4	Rainwater Basin	826.27	Unnamed reservoir	--	--
Steele City	Nebraska	No	829.47		X	X	X		3	758-847.4	Rainwater Basin	829.47	Unnamed reservoir	--	--
Steele City	Nebraska	No	829.81		X	X	X		3	758-847.4	Rainwater Basin	829.81	Unnamed reservoir	--	--
Steele City	Nebraska	No	829.88		X	X	X		3	758-847.4	Rainwater Basin	829.88	Unnamed reservoir	--	--
Steele City	Nebraska	No	829.99		X	X	X		3	758-847.4	Rainwater Basin	829.99	Unnamed reservoir	--	--
Steele City	Nebraska	No	830.61		X	X	X		3	758-847.4	Rainwater Basin	830.61	Unnamed reservoir	--	--
Steele City	Nebraska	No	831.33		X	X	X		3	758-847.4	Rainwater Basin	831.33	Cub Creek Reservoir 14-C	--	--
Steele City	Nebraska	No	832.18		X	X	X		3	758-847.4	Rainwater Basin	832.18	Cub Creek Reservoir 14-C	--	--
Steele City	Nebraska	No	832.71		X	X	X		3	758-847.4	Rainwater Basin	832.71	Cub Creek Reservoir 14-C	--	--
Steele City	Nebraska	No	832.73		X	X	X		3	758-847.4	Rainwater Basin	832.73	Cub Creek Reservoir 14-C	--	--
Steele City	Nebraska	No	832.74		X	X	X		3	758-847.4	Rainwater Basin	832.74	Cub Creek Reservoir 14-C	--	--
Steele City	Nebraska	No	833.9		X	X	X		3	758-847.4	Rainwater Basin	833.9	Cub Creek Reservoir 14-C	--	--
Steele City	Nebraska	No	835.29		X	X	X		3	758-847.4	Rainwater Basin	835.29	Cub Creek Reservoir 13-C	Pipeline passes within 0.2 mile of reservoir	--
Steele City	Nebraska	NE-14	836.32		X	X	X		3	758-847.4	Rainwater Basin	836.32	Cub Creek Reservoir 13-C	Pipeline passes within 0.2 mile of reservoir	--
Steele City	Nebraska	NE-14	836.94		X	X	X		3	758-847.4	Rainwater Basin	836.94	Cub Creek Reservoir 13-C	Pipeline passes within 0.2 mile of reservoir	--
Steele City	Nebraska	No	837.46		X	X	X		3	758-847.4	Rainwater Basin	837.46	Cub Creek Reservoir 13-C	Pipeline passes within 0.2 mile of reservoir	--
Steele City	Nebraska	No	837.53		X	X	X		3	758-847.4	Rainwater Basin	837.53	Cub Creek Reservoir 13-C	Pipeline passes within 0.2 mile of reservoir	--
Steele City	Nebraska	No	838.62		X	X	X		3	758-847.4	Rainwater Basin	838.62	Cub Creek Reservoir 13-C	Pipeline passes within 0.2 mile of reservoir	--
Steele City	Nebraska	No	838.76		X	X	X		3	758-847.4	Rainwater Basin	838.76	Cub Creek Reservoir 13-C	Pipeline passes within 0.2 mile of reservoir	--
Steele City	Nebraska	No	840.59		X	X	X		3	758-847.4	Rainwater Basin	840.59	Big Indian Creek Reservoir 10-A	Pipeline passes within 0.3 mile of reservoir	--
Steele City	Nebraska	No	843.03		X	X	X		3	758-847.4	Rainwater Basin	843.03	Big Indian Creek Reservoir 10-A	Pipeline passes within 0.3 mile of reservoir	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Steele City	Nebraska	No	847.32		X	X	X		3	758-847.4	Rainwater Basin	847.32	Big Indian Creek Reservoir 8-E	Pipeline passes within 0.3 mile of reservoir	--
Steele City	Nebraska	No	847.34		X	X	X		3	758-847.4	Rainwater Basin	847.34	Big Indian Creek Reservoir 8-E	Pipeline passes within 0.3 mile of reservoir	--
Steele City	Nebraska	NE-17	848.66				X		1	--	--	848.66	Big Indian Creek Reservoir 8-E	Pipeline passes within 0.3 mile of reservoir	--
Gulf Coast	Oklahoma	No	1.24	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	2.45	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	2.94	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	3.27	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	6.98	X			X		2	--	--	6.98	Stroud Lake	Perennial drainage flows southeast from the centerline into Stroud Lake via Camp Creek	Reservoir used for fishing, appears to be an ESA outside of the 5 mile boundary.
Gulf Coast	Oklahoma	No	7.6				X		1	--	--	7.6	Stroud Lake	Intermittent drainage flows southeast from the centerline into Stroud Lake via Camp Creek	Reservoir used for fishing, appears to be an ESA outside of the 5 mile boundary.
Gulf Coast	Oklahoma	OK-2	7.83	X			X		2	--	--	7.83	Stroud Lake	Intermittent drainage flows southeast from the centerline into Stroud Lake via Camp Creek	Reservoir used for fishing, appears to be an ESA outside of the 5 mile boundary.
Gulf Coast	Oklahoma	OK-2	8.38				X		1	--	--	8.38	Stroud Lake	Intermittent drainage flows southeast from the centerline into Stroud Lake via Camp Creek	Reservoir used for fishing, appears to be an ESA outside of the 5 mile boundary.
Gulf Coast	Oklahoma	OK-2	9.1				X		1	--	--	9.1	Stroud Lake	Intermittent drainage flows southeast from the centerline into Stroud Lake via Camp Creek	Reservoir used for fishing, appears to be an ESA outside of the 5 mile boundary.
Gulf Coast	Oklahoma	No	9.37				X		1	--	--	9.37	Stroud Lake	Intermittent drainage flows southeast from the centerline into Stroud Lake via Camp Creek	Reservoir used for fishing, appears to be an ESA outside of the 5 mile boundary.
Gulf Coast	Oklahoma	OK-3	14.06	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	OK-3	14.84	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	OK-3	15.23	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	OK-3	15.25	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	19.52	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	22.15	X	X	X			3	22.1-23.3	Deep Fork Wildlife Management Area	--	--	--	--

Segment	State	CPS?	Approx. Milepost	Special Attributes: Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Wildlife (Table 3.6.2-1): Approx. Milepost	Name	Downstream Waterbody within 10 Miles (Table E-4): Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Oklahoma	No	22.99		X	X			2	22.1-23.3	Deep Fork Wildlife Management Area	--	--	--	--
Gulf Coast	Oklahoma	No	24.03	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	28.3	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	30.41	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	32.65	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	38.3	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	38.55	X		X			2	38.6	North Canadian River Valley	--	--	--	--
Gulf Coast	Oklahoma	No	39.9	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	43.53	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	OK-4	46.82	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	47.29	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	47.95	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	50.01	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	52.44	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	58.7	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	59.84	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	59.98	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	60.28	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	60.33	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	OK-6	67.22	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	OK-6	70.38	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	72.95	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	OK-6	74.05	X		X			2	74.2	South Canadian River Valley	--	--	--	--
Gulf Coast	Oklahoma	OK-6	74.74	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	OK-7	79.56	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	80.17	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	87.34	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	95.02	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	96.14	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	102.25	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	102.69	X					1	--	--	--	--	--	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Oklahoma	No	111.06	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	119.15	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	122.57	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	123.08	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	124.08	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	125.62	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	126.2	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	126.89	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	127.09	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	127.26						0	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	129.45	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	131.34	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	133.24	X					1	--	--	--	--	--	--
Gulf Coast	Oklahoma	No	155.68	X		X			2	155.7	Red River Valley	--	--	--	--
Gulf Coast	Oklahoma	No	155.73	X		X			2	155.7	Red River Valley	--	--	--	--
Gulf Coast	Texas	No	158.53	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	162.02	X	X	X			3	162	Wetland Reserve Program	--	--	--	--
Gulf Coast	Texas	No	165.65	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	166.16	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	168.32				X	X	2	--	--	168.32	Pat Mayse Lake/WMA	Ephemeral drainage flows northeast from centerline into Pat Mayse Lake/WMA via Collins Creek	8,925 acre wildlife management area on the western edge of Pat Mayse Reservoir. Waterfowl viewing and hunting. This is an ESA, but it is outside of the 5 mile buffer from the pipeline.
Gulf Coast	Texas	No	168.33				X	X	2	--	--	168.33	Pat Mayse Lake/WMA	Ephemeral drainage flows northeast from centerline into Pat Mayse Lake/WMA via Collins Creek	8,925 acre wildlife management area on the western edge of Pat Mayse Reservoir. Waterfowl viewing and hunting. This is an ESA, but it is outside of the 5 mile buffer from the pipeline.
Gulf Coast	Texas	No	168.33				X	X	2	--	--	168.33	Pat Mayse Lake/WMA	Ephemeral drainage flows northeast from centerline into Pat Mayse Lake/WMA via Collins Creek	8,925 acre wildlife management area on the western edge of Pat Mayse Reservoir. Waterfowl viewing and hunting. This is an ESA, but it is outside of the 5 mile buffer from the pipeline.

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	168.84				X	X	2	--	--	168.84	Pat Mayse Lake/WMA	Intermittent drainage flows northeast from centerline into Pat Mayse Lake/WMA via Collins Creek	8,925 acre wildlife management area on the western edge of Pat Mayse Reservoir. Waterfowl viewing and hunting. This is an ESA, but it is outside of the 5 mile buffer from the pipeline.
Gulf Coast	Texas	No	169.29	X			X	X	3	--	--	169.29	Pat Mayse Lake/WMA	--	8,925 acre wildlife management area on the western edge of Pat Mayse Reservoir. Waterfowl viewing and hunting. This is an ESA, but it is outside of the 5 mile buffer from the pipeline.
Gulf Coast	Texas	No	169.48				X	X	2	--	--	169.48	Pat Mayse Lake/WMA	--	8,925 acre wildlife management area on the western edge of Pat Mayse Reservoir. Waterfowl viewing and hunting. This is an ESA, but it is outside of the 5 mile buffer from the pipeline.
Gulf Coast	Texas	No	170.3				X	X	2	--	--	170.3	Pat Mayse Lake/WMA	Ephemeral drainage flows north from centerline into Pat Mayse Lake/WMA via Sanders Creek.	8,925 acre wildlife management area on the western edge of Pat Mayse Reservoir. Waterfowl viewing and hunting. This is an ESA, but it is outside of the 5 mile buffer from the pipeline.
Gulf Coast	Texas	No	170.39				X	X	2	--	--	170.39	Pat Mayse Lake/WMA	Ephemeral drainage flows north from centerline into Pat Mayse Lake/WMA via Sanders Creek	8,925 acre wildlife management area on the western edge of Pat Mayse Reservoir. Waterfowl viewing and hunting. This is an ESA, but it is outside of the 5 mile buffer from the pipeline.
Gulf Coast	Texas	No	170.9	X			X	X	3	--	--	170.9	Pat Mayse Lake/WMA	Ephemeral drainage flows north from centerline into Pat Mayse Lake/WMA via Sanders Creek	8,925 acre wildlife management area on the western edge of Pat Mayse Reservoir. Waterfowl viewing and hunting. This is an ESA, but it is outside of the 5 mile buffer from the pipeline.
Gulf Coast	Texas	No	171.16	X			X	X	3	--	--	171.16	Pat Mayse Lake/WMA	--	8,925 acre wildlife management area on the western edge of Pat Mayse Reservoir. Waterfowl viewing and hunting. This is an ESA, but it is outside of the 5 mile buffer from the pipeline.
Gulf Coast	Texas	No	172.71	X			X	X	3	--	--	172.71	Pat Mayse Lake/WMA	--	8,925 acre wildlife management area on the western edge of Pat Mayse Reservoir. Waterfowl viewing and hunting. This is an ESA, but it is outside of the 5 mile buffer from the pipeline.
Gulf Coast	Texas	No	173.41				X	X	2	--	--	173.41	Pat Mayse Lake/WMA	Ephemeral drainage flows north from centerline into Pat Mayse Lake/WMA via Cottonwood Creek	8,925 acre wildlife management area on the western edge of Pat Mayse Reservoir. Waterfowl viewing and hunting. This is an ESA, but it is outside of the 5 mile buffer from the pipeline.
Gulf Coast	Texas	No	174.22	X					1	--	--	--	--	--	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	184				X		1	--	--	184	Proposed George Parkhouse Reservoir	Intermittent drainage flows south from centerline into area considered for proposed George Parkhouse Reservoir via Mallory Creek	--
Gulf Coast	Texas	No	184.08				X		1	--	--	184.08	Proposed George Parkhouse Reservoir	Ephemeral drainage flows south from centerline into area considered for proposed George Parkhouse Reservoir via Mallory Creek	--
Gulf Coast	Texas	No	185.09				X		1	--	--	185.09	Proposed George Parkhouse Reservoir	Ephemeral drainage flows south from centerline into area considered for proposed George Parkhouse Reservoir via Mallory Creek	--
Gulf Coast	Texas	No	186.41				X		1	--	--	186.41	Proposed George Parkhouse Reservoir	Intermittent drainage flows south from centerline into area considered for proposed George Parkhouse Reservoir via Mallory Creek	--
Gulf Coast	Texas	No	187.51				X		1	--	--	187.51	Proposed George Parkhouse Reservoir	--	--
Gulf Coast	Texas	No	188.52				X		1	--	--	188.52	Proposed George Parkhouse Reservoir	Intermittent drainage flows south from centerline into area considered for proposed George Parkhouse Reservoir via Mallory Creek	--
Gulf Coast	Texas	No	189.31				X		1	--	--	189.31	Proposed George Parkhouse Reservoir	--	--
Gulf Coast	Texas	No	190.52			X	X		2	190.2	North Sulphur River Valley	190.52	Proposed George Parkhouse Reservoir	Intermittent drainage flows south from centerline into area considered for proposed George Parkhouse Reservoir via North Sulphur River	--

Segment	State	CPS?	Approx. Milepost	Special Attributes: Fishery	Special Attributes: Wetland	Special Attributes: Wildlife	Special Attributes: Waterbody	Special Attributes: Special Waterbody	Special Attributes: Count	Wildlife (Table 3.6.2-1): Approx. Milepost	Wildlife (Table 3.6.2-1): Name	Downstream Waterbody within 10 Miles (Table E-4): Approx. Milepost	Downstream Waterbody within 10 Miles (Table E-4): Downstream Reservoir/ Fishery/ Wildlife Area	Downstream Waterbody within 10 Miles (Table E-4): Other Description	Comment
Gulf Coast	Texas	No	190.52			X	X		2	190.2	North Sulphur River Valley	190.52	Proposed George Parkhouse Reservoir	Intermittent drainage flows south from centerline into area considered for proposed George Parkhouse Reservoir via North Sulphur River	--
Gulf Coast	Texas	No	190.52			X	X		2	190.2	North Sulphur River Valley	190.52	Proposed George Parkhouse Reservoir	Intermittent drainage flows south from centerline into area considered for proposed George Parkhouse Reservoir via North Sulphur River	--
Gulf Coast	Texas	No	190.66			X	X		2	190.2	North Sulphur River Valley	190.66	Proposed George Parkhouse Reservoir	Ephemeral drainage flows north from centerline into area considered for proposed George Parkhouse Reservoir via North Sulphur River	--
Gulf Coast	Texas	No	190.67			X	X		2	190.2	North Sulphur River Valley	190.67	Proposed George Parkhouse Reservoir	Ephemeral drainage flows north from centerline into area considered for proposed George Parkhouse Reservoir via North Sulphur River	--
Gulf Coast	Texas	No	190.75			X	X		2	190.2	North Sulphur River Valley	190.75	Proposed George Parkhouse Reservoir	Perennial drainage flows north from centerline into area considered for proposed George Parkhouse Reservoir via North Sulphur River	--
Gulf Coast	Texas	No	190.76	X		X	X		3	190.2	North Sulphur River Valley	190.76	Proposed George Parkhouse Reservoir	Perennial drainage flows north from centerline into area considered for proposed George Parkhouse Reservoir via North Sulphur River	--
Gulf Coast	Texas	No	190.76	X		X	X		3	190.2	North Sulphur River Valley	190.76	Proposed George Parkhouse Reservoir	--	--
Gulf Coast	Texas	No	190.76	X		X	X		3	190.2	North Sulphur River Valley	190.76	Proposed George Parkhouse Reservoir	--	--

Segment	State	CPS?	Approx. Milepost	Special Attributes: Fishery	Special Attributes: Wetland	Special Attributes: Wildlife	Special Attributes: Waterbody	Special Attributes: Special Waterbody	Special Attributes: Count	Wildlife (Table 3.6.2-1): Approx. Milepost	Wildlife (Table 3.6.2-1): Name	Downstream Waterbody within 10 Miles (Table E-4): Approx. Milepost	Downstream Waterbody within 10 Miles (Table E-4): Downstream Reservoir/ Fishery/ Wildlife Area	Downstream Waterbody within 10 Miles (Table E-4): Other Description	Comment
Gulf Coast	Texas	No	190.82				X		1	--	--	190.82	Proposed George Parkhouse Reservoir	Ephemeral drainage flows north from centerline into area considered for proposed George Parkhouse Reservoir via North Sulphur River	--
Gulf Coast	Texas	No	191.05				X		1	--	--	191.05	Proposed George Parkhouse Reservoir	Ephemeral drainage flows north from centerline into area considered for proposed George Parkhouse Reservoir via North Sulphur River	--
Gulf Coast	Texas	No	192.85				X		1	--	--	192.85	Proposed George Parkhouse Reservoir	Intermittent drainage flows southeast from centerline into area considered for proposed George Parkhouse Reservoir via Lake Creek.	--
Gulf Coast	Texas	No	193.67				X		1	--	--	193.67	Proposed George Parkhouse Reservoir	Intermittent drainage flows southeast from centerline into area considered for proposed George Parkhouse Reservoir via Lake Creek.	--
Gulf Coast	Texas	No	194.24				X		1	--	--	194.24	Proposed George Parkhouse Reservoir	Ephemeral drainage flows east from centerline into area considered for proposed George Parkhouse Reservoir via Lake Creek.	--
Gulf Coast	Texas	No	194.25				X		1	--	--	194.25	Proposed George Parkhouse Reservoir	Ephemeral drainage flows east from centerline into area considered for proposed George Parkhouse Reservoir via Lake Creek.	--
Gulf Coast	Texas	No	194.26				X		1	--	--	194.26	Proposed George Parkhouse Reservoir	Ephemeral drainage flows east from centerline into area considered for proposed George Parkhouse Reservoir via Lake Creek.	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	194.96				X		1	--	--	194.96	Proposed George Parkhouse Reservoir	Intermittent drainage flows east from centerline into area considered for proposed George Parkhouse Reservoir via Lake Creek.	--
Gulf Coast	Texas	No	195.87				X		1	--	--	195.87	Proposed George Parkhouse Reservoir	Ephemeral drainage flows east from centerline into area considered for proposed George Parkhouse Reservoir via Lake Creek.	--
Gulf Coast	Texas	No	195.91				X		1	--	--	195.91	Proposed George Parkhouse Reservoir	Perennial drainage flows east from centerline into area considered for proposed George Parkhouse Reservoir via Lake Creek.	--
Gulf Coast	Texas	No	196.37				X		1	--	--	196.37	Proposed George Parkhouse Reservoir	Ephemeral drainage flows east from centerline into area considered for proposed George Parkhouse Reservoir via Lake Creek.	--
Gulf Coast	Texas	No	199.59				X		1	--	--	199.59	Proposed George Parkhouse Reservoir	Intermittent drainage flows south from centerline into area considered for proposed George Parkhouse Reservoir via Evans Branch.	--
Gulf Coast	Texas	No	199.84				X		1	--	--	199.84	Proposed George Parkhouse Reservoir	Seasonal drainage flows south from centerline into area considered for proposed George Parkhouse Reservoir via Evans Branch.	--
Gulf Coast	Texas	No	201.77	X			X		2	--	--	201.77	Proposed George Parkhouse Reservoir	Perennial drainage flows north from centerline into area considered for proposed George Parkhouse Reservoir via South Sulphur River.	--
Gulf Coast	Texas	No	201.78	X			X		2	--	--	201.78	Proposed George Parkhouse Reservoir	Perennial drainage flows north from centerline into area considered for proposed George Parkhouse Reservoir via South Sulphur River.	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	202.95				X		1	--	--	202.95	Proposed George Parkhouse Reservoir	--	--
Gulf Coast	Texas	No	202.95				X		1	--	--	202.95	Proposed George Parkhouse Reservoir	Perennial drainage flows north from centerline into area considered for proposed George Parkhouse Reservoir via South Sulphur River.	--
Gulf Coast	Texas	No	203.4				X		1	--	--	203.4	Proposed George Parkhouse Reservoir	Drainage flows north from centerline into area considered for proposed George Parkhouse Reservoir via South Sulphur River.	--
Gulf Coast	Texas	No	203.76				X		1	--	--	203.76	Proposed George Parkhouse Reservoir	Ephemeral drainage flows north from centerline into area considered for proposed George Parkhouse Reservoir via South Sulphur River.	--
Gulf Coast	Texas	No	203.77				X		1	--	--	203.77	Proposed George Parkhouse Reservoir	Ephemeral drainage flows north from centerline into area considered for proposed George Parkhouse Reservoir via South Sulphur River.	--
Gulf Coast	Texas	No	203.79				X		1	--	--	203.79	Proposed George Parkhouse Reservoir	--	--
Gulf Coast	Texas	No	203.95				X		1	--	--	203.95	Proposed George Parkhouse Reservoir	Perennial drainage flows north from centerline into area considered for proposed George Parkhouse Reservoir via South Sulphur River.	--
Gulf Coast	Texas	No	204.09				X		1	--	--	204.09	Proposed George Parkhouse Reservoir	Ephemeral drainage flows north from centerline into area considered for proposed George Parkhouse Reservoir via South Sulphur River.	--
Gulf Coast	Texas	No	204.14				X		1	--	--	204.14	Proposed George Parkhouse Reservoir	Ephemeral drainage flows north from centerline into area considered for proposed George Parkhouse Reservoir via South Sulphur River.	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	212.11	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	212.82	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	217.18	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	218.23	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	220.91	X					1	--	--	--	--	--	--
Gulf Coast	Texas	TX-1	223.05				X	X	2	--	--	223.05	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	No	224.15	X			X	X	3	--	--	224.15	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	No	225.03				X	X	2	--	--	225.03	Lake Cypress Springs	Intermittent drainage flows south from centerline into Lake Cypress Springs via Little Cypress Creek.	Attached to Lake Bob Sandlin
Gulf Coast	Texas	No	225.38				X	X	2	--	--	225.38	Lake Cypress Springs	Ephemeral drainage flows south from centerline into Lake Cypress Springs via Little Cypress Creek.	Attached to Lake Bob Sandlin
Gulf Coast	Texas	No	225.42				X	X	2	--	--	225.42	Lake Cypress Springs	Ephemeral drainage flows south from centerline into Lake Cypress Springs via Little Cypress Creek.	Attached to Lake Bob Sandlin
Gulf Coast	Texas	TX-1	226.04				X	X	2	--	--	226.04	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	TX-1	226.2				X	X	2	--	--	226.2	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	TX-1	226.23				X	X	2	--	--	226.23	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	TX-1	226.29				X	X	2	--	--	226.29	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	No	226.68	X			X	X	3	--	--	226.68	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	No	226.76	X			X	X	3	--	--	226.76	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	No	227.52				X	X	2	--	--	227.52	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	No	227.53				X	X	2	--	--	227.53	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	No	227.58				X	X	2	--	--	227.58	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	No	227.68				X	X	2	--	--	227.68	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	No	227.91				X	X	2	--	--	227.91	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	No	227.95				X	X	2	--	--	227.95	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	No	228.34				X	X	2	--	--	228.34	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	No	228.48	X			X	X	3	--	--	228.48	Lake Cypress Springs	--	Attached to Lake Bob Sandlin

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	228.86				X	X	2	--	--	228.86	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	No	228.88				X	X	2	--	--	228.88	Lake Cypress Springs	--	Attached to Lake Bob Sandlin
Gulf Coast	Texas	No	230.07				X	X	2	--	--	230.07	Lake Bob Sandlin	--	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	No	230.41				X	X	2	--	--	230.41	Lake Bob Sandlin	--	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	No	230.42				X	X	2	--	--	230.42	Lake Bob Sandlin	--	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	No	230.89				X	X	2	--	--	230.89	Lake Bob Sandlin	Ephemeral drainage flows south of the centerline into Lake Bob Sandlin via Gum Branch.	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	No	231.22				X	X	2	--	--	231.22	Lake Bob Sandlin	Ephemeral drainage flows south of the centerline into Lake Bob Sandlin via Gum Branch.	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	No	231.43				X	X	2	--	--	231.43	Lake Bob Sandlin	Ephemeral drainage flows south of the centerline into Lake Bob Sandlin via Gum Branch.	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	No	231.6				X	X	2	--	--	231.6	Lake Bob Sandlin	--	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	No	231.85				X	X	2	--	--	231.85	Lake Bob Sandlin	--	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	No	232.65	X			X	X	3	--	--	232.65	Lake Bob Sandlin	--	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	No	232.75	X			X	X	3	--	--	232.75	Lake Bob Sandlin	--	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	No	233.08	X			X	X	3	--	--	233.08	Lake Bob Sandlin	--	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	No	234.13	X			X	X	3	--	--	234.13	Lake Bob Sandlin	--	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	No	234.21				X	X	2	--	--	234.21	Lake Bob Sandlin	--	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	No	234.59	X			X	X	3	--	--	234.59	Lake Bob Sandlin	--	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	No	234.7				X	X	2	--	--	234.7	Lake Bob Sandlin	--	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	No	235.05	X			X	X	3	--	--	235.05	Lake Bob Sandlin	--	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	TX-2	235.54	X			X	X	3	--	--	235.54	Lake Bob Sandlin	Perennial drainage flows north of the centerline into Lake Bob Sandlin via Sand Branch.	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	TX-2	236.81				X	X	2	--	--	236.81	Lake Bob Sandlin	Intermittent drainage flows east of the centerline into Lake Bob Sandlin via South Fork Brushy Creek.	9,400 acre reservoir, eagles in winter months, bird watching,

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	TX-2	238.19				X	X	2	--	--	238.19	Lake Bob Sandlin	--	9,400 acre reservoir, eagles in winter months, bird watching,
Gulf Coast	Texas	TX-2	239.45				X		1	--	--	239.45	Proposed Little Cypress Reservoir	Intermittent drainage flows southeast from centerline into area considered for proposed Little Cypress Reservoir via Caney Creek.	--
Gulf Coast	Texas	TX-2	239.67				X		1	--	--	239.67	Proposed Little Cypress Reservoir	Ephemeral drainage flows southeast from centerline into area considered for proposed Little Cypress Reservoir via Caney Creek.	--
Gulf Coast	Texas	No	241.61				X		1	--	--	241.61	Proposed Little Cypress Reservoir	Ephemeral drainage flows southeast from centerline into area considered for proposed Little Cypress Reservoir via Caney Creek.	--
Gulf Coast	Texas	No	241.83				X		1	--	--	241.83	Proposed Little Cypress Reservoir	Drainage flows southeast from centerline into area considered for proposed Little Cypress Reservoir via Caney Creek.	--
Gulf Coast	Texas	No	241.86				X		1	--	--	241.86	Proposed Little Cypress Reservoir	Intermittent drainage flows southeast from centerline into area considered for proposed Little Cypress Reservoir via Little Cypress Creek.	--
Gulf Coast	Texas	No	242.09				X		1	--	--	242.09	Proposed Little Cypress Reservoir	Ephemeral drainage flows southeast from centerline into area considered for proposed Little Cypress Reservoir via Little Cypress Creek.	--
Gulf Coast	Texas	No	242.24				X		1	--	--	242.24	Proposed Little Cypress Reservoir	Intermittent drainage flows southeast from centerline into area considered for proposed Little Cypress Reservoir via Little Cypress Creek.	--
Gulf Coast	Texas	No	242.71	X			X		2	--	--	242.71	Proposed Little Cypress Reservoir	Perennial drainage flows southeast from centerline into area considered for proposed Little Cypress Reservoir via Little Cypress Creek.	--
Gulf Coast	Texas	No	243.9	X			X		2	--	--	243.9	Proposed Little Cypress Reservoir	--	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	244.87	X			X		2	--	--	244.87	Proposed Little Cypress Reservoir	Perennial drainage flows southeast from centerline into area considered for proposed Little Cypress Reservoir via Little Cypress Creek.	--
Gulf Coast	Texas	No	245.44	X			X		2	--	--	245.44	Proposed Little Cypress Reservoir	Perennial drainage flows southeast from centerline into area considered for proposed Little Cypress Reservoir via Little Cypress Creek.	--
Gulf Coast	Texas	No	245.53				X		1	--	--	245.53	Proposed Little Cypress Reservoir	Perennial drainage flows southeast from centerline into area considered for proposed Little Cypress Reservoir via Little Cypress Creek.	--
Gulf Coast	Texas	No	246.39				X		1	--	--	246.39	Proposed Little Cypress Reservoir	Drainage flows southeast from centerline into area considered for proposed Little Cypress Reservoir via Little Cypress Creek.	--
Gulf Coast	Texas	No	246.62	X			X		2	--	--	246.62	Proposed Little Cypress Reservoir	Perennial drainage flows southeast from centerline into area considered for proposed Little Cypress Reservoir via Little Cypress Creek.	--
Gulf Coast	Texas	No	247.51				X		1	--	--	247.51	Lake Greenbriar	Intermittent drainage flows southwest from centerline into Lake Greenbriar via Clear Creek.	Residential area, reservoir
Gulf Coast	Texas	No	248.01	X			X		2	--	--	248.01	Lake Greenbriar	Perennial drainage flows southwest from centerline into Lake Greenbriar via Clear Creek.	Residential area, reservoir
Gulf Coast	Texas	TX-4	248.6				X		1	--	--	248.6	Lake Greenbriar	Perennial drainage flows southwest from centerline into Lake Greenbriar via Clear Creek.	Residential area, reservoir
Gulf Coast	Texas	TX-4	249.96				X		1	--	--	249.96	Lake Greenbriar	Intermittent drainage flows southwest from centerline into Lake Greenbriar via Honey Creek.	Residential area, reservoir

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	TX-4	250.28				X		1	--	--	250.28	Lake Greenbriar	Intermittent drainage flows southwest from centerline into Lake Greenbriar via Honey Creek.	Residential area, reservoir
Gulf Coast	Texas	TX-5	252.97	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	254.89	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	255.17	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	256.92	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	258.35		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	258.72		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	260.05		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	260.94		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	261.24		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	263.5	X					1	--	--	--	--	--	--
Gulf Coast	Texas	TX-6	267.89	X					1	--	--	--	--	--	--
Gulf Coast	Texas	TX-6	268.86	X					1	--	--	--	--	--	--
Gulf Coast	Texas	TX-6	270.67	X					1	--	--	--	--	--	--
Gulf Coast	Texas	TX-6	270.84	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	272.14	X					1	--	--	--	--	--	--
Gulf Coast	Texas	TX-7	275.08	X			X		2	--	--	275.08	Prairie Creek Reservoir	Perennial drainage flows east from centerline into Prairie Creek Reservoir via Prairie Creek.	For water storage, recently constructed.
Gulf Coast	Texas	TX-7	275.48				X		1	--	--	275.48	Prairie Creek Reservoir	--	For water storage, recently constructed.
Gulf Coast	Texas	TX-7	275.53	X			X		2	--	--	275.53	Prairie Creek Reservoir	--	For water storage, recently constructed.
Gulf Coast	Texas	TX-7	275.55				X		1	--	--	275.55	Prairie Creek Reservoir	--	For water storage, recently constructed.
Gulf Coast	Texas	TX-7	277.06				X		1	--	--	277.06	Lake Tyler	Intermittent drainage flows west of centerline into Lake Tyler via Mud Creek.	Picnic and wildlife/bird watching
Gulf Coast	Texas	No	277.34	X			X		2	--	--	277.34	Lake Tyler	Perennial drainage flows west of centerline into Lake Tyler via Mud Creek.	Picnic and wildlife/bird watching

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	277.66	X			X		2	--	--	277.66	Lake Tyler	Perennial drainage flows east of centerline into Lake Tyler via Mud Creek.	Picnic and wildlife/bird watching
Gulf Coast	Texas	TX-8	279.73	X			X		2	--	--	279.73	Lake Tyler	--	Picnic and wildlife/bird watching
Gulf Coast	Texas	No	280.12				X		1	--	--	280.12	Lake Tyler	Intermittent drainage flows east of centerline into Lake Tyler via Mud Creek.	Picnic and wildlife/bird watching
Gulf Coast	Texas	No	280.71	X			X		2	--	--	280.71	Lake Tyler	Perennial drainage flows east of centerline into Lake Tyler via Mud Creek.	Picnic and wildlife/bird watching
Gulf Coast	Texas	TX-9	281.84				X		1	--	--	281.84	Lake Tyler	Ephemeral drainage flows southwest of centerline into Lake Tyler via Caney Creek.	Picnic and wildlife/bird watching
Gulf Coast	Texas	TX-9	281.97				X		1	--	--	281.97	Lake Tyler	Seasonal drainage flows south of centerline into Lake Tyler via Caney Creek.	Picnic and wildlife/bird watching
Gulf Coast	Texas	TX-9	282.02				X		1	--	--	282.02	Lake Tyler	Seasonal drainage flows south of centerline into Lake Tyler via Caney Creek.	Picnic and wildlife/bird watching
Gulf Coast	Texas	TX-10	283.06	X			X		2	--	--	283.06	Lake Tyler	Intermittent drainage flows south of centerline into Lake Tyler via Caney Creek.	Picnic and wildlife/bird watching
Gulf Coast	Texas	TX-10	283.45	X			X		2	--	--	283.45	Lake Tyler	Perennial drainage flows south of centerline into Lake Tyler via Caney Creek.	Picnic and wildlife/bird watching
Gulf Coast	Texas	TX-10	283.49	X			X		2	--	--	283.49	Lake Tyler	Perennial drainage flows south of centerline into Lake Tyler via Caney Creek.	Picnic and wildlife/bird watching
Gulf Coast	Texas	TX-10	283.54				X		1	--	--	283.54	Lake Tyler	--	Picnic and wildlife/bird watching
Gulf Coast	Texas	TX-10	284.62	X			X		2	--	--	284.62	Lake Tyler	Perennial drainage flows north of centerline into Lake Tyler via Caney Creek.	Picnic and wildlife/bird watching
Gulf Coast	Texas	TX-10	286.77	X			X		2	--	--	286.77	Proposed Lake Columbia	Perennial drainage flows southwest of centerline into area considered for proposed Columbia Lake via Kickapoo Creek.	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	287.55				X		1	--	--	287.55	Proposed Lake Columbia	Intermittent drainage flows west of centerline into area considered for proposed Columbia Lake via Kickapoo Creek.	--
Gulf Coast	Texas	No	287.84				X		1	--	--	287.84	Proposed Lake Columbia	Intermittent drainage flows west of centerline into area considered for proposed Columbia Lake via Kickapoo Creek.	--
Gulf Coast	Texas	No	288.15				X		1	--	--	288.15	Proposed Lake Columbia	Intermittent drainage flows west of centerline into area considered for proposed Columbia Lake via Kickapoo Creek.	--
Gulf Coast	Texas	No	288.24				X		1	--	--	288.24	Proposed Lake Columbia	Intermittent drainage flows west of centerline into area considered for proposed Columbia Lake via Kickapoo Creek.	--
Gulf Coast	Texas	No	297.62	X			X		2	--	--	297.62	Lake Striker	Perennial drainage flows south of centerline into Lake Striker via Mill Creek.	2,400 acre reservoir, industrial water, recreational uses (fishing)
Gulf Coast	Texas	No	297.67				X		1	--	--	297.67	Lake Striker	Intermittent drainage flows south of centerline into Lake Striker via Mill Creek	2,400 acre reservoir, industrial water, recreational uses (fishing)
Gulf Coast	Texas	No	297.68				X		1	--	--	297.68	Lake Striker	--	2,400 acre reservoir, industrial water, recreational uses (fishing)
Gulf Coast	Texas	No	300.74				X		1	--	--	300.74	Lake Striker	Ephemeral drainage flows south of centerline into Lake Striker via Mill Creek	2,400 acre reservoir, industrial water, recreational uses (fishing)
Gulf Coast	Texas	TX-11	301.32	X			X		2	--	--	301.32	Lake Striker	--	2,400 acre reservoir, industrial water, recreational uses (fishing)
Gulf Coast	Texas	No	301.74				X		1	--	--	301.74	Lake Striker	Ephemeral drainage flows north of centerline into Lake Striker via Johnson Creek	2,400 acre reservoir, industrial water, recreational uses (fishing)
Gulf Coast	Texas	No	302.32				X		1	--	--	302.32	Lake Striker	Ephemeral drainage flows west of centerline into Lake Striker via Striker Creek	2,400 acre reservoir, industrial water, recreational uses (fishing)
Gulf Coast	Texas	No	302.99				X		1	--	--	302.99	Lake Striker	Ephemeral drainage flows south of centerline into Lake Striker via Boggy Branch	2,400 acre reservoir, industrial water, recreational uses (fishing)
Gulf Coast	Texas	No	303				X		1	--	--	303	Lake Striker	Ephemeral drainage flows south of centerline into Lake Striker via Boggy Branch	2,400 acre reservoir, industrial water, recreational uses (fishing)

Segment	State	CPS?	Approx. Milepost	Special Attributes: Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Wildlife (Table 3.6.2-1): Approx. Milepost	Name	Downstream Waterbody within 10 Miles (Table E-4): Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	303.1				X		1	--	--	303.1	Lake Striker	--	2,400 acre reservoir, industrial water, recreational uses (fishing)
Gulf Coast	Texas	No	303.83				X		1	--	--	303.83	Lake Striker	Intermittent drainage flows west, directly into Lake Striker	2,400 acre reservoir, industrial water, recreational uses (fishing)
Gulf Coast	Texas	No	303.88				X		1	--	--	303.88	Lake Striker	Intermittent drainage flows west, directly into Lake Striker	2,400 acre reservoir, industrial water, recreational uses (fishing)
Gulf Coast	Texas	No	304.27				X		1	--	--	304.27	Lake Striker	Intermittent drainage flows west, directly into Lake Striker	2,400 acre reservoir, industrial water, recreational uses (fishing)
Gulf Coast	Texas	No	304.75				X		1	--	--	304.75	Lake Striker	Intermittent drainage flows west, directly into Lake Striker	2,400 acre reservoir, industrial water, recreational uses (fishing)
Gulf Coast	Texas	TX-11	308.27	X					1	--	--	--	--	--	--
Gulf Coast	Texas	TX-12	313.18		X				1	--	--	--	--	--	--
Gulf Coast	Texas	TX-12	313.23		X				1	--	--	--	--	--	--
Gulf Coast	Texas	TX-12	313.3	X	X				2	--	--	--	--	--	--
Gulf Coast	Texas	TX-12	313.55		X				1	--	--	--	--	--	--
Gulf Coast	Texas	TX-12	313.68		X				1	--	--	--	--	--	--
Gulf Coast	Texas	TX-12	314.5		X				1	--	--	--	--	--	--
Gulf Coast	Texas	TX-12	314.98		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	315.31		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	316.68	X					1	--	--	--	--	--	--
Gulf Coast	Texas	TX-13	319.34	X					1	--	--	--	--	--	--
Gulf Coast	Texas	TX-13	320.25	X					1	--	--	--	--	--	--
Gulf Coast	Texas	TX-13	320.79	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	334.17	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	337.73		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	338.31		X				1	--	--	--	--	--	--

Segment	State	CPS?	Approx. Milepost	Special Attributes: Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Wildlife (Table 3.6.2-1): Approx. Milepost	Name	Downstream Waterbody within 10 Miles (Table E-4): Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	338.48		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	338.49		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	338.52		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	338.53		X				1	--	--	--	--	--	--
Gulf Coast	Texas	TX-14	338.69		X				1	--	--	--	--	--	--
Gulf Coast	Texas	TX-14	338.77		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	340.17		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	340.18		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	342.53	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	344.69				X		1	--	--	344.69	Davy Crockett National Forest	Ephemeral drainage located within David Crocket National Forest which drains south into Watson Branch.	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	344.94	X			X		2	--	--	344.94	Davy Crockett National Forest	Ephemeral drainage located within David Crocket National Forest which drains south into Watson Branch.	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	345.45				X		1	--	--	345.45	Davy Crockett National Forest	Intermittent drainage located within David Crockett National Forest which drains northeast into Watson Branch.	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	345.46				X		1	--	--	345.46	Davy Crockett National Forest	Intermittent drainage located within David Crockett National Forest which drains northeast into Watson Branch.	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	345.52				X		1	--	--	345.52	Davy Crockett National Forest	Perennial drainage located within David Crockett National Forest which drains northeast into Watson Branch.	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.

Segment	State	CPS?	Approx. Milepost	Special Attributes: Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Wildlife (Table 3.6.2-1): Approx. Milepost	Name	Downstream Waterbody within 10 Miles (Table E-4): Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	345.59				X		1	--	--	345.59	Davy Crockett National Forest	Perennial drainage located within David Crockett National Forest which drains northeast into Watson Branch.	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	345.6	X			X		2	--	--	345.6	Davy Crockett National Forest	Perennial drainage located within David Crockett National Forest which drains northeast into Watson Branch.	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	346.52				X		1	--	--	346.52	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	346.52				X		1	--	--	346.52	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	346.59				X		1	--	--	346.59	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	346.6				X		1	--	--	346.6	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	347.76	X			X		2	--	--	347.76	Davy Crockett National Forest	Ephemeral drainage located within David Crocket National Forest which drains west into Bodan Creek	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	348.05				X		1	--	--	348.05	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	350.01		X		X		2	--	--	350.01	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	350.23		X		X		2	--	--	350.23	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	351.02	X	X		X		3	--	--	351.02	Davy Crockett National Forest	Perennial drainage located within David Crockett National Forest which drains west into Buncombe Creek	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	351.15	X	X		X		3	--	--	351.15	Davy Crockett National Forest	Perennial drainage located within David Crockett National Forest which drains west into Buncombe Creek	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	351.66		X		X		2	--	--	351.66	Davy Crockett National Forest	Perennial drainage located within David Crockett National Forest which drains west into Neches River	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	352.18	X	X		X		3	--	--	352.18	Davy Crockett National Forest	Perennial drainage located within David Crockett National Forest which drains west into Neches River	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	352.93		X		X		2	--	--	352.93	Davy Crockett National Forest	Ephemeral drainage located within David Crockett National Forest which drains west into Crawford Creek.	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	352.94		X		X		2	--	--	352.94	Davy Crockett National Forest	Ephemeral drainage located within David Crockett National Forest which drains west into Crawford Creek.	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	352.99		X		X		2	--	--	352.99	Davy Crockett National Forest	Ephemeral drainage located within David Crockett National Forest which drains west into Crawford Creek.	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	TX-15	353.12		X		X		2	--	--	353.12	Davy Crockett National Forest	Ephemeral drainage located within David Crockett National Forest which drains west into Crawford Creek.	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	353.26	X	X		X		3	--	--	353.26	Davy Crockett National Forest	Ephemeral drainage located within David Crockett National Forest which drains west into Crawford Creek.	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	353.28		X		X		2	--	--	353.28	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	TX-16	354.18		X		X		2	--	--	354.18	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	TX-16	354.2		X		X		2	--	--	354.2	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	TX-16	355.01		X		X		2	--	--	355.01	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	TX-16	355.11		X		X		2	--	--	355.11	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	TX-16	355.22		X		X		2	--	--	355.22	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	TX-16	355.27		X		X		2	--	--	355.27	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	TX-16	355.45	X	X		X		3	--	--	355.45	Davy Crockett National Forest	Drainage located within David Crockett National Forest which drains west into Neches River.	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	TX-16	355.64		X		X		2	--	--	355.64	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	356.08		X		X		2	--	--	356.08	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	356.74		X		X		2	--	--	356.74	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	356.91		X		X		2	--	--	356.91	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	357.41		X		X		2	--	--	357.41	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	357.5		X		X		2	--	--	357.5	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	357.92		X		X		2	--	--	357.92	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	358.17	X	X		X		3	--	--	358.17	Davy Crockett National Forest	Perennial drainage located within David Crockett National Forest which drains southwest into Neches River.	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	358.39		X		X		2	--	--	358.39	Davy Crockett National Forest	--	National forest managed for timber, grazing, oil production, hunting, and recreation. Range of birds seen in the park, including migratory game birds.
Gulf Coast	Texas	No	358.83		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	359.08		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	359.25		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	359.66		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	359.71		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	359.81		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	360.54		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	360.69		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	360.77		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	360.81		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	360.89	X	X				2	--	--	--	--	--	--
Gulf Coast	Texas	No	361.09	X	X				2	--	--	--	--	--	--
Gulf Coast	Texas	No	361.12	X	X				2	--	--	--	--	--	--
Gulf Coast	Texas	No	361.24		X				1	--	--	--	--	--	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	362.14		X				1	--	--	--	--	--	--
Gulf Coast	Texas	TX-17	362.79	X	X				2	--	--	--	--	--	--
Gulf Coast	Texas	TX-17	362.81		X				1	--	--	--	--	--	--
Gulf Coast	Texas	TX-17	362.81		X				1	--	--	--	--	--	--
Gulf Coast	Texas	TX-17	363.17		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	366.4		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	366.9		X				1	--	--	--	--	--	--
Gulf Coast	Texas	No	366.94		X	X			2	367.3	Neches River Valley	--	--	--	--
Gulf Coast	Texas	No	368.6	X					1	--	--	--	--	--	--
Gulf Coast	Texas	TX-19	376.43	X					1	--	--	--	--	--	--
Gulf Coast	Texas	TX-19	376.74	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	377.66	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	377.85	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	381.51	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	381.9	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	382.64	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	385.56	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	388.49	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	389.69	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	391.67	X					1	--	--	--	--	--	--
Gulf Coast	Texas	TX-20	397.18	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	400.67				X	X	2	--	--	400.67	Drainage in Big Thicket National Preserve	Ephemeral drainage located within Big Thicket National Preserve which drains east into Bluff Creek.	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	400.84				X	X	2	--	--	400.84	Drainage in Big Thicket National Preserve	Ephemeral drainage located within Big Thicket National Preserve which drains east into Bluff Creek.	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	401.35	X			X	X	3	--	--	401.35	Drainage in Big Thicket National Preserve	--	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	404.09	X			X	X	3	--	--	404.09	Drainage in Big Thicket National Preserve	Drainage located within Big Thicket National Preserve which drains south into Menard Creek.	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	404.1				X	X	2	--	--	404.1	Drainage in Big Thicket National Preserve	--	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	404.33				X	X	2	--	--	404.33	Drainage in Big Thicket National Preserve	--	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	404.57				X	X	2	--	--	404.57	Drainage in Big Thicket National Preserve	--	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	404.74				X	X	2	--	--	404.74	Drainage in Big Thicket National Preserve	--	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	404.75				X	X	2	--	--	404.75	Drainage in Big Thicket National Preserve	--	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	405.4				X	X	2	--	--	405.4	Drainage in Big Thicket National Preserve	--	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	407.13	X			X	X	3	--	--	407.13	Drainage in Big Thicket National Preserve	--	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	407.15				X	X	2	--	--	407.15	Drainage in Big Thicket National Preserve	--	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	407.22				X	X	2	--	--	407.22	Drainage in Big Thicket National Preserve	--	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	407.24				X	X	2	--	--	407.24	Drainage in Big Thicket National Preserve	--	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	407.24				X	X	2	--	--	407.24	Drainage in Big Thicket National Preserve	--	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	407.26				X	X	2	--	--	407.26	Drainage in Big Thicket National Preserve	--	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	TX-22	411.68				X	X	2	--	--	411.68	Drainage in Big Thicket National Preserve	Intermittent drainage located within Big Thicket National Preserve which drains southwest into Williams Creek.	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	TX-22	413.66				X	X	2	--	--	413.66	Drainage in Big Thicket National Preserve	Ephemeral drainage located within Big Thicket National Preserve which drains southwest into Williams Creek.	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	414.35				X	X	2	--	--	414.35	Drainage in Big Thicket National Preserve	Ephemeral drainage located within Big Thicket National Preserve which drains west into Williams Creek.	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	414.36				X	X	2	--	--	414.36	Drainage in Big Thicket National Preserve	Ephemeral drainage located within Big Thicket National Preserve which drains west into Williams Creek.	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	414.7				X	X	2	--	--	414.7	Drainage in Big Thicket National Preserve	Ephemeral drainage located within Big Thicket National Preserve	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	415.34	X			X	X	3	--	--	415.34	Drainage in Big Thicket National Preserve	Perennial drainage located within Big Thicket National Preserve	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.

Segment	State	CPS?	Approx. Milepost	Special Attributes: Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Wildlife (Table 3.6.2-1): Approx. Milepost	Name	Downstream Waterbody within 10 Miles (Table E-4): Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	415.35				X	X	2	--	--	415.35	Drainage in Big Thicket National Preserve	Perennial drainage located within Big Thicket National Preserve	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	415.35				X	X	2	--	--	415.35	Drainage in Big Thicket National Preserve	Perennial drainage located within Big Thicket National Preserve	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	416.19				X	X	2	--	--	416.19	Drainage in Big Thicket National Preserve	Perennial drainage located within Big Thicket National Preserve which drains south into Menard Creek	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	416.35	X		X	X	X	4	417.8-418.3	Big Thicket National Preserve (Menard Creek Unit)	416.35	Drainage in Big Thicket National Preserve	Perennial drainage located within Big Thicket National Preserve which drains south into Menard Creek	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	422.69				X	X	2	--	--	422.69	Trinity River National Wildlife Refuge	Ephemeral drainage located in National Wildlife Refuge which drains west into Beef Head Creek	25,000 acre wildlife refuge developed to protect bottomland hardwood forest ecosystem. Is valued for its high diversity of waterfowl species. Used during migration or nesting by nearly 50 percent of the neotropical migratory bird species listed by the U.S. Fish and Wildlife Service.
Gulf Coast	Texas	No	431.71				X		1	--	--	431.71	Daisetta Swamp	Ephemeral drainage flows south into Daisetta Swamp via Batiste Creek	Not much information available. There appears to be a wetland mitigation bank nearby.
Gulf Coast	Texas	No	432.87				X		1	--	--	432.87	Daisetta Swamp	Ephemeral drainage flows south into Daisetta Swamp via Batiste Creek	Not much information available. There appears to be a wetland mitigation bank nearby.
Gulf Coast	Texas	No	433.44				X		1	--	--	433.44	Daisetta Swamp	--	Not much information available. There appears to be a wetland mitigation bank nearby.
Gulf Coast	Texas	No	433.46				X		1	--	--	433.46	Daisetta Swamp	Ephemeral drainage flows west into Daisetta Swamp via Batiste Creek	Not much information available. There appears to be a wetland mitigation bank nearby.
Gulf Coast	Texas	No	434.11				X		1	--	--	434.11	Daisetta Swamp	Ephemeral drainage flows west into Daisetta Swamp via Batiste Creek	Not much information available. There appears to be a wetland mitigation bank nearby.
Gulf Coast	Texas	No	434.12				X		1	--	--	434.12	Daisetta Swamp	--	Not much information available. There appears to be a wetland mitigation bank nearby.
Gulf Coast	Texas	No	439.5	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	449.03	X					1	--	--	--	--	--	--
Gulf Coast	Texas	No	451.56	X					1	--	--	--	--	--	--

				Special Attributes						Wildlife (Table 3.6.2-1)		Downstream Waterbody within 10 Miles (Table E-4)			
Segment	State	CPS?	Approx. Milepost	Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Approx. Milepost	Name	Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	No	457.92	X	X		X	X	4	--	--	457.92	Drainage in Big Thicket National Preserve	Drainage located within Big Thicket National Preserve which drains into Cotton Creek.	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	457.96	X	X		X	X	4	--	--	457.96	Drainage in Big Thicket National Preserve	--	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	459.16		X		X	X	3	--	--	459.16	Drainage in Big Thicket National Preserve	Intermittent drainage located within Big Thicket National Preserve which drains into Pine Island Bayou.	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	459.94		X		X	X	3	--	--	459.94	Drainage in Big Thicket National Preserve	Drainage located within Big Thicket National Preserve which drains into Pine Island Bayou.	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	No	460.46		X		X	X	3	--	--	460.46	Drainage in Big Thicket National Preserve	Drainage located within Big Thicket National Preserve which drains into Pine Island Bayou.	Forested area with high biodiversity due to mix of habitats, bird watching (~186 birds live in or migrate through), fishing, camping, etc. Designated "Biosphere Reserve" by UNESCO in 1981.
Gulf Coast	Texas	TX-24	461.77	X	X				2	--	--	--	--	--	--
Gulf Coast	Texas	No	462.5	X					1	--	--	--	--	--	--
Gulf Coast	Texas	TX-25	469.89	X					1	--	--	--	--	--	--
Gulf Coast	Texas	TX-25	473.56				X	X	2	--	--	473.56	Drainage in J.D. Murphree WMA	Perennial drainage that flows southeast from centerline into J.D. Murphree WMA via Hillebrandt Bayou.	Wildlife Management Area for wildlife viewing and hunting. 24,250 acres of fresh, intermediate, and brackish water within the prairie marsh zone along the upper coast of Texas. Key nesting area for mottled ducks, with increasing nesting by Fulvous and Black-bellied whistling ducks. A large colonial water bird rockery is located west of Lost Lake Camp. The area is the center of the small, but principle stopover and staging area for much of the waterfowl of the Central Flyway and provides high quality winter habitat.

Segment	State	CPS?	Approx. Milepost	Special Attributes: Fishery	Wetland	Wildlife	Waterbody	Special Waterbody	Count	Wildlife (Table 3.6.2-1): Approx. Milepost	Name	Downstream Waterbody within 10 Miles (Table E-4): Approx. Milepost	Downstream Reservoir/ Fishery/ Wildlife Area	Other Description	Comment
Gulf Coast	Texas	TX-25	473.79				X	X	2	--	--	473.79	Drainage in J.D. Murphree WMA	Perennial drainage that flows east from centerline into J.D. Murphree WMA via Hillebrandt Bayou.	Wildlife Management Area for wildlife viewing and hunting. 24,250 acres of fresh, intermediate, and brackish water within the prairie marsh zone along the upper coast of Texas. Key nesting area for mottled ducks, with increasing nesting by Fulvous and Black-bellied whistling ducks. A large colonial water bird rockery is located west of Lost Lake Camp. The area is the center of the small, but principle stopover and staging area for much of the waterfowl of the Central Flyway and provides high quality winter habitat.
Gulf Coast	Texas	TX-25	473.83	X			X	X	3	--	--	473.83	Drainage in J.D. Murphree WMA	Perennial drainage that flows east from centerline into J.D. Murphree WMA via Hillebrandt Bayou.	Wildlife Management Area for wildlife viewing and hunting. 24,250 acres of fresh, intermediate, and brackish water within the prairie marsh zone along the upper coast of Texas. Key nesting area for mottled ducks, with increasing nesting by Fulvous and Black-bellied whistling ducks. A large colonial water bird rockery is located west of Lost Lake Camp. The area is the center of the small, but principle stopover and staging area for much of the waterfowl of the Central Flyway and provides high quality winter habitat.
Gulf Coast	Texas	TX-25	474.93				X	X	2	--	--	474.93	Drainage in J.D. Murphree WMA	--	Wildlife Management Area for wildlife viewing and hunting. 24,250 acres of fresh, intermediate, and brackish water within the prairie marsh zone along the upper coast of Texas. Key nesting area for mottled ducks, with increasing nesting by Fulvous and Black-bellied whistling ducks. A large colonial water bird rockery is located west of Lost Lake Camp. The area is the center of the small, but principle stopover and staging area for much of the waterfowl of the Central Flyway and provides high quality winter habitat.
Houston Lateral	Texas	TX-29	35.6	X					1	--	--	--	--	--	--
Houston Lateral	Texas	No	43.3	X		X			2	43.3	San Jacinto River Valley	--	--	--	--
Houston Lateral	Texas	Parts	18-28	X	X	X			3	18.9-22.4	Trinity River National Wildlife Refuge (Champion Lake Unit)	--	--	--	--

Appendix C

Listing of All Private Wells Registered with the State of Nebraska That Are Located within 1,000 ft of the Proposed Centerline of the Pipeline

Appendix C. Listing of All Private Wells Registered with the State of Nebraska That Are Located within 1,000 ft of the Proposed Centerline of the Pipeline

NEDNR ID Number	Status	Use ID	County	Pumping Rate (gpm)	Total Depth (ft bgs)	Static Water Level (ft bgs)	Pumping Water Level (ft bgs)	Latitude (dec. degrees)	Longitude (dec. degrees)	Distance to Pipeline (ft)
30427	A	I	York	660	183	74	83	41.01028	-97.798267	4
28803	A	I	Hamilton	1,200	290	80	101	41.059731	-97.852276	5
61324	A	I	Merrick	350	70	14	60	41.242161	-98.016796	12
75707	A	I	York	150	110	65	105	40.888707	-97.690476	17
42653	A	I	York	750	141	55	75	40.782133	-97.601828	25
47927	A	I	Jefferson	1,250	247	79	103	40.266113	-97.109539	28
9908	A	I	Hamilton	750	130	0	75	41.062904	-97.854304	31
22440	A	I	Merrick	650	33	8	31	41.176807	-97.958705	33
172381	A	I	Merrick	200	40	15	35	41.236514	-98.011453	34
51138	A	I	Merrick	650	43	10	37	41.225131	-98.002211	47
75180	A	I	Merrick	750	38	6	33	41.207272	-97.980464	52
67383	A	I	Hamilton	1,300	338	99	124	41.071923	-97.861468	58
465	A	I	Merrick	1,500	0	0	0	41.169443	-97.953584	66
104461	A	I	Fillmore	800	210	65	140	40.564252	-97.392373	67
32921	A	I	Jefferson	700	188	80	92	40.258929	-97.102671	72
199449	I	S	Keya Paha	0	37	27	35	42.954722	-99.496806	78
57180	A	I	York	1,000	248	80	175	40.841615	-97.662228	98
34246	A	I	Jefferson	1,000	100	22	50	40.349683	-97.196142	102
50627	A	I	York	250	111	80	110	40.894246	-97.697454	115
117611	A	I	Merrick	600	50	6	30	41.203815	-97.9794	116
159532	A	S	Greeley	5	220	120	122	41.673611	-98.525611	117
169826	A	I	Fillmore	800	329	170	200	40.6006	-97.430136	124
43852	A	I	Greeley	900	232	102	120	41.614042	-98.458622	129
153843	A	I	York	800	340	88	108	40.738556	-97.563917	131
66594	A	I	Merrick	800	45	8	20	41.151244	-97.934331	133
56057	A	I	Fillmore	850	286	105	135	40.604308	-97.439867	148
19979	A	I	Fillmore	750	264	85	97	40.679225	-97.515783	151
205091	A	D	Fillmore	15	200	65	67	40.566833	-97.395611	154
130219	A	I	Jefferson	800	202	102	124	40.179005	-97.034202	159
37318	A	I	York	1,000	240	105	137	40.709423	-97.540136	166
33722	A	I	York	350	105	73	96	40.890521	-97.691683	168
11797	A	I	York	1,000	181	64	76	41.012047	-97.800698	168
63338	A	I	Jefferson	800	160	80	90	40.344116	-97.196278	169
127940	A	I	Merrick	200	60	8	50	41.224085	-97.999751	171
76206	A	I	Merrick	500	64	7	55	41.235633	-98.011622	172
29114	A	I	York	1,200	201	88	104	40.953358	-97.752276	177
108255	A	I	Merrick	400	30	3	20	41.194018	-97.973064	179
72304	A	I	Merrick	500	65	8	50	41.235461	-98.0116	185
9906	A	I	York	500	174	90	100	40.999445	-97.783731	189
69187	A	I	Merrick	350	45	15	44	41.219986	-97.996264	193
51161	A	I	York	300	80	35	73	40.853294	-97.665757	193
153611	A	I	York	800	140	71	100	40.849833	-97.664417	204
843	A	I	Merrick	0	0	0	0	41.229053	-98.0069	206
8180	A	I	York	1,200	160	64	86	40.932265	-97.728512	207
60133	A	I	Fillmore	800	312	110	130	40.593276	-97.420806	208
8081	A	I	York	1,200	190	74	100	41.021	-97.812671	211
117841	A	I	Merrick	400	37	7	34	41.188829	-97.968467	222
174509	A	I	Nance	250	56	10	48	41.287333	-98.085167	242
31897	A	I	Jefferson	600	240	102	114	40.274534	-97.119935	244
208543	A	I	Greeley	800	405	97	130	41.53475	-98.344389	246
108513	A	I	York	600	110	73	100	40.882224	-97.687714	248
58778	A	I	Holt	900	117	7	17	42.481921	-99.1517	258
55203	A	I	Jefferson	2,000	218	114	130	40.280618	-97.128448	261
56967	A	I	York	1,000	260	85	140	41.006664	-97.793429	267
42320	A	I	Holt	1,000	136	4	15	42.65552	-99.240837	268
51285	A	I	Fillmore	1,000	261	110	150	40.68753	-97.523711	271
32376	A	I	York	1,300	150	85	95	40.799823	-97.64498	272
117843	A	I	Merrick	300	38	5	26	41.183805	-97.963775	272
144605	I	I	Merrick	300	40	10	32	41.21293	-97.98523	277

Appendix C. (cont.)

NEDNR ID Number	Status	Use ID	County	Pumping Rate (gpm)	Total Depth (ft bgs)	Static Water Level (ft bgs)	Pumping Water Level (ft bgs)	Latitude (dec. degrees)	Longitude (dec. degrees)	Distance to Pipeline (ft)
44157	A	I	York	1,253	186	96	112	40.785368	-97.613106	278
55605	A	I	Fillmore	900	260	105	127	40.694764	-97.52607	290
170095	A	S	Nance	12	235	140	145	41.394683	-98.162717	297
96532	A	I	Merrick	350	30	6	20	41.196972	-97.9731	300
41484	A	I	Merrick	400	53	17	0	41.219599	-97.998111	308
129627	A	I	Fillmore	800	307	96	190	40.651307	-97.497589	313
7557	I	I	York	0	77	38	60	40.745375	-97.568575	322
13206	A	I	Merrick	700	40	10	32	41.202552	-97.979393	322
67521	A	I	Garfield	900	240	72	92	42.040275	-98.829304	327
55702	A	I	Jefferson	800	164	106	135	40.162662	-97.022663	329
8274	I	I	Hamilton	0	135	68	118	41.055131	-97.846089	330
17548	A	I	Merrick	500	26	6	20	41.197285	-97.973157	338
59843	A	I	York	600	120	72	94	40.879742	-97.686928	345
46684	A	I	Hamilton	1,200	390	107	160	41.082942	-97.871089	346
14699	A	I	Merrick	500	86	26	70	41.223278	-97.998126	347
126306	A	S	Wheeler	15	164	90	100	41.836026	-98.67932	348
21920	A	I	Jefferson	0	154	58	94	40.251611	-97.100124	352
15580	A	I	Merrick	500	30	6	0	41.187209	-97.969544	353
40595	A	I	Holt	1,000	151	23	42	42.648384	-99.241	359
10134	A	I	York	730	120	73	93	40.910512	-97.71423	359
66596	A	I	Merrick	900	45	8	20	41.154786	-97.939553	360
34981	A	I	Rock	900	50	10	18	42.684789	-99.260517	363
60670	A	I	Fillmore	1,250	327	108	121	40.574897	-97.401514	364
46232	A	I	York	2,000	187	82	93	40.789058	-97.631594	366
19925	A	S	Nance	400	201	56	201	41.329499	-98.121407	369
60329	A	I	York	800	104	40	90	40.86161	-97.669294	370
185510	I	I	Wheeler	0	0	0	0	41.758438	-98.629327	374
189303	A	I	Jefferson	800	195	95	103	40.338694	-97.194111	376
191288	A	I	Jefferson	410	195	132	182	40.07725	-97.000583	377
78236	A	I	Merrick	450	43	10	40	41.229332	-98.004562	383
65531	A	I	Merrick	150	43	10	35	41.229332	-98.004562	383
170746	A	I	York	800	200	63	180	40.767427	-97.578302	385
9625	I	I	Fillmore	0	270	85	105	40.596847	-97.424461	388
207198	A	S	Keya Paha	5	77	7.8	8.5	42.863964	-99.403142	394
36154	A	I	Jefferson	900	230	93	115	40.268015	-97.114337	395
195968	I	S	Holt	0	76	14	15	42.4919	-99.156483	402
59101	A	I	Greeley	1,000	401	115	250	41.52936	-98.33212	405
4558	A	I	York	0	0	0	0	40.926759	-97.726128	408
114045	A	I	Merrick	800	60	7	35	41.121462	-97.904294	412
209729	A	I	Jefferson	666	155	120	131	40.193781	-97.043622	412
37499	A	I	York	750	140	80	120	40.827421	-97.649384	423
72839	A	I	York	1,000	169	90	125	40.791897	-97.632958	429
88806	A	D	York	12	147	115	135	40.713447	-97.542324	430
168867	A	I	Merrick	650	50	7	40	41.142758	-97.924886	431
66636	A	I	Fillmore	1,250	352	84	100	40.584234	-97.40888	441
208566	A	I	Jefferson	800	180	97	104	40.157194	-97.015556	445
16448	A	I	York	1,200	201	88	103	40.958638	-97.754843	448
179946	A	S	Keya Paha	10	40	10	20	42.921333	-99.4618	450
207098	A	D	York	20	165	80	80	40.73655	-97.5601	466
197028	I	S	Fillmore	0	188	70	0	40.538861	-97.371111	466
197027	A	S	Fillmore	24	186	74	76	40.538806	-97.371028	470
50172	A	I	York	1,200	208	100	130	40.951865	-97.750022	473
117842	A	I	Merrick	600	30	4	20	41.186605	-97.969539	475
20672	A	I	Hamilton	700	158	89	140	41.068321	-97.856647	478
172076	A	D	Saline	3	134	35	125	40.434388	-97.281194	479
67130	A	I	Merrick	1,350	60	10	25	41.166087	-97.948617	486
213134	A	I	Jefferson	800	241	99	106	40.146333	-97.009611	490
80753	A	I	Saline	1,200	136	71	0	40.360766	-97.21227	492
72159	A	I	York	1,050	143	52	68	41.030096	-97.824589	498
27093	A	I	York	1,000	182	107	122	40.817436	-97.649282	499

Appendix C. (cont.)

NEDNR ID Number	Status	Use ID	County	Pumping Rate (gpm)	Total Depth (ft bgs)	Static Water Level (ft bgs)	Pumping Water Level (ft bgs)	Latitude (dec. degrees)	Longitude (dec. degrees)	Distance to Pipeline (ft)
46890	A	I	York	550	78	25	62	40.856014	-97.665626	500
31257	A	I	Fillmore	1,350	280	90	120	40.665381	-97.507089	502
57179	A	I	York	800	128	76	86	40.837971	-97.657439	504
46078	A	I	Wheeler	1,250	210	28	39	41.902624	-98.717518	505
33373	A	I	York	1,300	217	77	86	40.937682	-97.738208	512
172023	I	I	Merrick	0	41	0	0	41.2118	-97.987883	515
173595	A	S	Greeley	5	139	70	70	41.718472	-98.590278	520
26649	A	I	Merrick	400	72	21	50	41.223072	-98.001906	524
179163	A	D	Nance	35	63	15	50	41.279694	-98.0795	524
100946	A	I	York	400	103	60	90	40.886685	-97.687359	529
11188	A	I	York	1,050	108	57	92	40.872361	-97.683119	534
181346	A	I	Fillmore	800	311	99	200	40.611706	-97.44922	539
128865	A	D	Saline	10	105	23	50	40.474502	-97.311259	547
165913	I	D	Jefferson	0	85	31	58	40.131139	-97.003697	551
15735	A	I	York	1,000	202	92	109	40.970382	-97.764578	560
68268	A	I	Holt	400	117	7	14	42.485525	-99.156602	563
181917	A	I	York	1,000	108	73	85	40.912297	-97.716756	563
109111	A	S	Greeley	15	200	85	100	41.52717	-98.328508	565
76938	A	I	York	1,000	185	89	114	40.794511	-97.637974	568
98761	A	D	Merrick	20	53	10	12	41.176942	-97.956508	570
145277	A	I	Merrick	0	72	0	0	41.221082	-98.00011	573
132571	I	I	Merrick	300	33	8	0	41.19385	-97.969883	574
29115	A	I	York	1,200	201	91	105	40.952681	-97.75488	574
37501	A	I	York	1,005	141	80	100	40.829765	-97.652756	575
174508	A	I	Nance	250	63	10	55	41.285417	-98.081528	577
172943	A	I	Jefferson	500	222	141	200	40.077389	-97.004	580
16987	A	I	York	750	83	35	54	40.862631	-97.674058	588
201276	A	D	York	10	154	82	85	40.793642	-97.636444	591
57181	A	I	York	485	130	79	125	40.837992	-97.662211	606
200555	A	S	Holt	10	76	7	8	42.620333	-99.22545	608
133223	A	I	Hamilton	1,400	260	82	116	41.046674	-97.842294	613
183184	A	I	Merrick	500	65	31	42	41.263889	-98.0475	615
32682	A	I	Saline	600	140	99	120	40.379233	-97.220457	616
8281	A	I	Merrick	750	52	5	20	41.147731	-97.933314	617
208652	A	S	Holt	5	155	25	42	42.167694	-98.9595	618
17698	A	I	Merrick	800	39	9	39	41.21265	-97.98294	618
60476	A	I	Hamilton	600	150	25	38	41.100911	-97.90004	619
6959	A	I	Merrick	700	0	0	0	41.176399	-97.960809	630
59912	A	I	York	680	104	42	90	40.859781	-97.666821	632
104551	I	D	York	0	110	70	100	40.888813	-97.687748	632
54013	A	I	Merrick	1,000	50	10	0	41.172909	-97.958711	634
22007	A	I	Hamilton	800	215	90	140	41.091852	-97.885494	638
80261	A	I	Merrick	500	55	12	30	41.225819	-98.006031	639
84203	A	I	Merrick	950	48	0	0	41.172769	-97.958624	640
74891	A	I	Holt	900	199	25	42	42.157126	-98.947709	642
51254	I	I	York	0	214	26	62	40.749261	-97.566547	646
172813	A	I	Jefferson	700	257	114	150	40.287931	-97.137306	647
108512	A	I	York	600	110	73	100	40.882226	-97.689161	648
152485	A	D	Jefferson	12	180	97	105	40.320694	-97.170504	648
51045	A	I	Merrick	400	58	6	47	41.227823	-98.002126	654
146020	A	D	Saline	15	124	34	80	40.394	-97.231333	656
166806	A	I	Merrick	850	50	9	35	41.172778	-97.95875	668
37674	I	I	Fillmore	1,200	304	92	127	40.600512	-97.425293	669
34376	A	I	Merrick	600	40	7	40	41.200685	-97.979564	673
14701	A	I	Merrick	500	55	11	40	41.223944	-97.997241	688
51761	A	I	York	1,000	248	88	132	40.824358	-97.654764	689
183177	A	I	Jefferson	700	220	62	77	40.258889	-97.105028	692
78615	A	I	York	450	130	85	110	40.905576	-97.709669	693
37347	A	I	Jefferson	1,200	220	106	115	40.306886	-97.151301	693
72588	A	I	Fillmore	1,200	143	13	26	40.549914	-97.376283	696

Appendix C. (cont.)

NEDNR ID Number	Status	Use ID	County	Pumping Rate (gpm)	Total Depth (ft bgs)	Static Water Level (ft bgs)	Pumping Water Level (ft bgs)	Latitude (dec. degrees)	Longitude (dec. degrees)	Distance to Pipeline (ft)
81435	A	I	York	1,200	161	75	96	40.796809	-97.639924	699
57345	A	I	Merrick	500	62	12	40	41.234864	-98.008125	704
105347	A	S	Holt	10	40	10	20	42.187117	-98.976777	704
27735	A	I	Fillmore	1,250	292	123	142	40.629613	-97.487853	705
12319	A	I	Merrick	1,000	56	8	45	41.136939	-97.916997	706
5292	A	I	Hamilton	850	0	0	0	41.067989	-97.861465	708
41120	A	I	York	1,000	208	85	120	41.035553	-97.82395	710
170166	A	I	Saline	1,250	135	59	69	40.350066	-97.193235	710
12812	A	I	Merrick	450	40	13	30	41.237621	-98.014481	713
70184	A	I	Merrick	1,000	65	6	36	41.126332	-97.913663	717
15136	A	I	Merrick	350	41	20	35	41.217856	-97.998161	734
8181	A	I	York	1,100	260	78	96	40.9413	-97.745369	736
175316	A	I	Jefferson	1,000	248	119	126	40.295168	-97.146672	738
98857	A	S	Holt	10	117	24	25	42.249583	-99.009571	746
182926	A	D	York	49	175	87	110	40.992002	-97.779245	747
17697	A	I	Merrick	680	40	14	40	41.20574	-97.977155	753
13394	A	I	Hamilton	1,000	198	91	120	41.077731	-97.861669	756
167639	I	D	Jefferson	15	200	90	130	40.305444	-97.157083	758
19318	I	I	Fillmore	0	260	87	105	40.578881	-97.404526	759
37574	A	I	Nance	300	68	12	64	41.279466	-98.081244	766
204794	A	S	Greeley	15	280	160	160	41.624444	-98.459167	767
76357	A	I	York	1,000	221	85	100	40.948508	-97.745357	769
122010	A	I	York	1,200	255	85	130	40.700743	-97.532217	775
127939	A	I	Merrick	100	50	12	45	41.216518	-97.987868	776
176426	I	I	Jefferson	0	192	120	185	40.081972	-96.999056	780
22998	A	I	Fillmore	1,050	280	78	92	40.618624	-97.463546	795
153838	A	I	York	1,200	120	23	80	40.922806	-97.720778	795
9905	A	I	York	1,000	218	91	125	40.99332	-97.779244	799
76336	A	I	Merrick	450	40	7	28	41.23625	-98.00815	807
210817	I	S	Merrick	0	92	45	0	41.260683	-98.050933	807
72164	A	I	Merrick	300	45	9	35	41.218231	-97.99025	809
15579	A	I	Merrick	500	28	6	0	41.185784	-97.963136	820
45628	A	I	York	1,000	207	25	51	40.753378	-97.572083	822
58027	A	I	Saline	1,250	160	102	112	40.368046	-97.221699	824
30499	A	I	York	1,200	210	78	89	40.941354	-97.736464	830
201131	A	D	Jefferson	20	200	89	175	40.336	-97.189639	830
19317	A	I	Fillmore	1,500	100	12	25	40.549861	-97.3819	834
82418	A	I	York	300	120	80	95	40.890141	-97.697003	839
128998	A	I	York	1,200	200	80	118	41.01754	-97.803193	840
147500	A	I	Merrick	800	52	10	40	41.267902	-98.064251	843
52629	A	I	Jefferson	800	163	128	145	40.184996	-97.043768	844
7636	A	O	Fillmore	1,000	297	102	140	40.629756	-97.482016	850
38443	A	I	Hamilton	1,250	412	105	127	41.089979	-97.875887	854
61802	A	I	Holt	600	80	5	8	42.510782	-99.171834	866
12239	A	I	York	1,100	186	82	88	40.948477	-97.753061	869
27273	A	I	York	550	100	0	85	40.895989	-97.702259	870
8046	A	I	York	1,002	192	83	113	40.961298	-97.762129	871
49083	A	I	York	1,200	199	29	60	40.751089	-97.565911	871
61349	A	I	Fillmore	1,250	283	121	142	40.578755	-97.411259	875
14460	A	I	York	360	99	68	88	40.895189	-97.693976	876
9552	A	I	York	575	138	75	130	40.845239	-97.66699	877
194508	A	I	Jefferson	800	250	116	121	40.295194	-97.1375	877
146382	I	S	Rock	0	30	7	10	42.69265	-99.258033	880
106294	I	I	Jefferson	400	240	120	240	40.171711	-97.025042	885
162318	A	D	Nance	20	133	20	55	41.445556	-98.221389	887
75706	A	I	York	150	110	65	105	40.892331	-97.690449	892
59270	A	I	York	700	130	40	60	40.776439	-97.590045	894
174510	I	I	Nance	0	62	10	58	41.284917	-98.079472	900
41912	A	I	Holt	900	117	14	27	42.496036	-99.15695	900
187821	A	D	Fillmore	20	285	116	126	40.6245	-97.464389	905

Appendix C. (cont.)

NEDNR ID Number	Status	Use ID	County	Pumping Rate (gpm)	Total Depth (ft bgs)	Static Water Level (ft bgs)	Pumping Water Level (ft bgs)	Latitude (dec. degrees)	Longitude (dec. degrees)	Distance to Pipeline (ft)
62852	A	I	Fillmore	1,250	290	152	175	40.624152	-97.485462	907
76951	A	I	York	1,000	208	74	87	41.012082	-97.795914	909
79323	A	I	York	1,300	260	26	61	40.745587	-97.563979	910
80857	A	I	Jefferson	1,200	172	95	108	40.149903	-97.015475	912
153063	A	S	Holt	10	75	9	10	42.482445	-99.156559	918
34269	A	I	York	1,300	192	87	94	40.779972	-97.606971	926
161323	A	S	Nance	13	285	170	200	41.39	-98.157222	933
169829	A	I	Fillmore	800	300	92	200	40.658623	-97.497581	936
5293	A	I	Hamilton	1,100	327	87	120	41.066814	-97.861467	938
34815	A	I	Jefferson	900	168	136	150	40.197052	-97.054071	940
168868	A	I	Merrick	700	55	8	45	41.135431	-97.924208	947
52506	A	I	Merrick	420	46	21	42	41.215137	-97.98485	949
22439	A	I	Merrick	550	34	8	32	41.177912	-97.963401	949
6469	A	I	York	800	70	24	40	40.760133	-97.567597	951
172021	A	I	Merrick	150	24	0	0	41.204417	-97.983167	960
168882	A	I	Fillmore	1,200	287	143	167	40.622421	-97.478391	971
189085	A	I	Jefferson	775	204	124	180	40.171722	-97.034056	974
34611	A	I	Merrick	900	42	4	35	41.245785	-98.016715	977
156066	A	I	York	650	312	102	180	40.71379	-97.540391	980
197470	A	O	York	23	120	55	65	40.889956	-97.697486	987
127041	A	I	York	700	97	53	94	40.882932	-97.683233	991
115595	A	S	Holt	8	83	2	3	42.413603	-99.109327	992
101637	A	I	York	500	120	70	96	40.885251	-97.692602	993

Note: Data from Nebraska Department of Natural Resources (NEDNR) searchable database: http://dnrdata.dnr.ne.gov/wellscs/Menu.aspx

bgs - below ground surface

Status Codes:

A - active
- inactive

Use ID Codes:

D - domestic
I - irrigation
O - other
S - livestock