Nebraska Department
of Environmental Quality

NEBRASKA'S Keystone XL Pipeline Evaluation

NEBRASKA'S KEYSTONE XL PIPELINE EVALUATION

FINAL EVALUATION REPORT

VOLUME TWO | Appendix A, C, D, F, and G

January 2013

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Appendix A

Project-Related Nebraska Legislative Bills

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Nebraska Legislative Bill 4

LEGISLATURE OF NEBRASKA

ONE HUNDRED SECOND LEGISLATURE

FIRST SPECIAL SESSION

LEGISLATIVE BILL 4

Final Reading

Introduced by Langemeier, 23; Haar, 21.

Read first time November 02, 2011

Committee: Natural Resources

A BILL

FOR AN ACT relating to oil pipelines; to amend sections 73-307, 73-507, and 81-1701, Reissue Revised Statutes of Nebraska; to state findings and intent; to provide powers and duties for the Department of Environmental Quality and the Governor relating to supplemental environmental impact statements; to provide for applicability of statutes; to harmonize provisions; to repeal the original sections; and to declare an emergency.

Be it enacted by the people of the State of Nebraska,

Section 1. The Legislature finds that:

(1) The State of Nebraska is responsible for protecting its natural resources, agricultural resources, aesthetics, economy, and communities through reasonable regulation for the common good and welfare. As such, the state is responsible for ensuring that an oil pipeline proposed to be located within, through, or across Nebraska is in compliance with all state laws, rules, and regulations relating to water, air, and wildlife under the Constitution of Nebraska and state law;

(2) Public policy should reflect this responsibility while simultaneously recognizing the necessity for energy use and the economic benefits to Nebraska of transporting oil within, through, or across the state, the need for economic development in Nebraska, and the opportunities for jobs and revenue that new development brings to the state;

(3) The United States has the important ability to work with foreign suppliers of crude oil to meet our overall energy needs and to further our national security interests; and

(4) The economic benefits of oil pipeline construction projects are important to the state, including the creation of jobs. Nevertheless, the benefits of any proposed oil pipeline project must be weighed against any concerns brought by the residents of Nebraska.

Sec. 2. For purposes of sections 1 to 3 of this act:

(1) Department means the Department of Environmental Quality;

(2) Oil pipeline means a pipeline which is larger than eight inches in inside diameter and which is constructed in Nebraska for the transportation of petroleum, or petroleum components, products, or wastes, including crude oil or any fraction of crude oil, within, through, or across Nebraska, but does not include in-field and gathering lines; and

(3) Pipeline carrier means an individual, a company, a corporation, an association, or any other legal entity that engages in owning, operating, or managing an oil pipeline.

Sec. 3. (1) The department may collaborate with a federal agency or agencies in a review under the National Environmental Policy Act involving a supplemental environmental impact statement for oil pipeline projects within, through, or across the state. Prior to entering into such shared jurisdiction and authority with a federal agency or agencies, the department shall enter into a memorandum of understanding with such federal agency or agencies that sets forth the responsibilities and schedules that will lead to an effective and timely review under the National Environmental Policy Act involving a supplemental environmental impact statement.

(2) Since the objectives of the process are to ensure adequate information gathering, full and careful agency and public review, objective preparation of a supplemental environmental impact statement, adherence to a defined schedule, and an appropriate role for a pipeline carrier which avoids the appearance of conflicts of interest, it is the intent of the Legislature that the state fully

fund the process of preparation of a supplemental environmental impact statement and that no fees will be required of an applicant. The department may contract with outside vendors in the process of preparation of a supplemental environmental impact statement. The department shall make every reasonable effort to ensure that each vendor has no conflict of interest or relationship to any pipeline carrier that applies for an oil pipeline permit.

(3) In order for the process to be efficient and expeditious, the department's contracts with vendors pursuant to this section for a supplemental environmental impact statement shall not be subject to the Nebraska Consultants' Competitive Negotiation Act or sections 73-301 to 73-306 or 73-501 to 73-509.

(4) After the supplemental environmental impact statement is prepared, the department shall submit it to the Governor. Within thirty days after receipt of the supplemental environmental impact statement from the department, the Governor shall indicate, in writing, to the federal agency or agencies involved in the review as to whether he or she approves any of the routes reviewed in the supplemental environmental impact statement.

Sec. 4. Section 73-307, Reissue Revised Statutes of Nebraska, is amended to read:

73-307 Sections 73-301 to 73-306 shall not apply to the Nebraska Consultants' Competitive Negotiation Act or section 3 of this act.

Sections 73-301 to 73-306 shall not be construed to apply

to renewals of contracts already approved pursuant to or not subject to such sections, to amendments to such contracts, or to renewals of such amendments unless the amendments would directly cause or result in the replacement by the private entity of additional permanent state employees or positions greater than the replacement caused by the original contract.

Sec. 5. Section 73-507, Reissue Revised Statutes of Nebraska, is amended to read:

73-507 (1) Subject to review by the Director of Administrative Services, the materiel division shall provide procedures to grant limited exceptions from the provisions of sections 73-504, 73-508, and 73-509 for:

(a) Sole source and emergency contracts; and

(b) Other circumstances or specific contracts when any of the requirements of sections 73-504, 73-508, and 73-509 are not appropriate for or are not compatible with the circumstances or contract. The materiel division shall provide a written rationale which shall be kept on file when granting an exception under this subdivision.

(2) The following types of contracts for services are not subject to sections 73-504, 73-508, and 73-509:

(a) Contracts for services subject to the Nebraska Consultants' Competitive Negotiation Act;

(b) Contracts for services subject to federal law, regulation, or policy or state statute, under which a state agency is

required to use a different selection process or to contract with an identified contractor or type of contractor;

(c) Contracts for professional legal services and services of expert witnesses, hearing officers, or administrative law judges retained by state agencies for administrative or court proceedings;

(d) Contracts involving state or federal financial assistance passed through by a state agency to a political subdivision;

(e) Contracts with direct providers of medical, behavioral, or developmental health services, child care, or child welfare services to an individual;

(f) Agreements for services to be performed for a state agency by another state or local government agency or contracts made by a state agency with a local government agency for the direct provision of services to the public;

(g) Agreements for services between a state agency and the University of Nebraska, the Nebraska state colleges, the courts, the Legislature, or other officers or agencies established by the Constitution of Nebraska;

(h) Department of Insurance contracts for financial or actuarial examination, for rehabilitation, conservation, reorganization, or liquidation of licensees, and for professional services related to residual pools or excess funds under the agency's control;

(i) Department of Roads contracts for all road and bridge projects; ~~and~~

(j) Nebraska Investment Council contracts; and ~~.~~

(k) Contracts under section 3 of this act.

Sec. 6. Section 81-1701, Reissue Revised Statutes of Nebraska, is amended to read:

81-1701 The purpose of ~~sections 81-1701 to 81-1721~~ the Nebraska Consultants' Competitive Negotiation Act is to provide managerial control over competitive negotiations by the state for acquisition of professional architectural, engineering, landscape architecture, or land surveying services. The act does not apply to contracts under section 3 of this act.

Sec. 7. Original sections 73-307, 73-507, and 81-1701, Reissue Revised Statutes of Nebraska, are repealed.

Sec. 8. Since an emergency exists, this act takes effect when passed and approved according to law.

Appendix A.2

Nebraska Legislative Bill 1161

LEGISLATIVE BILL 1161

Approved by the Governor April 17, 2012

Introduced by Smith, 14.

FOR AN ACT relating to oil pipelines; to amend section 57-1101, Reissue Revised Statutes of Nebraska, as amended by section 1, Legislative Bill 1, One Hundred Second Legislature, First Special Session, 2011, sections 2, 3, 5, and 6, Legislative Bill 1, One Hundred Second Legislature, First Special Session, 2011, and section 3, Legislative Bill 4, One Hundred Second Legislature, First Special Session, 2011; to change provisions relating to eminent domain; to change provisions of the Major Oil Pipeline Siting Act; to provide, change, and eliminate provisions relating to the review and evaluation of oil pipeline routes; to harmonize provisions; to appropriate funds to aid in carrying out the provisions of Legislative Bill 1161, One Hundred Second Legislature, Second Session, 2012; to provide severability; to repeal the original sections; and to declare an emergency.

Be it enacted by the people of the State of Nebraska,

Section 1. Section 57-1101, Reissue Revised Statutes of Nebraska, as amended by section 1, Legislative Bill 1, One Hundred Second Legislature, First Special Session, 2011, is amended to read:

57-1101 Any person engaged in, and any company, corporation, or association formed or created for the purpose of, transporting or conveying crude oil, petroleum, gases, or other products thereof in interstate commerce through or across the State of Nebraska or intrastate within the State of Nebraska, and desiring or requiring a right-of-way or other interest in real estate and being unable to agree with the owner or lessee of any land, lot, right-of-way, or other property for the amount of compensation for the use and occupancy of so much of any lot, land, real estate, right-of-way, or other property as may be reasonably necessary for the laying, relaying, operation, and maintenance of any such pipeline or the location of any plant or equipment necessary to operate such pipeline, shall have the right to acquire the same for such purpose through the exercise of the power of eminent domain, except that for any major oil pipeline as defined in section 5 of this act to be placed in operation in the State of Nebraska after the effective date of this act, any such person, company, corporation, or association shall comply with section 3, Legislative Bill 4, One Hundred Second Legislature, First Special Session, 2011, as amended by the One Hundred Second Legislature, Second Session, 2012, and receive the approval of the Governor for the route of the pipeline under such section or shall apply for and receive an order approving the application under the Major Oil Pipeline Siting Act, prior to having the rights provided under this section. If condemnation procedures have not been commenced within two years after the date the Governor's approval is granted or after the date of receipt of an order approving an application under the Major Oil Pipeline Siting Act, the right under this section expires. The procedure to condemn property shall be exercised in the manner set forth in sections 76-704 to 76-724.

Sec. 2. Section 2, Legislative Bill 1, One Hundred Second Legislature, First Special Session, 2011, is amended to read:

Sec. 2. Sections 2 to 13 of this act and section 3 of this act shall be known and may be cited as the Major Oil Pipeline Siting Act.

Sec. 3. The commission shall not withhold any documents or records relating to a major oil pipeline from the public unless the documents or records are of the type that can be withheld under section 84-712.05 or unless federal law provides otherwise.

Sec. 4. Section 3, Legislative Bill 1, One Hundred Second Legislature, First Special Session, 2011, is amended to read:

Sec. 3. (1) The purposes of the Major Oil Pipeline Siting Act are to:

(a) Ensure the welfare of Nebraskans, including protection of property rights, aesthetic values, and economic interests;

(b) Consider the lawful protection of Nebraska's natural resources in determining the location of routes of major oil pipelines within Nebraska;

(c) Ensure that a major oil pipeline is not constructed within Nebraska without receiving the approval of the commission under section 9 of this act;

(d) Ensure that the location of routes for major oil pipelines is in compliance with Nebraska law; and

(e) Ensure that a coordinated and efficient method for the authorization of such construction is provided.

(2) Nothing in the Major Oil Pipeline Siting Act shall be construed to regulate any safety issue with respect to any aspect of any interstate oil pipeline. The Major Oil Pipeline Siting Act is intended to deal solely with the issue of siting or choosing the location of the route aside and apart from safety considerations. The Legislature acknowledges and respects the exclusive federal authority over safety issues established by the federal law, the Pipeline Safety Act of 1994, 49 U.S.C. 60101 et seq., and the express preemption provision stated in that act. The Major Oil Pipeline Siting Act is intended to exercise only the remaining sovereign powers and purposes of Nebraska which are not included in the category of safety regulation.

~~(3) The Major Oil Pipeline Siting Act shall not apply to any major oil pipeline that has submitted an application to the United States Department of State pursuant to Executive Order 13337 prior to the effective date of this act.~~

Sec. 5. Section 5, Legislative Bill 1, One Hundred Second Legislature, First Special Session, 2011, is amended to read:

Sec. 5. For purposes of the Major Oil Pipeline Siting Act:

(1) Commission means the Public Service Commission;

(2) Major oil pipeline means a pipeline which is larger than six inches in inside diameter and which is constructed in Nebraska for the transportation of petroleum, or petroleum components, products, or wastes, including crude oil or any fraction of crude oil, within, through, or across Nebraska, but does not include in-field and gathering lines; ~~or major oil pipelines exempt under subsection (3) of section 3 of this act;~~ and

(3) Pipeline carrier means a person that engages in owning, operating, or managing a major oil pipeline.

Sec. 6. Section 6, Legislative Bill 1, One Hundred Second Legislature, First Special Session, 2011, is amended to read:

Sec. 6. (1) ~~Unless exempt pursuant to section 3 of this act,~~ If a pipeline carrier ~~proposing~~ proposes to construct a major oil pipeline to be placed in operation in Nebraska after the effective date of this act and the pipeline carrier has submitted a route for an oil pipeline within, through, or across Nebraska but the route is not approved by the Governor pursuant to section 3, Legislative Bill 4, One Hundred Second Legislature, First Special Session, 2011, as amended by the One Hundred Second Legislature, Second Session, 2012, the pipeline carrier shall file an application with the commission and receive approval pursuant to section 9 of this act prior to beginning construction of the major oil pipeline within Nebraska. ~~A~~ If a pipeline carrier ~~proposing~~ proposes a substantive change to the route of a major oil pipeline and the pipeline carrier has submitted a route for an oil pipeline within, through, or across Nebraska but the route is not approved by the Governor pursuant to section 3, Legislative Bill 4, One Hundred Second Legislature, First Special Session, 2011, as amended by the One Hundred Second Legislature, Second Session, 2012, the pipeline carrier shall file an application for the proposed change with the commission and receive approval pursuant to section 9 of this act prior to beginning construction relating to the proposed change. The applicant shall also file a copy of the application with the agencies listed in subsection (3) of section 8 of this act.

(2) The application shall be accompanied by written agreement to pay expenses assessed pursuant to section 7 of this act and written testimony and exhibits in support of the application. The application shall include:

(a) The name and address of the pipeline carrier;

(b) A description of the nature and proposed route of the major oil pipeline and evidence of consideration of alternative routes;

(c) A statement of the reasons for the selection of the proposed route of the major oil pipeline;

(d) A list of the governing bodies of the counties and municipalities through which the proposed route of the major oil pipeline would be located;

(e) A description of the product or material to be transported through the major oil pipeline;

(f) The person who will own the major oil pipeline;

(g) The person who will manage the major oil pipeline;

(h) A plan to comply with the Oil Pipeline Reclamation Act; and

(i) A list of planned methods to minimize or mitigate the potential impacts of the major oil pipeline to land areas and connected natural resources other than with respect to oil spills.

(3) The applicant shall publish notice of the application in at least one newspaper of general circulation in each county in which the major oil pipeline is to be constructed and forward a copy of such notice to the

commission. The applicant shall serve notice of the application upon the governing bodies of the counties and municipalities specified pursuant to subdivision (2)(d) of this section.

Sec. 7. Section 3, Legislative Bill 4, One Hundred Second Legislature, First Special Session, 2011, is amended to read:

Sec. 3. (1)(a) The department may:

(i) Evaluate any route for an oil pipeline within, through, or across the state and submitted by a pipeline carrier for the stated purpose of being included in a federal agency's or agencies' National Environmental Policy Act review process. Any such evaluation shall include at least one public hearing, provide opportunities for public review and comment, and include, but not be limited to, an analysis of the environmental, economic, social, and other impacts associated with the proposed route and route alternatives in Nebraska. The department may collaborate with a federal agency or agencies and set forth the responsibilities and schedules that will lead to an effective and timely evaluation; or

~~collaborate~~ (ii) Collaborate with a federal agency or agencies in a review under the National Environmental Policy Act involving a supplemental environmental impact statement for oil pipeline projects within, through, or across the state. Prior to entering into such shared jurisdiction and authority, the department shall collaborate with such agencies to set forth responsibilities and schedules for an effective and timely review process.

~~Prior to entering into such shared jurisdiction and authority with a federal agency or agencies, the department shall enter into a memorandum of understanding with such federal agency or agencies that sets forth the responsibilities and schedules that will lead to an effective and timely review under the National Environmental Policy Act involving a supplemental environmental impact statement.~~

(b) A pipeline carrier that has submitted a route for evaluation or review pursuant to subdivision (1)(a) of this section shall reimburse the department for the cost of the evaluation or review within sixty days after notification from the department of the cost. The department shall remit any reimbursement to the State Treasurer for credit to the Department of Environmental Quality Cash Fund.

(2) ~~Since the objectives of the process are to ensure adequate information gathering, full and careful agency and public review, objective preparation of a supplemental environmental impact statement, adherence to a defined schedule, and an appropriate role for a pipeline carrier which avoids the appearance of conflicts of interest, it is the intent of the Legislature that the state fully fund the process of preparation of a supplemental environmental impact statement and that no fees will be required of an applicant.~~ The department may contract with outside vendors in the process of preparation of a supplemental environmental impact statement or an evaluation conducted under subdivision (1)(a) of this section. The department shall make every reasonable effort to ensure that each vendor has no conflict of interest or relationship to any pipeline carrier that applies for an oil pipeline permit.

(3) In order for the process to be efficient and expeditious, the department's contracts with vendors pursuant to this section for a supplemental environmental impact statement or an evaluation conducted under subdivision (1)(a) of this section shall not be subject to the Nebraska Consultants' Competitive Negotiation Act or sections 73-301 to 73-306 or 73-501 to 73-509.

(4) After the supplemental environmental impact statement or the evaluation conducted under subdivision (1)(a) of this section is prepared, the department shall submit it to the Governor. Within thirty days after receipt of the supplemental environmental impact statement or the evaluation conducted under subdivision (1)(a) of this section from the department, the Governor shall indicate, in writing, to the federal agency or agencies involved in the review or any other appropriate federal agency or body as to whether he or she approves any of the routes reviewed in the supplemental environmental impact statement or the evaluation conducted under subdivision (1)(a) of this section. If the Governor does not approve any of the reviewed routes, he or she shall notify the pipeline carrier that in order to obtain approval of a route in Nebraska the pipeline carrier is required to file an application with the Public Service Commission pursuant to the Major Oil Pipeline Siting Act.

(5) The department shall not withhold any documents or records relating to an oil pipeline from the public unless the documents or records are of the type that can be withheld under section 84-712.05 or unless federal law provides otherwise.

Sec. 8. There is hereby appropriated (1) $2,000,000 from the Department of Environmental Quality Cash Fund for FY2012-13 and (2) $-0-

from the Department of Environmental Quality Cash Fund for FY2013-14 to the Department of Environmental Quality, for Program 513, to aid in carrying out the provisions of Legislative Bill 1161, One Hundred Second Legislature, Second Session, 2012.

Sec. 9. If any section in this act or any part of any section is declared invalid or unconstitutional, the declaration shall not affect the validity or constitutionality of the remaining portions.

Sec. 10. Original section 57-1101, Reissue Revised Statutes of Nebraska, as amended by section 1, Legislative Bill 1, One Hundred Second Legislature, First Special Session, 2011, sections 2, 3, 5, and 6, Legislative Bill 1, One Hundred Second Legislature, First Special Session, 2011, and section 3, Legislative Bill 4, One Hundred Second Legislature, First Special Session, 2011, are repealed.

Sec. 11. Since an emergency exists, this act takes effect when passed and approved according to law.

Appendix A.3

Nebraska Legislative Bill 845

LEGISLATIVE BILL 845

Approved by the Governor April 6, 2012

Introduced by Sullivan, 41; Dubas, 34.

FOR AN ACT relating to the Oil Pipeline Reclamation Act; to amend sections 76-3301, 76-3303, and 76-3304, Revised Statutes Supplement, 2011; to state intent; to provide requirements for reclamation; to harmonize provisions; to repeal the original sections; and to declare an emergency.

Be it enacted by the people of the State of Nebraska,

Section 1. Section 76-3301, Revised Statutes Supplement, 2011, is amended to read:

76-3301 Sections 76-3301 to 76-3306 and sections 4 and 5 of this act shall be known and may be cited as the Oil Pipeline Reclamation Act.

Sec. 2. Section 76-3303, Revised Statutes Supplement, 2011, is amended to read:

76-3303 (1) The purpose of the Oil Pipeline Reclamation Act is to ensure that a pipeline carrier which owns, constructs, operates, or manages a pipeline through this state for the transportation of oil is financially responsible for reclamation costs relating to the construction, operation, and management of the pipeline in this state as prescribed in the act.

(2) It is the intent of the Legislature that proper reclamation is accomplished as part of the oil pipeline construction process, including restoration of areas through which a pipeline is constructed as close as reasonably practicable to the condition, contour, and vegetation that existed prior to construction, including stabilizing disturbed areas, establishing a diverse plant environment of native grasses and forbs to create a safe and stable landscape, restoring active cropland to its previous productive capability, mitigating noxious weeds, and managing invasive plants, unless otherwise agreed to by the landowner.

Sec. 3. Section 76-3304, Revised Statutes Supplement, 2011, is amended to read:

76-3304 (1) A pipeline carrier owning, operating, or managing a pipeline or part of a pipeline for the transportation of oil in this state shall be responsible for all reclamation costs necessary as a result of constructing the pipeline as well as reclamation costs resulting from operating the pipeline, except to the extent another party is determined to be responsible.

(2) The pipeline carrier shall commence reclamation of the area through which a pipeline is constructed as soon as reasonably practicable after backfill as provided in sections 4 and 5 of this act.

(3) A pipeline carrier's obligation for reclamation and maintenance of the pipeline right-of-way shall continue until the pipeline is permanently decommissioned or removed.

Sec. 4. A pipeline carrier shall complete final grading, topsoil replacement, installation of erosion control structures, seeding, and mulching within thirty days after backfill except when weather conditions, extenuating circumstances, or unforeseen developments do not permit the work to be done within such thirty-day period.

Sec. 5. (1) A pipeline carrier shall ensure that all reclamation, including, but not limited to, choice of seed mixes, method of reseeding, and weed and erosion control measures and monitoring, is conducted in accordance with the Federal Seed Act, 7 U.S.C. 1551 et seq., the Nebraska Seed Law, and the Noxious Weed Control Act.

(2) A pipeline carrier shall ensure that genetically appropriate and locally adapted native plant materials and seeds are used based on site characteristics and surrounding vegetation as determined by a preconstruction site inventory.

(3) A pipeline carrier shall ensure that mulch is installed as required by site contours, seeding methods, or weather conditions or when requested by a landowner.

Sec. 6. Original sections 76-3301, 76-3303, and 76-3304, Revised Statutes Supplement, 2011, are repealed.

Sec. 7. Since an emergency exists, this act takes effect when passed and approved according to law.

Appendix A.4

Memorandum of Understanding between U.S. Department of State and Nebraska Department of Environmental Quality

MEMORANDUM OF UNDERSTANDING

Between

U.S. DEPARTMENT OF STATE, and

The NEBRASKA DEPARTMENT OF ENVIRONMENTAL QUALITY,

FOR CONDUCTING AN ENVIRONMENTAL REVIEW

FOR THE KEYSTONE XL PIPELINE PROJECT

This **Memorandum of Understanding (MOU)** is hereby entered into by and between the United States (U.S.) Department of State, hereinafter referred to as the "State Department" and the Nebraska Department of Environmental Quality, hereinafter referred to as the "DEQ."

I. Background

TransCanada Keystone Pipeline, L.P. (Keystone) proposes to construct, operate, and maintain a crude oil pipeline and ancillary facilities, referred to as the Keystone XL Pipeline Project, hereinafter referred to as the "Project." The Project would include construction of a new pipeline between a point east of Morgan, Montana southeast to an existing tank farm near Steele City, Nebraska.

Keystone has proposed several potential routes for the Project within Nebraska in order to avoid impacting the sensitive environmental resources in the Sandhills of Nebraska. Those routes will be evaluated by both the State Department and the DEQ.

The participants to this MOU are the State Department and DEQ, collectively referred to as "the Participants."

Further details about the Project are contained in Keystone's application to the State Department, filed on May 4, 2012, for a Presidential Permit to cross the U.S./Canada international border and associated environmental documents prepared by the State Department.

The State Department has jurisdiction for authorizing presidential permits for the crossing of the U.S. international border pursuant to Executive Order 11423, 33 Federal Register 11714 (August 16, 1968), as amended, and Executive Order 13337, 69 Federal Register 25229 (April 30, 2004), as amended. The State Department conducts an environmental review consistent with National Environmental Policy Act (NEPA), 42 USCA 4321 et. seq., the National Historical Preservation Act (NHPA), 16 USC 470 et. seq.) and other relevant statutes. DEQ has the authority and general jurisdiction for the administration and enforcement of environmental laws in the State of Nebraska pursuant to Neb. Rev. Stat. 81-1504.

The Nebraska Legislature enacted Legislative Bill 4 (LB 4) in November 2011 and as amended by LB 1161 in April 2012 that authorized the DEQ to collaborate with the State Department on an environmental review for oil pipeline projects within, through or across the State, including the Project, and to enter into a MOU with the State Department that sets forth the responsibilities and schedules that will lead to an effective and timely review of the environmental document under NEPA. DEQ has selected and contracted with HDR Engineering, Inc. (HDR) to assist in preparation of an environmental review and

DEQ will direct and pay for HDR's activities as necessary to comply with LB 4.

Nothing in this MOU alters, extends or supersedes the authorities and responsibilities of either of the Participants beyond that which exists under current laws and regulations on any matter under their respective jurisdictions.

II. Purpose

The purpose of this MOU is to document consensus among the Participants regarding relative roles, responsibilities, and procedures to be followed in conducting an environmental review of the Project. A primary purpose of this MOU is to ensure that the environmental review is thorough, efficient, and adequate and that it satisfies all environmental compliance requirements of the lead and cooperating agencies.

The MOU is meant to provide a framework for cooperation between the State Department and DEQ to work together in preparing and completing in a timely manner, a collaborative environmental analysis of routes within Nebraska that is consistent with NEPA, the NHPA, and all other relevant laws, executive orders, regulations, directives and guidelines.

Specifically, the purposes are to acknowledge and affirm:

- the Participants' joint collaboration on the conduct of an environmental review of potential routes for the Project within, through, or across a portion of the State of Nebraska.
- the DEQ as a cooperating agency in the environmental review process.
- that the State Department has the decision-making authority for the final cross-border permitting decision and primary responsibility for conducting an environmental review consistent with NEPA.
- the commitment of the Participants to seek agreement on key steps in the environmental review in order to avoid unnecessary duplication of effort and to expedite the process to the extent practicable.
- the commitment of the State Department to fully consider the views of the State of Nebraska in conducting its environmental review consistent with NEPA.
- the Participants' cooperation in a multi-stakeholder process in which they will collectively consult with and seek the involvement and participation of other interested persons or entities.

III. Representatives

The Participants will designate a representative and backup representative for purposes of consultation under this MOU. State Department will designate a NEPA coordinator to oversee its independent third-party contractor. The DEQ will have primary authority to direct the activities of its own contractor, HDR in preparing documents consistent with Nebraska's environmental review of the Project. The Participants may change their representative(s) at any time.

IV. Roles and Responsibilities

A. State Department Responsibilities:

1. Serve as the lead agency for preparing the environmental documents consistent with NEPA.

2. Maintain the Administrative Record for the Project, protecting proprietary information and data collected by its independent third-party contractor and its sub-contractors. Any information furnished to the State Department under this MOU is subject to the Freedom of Information Act (5 U.S.C. 552).

3. Coordinate the exchange of information among the Participants and its own independent third-party contractor and subcontractors.

4. Provide DEQ 30 days to review documents produced consistent with the environmental review of the Project.

5. Cooperate in the development of a joint Public Participation Plan with DEQ.

6. Consult with DEQ to ensure information and analysis developed by DEQ's contractor is done consistent with NEPA, NHPA, and other relevant federal law and provide timely review and comments of DEQ-developed work products including communication and public participation plans, scoping summary, and DEQ-prepared documents.

7. Lead any Section 7, Endangered Species Act, consultation with the U.S. Department of the Interior, Fish and Wildlife Service (FWS), Grand Island, regarding the Project. Ensure the studies and surveys for the consultation are conducted in accordance with requirements of the cooperating agencies, and, if required, negotiate any terms and conditions between the FWS and Keystone.

8. Lead any additional consultation consistent with Section 106 of the NHPA with all State Historic Preservation Offices affected by the proposed routes, including Native American consultation, in accordance with the regulations at 36 CFR part 800 for cultural resources on Federal and private lands.

9. Consult with DEQ in formulating responses to any comments received relevant to both the Department's review and DEQ's review under Nebraska Law.

B. DEQ Responsibilities:

1. Serve as a cooperating agency for the State of Nebraska in preparing environmental review documents, including evaluation of environmental, economic, social, and other impacts associated with the proposed routes in Nebraska and compliance with Nebraska law.

2. Establish goals and a schedule for the State Department's concurrence.

3. Maintain any Administrative Records for the Project required by Nebraska law, and provide to the State Department copies of documents and correspondences for inclusion in the Federal Administrative Record of the preparation of the environmental review

documents and Record of Decision. Documents and correspondences not in the possession of the State Department might not be included in the final Administrative Record.

4. Oversee Nebraska's review of the Project in Nebraska.

5. Coordinate the exchange of information relevant to Nebraska's review, in Nebraska, including information and analysis produced by HDR under contract to DEQ, among the Participants.

6. In consultation with the State Department, ensure that HDR conducts and completes necessary field and literature studies, inventories, reports, consultations, and data collection for an analysis of impacts to natural and human resources, consistent with NEPA, NHPA, and other relevant federal laws.

7. Consult with the State Department prior to issuing task orders to HDR in order to ensure that its analysis of the routes in Nebraska are consistent with NEPA, NHPA, and other federal laws.

8. Consult with the State Department in formulating responses to any comments received relevant to both DEQ's review under Nebraska Law and the State Department's review.

9. Cooperate with the State Department in developing a comprehensive mailing list for distribution of information and documents relevant to the project review.

V. Administrative and Legal Provisions

A. Amendments

This MOU may be modified revised, or amended with the written consent of both the Participants.

B. Ceasing Cooperation

Either participant may cease its cooperation under this MOU by providing the other participants with a 30-day written notice of the participant's intent to cease cooperation under the MOU. During the 30-day period, the participants will enter negotiations to resolve the disagreement(s). If the disagreement(s) have not been resolved by the end of the 30-day period, the Participants who wished to cease cooperation under this MOU may do so. In the event negotiations are progressing but are not concluded by the end of the 30-day period, the participant initiating the notice may request that cooperation continue for an additional 30-day period.

C. Exchange of Information

Documents provided pursuant to this agreement may contain proprietary or business confidential information, tribal information, protected endangered species survey data, and/or pre-decisional information. Prior to furnishing documents, the Participants shall identify any proprietary and/or pre-decisional information that should be maintained as non-public . If the Participants are recipients of the documents, subject to the appropriate laws and regulations, they intend to use best efforts not to disclose the information. If DEQ is the intended recipient,

DEQ plans to conduct a review for non-public documents at either DEQ's office in Lincoln or State Department's office in Washington, DC. DEQ plans to identify the information it believes constitutes a trade secret that is entitled to confidentiality under the Nebraska Public Records Act, Neb. Rev. Stat. 84-712 et seq. The State Department acknowledges DEQ's need for timely communication of confidentiality claims, as defined under the Nebraska Public Records Act. Consistent with existing laws and regulations, all Participants intend to share all relevant information with each other and the public. Any information furnished to the State Department under this Memorandum of Understanding may be subject to the Freedom of Information Act (5 USC 552).

D. Third Party Beneficiary Rights

The Participants do not intend to create in any other individual or entity the status of third party beneficiary, and this MOU shall not be construed so as to create such status or any other legally enforceable rights or obligations. The provisions of this MOU are intended only to assist the Participants by providing a framework for cooperation between the Participants to work together in preparing and completing a collaborative environmental analysis of the Keystone XL Pipeline Project that is consistent with NEPA.

E. Administrative Considerations

The terms of this MOU shall not provide a basis for discrimination against any person based on race, creed, color, gender, sexual orientation, or national origin.

F. Legal Rights and Remedies

Nothing in this MOU shall be construed to alter the legal rights and remedies that each Participant would otherwise have. No Participant waives any legal rights or defenses by entering into this MOU or participating in the process contemplated hereby.

G. Immunity

The Participants do not waive any applicable immunities by entering into this MOU, and each fully retains all immunities and defenses provided by law with respect to any action based on or occurring as a result of this MOU.

VI. Contingent on Appropriation, Authorizations, or Allotment of Funds

This MOU sets forth the Participants' intent to cooperate in the environmental review of the Project. This MOU does not authorize the transfer of funds between Participants.

This MOU is not intended to, and does not create, any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity, by a party against the United States, its agencies, its officers, or any person.

Nothing in this MOU authorizes the expenditure of federal agency funds. The expenditure or advance of any money or the performance of any action by the United States under this MOU shall be contingent upon the appropriation or allotment of funds, and upon Congress making the necessary authorizations. No liability shall accrue to the United States in case funds are not appropriated or allocated, or authorizations not made.

VII. Effective Date

This MOU will become effective as soon as signed by both parties.

VIII. Contacts

Department of State

Primary POC:

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The Participants have signed this Memorandum of Understanding:

U.S. Department of State

George N. Sibley, Director
Office of Environmental Policy

May 24, 2012
Date

Nebraska Department of Environmental Quality

Michael J. Linder, Director

May 21 2012
Date

Appendix C

Mitigation Documents from Keystone

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Appendix C

Mitigation Documents from Keystone

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KEYSTONE XL PROJECT

CONSTRUCTION, MITIGATION, AND RECLAMATION PLAN

April 2012
Rev. 4

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1.0 INTRODUCTION

The construction, mitigation, and reclamation requirements described in this Plan apply to work on all of TransCanada Keystone Pipeline, L.P.'s (Keystone's) Keystone XL Project (Project) lands, including the following;

- uplands, including agricultural (cultivated or capable of being cultivated) lands, pasture lands; range lands; grass lands; forested lands; lands in residential, commercial, or industrial areas; lands in public rights of way; and lands in private rights-of-way;
- wetlands; and
- waterbodies and riparian areas.

Keystone, during the construction, operation, and maintenance of the Project, shall implement the construction, mitigation, and reclamation actions contained in this Plan to the extent that they do not conflict with the requirements of any applicable federal, state, or local rules and regulations, or other permits or approvals that are applicable to the Project. Additionally, Keystone may deviate from specific requirements of this Plan on specific private lands as agreed to by landowners or as required to suit actual site conditions as determined and directed by Keystone. All work must be in compliance with federal, state, and local permits.

The Project will be designed, constructed, operated and maintained in a manner that meets or exceeds applicable industry standards and regulatory requirements. Keystone's Integrity Management Plan and Emergency Response Plan outlines the preventative maintenance, inspection, line patrol, leak detection systems, SCADA, and other pipeline integrity management procedures to be implemented during operation of the Project.

2.0 GENERAL CONDITIONS

2.1 Training

Experienced, well-trained personnel are essential for the successful implementation of this Plan. Keystone and its Contractors shall undergo prevention and response, as well as safety training. The program shall be designed to improve awareness of safety requirements, pollution control laws and procedures, and proper operation and maintenance of equipment.

The construction contractor (Contractor), and all of his subcontractors shall ensure that persons engaged in Project construction are informed of the construction issues and concerns and that they attend and receive training regarding these requirements as well as all laws, rules and regulations applicable to the work. Prior to construction, all Project personnel will be trained on environmental permit requirements and environmental specifications, including fuel handling and storage, cultural resource protection methods, stream and wetland crossing requirements, and sensitive species protection measures.

Different levels of training shall be required for different groups of Contractor personnel. Contractor supervisors, managers, field foremen, and other Contractor personnel designated by Keystone shall attend a comprehensive environmental training session. All other Contractor personnel shall attend a training session before the beginning of construction and during construction as environmental issues and incidents warrant. Additional training sessions shall be held for newly assigned personnel prior to commencing work on the Project.

All Contractor personnel shall attend the training session prior to entering the construction right-of-way. All Contractor personnel shall sign an acknowledgement of having attended the appropriate level of training and shall display a hard hat sticker that signifies attendance at environmental training. In order to ensure successful compliance, Contractor personnel shall attend repeat or supplemental training if compliance is not satisfactory or as new, significant new issues arise.

All visitors and any other personnel without specific work assignments shall be required to attend a safety and environmental awareness orientation.

2.2 Environmental Inspection

Keystone will use Environmental Inspectors on each construction spread. The Environmental Inspectors will review the Project activities daily for compliance with state, federal and local regulatory requirements. The Environmental Inspectors will have the authority to stop specific tasks as approved by the Chief Inspector. They can also order corrective action in the event that construction activities violate the provisions of this Plan, landowner requirements, or any applicable permit requirements.

2.3 Advance Notice of Access to Property Prior to Construction

Prior to initially accessing landowners' property, Keystone shall provide the landowner or tenant with a minimum of 24 hours prior notice unless otherwise negotiated with the landowner and as described in the Project line list). Additionally, the landowner or tenant shall be provided with Keystone contact information. Landowners may utilize contact information to inform Keystone of any concerns related to construction.

Prior notice shall consist of a personal contact, a telephone contact, or delivery of written notice to the landowner to inform the landowner of whereby the landowner or tenant is informed of Keystone's intent to initially access the land. The landowner or tenant need not acknowledge receipt of written notice before Keystone can enter the landowner's property.

Keystone will coordinate with managers of public lands to reduce conflicts between construction activities and recreational uses. Keystone will consult with land managers on state and federal lands regarding any necessary construction and maintenance restrictions consistent with management and use of such lands. Damages from disruption of recreational uses of private lands will be the subject of compensation negotiations with individual landowners.

If pipeline activities occur during the winter season Keystone will consult with the appropriate regulatory agencies to establish the appropriate protective measures to avoid or mitigate wildlife seasonal, timing or migration concerns.

2.4 Other Notifications

The Contractor shall notify, in writing, both Keystone and the authority having jurisdiction over any road, railroad, canal, drainage ditch, river, foreign pipeline, or other utility to be crossed by the pipeline at least 48 hours (excluding Saturdays, Sundays, and statutory holidays), or as specified on the applicable permit(s), prior to commencement of pipeline construction, in order that the said authority may appoint an inspector to ensure that the crossing is constructed in a satisfactory manner.

The Contractor shall notify Keystone immediately of any spill of a potentially hazardous substance that creates a sheen on a wetland or waterbody, as well as any existing soil contamination discovered during construction.

The Contractor shall immediately notify Keystone of the discovery of previously unreported historic property, other significant cultural materials, or suspected human remains uncovered during pipeline construction.

The Contractor shall immediately notify Keystone of a Project-related injury to or mortality of a threatened or endangered animal.

2.5 Damages to Private Property

Pipeline construction activities shall be confined to the construction right-of-way, temporary work space, additional temporary work space, and approved access routes.

Keystone shall reasonably compensate landowners for any construction-related damages caused by Keystone which occur on or off of the established pipeline construction right-of-way.

Keystone shall reasonably compensate landowners for damages to private property caused by Keystone beyond the initial construction and reclamation of the pipeline, to include those damages caused by Keystone during future construction, operation, maintenance, and repairs relating to the pipeline.

2.6 Appearance of Worksite

The construction right-of-way shall be maintained in a clean, neat condition at all times. At no time shall litter be allowed to accumulate at any location on the construction right-of-way. The Contractor shall provide a daily garbage detail with each major construction crew to keep the construction right-of-way clear of trash, pipe banding and spacers, waste from coating products, welding rods, timber skids, defective materials and all construction and other debris immediately behind construction operations unless otherwise approved by Keystone. Paper from wrapping or coating products or lightweight items shall not be permitted to be scattered by the wind.

The traveled surfaces of roads, streets, highways, etc. (and railroads when applicable) shall be cleaned free of mud, dirt, or any debris deposited by equipment traversing these roads or exiting from the construction right-of-way.

2.7 Access

Prior to the pipeline's installation, Keystone and the landowner shall reach a mutually acceptable agreement on the route that shall be utilized by the Contractor for entering and exiting the pipeline construction right-of-way should access to the construction right-of-way not be practicable or feasible from adjacent segments of the pipeline construction right-of-way, public road, or railroad right-of-way.

All construction vehicles and equipment traffic shall be confined to the public roads, private roads acquired for use by Keystone, and the construction right-of-way. If temporary private access roads are constructed, they shall be designed to maintain proper drainage and shall be built to minimize soil erosion.

Sufficiently sized gaps shall be left in all spoil and topsoil wind rows and a hard or soft plug shall be left in the trench at all temporary private access roads and obvious livestock or wildlife trails unless the landowner agrees prior to construction that these access points can be blocked during construction.

All construction-related private roads and access points to the right-of-way shall be marked with signs. Any private roads not to be utilized during construction shall also be marked.

2.8 Aboveground Facilities

Locations for aboveground facilities shall be selected in a manner so as to be as unobtrusive as reasonably possible to ongoing agricultural or other landowner activities occurring on the lands adjacent to the facilities. If it is not feasible, to avoid interference, such activities shall be located so as to incur the least hindrance to the adjacent agricultural operations (i.e., located in field corners or areas where at least one side is not used for cropping purposes) provided the location is consistent with the design constraints of the pipeline. Aboveground facilities shall avoid floodplains and wetlands to the maximum extent possible. Additionally, they shall be located to avoid existing drain tile systems to the extent possible. To further reduce visual impacts from aboveground pipeline facilities and structures, Keystone will comply with standard industry painting practices with respect to aboveground facilities. Keystone will address any visual aesthetics issues with landowners in individual consultations.

2.9 Minimum Depth of Cover

The pipeline shall be installed so that the top of the pipe and coating is a minimum depth of 5 feet below the bottom of waterbodies including rivers, creeks, streams, ditches, and drains. This depth shall normally be maintained

over a distance of 15 feet on each side of the waterbody measured from the top of the defined stream channel. If concrete weights or concrete coated pipe is utilized for negative buoyancy of the pipeline, the minimum depth of cover shall be measured from the top of the concrete to the original ground contour. The following table indicates standard depths that would apply to pipeline construction.

Location	Normal Excavation (inches)	For Rock Excavation (inches
Most areas	48	36
All waterbodies	60	36
Dry creeks, ditches, drains, washes, gullies, etc.	60	36
Drainage ditches at public roads and railroads	60	48

Depth of cover requirements may be modified by Keystone based on site-specific conditions. However, all depths shall be in compliance with all established codes.

2.10 Non-Hazardous Waste Disposal

Non-hazardous pipeline construction wastes include human waste, trash, pipe banding and spacers, waste from coating products, welding rods, timber skids, cleared vegetation, stumps, and rock.

All waste which contains (or at any time contained) oil, grease, solvents, or other petroleum products falls within the scope of the oil and hazardous substances control, cleanup, and disposal procedures. This material shall be segregated for handling and disposal as hazardous wastes.

The Contractor shall be responsible for ensuring that human wastes are handled and disposed of exclusively by means of portable, self-contained toilets during all construction operations. Wastes from these units shall be collected by a licensed contractor for disposal only at licensed and approved facilities.

The Contractor shall remove all trash from the construction right-of-way on a daily basis unless otherwise approved or directed by Keystone.

The Contractor shall dispose of HDD drill cuttings and drilling mud at a Keystone-approved location. Disposal options may include spreading over the construction right-of-way in an upland location approved by Keystone, or hauling to an approved licensed landfill or other site approved by Keystone.

The Contractor shall remove all extraneous vegetative, rock, and other natural debris from the construction right-of-way by the completion of cleanup

The Contractor shall remove all trash and wastes from Contractor yards, and Pipe Stockpipe Sites, and staging areas when work is completed at each location.

The Contractor shall dispose of all waste materials at licensed waste disposal facilities. Wastes shall not be disposed of in any other fashion such as un-permitted burying or burning.

2.11 Hazardous Wastes

The Contractor shall ensure that all hazardous and potentially hazardous materials are transported, stored, and handled in accordance with all applicable legislation. Workers exposed to or required to handle dangerous materials shall be trained in accordance with the applicable regulator and the manufacturer's recommendations.

The Contractor shall dispose of all hazardous materials at licensed waste disposal facilities. Hazardous wastes shall not be disposed of in any other fashion such as un-permitted burying or burning.

All transporters of oil, hazardous substances, and hazardous wastes shall be licensed and certified according to the applicable state vehicle code. Incidents on public highways shall be reported to the appropriate agencies.

All hazardous wastes being transported off-site shall be manifested. The manifest shall conform to requirements of the appropriate state agency. The transporter shall be licensed and certified to handle hazardous wastes on the public highways. The vehicles as well as the drivers must conform to all applicable vehicle codes for transporting hazardous wastes. The manifest shall conform to 49 CFR Parts 172.101, 172.202, and 172.203.

If toxic or hazardous waste materials or containers are encountered during construction, the Contractor shall stop work immediately to prevent disturbing or further disturbing the waste material and shall immediately notify Keystone. The Contractor shall not restart work until clearance is granted by Keystone.

2.12 Noise Control

The Contractor shall minimize noise during non-daylight hours and within 1 mile of residences or other noise-sensitive areas such as hospitals, motels or campgrounds. Keystone shall abide by all applicable noise regulations regarding noise near residential and commercial/industrial areas. The Contractor shall provide notice to Keystone if noise levels are expected to exceed bylaws for a short duration. Keystone will give advanced notice to landowners within 500 feet of right-of-way prior to construction, limit the hours during which construction activities with high-decibel noise levels are conducted, coordinate work schedules, and ensure that construction proceeds quickly through such areas. The Contractor shall minimize noise in the immediate vicinity of herds of livestock or poultry operations, which are particularly sensitive to noise.

Keystone will set up a toll-free telephone line for landowners to report any construction noise-related issues.

2.13 Weed Control

Keystone will prepare a weed management plan for each state crossed by the project, as required. In general, these plans will consider the following measures listed below.

Prior to mobilization for the Project, the Contractor shall thoroughly clean all construction equipment, including timber mats, prior to moving the equipment to the job site to limit the potential for the spread of noxious weeds, insects and soil-borne pests. The Contractor shall clean the equipment with high-pressure washing equipment.

Prior to construction, Keystone will mark all areas of the right-of-way which contain infestations of noxious, invasive species or soil-borne pests. Such marking will clearly indicate the limits of the infestation along the right-of-way. During construction, the Contractor shall clean the tracks, tires, and blades of equipment by hand (track shovel) or compressed air to remove excess soil prior to movement of equipment out of weed or soil-borne pest infested areas, or utilize cleaning stations to remove vegetative materials using water under high pressure (see detail Drawings 30 and 31).

In areas of isolated weed populations, the Contractor shall strip topsoil from the full width of the construction right-of-way and store the topsoil separately from other topsoil and subsoil. The Environmental Inspectors will identify these locations in the field prior to grading activities.

The Contractor shall use mulch and straw or hay bales that are free of noxious weeds for temporary erosion and sediment control.

The Contractor shall implement pre-construction treatments such as mowing prior to seed development or herbicide application to areas of noxious weed infestation prior to other clearing, grading, trenching, or other soil disturbing work at locations identified in the construction drawings.

Keystone will implement Best Management Practices (BMPs) for conducting vegetation control where necessary before and after construction. Typical agricultural herbicides, developed in consultation with county or state regulatory agencies, will be used. Herbicide types will be determined based on the weed species requiring control. The Contractor shall apply herbicides, where required, within one week, or as deemed necessary for optimum mortality success, prior to disturbing the area by clearing, grading, trenching, or other soil disturbing work. Herbicides shall be applied by applicators appropriately licensed or certified by the state in which the work is conducted. All herbicides applied prior to construction shall be non-residual or shall have a significant residual effect no longer than 30 days. Herbicides applied during construction shall be non-residual. Keystone will implement BMPs in the use of pesticides and herbicides along the pipeline corridor to reduce potential impacts to avian and wildlife species.

The Contractor shall not use herbicides in or within 100 feet of a wetland or waterbody.

After pipeline construction, on any construction right-of-way over which Keystone will retain control over the surface use of the land after construction (i.e., valve sites, metering stations, pump stations, etc.), Keystone shall provide for weed control to limit the potential for the spread of weeds onto adjacent lands used for agricultural purposes. Any weed control spraying performed by Keystone shall be done by a state-licensed pesticide applicator.

Keystone shall be responsible for reimbursing all reasonable costs incurred by owners of land adjacent to aboveground facilities when the landowners must control weeds on their land which can be reasonably determined to have spread from land occupied by Keystone's aboveground facilities.

2.14 Dust Control

The Contractor shall at all-time control airborne dust levels during construction activities to levels acceptable to Keystone. The Contractor shall employ water trucks, sprinklers or calcium chloride as necessary to reduce dust to acceptable levels. Utilization of calcium chloride is limited to roads.

Dust shall be strictly controlled where the work approaches dwellings, farm buildings, and other areas occupied by people and when the pipeline parallels an existing road or highway. This shall also apply to access roads where dust raised by construction vehicles may irritate or inconvenience local residents. The speed of all Contractor vehicles shall be controlled in these areas. Emissions from construction equipment combustion, open burning, and temporary fuel transfer systems and associated tanks will be controlled to the extent required by state and local agencies through the permit process.

The Contractor shall take appropriate precautions to prevent fugitive emissions caused by sand blasting from reaching any residence or public building. The Contractor shall place curtains of suitable material, as necessary, to prevent wind-blown particles from sand blasting operations from reaching any residence or public building.

Additional measures may be required by state regulations or local ordinances. The Contractor will comply with all applicable state regulations and local ordinances with respect to truck transportation and fugitive dust emissions.

2.15 Off Road Vehicle Control

Keystone shall offer to landowners or managers of forested lands to install and maintain measures to control unauthorized vehicle access to the construction right-of-way where appropriate. These measures may include the following unless otherwise approved or directed by Keystone based on site specific conditions or circumstances:

- signs;
- fences with locking gates;
- slash and timber barriers, pipe barriers, or boulders lined across the

construction right-of-way; and

- conifers or other appropriate trees or shrubs across the construction right-of-way.

2.16 Fire Prevention and Control

The Contractor shall comply with all federal, state, county and local fire regulations pertaining to burning permits and the prevention of uncontrolled fires. The following mitigative measures shall be implemented to prevent fire hazards and control of fires:

- A list of relevant fire authorities and their designated representative to contact shall be maintained on site by construction personnel.
- Adequate firefighting equipment shall be available on site in accordance with the applicable regulatory requirements shall be available on site.
- The level of forest fire hazard shall be posted at the construction office (where visible for workers) and workers shall be made aware of the hazard level and related implications.
- The Contractor shall provide equipment to handle any possible fire emergency. This shall include, although not be limited to, water trucks; portable water pumps; chemical fire extinguishers; hand tools such as shovels, axes, and chain saws; and heavy equipment adequate for the construction of fire breaks when needed.
- Specifically, the Contractor shall supply and maintain in working order an adequate supply of fire extinguishers for each crew engaged in potentially combustible work such as welding, cutting, grinding, and burning of brush or vegetative debris.
- In the event of a fire, the Contractor shall immediately use resources necessary to contain the fire. The Contractor shall then notify local emergency response personnel.
- All tree clearing activities are to be carried out in accordance with local rules and regulations for the prevention of forest fires.
- Burning shall be done in compliance with state, county, or local applicable regulations.
- Any burning will be done within the right-of-way. Only small piles shall be burned to avoid overheating or damage to trees or other structures along the right-of-way.
- Flammable wastes shall be removed from the construction site on a regular basis.
- Flammable materials kept on the construction site must be stored in approved containers away from ignition sources.
- Smoking shall be prohibited around flammable materials.
- Smoking shall be prohibited on the entire construction site when the fire hazard is high.

2.17 Road and Railroad Crossings

Construction across paved roads, highways, and railroads will be in accordance with the requirements of the road and railroad crossing permits and approvals obtained by Keystone. In general, all major paved roads, all primary gravel roads, highways, and railroads will be crossed by boring beneath the road or railroad. Detail drawing 21 illustrates a typical bored road or railroad crossing. Boring requires the excavation of a pit on each side of the feature, the placement of boring equipment in the pit, and boring a hole under the road at least equal to the diameter of the pipe. For long crossings, sections can be welded onto the pipe string just before being pulled through the borehole. Boring will result in minimal or no disruption to traffic at road or railroad crossings. Each boring will be expected to take 1 to 2 days for most roads and railroads and up to 10 days for long crossings such as interstate or four-lane highways.

Most smaller, unpaved roads and driveways will be crossed using the open-cut method where permitted by local authorities or private owners. The open-cut method will require temporary closure of the road to traffic and establishment of detours. If no reasonable detour is feasible, at least one lane of traffic will be kept open, except during brief periods when it is essential to close the road to install the pipeline. Most open-cut road crossings can be finished and the road resurfaced in 1 or 2 days. Keystone will take measures, such as posting signs at open-cut road crossings, to ensure safety and minimize traffic disruptions.

2.18 Adverse Weather

The Contractor shall restrict certain construction activities and work in cultivated agricultural areas in excessively wet soil conditions to minimize rutting and soil compaction. In determining when or where construction activities should be restricted or suspended during wet conditions, the Contractor shall consider the following factors:

- the extent that rutting may cause mixing of topsoil with subsoil layers or damage to tile drains;
- excessive buildup of mud on tires and cleats;
- excessive ponding of water at the soil surface; and
- the potential for excessive soil compaction.

The Contractor shall implement mitigative measures as directed by Keystone in order to minimize rutting and soil compaction in excessively wet soil conditions which may include:

- restricting work to areas on the spread where conditions allow;
- using low ground weight, wide-track equipment, or other low impact construction techniques;
- limiting work to areas that have adequately drained soils or have a cover of vegetation ,such as sod, crops or crop residues, sufficient to prevent mixing of topsoil with subsoil layers or damage to drain tiles; and

- installing geotextile material or construction mats in problem areas.

"Stop work" authority will be designated to the chief inspector but will be implemented when recommended by the Environmental Inspector.

2.19 Cultural Resources

Keystone intends to avoid cultural resources to the extent practicable by rerouting the pipeline corridor and related appurtenances, avoiding construction activities on properties listed in or eligible for listing in the National Register of Historic Places (NRHP), as well as boring or using HDD through culturally sterile soils.

The Contractor shall implement the measures outlined in any unanticipated discovery plan or any Programmatic Agreement that is adopted to minimize disturbance to cultural sites and shall take immediate action as outlined in the Programmatic Agreement if any unanticipated cultural discovery is encountered during construction.

The preferred treatment of any historical property or culturally significant site is avoidance. Where required, Keystone will monitor the construction spread using a cultural resource monitor working under the direction of a professional who meets the standards of the *Secretary of the Interior's Historic Preservation Professional Qualification Standards* (48 FR 44716, September 29, 1983).

Prior to commencing construction, Keystone also will provide an appropriate level of training to all construction personnel so that the requirements of any unanticipated discovery plan or Programmatic Agreement are understood and unanticipated discoveries quickly identified.

In the event an unanticipated cultural discovery is made, the Contractor will immediately halt all construction activities within a 100-foot radius, including traffic; notify the Keystone Environmental Inspector; and implement interim measures to protect the discovery from looting or vandalism. The appropriate federal, state, local, or tribal authorities will be notified of discovery within 48 hours of the initial find. Construction will not proceed within the 100-foot radius of discovery site until all mitigation measures defined in the Programmatic Agreement are concluded and Keystone receives approval from the appropriate agencies that construction may resume. No work or activity within the 100-foot buffer area may take place until approvals are communicated at the spread level by the lead Environmental Inspector.

3.0 SPILL PREVENTION AND CONTAINMENT

Spill prevention and containment applies to the use and management of hazardous materials on the construction right-of-way and all ancillary areas during construction. This includes the refueling or servicing of all equipment with diesel fuel, gasoline, lubricating oils, grease, and hydraulic and other fluids during normal upland applications and special applications within 100 feet of perennial streams or wetlands.

Keystone will prepare a project-specific Spill Prevention Containment and Countermeasure (SPCC) Plan. The Contractor shall provide additional information to complete the SPCC Plan for each construction spread, and shall provide site-specific data that meets the requirements of 40 CFR Part 112 for every location used for staging fuel or oil storage tanks and for every location used for bulk fuel or oil transfer. Each SPCC Plan will be prepared prior to introducing the subject fuel, oil, or hazardous material to the subject location.

3.1 Spill Prevention

3.1.1 Staging Areas

Staging areas (including Contractor yards and pipe stockpile sites) shall be set up for each construction spread. Bulk fuel and storage tanks will be placed only at Contractor yards. No bulk fuel and storage tanks will be placed in the construction ROW. Hazardous materials at staging areas shall be stored in compliance with federal and state laws. The following spill prevention measures shall be implemented by the Contractor:

- Contractor fuel trucks shall be loaded at existing bulk fuel dealerships or from bulk tanks set up for that purpose at the staging area. In the former case, the bulk dealer is responsible for preventing and controlling spills.
- The Environmental Inspector shall inspect the tank site for compliance with the 100-foot setback requirement and approve the tank site prior to installing bulk fuel or storage tanks on the construction yard.
- Fuels and lubricants shall be stored only at designated staging areas. Storage of fuel and lubricants in the staging area shall be at least 100 feet away from the water's edge. Refueling and lubrication of equipment shall be restricted to upland areas at least 100 feet away from streams and wetlands.
- Contractors shall be required to perform all routine equipment maintenance at the staging area and recover and dispose of wastes in an appropriate manner.
- Fixed fuel dispensing locations will be provided with secondary containment to capture fuel from leaks, drips, and overfills.
- Temporary liners, berms, or dikes (secondary containment) shall be constructed around the aboveground bulk tanks, providing 110 percent containment volume of the largest storage tank or trailer within the containment structure, so that potential spill materials shall be contained and collected in specified areas. Tanks shall not be placed in areas subject to periodic flooding or washout.
- Drivers of tank trucks are responsible for safety and spill prevention during tank truck unloading. Procedures for loading and unloading tank trucks shall meet the minimum requirements established by the Department of Transportation.

- Drivers of tank trucks are responsible for setting brakes and chocking wheels prior to off loading. Warning signs requiring drivers to set brakes and chock wheels shall be displayed at all tanks. Proper grounding of equipment shall be undertaken during fuel transfer operations. Drivers shall observe and control the fueling operations at all times to prevent overfilling the temporary tank.
- Prior to departure of any tank truck, all vehicle outlets shall be examined closely by the driver for leakage, tightened, adjusted or replaced to prevent leakage while in transit.
- A supply of sorbent and barrier materials sufficient to allow the rapid containment and recovery of spills shall be maintained at each construction staging area. Sorbent and barrier materials shall also be utilized to contain runoff from contaminated areas.
- Shovels and drums shall be kept at each of the individual staging areas. In the event that small quantities of soil become contaminated, shovels shall be utilized to collect the soil and the material shall be stored in 55-gallon drums. Large quantities of contaminated soil may be bio-remediated on site or disposed in an approved landfill, subject to government approval, or collected utilizing heavy equipment, and stored in drums or other suitable containers prior to disposal. Should contamination occur adjacent to staging areas as a result of runoff, shovels or heavy equipment shall be utilized to collect the contaminated material. Contaminated soil shall be disposed of in accordance with state and federal regulations.
- Temporary aboveground tanks shall be subject to visual inspection on a monthly basis and when the tank is refilled. Inspection records shall be maintained. Operators shall routinely keep tanks under close surveillance and potential leaks or spills shall be quickly detected.
- Visible fuel leaks shall be reported to the Contractors' designated representative and corrected as soon as conditions warrant. Keystone's designated representative shall be informed.
- Drain valves on temporary tanks shall be locked to prevent accidental or unauthorized discharges from the tank.
- Oil and other hazardous materials stored in 350-gallon totes, 55-gallon drums, 5-gallon pails, smaller retail-size containers or other portable containers will be staged or stored in areas with a secondary temporary containment structure. Secondary containment structures may consist of temporary earthen berms with a chemical resistant liner, or a portable containment system constructed of steel, PVC, or other suitable material. The secondary containment structure will be capable of containing 110 percent of the volume of material stored in these areas.

Keystone may allow modification of the above specifications as necessary to accommodate specific situations or procedures. Any modifications must comply with all applicable regulations and permits.

3.1.2 Construction Right-of-Way

The Contractor will ensure that all equipment is free of leaks prior to use on the Project and prior to entering or working in or near waterbodies or wetlands. Throughout construction, the Contractor will conduct regular maintenance and inspections of the equipment to reduce the potential for spills or leaks.

Rubber-tired vehicles (pickup trucks, buses) normally shall refuel at the construction staging areas or commercial gas stations. Tracked machinery (backhoes, bulldozers) shall be refueled and lubricated on the construction right-of-way. Equipment maintenance shall be conducted in staging areas when practical. When impractical, repairs to equipment can be made on the construction right-of-way when approved by Keystone's representative.

Each fuel truck that transports and dispenses fuel to construction equipment or Project vehicles along the construction ROW or within equipment staging and material areas shall carry an oil spill response kit and spill response equipment onboard at all times. In the event that response materials are depleted through use or their condition is deteriorated through age, the materials will be replenished prior to placing the fueling vehicle back into service.

The following preventive measures apply to refueling and lubricating activities on the construction right-of-way:

- Construction activities shall be conducted to allow for prompt and effective cleanup of spills of fuel and other hazardous materials. Each construction crew, including cleanup crews shall have on hand sufficient tools and material to stop leaks and supplies of absorbent and barrier materials to allow rapid containment and recovery of spilled materials. Crew members must know and follow the procedure for reporting spills.
- Refueling and lubricating of construction equipment shall be restricted to upland areas at least 100 feet away from streams and wetlands. Where this is not possible (e.g., trench dewatering pumps), the equipment shall be fueled by designated personnel with special training in refueling, spill containment, and cleanup. The Environmental Inspector shall ensure that signs are installed identifying restricted areas.
- No fuel, oil or hazardous material storage, staging, or transfer other than refueling will occur within 100 feet of any storm drain, drop inlet, or high consequence area (HCA).
- Spent oils, lubricants, filters, etc. shall be collected and disposed of at an approved location in accordance with state and federal regulations.
- Equipment shall not be washed in streams.
- Stationary equipment will be placed within a secondary containment if it will be operated or require refueling within 100 feet of a wetland or waterbody boundary.

Keystone may allow modification of the above specifications as necessary to accommodate specific situations or procedures. Any modifications must comply with all applicable regulations and permits.

3.2 Contingency Plans

The Contractor shall develop emergency response procedures for all incidents (e.g., spills, leaks, fires) involving hazardous materials which could pose a threat to human health or the environment. The procedures shall address activities in all work areas, as well as during transport to and from the construction right-of-way and to any disposal or recycling facility.

3.3 Equipment

The Contractor shall retain emergency response equipment in all areas where hazardous materials are handled or stored. This equipment shall be readily available to respond to a hazardous material emergency. Such equipment shall include, but not be limited to, the following:

- first aid supplies;
- phone or communications radio;
- protective clothing (Tyvek suit, gloves, goggles, boots);
- hand-held fire equipment;
- absorbent material and storage containers;
- non-sparking bung wrench and shovel; and
- brooms and dust pan.

Hazardous material emergency equipment shall be carried in all mechanic and supervisor vehicles. This equipment shall include, at a minimum:

- first aid supplies;
- phone or communications radio;
- 2 sets of protective clothing (Tyvek suit, gloves, goggles, boots);
- 1 non-sparking shovel;
- 6 plastic garbage bags (20 gallon);
- 10 absorbent socks and spill pads;
- Hand-held fire extinguisher;
- barrier tape; and
- 2 orange reflector cones.

Fuel and service trucks shall carry a minimum of 20 pounds of suitable commercial sorbent material.

The Contractor shall inspect emergency equipment weekly, and service and maintain equipment regularly. Records shall be kept of all inspections and services.

3.4 Emergency Notification

Emergency notification procedures between the Contractor and Keystone shall be established in the planning stages of construction. A Keystone representative shall be identified to serve as contact in the event of a spill during construction activities. In the event of a spill meeting government reporting criteria, the Contractor immediately shall notify the Keystone representative who, in turn, shall notify the appropriate regulatory agencies.

Any material released into water that creates a sheen must be reported immediately to Keystone. The Contractor is required to notify Keystone immediately if there is any spill of oil, oil products, or hazardous materials that reaches a wetland or waterbody. Incidents on public highways shall be reported to Keystone and the appropriate agencies by Keystone.

If a spill occurs on navigable waters of the United States, Keystone shall notify the National Response Center (NRC) at 1-800-424-8802. For spills that occur on public lands, into surface waters, or into sensitive areas, the appropriate governmental agency's district office also shall be notified.

3.5 Spill Containment and Countermeasures

In the event of a spill of hazardous material, Contractor personnel shall:

- notify the appointed Keystone representative;
- identify the product hazards related to the spilled material and implement appropriate safety procedures, based on the nature of the hazard;
- control danger to the public and personnel at the site;
- implement spill contingency plans and mobilize appropriate resources and manpower;
- isolate or shutdown the source of the spill;
- block manholes or culverts to limit spill travel;
- initiate containment procedures to limit the spill to as small an area as possible to prevent damage to property or areas of environment concern (e.g., watercourses); and
- commence recovery of the spill and cleanup operations.

When notified of a spill, the Keystone representative shall immediately ensure that:

- Action is taken to control danger to the public and personnel at the site.
- Spill contingency plans are implemented and necessary equipment and manpower are mobilized.

- Measures are taken to isolate or shutdown the source of the spill.
- All resources necessary to contain, recover and clean up the spill are available.
- Any resources requested by the Contractor from Keystone are provided.
- The appropriate agencies are notified. For spills which occur on public lands, into surface waters or into sensitive areas, the appropriate federal or state managing office shall also be notified and involved in the incident.

For a land spill, berms shall be constructed with available equipment to physically contain the spill. Personnel entry and travel on contaminated soils shall be minimized. Sorbent materials shall be applied or, if necessary, heavily contaminated soils shall be removed to an approved facility. Contaminated sorbent materials and vegetation shall also be disposed of at an approved facility.

For a spill threatening a waterbody, berms or trenches shall be constructed to contain the spill prior to entry into the waterbody. Deployment of booms, skimmers, and sorbent materials shall be necessary if the spill reaches the water. The spilled product shall be recovered and the contaminated area shall be cleaned up in consultation with spill response specialists and appropriate government agencies.

4.0 UPLANDS (AGRICULTURAL, FOREST, PASTURE, RANGE AND GRASS LANDS)

4.1 Interference with Irrigation Systems

If existing irrigation systems (flood irrigation, ditch irrigation, pivot, wheel, or other type of spray irrigation systems), irrigation ditches, or sheet flow irrigation shall be impacted by the construction of the pipeline, the following mitigative measures shall be implemented unless otherwise approved or directed by Keystone:

- If it is feasible and mutually acceptable to Keystone and the landowner or landowner's designate, temporary measures shall be implemented to allow an irrigation system to continue to operate across land on which the pipeline is being constructed.
- If the pipeline or temporary work areas intersect an operational (or soon to be operational) pivot or other spray irrigation system, Keystone shall establish with the landowner or landowner's designate an acceptable amount of time the irrigation system may be out of service. If an irrigation system interruption results in crop damages, either on the pipeline construction right-of-way or off the construction right-of-way, the landowner shall be compensated reasonably for all such crop damages.
- If the pipeline or temporary work areas intersect an operational sheet flow irrigation system, Keystone shall establish with the landowner or landowner's designate an acceptable amount of time the irrigation system may be out of service. If an irrigation system interruption results in crop

damages, either on the pipeline construction right-of-way or off the construction right-of-way, the landowner shall be compensated reasonably for all such crop damages.

- Irrigation ditches that are active at the time of construction shall not be stopped or obstructed except for the length of time to install the pipeline beneath the ditch (typically, one day or less) unless otherwise approved or directed by Keystone.

4.2 Clearing

The objective of clearing is to provide a clear and unobstructed right-of-way for safe and efficient construction of the pipeline. The following mitigable measures shall be implemented:

- Construction traffic shall be restricted to the construction right-of-way, existing public roads, and approved private roads.
- Construction right-of-way boundaries including pre-approved temporary workspace shall be clearly staked to prevent disturbance to unauthorized areas.
- If crops are present, they shall be mowed or disced to ground level unless an agreement is made for the landowner to remove.
- Burning is prohibited on cultivated land.
- Construction right-of-way at timber shelterbelts in agricultural areas shall be reduced to the minimum necessary to construct the pipeline.

4.3 Topsoil Removal and Storage

The objective of topsoil handling is to maintain topsoil capability by conserving topsoil for future replacement and reclamation and to minimize the degradation of topsoil from compaction, rutting, loss of organic matter, or soil mixing so that successful reclamation of the right-of-way can occur. The following mitigative measures shall be implemented during topsoil removal and storage unless otherwise approved or directed by Keystone based on site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- In areas designated for topsoil segregation, the actual depth of the topsoil, to a maximum depth of 12 inches, will be stripped from:
    - The area excavated above the pipeline; or
    - The area above the pipeline plus the spoil storage; or
    - The area above the pipeline plus the working side; or
    - Entire ROW

  as required by applicable permit agreements with the landowner or as dictated by site-specific conditions.

- Stripped topsoil is to be stockpiled in a windrow along the edge of the right-of-way. The Contractor shall perform work in a manner to minimize the potential for subsoil and topsoil to be mixed.
- Under no circumstances shall the Contractor use topsoil to fill a low area.
- If required due to excessively windy conditions, topsoil piles shall be tackified using either water or a suitable tackifier (liquid mulch binder).
- Gaps in the rows of topsoil will be left in order to allow drainage and prevent ponding of water adjacent to or on the right-of-way.
- Topsoil shall not be utilized to construct ramps at road or waterbody crossings.
- In areas with defined saline or sodic soil concerns, a triple-ditch method will be used to segregate problem soils as indicated in Detail 67 and 67A.
- If frozen topsoil conditions are encountered during winter construction, specialized construction equipment (i.e. ripping, frozen topsoil cutter, road reclaimer, etc) may be required to adequately segregate and conserve topsoil resources.

4.4 Grading

The objective of grading is to develop a right-of-way that allows the safe passage of equipment and meets the bending limitations of the pipe. The following mitigative measures shall be implemented during grading unless otherwise approved or directed by Keystone based on site-specific conditions or circumstances. However, all work shall be conducted in accordance with applicable permits.

- All grading shall be undertaken with the understanding that original contours and drainage patterns shall be re-established to the extent practicable..
- Agricultural areas that have terraces shall be surveyed to establish pre-construction contours to be utilized for restoration of the terraces after construction.
- On steep slopes, or wherever erosion potential is high, temporary erosion control measures shall be implemented.
- Bar ditches adjacent to existing roadways to be crossed during construction shall be adequately ramped with grade or ditch spoil to prevent damage to the road shoulder and ditch.
- Where the construction surface remains inadequate to support equipment travel, timber mats, timber riprap, or other method shall be used to stabilize surface conditions.

The Contractor shall limit the interruption of the surface drain network in the vicinity of the right-of-way using the appropriate methods:

- providing gaps in the rows of subsoil and topsoil in order to prevent any accumulation of water on the land;

- preventing obstructions in furrows, furrow drains, and ditches;
- installing flumes and ramps in furrows, furrow drains, and ditches to facilitate water flow across the construction right-of-way and allow for construction equipment traffic; and
- installing flumes over the trench for any watercourse where flow is continuous during construction.

4.5 Temporary Erosion and Sediment Control

4.5.1 General

Temporary erosion and sediment control measures shall be installed immediately after initial disturbance of the soil, maintained throughout construction (on a daily basis), and reinstalled as necessary until replaced by permanent erosion control structures or restoration of the construction right-of-way is complete.

Specifications and configurations for erosion and sediment control measures may be modified by Keystone as necessary to suit actual site conditions. However, all work shall be conducted in accordance with applicable permits.

The Contractor shall inspect all temporary erosion control measures at least daily in areas of active construction or equipment operation, weekly in areas with no construction or equipment operation, and within 24 hours of each significant rainfall event of 0.5 inches or greater. The Contractor shall repair all ineffective temporary erosion control measures as expediently as practicable.

4.5.2 Sediment Barriers

Sediment barriers shall be constructed of silt fence, staked hay or straw bales, compacted earth (e.g., drivable berms across travel lanes), sand bags, or other appropriate materials.

The Contractor shall install sediment barriers in accordance with Details 1 and 2 or as otherwise approved or directed by Keystone. The Contractor is responsible for properly installing, maintaining, and replacing temporary and permanent erosion controls throughout construction and cleanup. In wetland or riparian zones, the Contractor will install sediment control structures along the construction right-of-way edges prior to vegetation removal where practicable. The aforementioned sediment barriers may be used interchangeably or together depending on site-specific conditions. In most cases, silt fence shall be utilized where longer sediment barriers are required.

Sediment barriers shall be installed below disturbed areas where there is hazard of offsite sedimentation. These areas include:

- the base of slopes adjacent to road crossings;

- the edge of the construction right-of-way adjacent to and upgradient of a roadway, flowing stream, spring, wetland, or impoundment;
- trench or test water discharge locations where required;
- where waterbodies or wetlands are adjacent to the construction right-of-way; (the Contractor shall install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil and sediment within the construction right-of-way)
- across the entire construction right-of-way at flowing waterbody crossings;
- right-of-way immediately upslope of the wetland boundary at all standard (saturated or standing water) wetland crossings as necessary to prevent sediment flow into the wetland; (Sediment control barriers are not required at “dry” wetlands.)
- along the edge of the construction right-of-way within standard (saturated or standing water) wetland boundaries as necessary to contain spoil and sediment within the construction right-of-way. Sediment control barriers are not required at “dry” wetlands (Detail 8).

Sediment barriers placed at the toe of a slope shall be set a sufficient distance from the toe of the slope, if possible, in order to increase ponding volume.

Sediment control barriers shall be placed so as not to hinder construction operations. If silt fence or straw bale sediment barriers (in lieu of drivable berms) are placed across the entire construction right-of-way at waterbodies, wetlands, or upslope of roads, a provision shall be made for temporary traffic flow through a gap for vehicles and equipment to pass within the structure. Immediately following each day’s shutdown of construction activities, a row of straw bales or a section of silt fence shall be placed across the up gradient side of the gap with sufficient overlap at each end of the barrier gap to eliminate sediment bypass flow, followed by bales tightly fitted to fill the gap. Following completion of the equipment crossing, the gap shall be closed using silt fence or straw bale sediment barrier.

The Contractor shall maintain straw bale and silt fence sediment barriers by removing collected sediment and replacing damaged bales. Sediment shall be removed and placed where it shall not reenter the barrier when sediment loading is greater than 40 percent or if directed by Keystone. If straw bale filters cannot be cleaned out due to access problems, the Contractor shall place a new row of sediment barriers upslope.

The Contractor shall use mulch and straw bales that are free of noxious weeds. Mulch or straw bales that contain evidence of noxious weeds or other undesirable species shall be rejected by the Contractor.

The Contractor shall remove sediment barriers, except those needed for permanent erosion and sediment control, during cleanup of the construction right-of-way.

4.5.3 Trench Plugs

The Contractor shall use trench plugs at waterbody and wetland crossings at the direction of the Environmental Inspector to prevent diversion of water into upland portions of the pipeline trench and to keep any accumulated trench water out of the waterbody. Trench plugs shall be of sufficient size to withstand upslope water pressure.

4.5.4 Temporary Slope Breakers (Water Bars)

The Contractor shall install temporary slope breakers on slopes greater than 5% on all disturbed lands at the following recommended spacing:

Slope (%)	Spacing (feet)
5 - 15	300
>15 - 30	200
>30	100

The gradient of each slope breaker shall be 2 to 4 percent.

If so directed by the landowner, the Contractor may not install temporary slope breakers (water bars) in cultivated land.

Temporary slope breakers shall be constructed of soil, silt fence, staked straw bales, sand bags, or similar materials authorized by Keystone.

The Contractor shall direct the outfall of each temporary slope breaker to a stable, well-vegetated area or construct an energy-dissipating device at the end of the slope breaker and off the construction right-of-way as permitted in the landowner agreement as shown in Detail 3. The outfall of each temporary slope breaker shall be installed to prevent sediment discharge into wetlands, waterbodies, or other sensitive resources.

Specifications and configurations for temporary slope breakers may be modified by Keystone as necessary to suit actual site conditions. However, all work shall be conducted in accordance with applicable permits.

4.5.5 Drainage Channels or Ditches

Drainage channels or ditches shall be used on a limited basis to provide drainage along the construction right-of-way and toe of cut slopes as well as to direct surface runoff across the construction right-of-way or away from disturbances and onto natural undisturbed ground. Channels or ditches shall be constructed by the Contractor during grading operations. Where there is inadequate vegetation at the channel or ditch outlet,

sediment barriers, check berms, or other appropriate measures shall be used to control erosion.

4.5.6 Temporary Mulching and Cover Crops

Unless otherwise directed by Keystone, the Contractor shall apply temporary seed and/or mulch on disturbed construction work areas that have been inactive for one month or are expected to be inactive for a month or more. The Contractor shall not apply temporary mulch in cultivated areas unless specifically requested by the landowner or in areas particularly prone to erosion. The Contractor shall not apply mulch within wetland boundaries.

Temporary mulch of straw or equivalent applied on slopes shall be spread uniformly to cover at least 75 percent of the ground surface at an approximate rate of 2 tons per acre of straw or its equivalent. Mulch application on slopes within 100 feet of waterbodies and wetlands shall be increased to an approximate rate of 3 tons per acre.

All seed that is used as a temporary cover crop will be approved and/or provided by Keystone.

4.5.7 Tackifier

When wetting topsoil piles with water does not prevent wind erosion, the Contractor shall temporarily suspend topsoil handling operations and apply a tackifier to topsoil stockpiles at the rate recommended by the manufacturer. The type of Tackifier will be approved by Keystone.

Should construction traffic, cattle grazing, heavy rains, or other related construction activity disturb the tackified topsoil piles and create a potential for wind erosion, additional tackifier shall be applied by the Contractor.

4.6 Stringing

The objective of stringing is to place the line pipe along the construction right-of-way for bending and welding in an expedient and efficient manner.

The Contractor shall utilize one or more of the following mitigative measures as applicable and when necessary to reduce compaction on the working side of the right-of-way or as directed by Keystone. However, all work shall be conducted in accordance with applicable permits.

- prohibiting access by certain vehicles;
- using only machinery possessing low ground pressure (tracks or extra-wide tires);
- limiting access and thus minimizing the frequency of all vehicle traffic;
- digging ditches to improve surface drainage;

- using timber riprap, matting, or geotextile fabric overlain with soil; and
- stopping construction for a period of time.

4.7 Trenching

The objective of trenching is to provide a ditch of sufficient depth and width with a bottom to continuously support the pipeline. During trenching operations, the following mitigative measures shall be implemented unless otherwise approved or directed by Keystone based on site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Where required, subsoil shall be segregated from topsoil in separate, distinct rows with a separation that shall limit any admixing of topsoil and subsoil during handling.
- Triple ditch soil handling will be completed at sites identified by Keystone according to Detail 67 and 67A to prevent soil degradation.
- Gaps must be left in the spoil piles that coincide with breaks in the strung pipe to facilitate natural drainage patterns and to allow the passage of livestock or wildlife.
- Trenching operations shall be followed as closely as practicable by lower in and backfill operations to minimize the length of time the ditch is open.
- Construction debris (e.g., welding debris) and other garbage shall not be deposited in the ditch.
- If trenching, pipe installation and backfill operations take place during frozen soil conditions, final clean-`up (including additional trench compaction, subsoil feathering, final contouring and topsoil replacement) will be delayed until the subsoil and topsoil thaw completely the following spring/summer. A pronounced subsoil berm will be left over the trench line until final clean-up takes place to account for settlement of thawing backfill. Gaps will be left in the berm to maintain cross-ROW drainage

The Contractor shall prepare a blasting plan that is applicable to any locations where blasting will be necessary adjacent to existing high pressure pipelines, overhead or underground utilities, farm operations, or public crossings. The Contractor and its blasting supervisor shall be thoroughly familiar with and comply with the rules and regulations of Occupational Safety and Health Administration (OSHA) and all federal, state, county and local regulations governing blasting operations. Keystone will file the blasting plan with applicable state or local jurisdictions, where required. Excavation and blasting along the ROW may uncover paleontological resources of scientific value. Keystone will consult with the appropriate regulatory agencies in each state on the applicability and requirements for Paleontological Resource Protection Plans. Keystone will prepare and file plans addressing vertebrate fossils with any respective states, as required.

Should blasting be necessary for removal of rock, the following mitigative measures may be implemented:

- The Contractor shall use non-electric initiation systems for all blasting operations. If required by the blasting plan, blasting will be monitored for vibration levels and peak particle velocity. This work shall be performed by a third-party vibration monitoring consultant hired by and reporting to the Constructor Representative. The Contractor shall arrange for detonations to be carried out in cooperation with this consultant.
- Prior to using explosives, the Contractor shall advise residents of the immediate area, in order to prevent any risk of accidents or undue disturbances.
- No blasting shall be done without approval of the Constructor Representative. Prior to any detonation of explosives in the vicinity of a loaded line, dwelling, structure, overhead or underground utility, farm operation, or public crossings, a minimum of 48 hour's notice shall be given to the Constructor Representative, in order that the appropriate people can be notified and the upstream and downstream mainline valves can be staffed.
- The Contractor shall obtain all necessary permits and shall comply with all legal requirements in connection with the use, storage, and transportation of explosives.
- Blasting mats or subsoil may be piled over the trench line to prevent rock from being blown outside the construction right-of-way.
- Each blasting location shall be cleared and cleaned up before and after all blasting operations.
- Blasting shall be carried out during regular, daylight working hours.
- The Contractor shall at all times protect his workers and the public from any injury or harm that might arise from drilling dust and the use of explosives.
- Only workers thoroughly experienced in handling explosives shall be permitted to supervise, handle, haul, load or shoot explosives. In those jurisdictions where the licensing of blasters is mandatory, the Contractor shall provide the Constructor Representative with proof of the required certification for every person so required.
- The drilling pattern shall be set in a manner to achieve smaller rock fragmentation (maximum 1 foot in diameter) in order to use as much as possible of the blasted rock as backfill material after the pipe has been padded in accordance with the specifications.
- Blasting testing of surface-water resources and water wells within 150 feet of the centerline will be performed in compliance with all applicable permits.

4.7.1 Trench Dewatering/Well Points

The Contractor shall make all reasonable efforts to discharge trench water in a manner that avoids damage to adjacent agricultural land, crops, and pasture. Damage includes, but is not limited to, the inundation of crops for more than 24 hours, deposition of sediment in ditches, and the deposition of gravel in fields or pastures.

If trench dewatering is necessary in an area where salt damage to adjacent crops is evident, the Environmental Inspector shall conduct a field conductivity test on the trench water before it is discharged. If the conductivity of the trench water is determined to potentially affect soil quality, it shall not be discharged to areas where salt damage to crops is evident, but shall be directed as feasible so that water flows over a well vegetated, non-cropland area or through an energy dissipater and sediment barrier.

When pumping water from the trench for any reason, the Contractor shall ensure that adequate pumping capacity and sufficient hose is available to permit dewatering as follows:

- No heavily silt-laden trench water shall be allowed to enter a waterbody or wetland directly but shall instead be diverted through a well vegetated area, a geotextile filter bag, or a permeable berm (straw bale or Keystone approved equivalent).
- Trench water shall not be disposed of in a manner which could damage crops or interfere with the functioning of underground drainage systems.

The Contractor shall screen the intake hose and keep the hose either one foot off the bottom of the trench or in a container to minimize entrainment of sediment.

4.8 Welding, Field Joint Coating, and Lowering In

The objectives of welding, field joint coating, and lowering in are to provide continuous segments of pipeline, to provide corrosion protection to the weld areas of the pipeline, and to place the pipeline in the center of the trench, without stress, at the required depth of cover. The following mitigative measures shall be followed during pipe welding, field joint coating, and lowering in, unless otherwise specified by Keystone in response to site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Shavings produced during beveling of the line pipe are to be removed immediately following this operation to ensure that livestock and wildlife do not ingest this material. When welding operations create a continuous line of pipe that may be left in the right-of-way for an extended period of time due to construction or weather constraints, a gap in the welded pipe shall be provided to allow for access at farm road crossings and for passage of livestock and wildlife.
- Prior to the application of epoxy powder, urethane epoxy, or other approved pipe coatings, a tarp shall be placed underneath the pipe in wetlands to collect any overspray of epoxy powder and liquid drippings. Excess powder, liquid, or other hazardous materials (e.g. brushes, rollers, gloves) shall be continuously collected and removed from the construction right-of-way and disposed of in a manner appropriate for these materials.

4.9 Padding and Backfilling

The objective of padding and backfilling is to cover the pipe with material that is not detrimental to the pipeline and pipeline coating. The following mitigative measures shall be utilized during backfilling, unless otherwise approved or directed by Keystone based on site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Excessive water accumulated in the trench shall be eliminated prior to backfilling.
- In the event it becomes necessary to pump water from open trenches, the Contractor shall pump the water and discharge it in accordance with the requirements of the Stormwater Pollution Prevention Plan (SWPPP) in order to avoid damaging adjacent areas. Detail 5 and Detail 6 provide typical examples of dewatering structures.
- If it is impossible to avoid water-related damages (including inundation of crops for more than 24 hours, deposition of sediment in ditches and other water courses, and the deposition of gravel in fields, pastures, and any water courses), Keystone shall reasonably compensate the landowners for the damage and/or shall correct the damage so as to restore the land, crops, pasture, water courses, etc. to their pre-construction condition.
- All pumping of water shall comply with existing drainage laws and local ordinances relating to such activities and provisions of the Clean Water Act.
- Prior to backfilling, all drain tile shall be permanently repaired, inspected, and the repair documented as described in Section 5.5.
- Prior to backfilling, trench breakers shall be installed on slopes where necessary to minimize the potential for water movement down the ditch and potential subsequent erosion.
- During backfill, the stockpiled subsoil shall be placed back into the trench before replacing the topsoil.
- Topsoil shall not be utilized for padding the pipe.
- Backfill shall be compacted to a minimum of 90% of pre-existing conditions where the trench line crosses tracks of wheel irrigation systems (pivots).
- To reduce the potential for ditch line subsidence, spoil shall be replaced and compacted by backhoe bucket or by the wheels or tracks of equipment traversing down the trench.
- The lesser of 4 feet or the actual depth of topsoil cover, shall not be backfilled with soil containing rocks of any greater concentration or size than existed prior to pipeline construction in the pipeline trench, bore pits, or other excavations.

4.10 Cleanup

The objective of cleanup activities shall be to prepare the right-of-way and other disturbed areas to approximate pre-activity ground contours where appropriate and to replace spoil and stockpiled material in a manner which preserves soil

capability and quality to a degree reasonably equivalent to the original or that of representative undisturbed land. The following mitigative measures shall be utilized during cleanup, unless otherwise approved or directed by Keystone based on specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Cleanup shall occur immediately following backfilling operations when weather or seasonal conditions allow.
- All garbage and construction debris (e.g., lathing, ribbon, welding rods, pipe bevel shavings, pipe spacer ropes, end caps, pipe skids) shall be collected and disposed of at approved disposal sites.
- The right-of-way shall be re-contoured with spoil material to approximate pre-construction contours and as necessary to limit erosion and subsidence. Loading of slopes with unconsolidated spoil material shall be avoided during slope re-contouring. Topsoil shall be replaced after re-contouring of the grade with subsoil. The topsoil shall be replaced on the subsoil storage area and over the trench so that after settling occurs, the topsoil's approximate original depth and contour (with an allowance for settling) shall be achieved.
- Where topsoil has been segregated, subsoil shall not be permanently placed on top of topsoil.
- Surface drainage shall be restored and re-contoured to conform to the adjacent land drainage system.
- Erosion control structures such as permanent slope breakers and cross ditches shall be installed on steep slopes where necessary to control erosion by diverting surface run-off from the right-of-way to stable and vegetated off right-of-way areas.
- During cleanup, temporary sediment barriers such as silt fence and hay bale diversions will be removed; accumulated sediment will re-contoured with the rest of the ROW; and permanent erosion controls will be installed as necessary.
- After construction, all temporary access shall be returned to prior construction conditions unless specifically agreed with the landowner or otherwise specified by Keystone.
- Warning signs, aerial markers, and cathodic protection test leads shall be installed in locations in compliance with U.S. Federal code and in locations that shall not impair farming operations where practicable.
- All bridges, fences and culverts existing prior to construction shall be restored to meet or exceed approximate pre-construction conditions. Caution shall be utilized when re-establishing culverts to ensure that drainage is not improved to a point that would be detrimental to existing waterbodies and wetlands.
- All temporary gates installed during construction shall be replaced with permanent fence unless otherwise requested by the landowner.

4.11 Reclamation and Revegetation

The objectives of reclamation and revegetation are to return the disturbed areas to approximately pre-construction use and capability. This involves the treatment of soil as necessary to preserve approximate pre-construction capability and the stabilization of the work surface in a manner consistent with the initial land use.

The following mitigative measures will be utilized unless otherwise approved or directed by Keystone based on site specific conditions or circumstances. However, all work shall be conducted in accordance with applicable permits.

4.11.1 Relieving Compaction

Compaction will typically be relieved in subsoils that have received substantial construction traffic, as determined by Keystone, prior to replacing and respreading topsoil. Compaction will typically not be relieved in topsoils that have been left in place and that have not been driven on. Any rock that is brought to the surface during decompaction activities will be removed until the quantity, size, and distribution of rock is equivalent to that found on adjacent land as determined by the Environmental Inspector. Compaction will typically be relieved as follows:

- Compacted cropland compacted shall be ripped a minimum of 3 passes at least 18 inches deep and all pasture shall be ripped or chiseled a minimum of three passes at least 12 inches deep before replacing topsoil.
- Areas of the construction right-of-way that were stripped for topsoil salvage shall be ripped a minimum of 3 passes (in cross patterns, as practical) prior to topsoil replacement. The approximate depth of ripping shall be 18 inches (or a lesser depth if damage may occur to existing drain tile systems). After ripping, the subsoil surface shall be graded smooth and any subsoil clumps broken up (disc and harrow) in an effort to avoid topsoil mixing.
- The de-compacted construction right-of-way shall be tested by the Contractor at regular intervals for compaction in agricultural and residential areas. Tests shall be conducted on the same soil type under similar moisture conditions in undisturbed areas immediately adjacent to the right-of-way to approximate pre-construction conditions. Penetrometers or other appropriate devices shall be used to conduct tests
- Topsoil shall be replaced to pre-existing depths once ripping and discing of subsoil is complete up to a maximum of 12 inches. Topsoil compaction on cultivated fields shall be alleviated with cultivation methods by the contractor.
- If there is any dispute between the landowner and Keystone as to what areas need to be ripped or chiseled, the depth at which compacted areas should be ripped or chiseled, or the necessity or

rates of lime and fertilizer application, the appropriate NRCS shall be consulted by Keystone and the landowner.

Plowing under of organic matter including wood chips and manure, or planting of a green crop such as alfalfa to decrease soil bulk density and improve soil structure or any other measures in consultation with the Natural Resource Conservation Service (NCRS) shall be considered if mechanical relief of compaction is deemed not satisfactory.

In the first year after construction, Keystone will inspect the ROW to identify areas of erosion or settling. Subsequently, Keystone will monitor erosion and settling through aerial patrols, which are part of Keystone's Integrity Management Plan, and through landowner reporting. Landowner reporting will be facilitated through use of Keystone's toll-free telephone number, which will be made available to all landowners on the ROW. Landowner reporting also may be facilitated through contact with Keystone's field offices.

Keystone plans to minimize impacts on soil productivity that may result from construction activities, but recognizes that some short- to long-term decreases in agricultural productivity are possible. Keystone recognizes its responsibility to restore agricultural productivity on the pipeline ROW and to compensate landowners for demonstrated decreases in productivity that may result from any degradation of agricultural soils along the ROW.

4.11.2 Rock Removal

- Rocks that are exposed on the surface due to construction activity shall be removed from the right-of-way prior to and after topsoil replacement This effort will result in an equivalent quantity, size and distribution of rocks to that found on adjacent lands, as determined by the Environmental Inspectors.
- Clearing of rocks may be carried out with a mechanical rock picker or by manual means, provided that preservation of topsoil is assured. Rock removed from the right-of-way shall be hauled off the landowner's premises or disposed of on the landowner's premises at a location that is mutually acceptable to the landowner and to Keystone.

4.11.3 Soil Additives

If site-specific conditions warrant and if agreed to by the landowner, the Contractor shall apply amendments (fertilizer and soil pH modifier materials and formulations) commonly used for agricultural soils in the area and in accordance with written recommendations from the local soil conservation authority, land management agencies, or landowner. Amendments shall be incorporated into the normal plow layer as soon as possible after application.

4.11.4 Seeding

- The final seed mix shall be based on input from the local Natural Resource Conservation Service and the availability of seed at the time of reclamation. The landowner may request specific seeding requirements during easement negotiations.
- Certificates of seed analysis are required for all seed mixes to limit the introduction of noxious weeds.
- Seed not utilized within 12 months of seed testing shall be approved by Keystone prior to use. Seeding shall follow cleanup and topsoil replacement as closely as possible. Seed shall be applied to all disturbed surfaces (except cultivated fields unless requested by the landowner) as indicated on the construction drawings
- If mulch was applied prior to seeding for temporary erosion control, the Contractor shall remove and dispose of the excess mulch prior to seedbed preparation to ensure that seedbed preparation equipment and seed drills do not become plugged with excess mulch; and to support an adequate seedbed; and to ensure that seed incorporation or soil packing equipment can operate without becoming plugged with mulch.
- Identified seeding areas shall be seeded as specified by Keystone. Seeding rates shall be based on pure live seed.
- Weather conditions, construction right-of-way constraints, site access, topography and soil type shall influence the seeding method to be used (i.e., drill seeding versus broadcast seeding).
- The Contractor shall delay seeding as directed by Keystone until the soil is in the appropriate condition for seeding.
- The Contractor shall use a Truax brand or Keystone approved equivalent-type drill seeder equipped with a cultipacker designed and equipped to apply grass and grass-legume seed mixtures with mechanisms such as seed box agitators to allow even distribution of all species in each seed mix, with an adjustable metering mechanism to accurately deliver the specified seeding rate and with a mechanism such as depth bands to accurately place the seed at the specified depth.
- The Contractor shall operate drill seeders at an appropriate speed so the specified seeding rate and depth is maintained, as directed by Keystone.
- The Contractor shall calibrate drill seeders so that the specified seeding rate is planted. The row spacing on drill seeders shall not exceed 8 inches.
- The Contractor shall plant seed at depths consistent with the local or regional agricultural practices.

- Broadcast or hydro seeding, used in lieu of drilling, shall utilize NRCS-recommended seeding rates. Where seed is broadcast, the Contractor shall use a harrow, cultipacker, or other equipment immediately following broadcasting to incorporate the seed to the specified depth and to firm the seedbed.
- The Contractor shall delay broadcast seeding during high wind conditions if even distribution of seed is impeded.
- The Contractor shall hand rake all areas that are too steep or otherwise cannot be safely harrowed or cultipacked in order to incorporate the broadcast seed to the specified depth.
- Hydro seeding may be used, on a limited basis, where the slope is too steep or soil conditions do not warrant conventional seeding methods. Fertilizer, where specified, may be included in the seed, virgin wood fiber, tackifier, and water mixture. When hydro-seeding, virgin wood fiber shall be applied at the rate of approximately 3,000 pounds per acre on an air-dry weight basis as necessary to provide at least 75% ground cover. Tackifier shall consist of biodegradable, vegetable-based material and shall be applied at the rate recommended by the manufacturer. The seed, mulch, and tackifier slurry shall be applied so that it forms a uniform, mat-like covering of the ground.
- Keystone shall work with landowners to discourage intense livestock grazing of the construction right-of-way during the first growing season by utilization of temporary fencing or deferred grazing, or increased grazing rotation frequency.

4.11.5 Permanent Erosion and Sediment Control

The Contractor shall restore all existing landowner soil conservation improvements and structures disturbed by pipeline construction to the approximate pre-construction line and grade. Soil conservation improvements and structures include, but are not limited to, grassed waterways, toe walls, drop inlets, grade control works, terraces, levees, and farm ponds.

4.11.5.1 Trench Breakers

The Contractor shall install trench breakers in steep terrain where necessary to limit the potential for trench line erosion and at the base of slopes adjacent to waterbodies and wetlands.

Trench breakers shall be constructed of materials such as sand bags, sand/cement bags, bentonite bags, or other suitable materials by the Contractor (Detail 7). The Contractor shall not use topsoil in trench breakers.

4.11.5.2 Permanent Slope Breakers (Water Bars)

Permanent slope breakers (water bars) shall be constructed of soil or, in some instances, sand bags.

The Contractor shall construct permanent slope breakers on the construction right-of-way where necessary to limit erosion, except in cultivated and residential areas. Slope breakers shall divert surface runoff to adjacent stable vegetated areas or to energy-dissipating devices as shown on Detail 3. In general, permanent slope breakers should be installed immediately downslope of all trench breakers. Permanent slope breakers shall be installed as specified on the construction drawings or generally with a minimum spacing as shown on the following table:

Slope (%)	Spacing (feet)
5 - 15	300
>15 – 30	200
>30	100

The gradient (fall) for each slope breaker shall be two percent to four percent unless otherwise approved by Keystone based on site-specific conditions.

The Contractor shall construct slope breakers to divert surface flow to a stable, well-vegetated area. In the absence of a stable area, the Contractor shall construct appropriate energy-dissipating devices at the end of the slope breaker and beyond the area disturbed by construction.

4.11.5.3 Mulching

The Contractor shall apply mulch on all areas with high erosion potential and on slopes greater than 8 percent unless otherwise approved by Keystone based on site-specific conditions or circumstances. The Contractor shall spread mulch uniformly over the area to cover at least 75 percent of the ground surface at an approximate rate of 2 tons per acre of straw or its equivalent. The Environmental Inspector may reduce the application rate or forego mulching an area altogether if there is an adequate cover of rock or organic debris to protect the slope from erosion, or if annual companion crops have stabilized the soil.

Mulch application includes straw mulch, hydro mulch and tackifier or other materials as approved by Keystone.

The Contractor shall use mulch that is free of noxious weeds.

The Contractor shall apply mulch immediately following seeding. The Contractor shall not apply mulch in wetlands.

If a mulch blower is used, the majority of strands of the mulching material shall not be shredded to less than 8 inches in length to allow anchoring. The Contractor shall anchor mulch immediately after application to minimize loss by wind and water.

When anchoring (straw crimping) by mechanical means, the Contractor shall use a tool specifically designed for mulch anchoring with flat, notched disks to properly crimp the mulch to a depth of 2 to 3 inches. A regular farm disk shall not be used to crimp mulch. The crimping of mulch shall be performed across the slope of the ground, not parallel to it. In addition, in areas of steep terrain, tracked vehicles may be used as a means of crimping mulch (equipment running up and down the hill to leave crimps perpendicular to the slope), provided they leave adequate coverage of mulch.

In soils possessing high erosion potential, the Contractor may be required to make two passes with the mulch-crimping tool; passes must be as perpendicular to the others as possible.

When anchoring with liquid mulch binders (tackifiers), the Contractor shall use a biodegradable tackifier derived from a vegetable-based, organic source. The Contractor shall apply mulch binders at rates recommended by the manufacturer.

The Contractor shall limit the use of tackifiers for anchoring straw and the use of hydromulch and tackifier to areas that are too steep or rocky to safely or effectively operate mechanical mulch-anchoring tools. No asphalt-based tackifiers shall be used on the Project.

4.11.5.4 Erosion Control Matting

Erosion control matting shall be applied where shown on the construction drawings as shown on Detail 4. The Contractor shall anchor the erosion control matting with staples or other approved devices.

The Contractor shall use erosion control matting made of biodegradable, natural fiber such as straw or coir (coconut fiber).

The Contractor shall prepare the soil surface and install the erosion control matting to ensure it is stable and the matting makes uniform contact with the soil of the slope face or stream bank with no bridging of rills, gullies, or other low areas.

4.11.5.5 Riprap and Stream Bank Stabilization

Disturbed banks of streambeds and waterbodies shall be restored to their approximate original contours unless otherwise directed. Erosion protection shall be applied as specified in the construction drawings.

Most restored banks will be protected through the use of flexible channel liners installed as specified in Detail 19.

If the original stream bank is excessively steep and unstable and/or flow conditions are severe, a more stable final contour may be specified and alternate stabilization measures may be installed.

Alternate stabilization measures may consist of rock riprap, bio-stabilization, or engineered structures such as brush layering, logwalls, cribwalls, or vegetated geo-grids. See Details 20, 23, and 24.

Stream bank riprap structures shall consist of a layer of stone underlain with approved filter fabric or a gravel filter blanket. Riprap shall extend from the stabilized streambed to the top of the stream bank. Native rock shall be utilized wherever practicable.

4.11.6 Fences

Upon completion of all backfilling, cleanup, and restoration, including mulching and seeding of the construction right-of-way, permanent repairs shall be made to all fences by using either the original material or good quality new material similar to existing fences.

Historic fences shall be carefully reassembled by hand from the original material. Where the original material has deteriorated to a state that makes it unsalvageable, replacement material similar to the original shall be used if possible.

4.11.7 Farm Terraces

Keystone will work with landowners and farm service agencies to ensure restoration of farm terraces to their pre-construction function. Keystone may elect to negotiate a fair settlement with the landowner to employ a local land leveling contractor to restore the terrace.

Before any groundwork is performed in areas with farm terraces, Keystone will conduct a civil survey to document the location and contours of each terrace. Both the channel contour and the terrace berm will be surveyed within the construction right-of-way and up to 100 feet on either side of the ROW boundaries. The pre-construction survey will

provide a baseline to ensure the proper restoration of the terrace following construction.

The Contractor will maintain the pre-disturbance drainage of water along the terrace channel and will install temporary flume pipe for this purpose. As necessary, temporary erosion control measures such as water bars and sediment barriers will be installed and maintained throughout construction to reduce the potential for soil erosion along or off the construction ROW.

Following installation of the pipe, the trench will be backfilled, and the Contractor will restore the terrace contours as agreed to with the landowner.

Should the landowner agree to have a local contractor restore the terraces, the Contractor will backfill the trench and restore the terrace using typical compaction methods for pipeline construction with the understanding that the landowner's contractor will re-excavate the location and re-install the terrace utilizing land levelling equipment and special compaction methods.

Should the landowner desire the Contractor to restore the terraces, the pipeline contractor will compact the trench before the terrace berm is replaced. Following restoration of the terraces, final contours and grades will be re-surveyed and documented with survey notes. Keystone will perform post-construction monitoring and inspection with the landowner's concurrence. Should the terraces require further work, Keystone will either compensate the landowner to perform the work or arrange for a local contractor to perform the work.

4.11.8 Right-of-Way and Pipeline Markers

Upon completion of all backfilling, cleanup and restoration, including mulching and seeding of the construction right-of-way, and during the time when the Contractor is making permanent repairs to fences, the Contractor shall install pipeline markers on each side of all roads, railroads, fence lines, stream crossings, and other areas where the pipeline markers do not conflict with intended land use.

4.12 Pasture and Range Lands

The following mitigative measures shall be implemented in addition to the requirements previously stated in Sections 4.1 thru 4.11 unless otherwise approved by Keystone based on site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Access across the right-of-way during construction shall be provided at locations requested by landowners, if practicable.
- Shavings produced during pipe bevel operations are to be removed immediately to ensure that livestock and wildlife do not ingest this material.

- Litter and garbage shall be collected and removed from the construction site at the end of the day's activities.
- Temporary gates shall be installed at fence lines for access to the construction right-of-way. These gates shall remain closed at all times. Upon completion of construction, the temporary gates shall be removed and the permanent fence replaced.
- Feeding or harassment of livestock or wildlife is prohibited.
- Construction personnel shall not be permitted to have firearms or pets on the construction right-of-way.
- All food and wastes shall be stored and secured in vehicles or appropriate facilities.
- Areas of disturbance in native range shall be seeded with a native seed mix after topsoil replacement.
- Improved pasture shall be seeded with a seed mix approved by individual landowners.

4.13 Forested Lands

Mitigation measures are required to ensure that pipeline construction activities have a minimal impact on forested lands.

Clearing, grubbing, and grading of trees, brush, and stumps shall be performed in accordance with the following mitigative measures in addition to the requirements previously stated in Sections 4.1 thru 4.11 unless otherwise approved or directed by Keystone based on site-specific conditions or circumstances. Keystone will address mitigation, reclamation and remediation measures with individual landowners and comply with any applicable state requirements. These measures include non-vegetative remediation to reverse impacts on windbreaks, shelterbelts, and living snow fences. Where the pipeline follows an existing ROW in forested areas, Keystone attempted to route the pipeline as close as practical to the existing ROW. All work shall be conducted in accordance with applicable permits.

- Prior to the start of clearing activity, right-of-way boundaries, including pre-approved temporary workspaces, shall be clearly staked to prevent disturbance of unauthorized areas.
- If trees are to be removed from the construction right-of-way, Keystone shall consult with the landowner or landowner's designate to see if there are trees of commercial or other value to the landowner. Timber shall be salvaged as per landowner request.
- If there are trees of commercial or other value to the landowner, Keystone shall allow the landowner the right to retain ownership of the trees with the disposition of the trees to be negotiated prior to the commencement of land clearing and included in the easement agreement.
- If not performed by the landowner, the construction right-of-way Contractor may salvage all marketable timber from designated areas.

- Tree stumps shall be grubbed to a maximum of 5 feet on either side of the trench line and where necessary for grading a level surface for pipeline construction equipment to operate safely.
- Keystone shall follow the landowner's or landowner designee's desires as stated in the easement agreement regarding the disposal of trees, brush, and stumps of no value to the landowner by burning, burial, etc., or complete removal from any affected property.
- Timber salvage operations shall use cut-off-type saw equipment. Felling shall be undertaken in a manner that minimizes butt shatter, breakage, and off ROW disturbance. Skidders or alternate equipment shall be used to transport salvaged logs to stacking sites.
- Trees shall be felled to fall toward the center line of the right-of-way to avoid breaking trees and branches off ROW. Leaners (felled trees that inadvertently fall into adjacent undisturbed vegetation) shall be salvaged.
- Trees and slash falling outside the right-of-way shall be recovered and disposed..
- Salvaged logs shall be limbed and topped before removal from the construction right-of-way. Log decks (if required) shall be oriented to best facilitate loading by picker trucks and be located adjacent to the working side of the right-of-way, where possible.
- The Contractor shall not be allowed to dispose of woody debris in wooded areas along the pipeline right-of-way.
- Pruning of branches hanging over the right-of-way shall be done only when necessary for construction. Any branch that is broken or seriously damaged should be cut off near its fork and the collar of the branch preserved.
- All tree wastes, stumps, tree crowns, brushes, branches, and other forest debris shall be either burned, chipped (using a mobile chipper), or removed from the right-of-way according to Keystone instructions contained in the specific mitigation measures. Burial of this waste material on the site by the Contractor shall require the landowner’s authorization. Chips must not be spread over cultivated land. However, they may be spread and incorporated with mineral soil over the forest floor at a density that shall not prevent revegetation of grass.
- Stump removal and brush clearing shall be done with bulldozers equipped with brush rakes to preserve organic matter.
- Decking sites shall be established: (1) approximately 2000 feet apart in timbered areas; (2) on sites located on approved temporary workspace in existing cleared areas; (3) in non-merchantable stands of timber; or (4) if no other options are available, in merchantable timber stands. Deck sites shall be appropriately sized to accommodate the loading equipment.
- If the landowner does not want the timber, the Contractor shall remove decked timber from the construction right-of-way and transport it to a designated all-weather access point or mill

4.14 Residential and Commercial/Industrial Areas

4.14.1 Residential and Commercial Areas

The principal measures that shall be used to mitigate impacts on existing residential and commercial areas include the following unless otherwise directed or approved by Keystone based on site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- notifying landowners prior to construction;
- posting warning signs as appropriate;
- reducing the width of construction right-of-way, if practicable, by eliminating the construction equipment passing lane, reducing the size of work crews, or utilizing the “stove pipe” or “drag section” construction techniques;
- removing fences, sheds, and other improvements as necessary for protection from construction activities;
- to the extent possible, preserving mature trees and landscaping while ensuring the safe operation of construction equipment;
- fencing the edge of the construction work area that is within 25 feet to a residence for a distance of 100 feet on either side of the residence to ensure that construction equipment and materials, including the spoil pile, remain within the construction work area;
- limiting the hours during which operations with high-decibel noise levels (i.e., drilling and boring) can be conducted;
- limiting dust impact through prearranged work hours and by utilizing dust minimization techniques;
- ensuring that construction proceeds quickly through such areas, thus minimizing exposure to nuisance effects such as noise and dust;
- maintaining access and traffic flow during construction activities, particularly for emergency vehicles;
- cleaning up construction trash and debris daily;
- fencing or plating open ditches during non-construction activities;
- if the pipeline centerline is within 25 feet of a residence, ensuring that the trench is not excavated until the pipe is ready for installation and that the trench shall be backfilled immediately after pipe installation; and
- immediately after backfilling the trench, restoring all lawn areas, shrubs, specialized landscaping, fences, and other structures within the construction work area to its pre-construction appearance or the requirements of the landowner. Restoration work shall be done by personnel familiar with local horticultural and turf establishment practices.
- to the extent possible, preserving mature trees and landscaping while ensuring the safe operation of construction equipment;

4.14.2 Site-Specific Plans

For any residence or commercial/industrial building closer than 25 feet to the construction work area, Keystone shall prepare a site-specific construction plan. The plan shall include:

- a description of construction techniques to be used;
- a dimensioned site plan that shows, at a minimum:
  - the location of the residence or commercial/industrial area in relation to the new pipeline;
  - the edge of the construction work area;
  - the edge of the new permanent construction right-of-way; and
  - other nearby topographical obstacles including landscaping, trees, structures, roads, parking areas, ditches, and streams; and
- a description of how Keystone would ensure that the trench is not excavated until the pipe is ready for installation and that the trench is backfilled immediately after pipe installation.

4.14.3 Landowner Complaint Resolution Procedure

Keystone shall implement a landowner complaint procedure as follows:

- Landowners should first contact the construction spread office to express their concern over restoration or mitigation of environmental damages on their property. The Construction Manager or his designated representative shall respond to the landowner within 24 hours of receipt of the phone call.
- If the landowner has not received a response or is not satisfied with the response, he can contact Keystone's representative at 1-877-880-4881. The landowner should expect a response within 48 hours.

4.15 Fragile Soil Clean-up and Reclamation/Revegetation

4.15.1 General

Fragile soil types are a result of the high percentage of sand content that exists within the surficial soil. Theses soil types exist within regions found in southern South Dakota and central Nebraska and fragile due to their inherent high wind and water erosion potential, low water holding capacity and arid nature of the region, rolling to steep terrain and usually consists of predominantly native prairie landscapes and supports a variety of uses such as livestock grazing, wildlife habitat and recreational opportunities.

4.15.2 Right-of-way Construction

- KXL will educate construction personnel regarding these areas and the necessity to strictly adhere to Project Best Management Practices (BMPs) designed to minimize impacts.

- Minor route re-alignments will be incorporated through these areas to avoid particularly erosion-prone locations, such as ridge tops and existing blowouts as much as practicable.
- KXL will avoid highly saturated areas, such as wetland, to the maximum extent possible.
- Construction soil handling procedures will strive to reduce the width of disturbance to the native prairie landscape by adopting "Trench-line or Blade-width stripping procedures where practicable.
- Topsoil conservation will be conducted on all areas where excavation occurs.
- Topsoil piles will be protected from erosion through matting, mulching, watering or tackifying as deemed practicable.
- Traffic management limitations will be employed on specific areas possessing high erosion potential or sensitive habitat.

4.15.3 Right-of-Way Reclamation

- Native seed mixes will be developed with input from the local NRCS offices and through collaboration with regional experts. All seed will be certified noxious weed-free and will be calculated on a pure live seed (PLS) basis.
- Straw or native prairie hay may be used as mulch, applied to the right-of-way and crimped into the soil to prevent wind erosion. All mulch will be documented as noxious weed-free.
- Land imprinting may be employed to create impressions in the soil, thereby reducing erosion, improving moisture retention and creating micro-sites for seed germination.
- Sediment logs or straw wattles will be used in place of slope breakers (short terraces) that are constructed of soil. Using sediment logs will result in less soil disturbance to the right-of-way.
- Photodegradable matting will be applied on steep slopes or areas prone to extreme wind exposure such as north- or west-facing slopes and ridge tops. Biodegradable pins will be used in place of metal staples to hold the matting in place.
- Keystone will work with landowners to evaluate fencing the right-of-way from livestock, or alternatively, provide compensation to rest a pasture until vegetation can become established. Management concerns such as livestock access to water or movement within a pasture would be incorporated as necessary.

4.15.4 Post-Construction

Keystone is committed to post-construction monitoring and repair and will monitor reclamation on the right-of-way for several years and repair

erosion and reseed poorly revegetated areas as necessary. During monitoring, landowners are informed of our efforts and intentions.

A noxious weed management plan will be established on these lands pending consultation with state and county experts

4.16 Operations and Maintenance

Operations and maintenance programs, such as vegetation management, pipeline maintenance, integrity surveys, and hydrostatic testing, may have an impact on the final reclamation of the right-of-way. To ensure the integrity of the facility and land surface reclamation of the right-of-way is maintained after completion of construction and that regulatory requirements are adhered to during operations, the following measures shall be implemented unless otherwise directed by Keystone in response to site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Keystone shall monitor the pipeline right-of-way and all stream crossings for erosion or other potential problems that could affect the integrity of the pipeline. Any erosion identified shall be reclaimed as expediently as practicable by Keystone or by compensating to the landowner to reclaim the area.
- Trench depressions on ditch line that may interfere with natural drainage, vegetation establishment, or land use shall be repaired as expediently as practicable by Keystone or by compensating the landowner to repair the area.
- Post-construction monitoring inspections shall be conducted after the first growing season to determine the success of revegetation, unless otherwise required by permit. Areas which have not been successfully re-established shall be revegetated by Keystone or by compensation of the landowner to reseed the area. If, after the first growing season, revegetation is successful, no additional monitoring shall be conducted unless otherwise required by permit.
- In non-agricultural areas, revegetation shall be considered successful if, upon visual survey, the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands, unless otherwise required by permit.
- In agricultural areas, revegetation shall be considered successful if crop yields are similar to adjacent undisturbed portions of the same field.
- Restoration shall be considered successful if the surface condition is similar to adjacent undisturbed lands, construction debris is removed (unless requested otherwise by the landowner or land managing agency), revegetation is successful, and drainage has been restored.
- Weed control measures shall be implemented as required by any applicable plan and in conjunction with the landowner.
- Keystone shall be responsible for correcting tile line or irrigation system

repairs that fail, provided those repairs were made by Keystone. Keystone shall not be responsible for tile line or irrigation system repairs which Keystone compensated the landowner to perform.

- When requested by owners in cultivated land, Keystone shall monitor the yield of land impacted by construction with the help of agricultural specialists. If yield deficiencies are indicated compared to yields on unaffected land, Keystone will compensate the landowner for reduced yields and shall implement procedures to return the land to equivalent capability.
- In residential areas, landowners may use the right-of-way provided they do not interfere with the rights granted to Keystone. Trees, bushes, structures, including houses, tool sheds, garages, poles, guy wires, catch basins, swimming pools, trailers, leaching fields, septic tanks, and any other objects not easily removable, shall not be permitted on the permanent construction right-of-way without the written permission of Keystone, because they could impair access for maintenance of the pipeline.
- Keystone shall maintain communication with the landowner and tenant throughout the operating life of the pipeline to allow expedient communication of issues and problems as they occur. Keystone shall provide the landowner with corporate contact information for these purposes. Keystone shall work with landowners to prevent excessive erosion on lands disturbed by construction. Reasonable methods shall be implemented to control erosion. These may not be implemented if the property across which the pipeline is constructed is bare cropland which the landowner intends to leave bare until the next crop is planted.
- If the landowner and Keystone cannot agree upon a reasonable method to control erosion on the landowner's property, the recommendations of the appropriate NRCS office shall be considered by Keystone and the landowner.

5.0 DRAIN TILE SYSTEMS

5.1 General

If underground drainage tile is damaged by the pipeline installation, it shall be repaired in a manner that ensures the tile line's proper operating condition at the point of repair. Keystone may elect to negotiate a fair settlement with the affected county or landowner for repair of the damaged drain tile. In the event the landowner chooses to have the damaged tile repaired by Keystone, the Contractor shall follow these guidelines and procedures to identify the location of drain tiles, to mitigate damages to drain tiles prior to and during construction, to repair drain tiles damaged during installation of the pipeline, to inspect the proper repair of drain tiles, and to provide post-construction monitoring to determine any impacts caused by repair of drain tiles. Since all public and private drain tile systems are unique, i.e., varying age, depth of cover, type of material, geometry on the land, etc., it is not possible to develop a standard procedure for resolving each county’s or landowner’s drain tile issues. These guidelines provide a basis on which to develop site specific methodology to mitigate damage and to repair drain tiles affected by construction of the Project. A typical right-of-way layout and typical orientation for crossing drain tiles is provided in Detail 25. Typical header and main

crossovers are provided in Details 26 and 27. Actual measures will be developed based on site-specific information unique to specific installations. However, all work will be conducted in accordance with applicable permits.

5.2 Identification and Classification of Drain Tile Systems

Personnel shall attempt to identify and classify existing drain tile systems by meeting with local public officials and county engineers, and individual private landowners and tenants.

5.2.1 Publicly Owned Drain Tiles

Personnel shall identify and meet with the responsible county or local authority responsible for publicly owned drain tiles. Publicly owned drain tiles shall be identified and documented on the Project's 1" = 2000' USGS quad strip maps and additional data collected for input into an electronic spreadsheet by county, township, range, and section; responsible agency; and size, type, and depth of cover (if known). This data shall be cross-referenced to the centerline survey to be completed by Keystone. Additionally, any public records including maps or easement instruments on the drain tiles shall be acquired as well as any requirements of the local authority for installation of the pipeline.

5.2.2 Privately Owned Drain Tiles

Right-of-way agents shall meet with landowners and tenants of privately owned land along the route. As a minimum, the right-of-way agents shall ascertain the data concerning drain tiles outlined in a landowner questionnaire. The questionnaire requests data concerning: type of drain tile system; size, type of material, and depth of cover; preference for repair of drain tiles; and identification of local drain tile contractors. These data shall be collected into an electronic spreadsheet for utilization by right-of-way personnel in negotiating payments for easements and damages and by engineering or construction personnel for inclusion in specifications for the construction Contractor.

5.3 Mitigation of Damage to Drain Tile Systems

Keystone shall undertake mitigation measures to reduce damage to publicly and privately owned drain tile systems prior to and during installation of the pipeline.

5.3.1 Non-interference with Drain Tile

The Project shall be installed at a depth of cover and elevation so as not to interfere with the elevation and grade of existing drain tiles where practicable. Where not practicable, Keystone shall pursue alternative mitigation measures mutually acceptable to the landowner and jurisdictional agencies. Typically, the pipeline shall be installed below the elevation of drain tiles with a minimum clearance of 12 inches. Detail 25, Typical Right-of-Way Layout/Soil Handling, represents a typical drain tile crossing by the

pipeline with additional temporary work space to facilitate handling of topsoil and trench spoil created by the additional depth of cover for the pipeline.

5.3.2 Non-disturbance of Drain Tile Mains

Publicly owned and privately owned drain tile mains shall be identified through the processes identified in Section 5.2. Drain tile mains are essential to the overall drainage system of a land area and if disturbed, may require excessive pumping/dewatering of the pipe trench unless temporarily repaired and maintained until permanently repaired.

Keystone shall review drain tile mains and consider their size, flow rate, type of material, depth of cover, and geographic location. If determined to be practicable and reasonable for construction, the drain tile main shall not be cut and repaired during mainline installation (a pipe section shall be left out and installed by a tie-in crew without damaging the drain tile main).

5.3.3 Relocation or Replacement of Existing Drain Tiles Prior to Construction

In many instances, drain tile systems that have been installed after the installation of adjacent existing pipelines were installed with “headers” parallel to the existing pipeline with periodic jump overs as depicted on Detail 26, Header/Main Crossovers of Keystone XL Pipeline. The distance of these headers from the existing pipeline may vary.

Some of these drain tile headers may be most effectively relocated and/or replaced to the east of the Project. The existing header will be capped and made into a single drain tile as depicted on Detail 27, Relocate/Replace Drainage Header/Main. This could reduce the number of drain tile crossings on a particular landowner’s property by a significant quantity, thereby reducing the risk that repairs will fail.

5.3.4 Future Drain Tiles/Systems

Keystone shall attempt to determine where public agencies and private landowners or tenants are proposing to install drain tile systems in the future. These locations shall be input into an electronic spreadsheet by county, township, range, and section; landowner or responsible public agency; and proposed size and depth of cover. Keystone shall endeavor to construct the pipeline at a depth and elevation to accommodate the future installation of the proposed drain tile systems.

5.3.5 Other Mitigation Measures

Other mitigation measures that may be implemented during installation of the pipeline are as follows:

- not removing topsoil from the working side of the construction right-of-way to prevent crushing of drain tile by heavy equipment;
- spreading ditch and spoil side topsoil (not subsoil) over the working side to provide additional soil depth to protect existing drain tiles;

- restricting the work of the pipe lower in crew if ground conditions are too wet to adequately support the heavy equipment;
- limiting travel of heavy equipment the working lane of the construction right-of-way where possible;
- limiting travel of heavy equipment to one pass over the drain tile per work crew where possible; and
- removing and replacing topsoil during drain tile replacement should tile be crushed on the working side of the right-of-way.

5.4 Responsibility for Repair of Drain Tile Systems

Temporary and permanent drain tile repairs shall be the responsibility of the Contractor. The physical repairs shall be made by qualified and experienced drain tile repair personnel.

5.4.1 Local Drain Tile Contractor Repair

Keystone shall identify and qualify local drain tile contractors in the geographical area of the pipeline route from interviews with local public officials, landowners, tenants, and drain tile contractors. The preferred responsibility for permanent repair of drain tiles shall be for the pipeline Contractor to subcontract the supervision and repair to local reputable drain tile contractors acceptable to the landowners and tenants.

5.4.2 Pipeline Contractor Repair

In the event local drain tile contractors are not available to subcontract the supervision and repair, permanent repair shall be made with the Contractor's supervision, equipment, and labor.

5.4.3 Landowner/Tenant Repair

The landowner or tenant may agree to take responsibility for the permanent repair of his drain tiles if not precluded by regulatory agency. The landowner or tenant shall be requested to ensure his ability to coordinate and complete the drain tile repair in a timely manner to allow the pipeline Contractor to completely backfill the damaged drain tile for repair by landowner/tenant in the immediate future. Keystone shall require that its representative be present to ensure the permanent drain tile repairs are made in accordance with the minimum requirements of this manual.

5.5 Drain Tile Repairs

The Contractor shall endeavour to locate all tile lines within the construction right-of-way prior to and during installation so repairs can be made if necessary.

5.5.1 Temporary Repairs During Construction

Drain tiles damaged or cut during the excavation of the trench shall be marked with a lath and ribbon in the spoil bank. Care shall be taken to

locate markers where the chance of disturbance shall be minimized and a written record maintained of each drain tile crossing. A work crew following the pipeline trench crew shall complete a temporary repair to allow continuing flow. Detail 28, Temporary Drain Tile Repair, depicts the materials and installation procedure to complete the temporary repair. If a drain tile line shall not be temporarily repaired, the open ends of the drain tile shall be screened to prevent entry of foreign materials and small animals.

5.5.2 Permanent Repairs

Permanent repairs shall be made for all drain tiles damaged by installation of the pipeline.

5.5.2.1 Ditch Line Only Repairs

If water is flowing through a damaged tile line, the tile line shall be immediately and temporarily repaired until such time that permanent repairs can be made. If tile lines are dry and water is not flowing, temporary repairs are not required if the permanent repair is made within 7 days of the time damage

occurred. The temporary repair shall be removed just prior to lowering in the pipeline.

Drain tiles must be permanently repaired before the pipeline trench is backfilled and within 14 days of construction completion, weather and soil conditions permitting. All tile lines shall be repaired with materials of the same or better quality as that which was damaged. The drain tile marker shall not be removed until the tile repairs have been inspected, approved, and accepted by Keystone's inspectors, the county inspectors, where applicable, and the landowner or tenant. Detail 29, Permanent Repair Method of Drain Tiles, depicts the minimum materials and installation procedure to complete a permanent repair.

5.5.2.2 Ditch Line and Temporary Work Space Repairs

Prior to making the permanent drain tile repair, the Contractor shall probe a segmented sewer rod with a plug that is not more than 15% smaller than the internal diameter of the drain tile to determine if additional damage has occurred to the drain tile. If the probe does not freely insert into the drain tile across the temporary workspace of pipeline construction, the Contractor shall excavate, expose, and repair the damaged drain tile to its original or better condition.

5.6 Inspection/Acceptance of Drain Tile Repairs

Drain tile repairs shall be inspected by Keystone construction inspectors, county inspectors, as applicable, and the landowner or tenant or his representative.

Keystone shall designate inspector(s) for the sole purpose and responsibility for inspection of all repairs of drain tiles. These inspectors shall be, if possible, employed from local drain tile installation contractors, local farmers with extensive drain tile experience, or previously employed or retired employees of local jurisdictions familiar with drain tile installation and repair. In the event that a sufficient quantity of inspectors from these sources is not available, Keystone shall conduct in-the-field training seminars on drain tile repair for additional inspection personnel.

Inspection personnel shall observe the permanent repair of all drain tiles to ensure the replacement drain tile is: (1) the proper size and type; (2) installed at the proper grade; (3) properly supported and backfill beneath the drain tile is properly placed and compacted; and (4) properly tied into the existing drain tile. The inspection shall be documented on the Drain Tile Inspection Report Form.

A drain tile repair shall not be accepted until Keystone's construction inspector and the landowner or tenant or designated representative approves the inspection form.

6.0 WETLAND CROSSINGS

6.1 General

Wetland boundaries shall be clearly marked in the field with signs and/or highly visible flagging during construction.

In the event a waterbody crossing is located within or adjacent to a wetland crossing, the measures of both Section 6 - Wetland Crossings and Section 7 - Waterbodies and Riparian Lands shall be implemented to the extent practicable.

A dry wetland is defined in Section 6.5.1. In these wetlands, equipment can traverse the wetland without the support of mats or timber riprap.

A standard wetland environment typically has soils that are saturated and non-cohesive. Difficult trenching conditions are likely resulting in excessively wide trenches. In these wetland environment types, supplemental support in the form of timber riprap or prefabricated equipment mats may be required for construction equipment to safely and efficiently operate.

A flooded wetland involves the presence of standing water over much of the wetland area. Equipment typically cannot traverse the wetland and must generally move around that portion of the area. Access is typically limited to marsh backhoes or equipment working from flexifloats or equivalents.

Keystone may allow modification of the following specifications as necessary to accommodate site-specific conditions or procedures. Any modifications must still comply with all applicable regulations and permits.

6.2 Easement and Workspace

The Contractor shall maintain wetland boundary markers during construction in all areas and until permanent seeding is complete in non-cultivated areas.

The width of the construction right-of-way shall be reduced to 85 feet or less in standard wetlands unless non-cohesive soil conditions require utilization of a greater width and unless the USACE or other regulatory authority authorizes a greater width.

The Contractor shall locate extra work areas (such as staging areas and additional spoil storage areas) shall be at least 10 feet away from wetland boundaries, where topographic conditions permit.

The Contractor shall limit clearing of vegetation between extra work areas and the edge of the wetland to the construction right-of-way and limit the size of extra work areas to the minimum needed to construct the wetland crossing.

6.3 Vehicle Access and Equipment Crossing

The only access roads, other than the construction right-of-way, that the Contractor shall use in wetlands are those existing public roads and private roads acquired by Keystone from the landowner shown on the construction drawings.

To the extent practicable, the Contractor's construction equipment operating in saturated wetlands or wetlands with standing water shall be limited to that needed to clear the construction right-of-way, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the construction right-of-way.

If equipment must operate within a wetland containing standing water or saturated soils, the Contractor shall use the following methods for equipment access unless otherwise approved by Keystone based on site-specific conditions:

- wide-track or balloon-tire construction equipment; and
- conventional equipment operated from timber and slash (riprap) cleared from the right-of-way, timber mats, or prefabricated equipment mats.

6.4 Temporary Erosion and Sediment Control

The Contractor shall install sediment barriers across the entire construction right-of-way immediately upslope of the wetland boundary at all standard wetland crossings, as necessary, to prevent sediment flow into the wetland. Sediment barriers must be properly maintained by the Contractor throughout construction and reinstalled as necessary. In the travel lane, these may incorporate removable sediment barriers or drivable berms. Removable sediment barriers can be removed during the construction day, but shall be re-installed after construction has stopped for the day or when heavy precipitation is imminent. The Contractor shall maintain sediment barriers until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. The Contractor shall not install sediment barriers at wetlands designated as "dry" unless otherwise specified by Keystone.

Where standard wetlands are adjacent to the construction right-of-way, the Contractor shall install sediment barriers along the edge of the construction right-of-way as necessary to prevent a sediment flow into the wetland.

6.5 Wetland Crossing Procedures

The following general mitigative procedures shall be followed by the Contractor in all wetlands unless otherwise approved or directed by Keystone based on site-specific conditions. All work shall be conducted in accordance with applicable permits.

- limit the duration of construction-related disturbance within wetlands to the extent practicable;

- use no more than two layers of timber riprap to stabilize the construction right-of-way;
- cut vegetation off at ground level leaving existing root systems in place and remove it from the wetland for disposal;
- limit pulling of tree stumps and grading activities to directly over the trench line unless safety concerns require the removal of stumps from the working-side of the construction ROW;
- segregate a maximum of 12 inches of topsoil from the area disturbed by trenching in dry wetlands, where practicable;
- restore topsoil to its approximate original stratum, after backfilling is complete;
- dewater the trench in a manner to prevent erosion and heavily silt-laden flowing directly into any wetland or waterbody;
- remove all timber riprap and prefabricated equipment mats upon completion of construction;
- locate hydrostatic test manifolds outside wetlands and riparian areas to the maximum extent practicable;
- prohibit storing hazardous materials, chemicals, fuels, lubricating oils, or perform concrete coating activities in a wetland, or within 100 feet of any wetland boundary;
- perform all equipment maintenance and repairs upland locations at least 100 feet from waterbodies and wetlands;
- avoid parking equipment overnight within 100 feet of a watercourse or wetland;
- prohibit washing equipment in streams or wetlands;
- install trench breakers and/or seal the trench to maintain the original wetland hydrology, where the pipeline trench may drain a wetland;
- attempt to refuel all construction equipment in an upland area at least 100 feet from a wetland boundary (otherwise follow the procedures outlined in Section 3); and
- avoid sand blasting in wetlands to the extent practicable. If sandblasting is performed within a wetland, the Contractor shall place a tarp or suitable material in such a way as to collect as much waste shot as possible and dispose of the collected waste. The Contractor shall clean up all visible deposits of wastes and dispose of the waste at an approved disposal facility.

Specific procedures for each type of wetland crossing method are listed below and shall be designated on the construction drawings but may be modified depending on site conditions at the time of construction. All work shall be conducted in accordance with applicable permits.

6.5.1 Dry Wetland Crossing Method

Topsoil shall be segregated. Pipe stringing and fabrication may occur within the wetland adjacent to the trench line or adjacent to the wetland in a designated extra workspace.

The dry wetland crossing procedure depicted in Detail 8 shall be used where this type of wetland is identified on the construction drawings. The following are exceptions to standard wetland crossing methods:

- The width of the construction right-of-way for upland construction is maintained through the wetland.
- Where extra work areas (such as staging areas and additional spoil storage areas) are designated on the construction drawings, they may be placed no closer than 10 feet from the wetland's edge.
- Seeding requirements for agricultural lands shall be applied to farmed wetlands.

6.5.2 Standard Wetland Crossing Method

Topsoil stripping is impracticable due to the saturated nature of the soil. Pipe stringing and fabrication may occur within the wetland adjacent to the trench line or adjacent to the wetland in a designated extra workspace. Based upon the length of a standard wetland crossing and presence of sufficient water to float the pipe, the Contractor may elect to install a standard wetland crossing utilizing the “push/pull” method.

The standard wetland crossing procedure depicted in Detail 9 shall be used where this type of wetland is identified on the construction drawings.

Procedures unique to standard wetlands include:

- limiting construction right-of-way width to a maximum of 85 feet unless site conditions warrant a wider width;
- utilizing low-ground-pressure construction equipment or support equipment on timber riprap or timber mats; and
- installing sediment barriers across the entire right-of-way where the right-of-way enters and exits the wetland.

6.5.3 Flooded Push/Pull Wetland Crossing Method

Where standing surface water or high groundwater levels make trenching difficult, trench widths up to 35 feet are common. Topsoil stripping is impossible due to the flooded conditions. Pipe stringing and fabrication is required adjacent to the wetland in a designated extra workspace. Using floatation devices, the pipe string is pushed and pulled from the extra workspace to the trench.

The Push/Pull wetland crossing procedure as depicted in Detail 10 shall be used where water is sufficient to float the pipeline in the trench and other site conditions allow.

Clean metal barrels or Styrofoam floats may be used to assist in the flotation of the pipe. Metal banding shall be used to secure the barrels or floats to the pipe. All barrels, floats, and banding shall be recovered and removed upon completion of lower in. Backfill shall not be allowed before recovery of barrels, floats, and banding.

6.6 Restoration and Reclamation

All timber riprap, timber mats, and prefabricated equipment mats and other construction debris shall be removed upon completion of construction. As much as is feasible, the Contractor shall replace topsoil and restore original contours with no crown over the trench. Any excess spoil shall be removed from the wetland. The Contractor shall stabilize wetland edges and adjacent upland areas by establishing permanent erosion control measures and revegetation, as applicable, during final clean up.

For each standard wetland crossed, the Contractor shall install a permanent slope breaker and trench breaker at the base of slopes near the boundary between the wetland and adjacent upland areas. The Contractor shall locate the trench breaker immediately upslope of the slope breaker.

The Contractor shall not use fertilizer, lime, or mulch in wetlands unless required in writing by the appropriate land management agency.

All wetland areas within conservation lands or easements will be restored to a level consistent with any additional criteria established by the relevant managing agency.

7.0 WATERBODIES AND RIPARIAN AREAS

7.1 General

The Contractor shall comply with requirements of all permits issued for the waterbody crossings by federal, state or local agencies.

Waterbody includes any areas delineated as jurisdictional natural or artificial stream, river, or drainage, and other permanent waterbodies such as ponds and lakes:

- Minor Waterbody includes all waterbodies less than or equal to 10 feet wide at the water's edge at the time of construction.
- Intermediate Waterbody includes all waterbodies greater than 10 feet wide but less than or equal to 100 feet wide at the water's edge at the time of construction.
- Major Waterbody includes all waterbodies greater than 100 feet wide at the water's edge at the time of construction.

In the event a waterbody crossing is located within or adjacent to a wetland crossing, the Contractor, to the extent practicable, shall implement the provisions of both Section 6 - Wetland Crossings and Section 7 - Waterbodies and Riparian Areas.

The Contractor shall supply and install advisory signs in a readily visible location along the construction right-of-way at a distance of approximately 100 feet on each side of the crossing and on all roads which provide direct construction access to waterbody crossing sites. Signs shall be supplied, installed, maintained, and then removed upon completion of the Project. Additionally, signs shall be supplied and installed by the Contractor on all intermediate and major waterbodies accessible to recreational boaters warning boaters of pipeline construction operations.

The Contractor shall not store hazardous materials, chemicals, fuels, lubricating oils, or perform concrete coating within 100 feet of any waterbody. The Contractor shall not refuel construction equipment within 100 feet of any waterbody. If the Contractor must refuel construction equipment within 100 feet of a waterbody, it must be done in accordance with the requirements outlined in Section 3. All equipment maintenance and repairs will be performed in upland locations at least 100 feet from waterbodies and wetlands. All equipment parked overnight shall be at least 100 feet from a watercourse or wetland, if possible. Equipment shall not be washed in streams or wetlands.

Throughout construction, the Contractor shall maintain adequate flow rates to protect aquatic life and to prevent the interruption of existing downstream uses.

Keystone may allow modification of the following specifications as necessary to accommodate specific situations or procedures. Any modifications must comply with all applicable regulations and permits. Keystone will complete site-specific

crossing plans for certain waterbody crossings if required by the applicable regulatory agencies during federal or state permitting processes.

7.2 Easement and Work Space

The permanent easement, temporary work space, additional temporary work space, and any special restrictions shall be depicted on the construction drawings. The work shall be contained within these areas and be limited in size to the minimum required to construct the waterbody crossing.

The Contractor shall locate all extra work areas (such as staging areas and additional spoil storage areas) at least 10 feet from the water's edge if practicable.

At all waterbody crossings, the Contractor shall install flagging across the construction right-of-way at least 10 feet from the water's edge prior to clearing and ensure that riparian cover is maintained where practicable during construction.

7.3 Vehicle Access and Equipment Crossings

The Contractor shall inspect equipment for fluid leaks prior to entering or crossing over waterbodies.

Equipment bridges shall be installed at all flowing waterbodies and as directed by the Keystone EI. Equipment crossings shall be constructed as described in Details 16, 17
and/or 18.

Equipment crossings shall be perpendicular to drainage bottoms wherever possible.

Erosion and sediment control barriers will be installed and maintained around vehicle access points as necessary to prevent sediment from reaching the waterway.

The Contractor shall be responsible for the installation, maintenance, and removal of all temporary access crossings including portable bridges, bridges made from timber or mats, flumes, culverts, sand bags, subsoil, coarse granular material, and riprap.

The Contractor shall ensure that culverts and flumes are sized and installed of sufficient diameter to accommodate the existing flow of water and those that may potentially be created by sudden runoffs. Flumes shall be installed with the inlet and outlet at natural grade if possible.

Where bridges, culverts or flumes are installed across the work area, the Contractor shall be responsible for maintaining them (e.g. preventing collapse, clogging or tilting). All flumes and culverts shall be removed as soon as possible upon completion of construction.

The width of the temporary access road across culverts and flumes and the design of the approaches and ramps shall be adequate for the size of vehicle and equipment access required. The ramps shall be of sufficient depth and constructed to prevent collapse of the flumes, and the approaches on both sides of the flume shall be feathered.

Where culverts are installed for access, the culvert shall be of sufficient length to convey the stream flow through the construction zone.

The Contractor shall maintain equipment bridges to prevent soil from entering the waterbody.

7.4 Waterbody Crossing Methods

Construction methods pertinent to waterbody crossings are presented below. Selection of the most appropriate method at each crossing shall be depicted on the construction drawings but may be amended or changed based on site-specific conditions (i.e., environmental sensitivity of the waterbody, depth, and rate of flow, subsurface soil conditions, and the expected time and duration of construction) at the time of crossing. Construction will involve dry-ditch techniques at crossings where the timing of construction does not adequately protect environmentally sensitive waterbodies, as determined by the appropriate regulatory authority. Where required, horizontal directional drilling (HDD) will be used at designated major and sensitive waterbodies crossings. Each waterbody crossing shall be accomplished using one of the following construction methods:

- Non-flowing Open Cut Crossing Method - (Detail 11)
- Flowing Open Cut Crossing Method – Minor, Intermediate or Major Waterbody - (Detail 12)
- Flowing Stream Crossing – Dry Flume Method - (Detail 13)
- Flowing Stream Crossing – Dry Dam-and-Pump Method - (Detail 14)
- Horizontal Directional Drill Crossing - (Detail 15)
- Horizontal Bore Crossing - (Detail 21)

In conjunction with the appropriate jurisdictional agency, Keystone will develop specific crossing plans for major water bodies that contain recreationally or commercially important fisheries, or are classified as special use. Keystone will consult with state fisheries agencies with respect to applicable construction windows for each crossing and develop specific construction and crossing methods for open cuts in conjunction with USACE permitting and USFWS consultation.

7.4.1 Non-flowing Open Cut Crossing Method

The Contractor shall utilize the Non-flowing Open Cut Crossing Method (Detail 11) for all waterbody crossings (ditches, gullies, drains, swales, etc.) with no perceptible flow at the time of construction. Should site conditions change and the waterbody is flowing at the time of

construction, the Contractor shall install the crossing utilizing the Flowing Open Cut Crossing Method (Detail 12) unless otherwise approved by Keystone.

7.4.2 Flowing Open Cut Crossing Method of Minor, Intermediate, and Major Waterbodies

For minor waterbody crossings, except where the flume method is used, the Contractor shall complete construction in the waterbody (not including blasting, if required) as shown on Detail 12 within 24 hours if practicable.

For intermediate waterbodies, the Contractor shall attempt to complete trenching and backfill work within the waterbody (not including blasting if required) within 48 hours if practicable as shown on Detail 12.

The Contractor shall construct each major waterbody crossing in accordance with a site-specific plan as shown in the construction drawings. The Contractor shall complete in-stream construction activities as expediently as practicable.

7.4.3 Flowing Stream Crossing – Dry Flume Method

Where required, the Contractor shall utilize the Flowing Open Cut Crossing – Dry Flume Method as shown on Detail 13 with the following "dry ditch" techniques:

- Flume pipe shall be installed after blasting (if necessary), but before any trenching.
- Sand bag, sand bag and plastic sheeting diversion structure, or equivalent shall be used to develop an effective seal and to divert stream flow through the flume pipe (some modifications to the stream bottom may be required in order to achieve an effective seal).
- Flume pipe(s) shall be aligned to prevent bank erosion and streambed scour.
- Flume pipe shall not be removed during trenching, pipe laying, or backfilling activities, or initial streambed restoration efforts.
- All flume pipes and dams that are not also part of the equipment bridge shall be removed as soon as final clean up of the stream bed and bank is complete.

7.4.4 Flowing Stream Crossing – Dry Dam-and-Pump Method

Where specified in the construction drawings, the Contractor shall utilize the Flowing Open Cut Crossing – Dry Dam-and-Pump Method as shown on Detail 14. The dam-and-pump crossing method shall meet the following performance criteria:

- sufficient pumps to maintain 1.5 times the flow present in the stream at the time of construction;

- at least one back up pump available on site;
- dams constructed with materials that prevent sediment and other pollutants from entering the waterbody (e.g., sandbags or clean gravel with plastic liner);
- screen pump intakes installed;
- streambed scour prevented at pump discharge; and
- dam and pumps shall be monitored to ensure proper operation throughout the waterbody crossing.

7.4.5 Horizontal Directional Drill Crossings

Where required, the horizontal directional drill method as shown on Detail 15 shall be utilized for designated major and sensitive waterbodies. The Contractor shall construct each directional drill waterbody crossing in accordance with a site specific plan as shown in the construction drawings.

Drilling fluids and additives utilized during implementation of a directional drill shall be non-toxic to the aquatic environment.

The Contractor shall develop a contingency plan to address a frac-out during a directional drill. The plan shall include instructions for monitoring during the directional drill and mitigation in the event that there is a release of drilling fluids. Additionally, the waterbody shall be monitored downstream by the Contractor for any signs of drilling fluid.

The Contractor shall dispose of all drill cuttings and drilling mud as permitted by the appropriate regulatory authority at a Keystone-approved location. Disposal options may include spreading over the construction right-of-way in an upland location approved by Keystone or hauling to an approved licensed landfill or other site approved by Keystone.

7.4.6 Horizontal Bore Crossings

Where required, the horizontal bore method as shown on Detail 21 shall be utilized for crossing waterbodies. The Contractor shall construct each horizontal bore waterbody crossing in accordance with a site specific plan as shown in the construction drawings.

7.5 Clearing

Except where rock is encountered and at non-flowing open cut crossings, all necessary equipment and materials for pipe installation must be on site and assembled prior to commencing trenching in a waterbody. All staging areas for materials and equipment shall be located at least 10 feet from the waterbody edge. The Contractor shall preserve as much vegetation as possible along the waterbody banks while allowing for safe equipment operation.

Clearing and grubbing for temporary vehicle access and equipment crossings shall be carefully controlled to minimize sediment entering the waterbody from the construction right-of-way.

Clearing and grading shall be performed on both sides of the waterbody prior to initiating any trenching work. All trees shall be felled away from watercourses.

Plant debris or soil inadvertently deposited within the high water mark of waterbodies shall be promptly removed in a manner that minimizes disturbance of the waterbody bed and bank. Excess floatable debris shall be removed above the high water mark from areas immediately above crossings.

Vegetation adjacent to waterbody crossings by horizontal directional drill or boring methods shall not be disturbed except by hand clearing as necessary for drilling operations.

7.6 Grading

The construction right-of-way adjacent to the waterbody shall be graded so that soil is pushed away from the waterbody rather than towards it whenever possible.

In order to minimize disturbance to woody riparian vegetation within extra workspaces adjacent to the construction right-of-way at waterbody crossings, the Contractor shall minimize grading and grubbing of waterbody banks. To the extent practicable, grubbing shall be limited to the ditch line plus an appropriate width to accommodate safe vehicle access and the crossing.

7.7 Temporary Erosion and Sediment Control

The Contractor shall install and maintain sediment barriers across the entire construction right-of-way at all flowing waterbody crossings.

The Contractor shall install sediment barriers immediately after initial disturbance of the waterbody or adjacent upland. Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration of adjacent upland areas is complete.

Where waterbodies are adjacent to the construction right-of-way, the Contractor shall install and maintain sediment barriers along the edge of the construction right-of-way as necessary to contain spoil and sediment within the construction right-of-way.

7.8 Trenching

The following requirements apply to all waterbody crossings except those being installed by the non-flowing open cut crossing method.

All equipment and materials shall be on site before trenching in the active channel of all minor waterbodies containing state-designated fisheries, and in

intermediate and major waterbodies. All activities shall proceed in an orderly manner without delays until the trench is backfilled and the stream banks stabilized. The Contractor shall not begin in-stream activity until the in-stream pipe section is complete and ready to be installed in the waterbody.

The Contractor shall use trench plugs at the end of the excavated trench to prevent the diversion of water into upland portions of the pipeline trench and to keep any accumulated upland trench water out of the waterbody. Trench plugs must be of sufficient size to withstand upslope water pressure.

The Contractor shall conduct as many in-stream activities as possible from the banks of the waterbodies. The Contractor shall limit the use of equipment operating in waterbodies to that needed to construct each crossing.

The Contractor shall place all spoil from minor and intermediate waterbody crossings and upland spoil from major waterbody crossings in the construction right-of-way at least 10 feet from the water's edge or in additional extra work areas. No trench spoil, including spoil from the portion of the trench across the stream channel, shall be stored within a waterbody unless the crossing cannot be reasonably completed without doing so.

The Contractor shall install and maintain sediment barriers around spoil piles to prevent the flow of spoil into the waterbody.

Spoil removed during ditching shall be used to backfill the trench usually with a backhoe, clamshell, or a dragline working from the waterbody bank. Sand, gravel, rockshield, or fill padding shall be placed around the pipe where rock is present in the channel bottom.

7.9 Pipe Installation

The following requirements apply to all waterbody crossings except those being installed by the non-flowing open cut crossing method.

A "free stress" pipe profile shall be used at all minor, intermediate, and major waterbodies with gradually sloping stream banks. The "box bend" pipe profile may be used for intermittent and major waterbodies with steep stream banks.

The trench shall be closely inspected to confirm that the specified cover and adequate bottom support can be achieved, and shall require Keystone approval prior to the pipe being installed. Such inspections shall be performed by visual inspection and/or measurement by a Keystone representative. In rock trench, the ditch shall be adequately padded with clean granular material to provide continuous support for the pipe.

The pipe shall be pulled into position or lowered into the trench and shall, where necessary, be held down by suitable negative buoyancy control, as-built recorded and backfilled immediately to prevent the pipe from floating.

The Contractor shall provide sufficient approved lifting equipment to perform the pipe installation in a safe and efficient manner. As the coated pipe is lowered in,

it shall be prevented from swinging or rubbing against the sides of the trench. Only properly manufactured slings, belts, and cradles suitable for handling coated pipe shall be used. All pipes shall be inspected for coating flaws and/or damage as it is being lowered into the trench. Any damage to the pipe or coating shall be repaired.

7.10 Backfilling

The following requirements apply to all waterbody crossings except those being installed by the non-flowing open cut crossing method.

Trench spoil excavated from waterbodies shall be used to backfill the trench across waterbodies.

After lowering in is complete, but before backfilling, the line shall be re-inspected to ensure that no skids, brush, stumps, trees, boulders, or other debris is in the trench. If discovered, such materials or debris shall be removed from the trench prior to backfilling.

For each major waterbody crossed, the Contractor shall install a trench breaker at the base of slopes near the waterbody unless otherwise directed by Keystone based on site specific conditions. The base of slopes at intermittent waterbodies shall be assessed on site and trench breakers installed only where necessary.

Slurred muck or debris shall not be used for backfill. At locations where the excavated native material is not acceptable for backfill or must be supplemented, the Contractor shall provide granular material approved by Keystone.

If specified in the construction drawings, the top of the backfill in the stream shall be armored with rock riprap or bio-stabilization materials as appropriate.

7.11 Stabilization and Restoration of Stream Banks and Slopes

The Contractor will restore the contours of the bed and banks of all waterways immediately after pipe installation and backfill, except over the travel lane. Travel lanes and bridges may stay in place until hydrostatic testing and cleanup are complete. All materials used to support construction activities will be removed from waterbodies and wetlands, including, but not limited to, flumes, mats, plastic sheeting, and sandbags.

The stream bank contour shall be re-established. All debris shall be removed from the streambed and banks. Stream banks shall be stabilized and temporary sediment barriers shall be installed within 24 hours of completing the crossing if practicable.

Approach slopes shall be graded to an acceptable slope for the particular soil type and surface run off controlled by installation of permanent slope breakers. Where considered necessary, the integrity of the slope breakers shall be ensured by lining with erosion control blankets.

Immediately following reconstruction of the stream banks, the Contractor shall install seed and flexible channel liners on waterbody banks as shown in Detail 19.

If the original stream bank is excessively steep and unstable or flow conditions are severe, or if specified on the construction drawings, the banks shall be stabilized with rock riprap, gabions, stabilizing cribs, or bio-stabilization measures to protect backfill prior to reestablishing vegetation.

Stream bank riprap structures shall consist of a layer of stone, underlain with approved filter fabric or a gravel filter blanket in accordance with Detail 20. Riprap shall extend from the stabilized streambed to the top of the stream bank. Where practicable, native rock shall be utilized.

Bio-stabilization techniques which may be considered for specific crossings are shown in Details 23 and 24.

The Contractor shall remove equipment bridges as soon as possible after final clean up.

8.0 HYDROSTATIC TESTING

8.1 Testing Equipment Location

The Contractor shall provide for the safety of all pipeline construction personnel and the general public during hydrostatic test operations by placing warning signs in populated areas.

The Contractor shall locate hydrostatic test manifolds 100 feet outside wetlands and riparian areas to the maximum extent practicable.

8.2 Test Water Source and Discharge Locations

Keystone is responsible for acquiring all permits required by federal, state and local agencies for procurement of water and for the discharge of water used in the hydrostatic testing operation. Keystone shall provide the Contractor with a copy of the appropriate withdrawal/discharge permits for hydrostatic test water. The Contractor shall keep water withdrawal/discharge permits on site at all times during testing operations.

Any water obtained or discharged shall be in compliance with permit notice requirements and with sufficient notice for Keystone's Testing Inspector to make water sample arrangements prior to obtaining or discharging water. Keystone will obtain water samples for analysis from each source before filling the pipeline. In addition, water samples will be taken prior to discharge of the water, as required by state and federal permits.

In some instances sufficient quantities of water may not be available from the permitted water sources at the time of testing. Withdrawal rates may be limited as stated by the permit. Under no circumstances shall an alternate water source be used without prior authorization from Keystone.

The Contractor shall be responsible for obtaining any required water analyses from each source to be used in sufficient time to have a lab analysis performed prior to any filling operations. The sample bottle shall be sterilized prior to filling with the water sample. The analysis shall determine the pH value and total suspended solids. Each bottle shall be marked with:

- source of water with pipeline station number;
- date taken;
- laboratory order number; and
- name of person taking sample.

Staging/work areas for filling the pipeline with water will be located a minimum of 100 feet from the waterbody or wetland boundary if topographic conditions permit. The Contractor will install temporary sediment filter devices adjacent to all streams to prevent sediments from leaving the construction site.

The Contractor shall screen the intake hose to prevent the entrainment of fish or debris. The hose shall be kept at least 1 foot off the bottom of the waterbody. Refueling of construction equipment shall be conducted a minimum distance of 100 feet from the stream or a wetland. Pumps used for hydrostatic testing within 100 feet of any waterbody or wetland shall be operated and refueled in accordance with Section 3.

During hydrostatic test water withdrawals, the Contractor will maintain adequate flow rates in the waterbody to protect aquatic life and provide for downstream uses, in compliance with regulatory and permit requirements.

The Contractor shall not use chemicals in the test water. The Contractor shall not discharge any water containing oil or other substances that are in sufficient amounts as to create a visible color film or sheen on the surface of the receiving water.

Selected road, railroad, and river crossing pipe sections may be specified to be pre-tested for a minimum of 4 hours. The water for pre-testing of any road and railroad crossings shall be hauled by a tanker truck from an approved water source. Water for pre-testing of a river crossing may be hauled or taken from the respective river if it is an approved water source. Since the volume of water utilized in these pre-tests shall be relatively small, the water shall be discharged overland along the construction right-of-way and allowed to soak into the ground utilizing erosion and sediment control mitigative measures.

Selection of final test water sources will be determined based on site conditions at the time of construction and applicable permits.

8.3 Filling the Pipeline

After final positioning of the pipe, the Contractor shall fill the pipe with water. Pipe ends shall not be restrained during the fill. The fill pump shall be set on a metal catch pan of sufficient dimensions to contain all leaking lubricants or fuel and prevent them from entering the water source. The suction inlet must be placed in a screened enclosure located at a depth that shall not allow air to be drawn in with the water. The screened enclosure shall be such that the fill water is free of organic or particulate matter.

The Contractor shall provide a filter of the back flushing or cartridge type with a means of cleaning without disconnecting the piping. The filter shall have the specifications of 100 mesh screen. If the cartridge type is used, a sufficient quantity of cartridges shall be on hand at the filter location. The Contractor shall install the filter between the fill pump and the test header. The Contractor shall be responsible for keeping the back flush valve on the filter closed during the filling operation. The Contractor shall be responsible for the proper disposal of materials back flushed from the filter or filter cartridges. The Contractor shall not be allowed to back flush the filter into the stream or other water source.

During water-filling of the pipeline, the Contractor shall employ fill pumps capable of injecting water into the pipeline at a maximum rate of approximately 0.7 to 1.0 mile per hour, except as limited by permits or the maintenance of adequate flow rates in the waterbody, as follows:

Nominal OD	Max GPM
36”	3000

The Contractor shall maintain flow rates as necessary to protect aquatic life, provide for all waterbody uses, and provide for downstream withdrawals of water by existing users.

In areas where zebra mussels are known to occur, all equipment used during the hydrostatic test withdrawal and discharge will be thoroughly cleaned before being used at subsequent hydrostatic test locations to prevent the transfer of zebra mussels or their larvae (veligers) to new locations.

8.4 Dewatering the Pipeline

The Contractor shall comply with state-issued NPDES permits for discharging test water.

The Contractor shall not discharge any water containing oil or other substances that are in sufficient amounts as to create a visible color film on the surface of the receiving water.

The Contractor shall not discharge into state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless appropriate federal, state, and local permitting agencies grant written permission.

To avoid impacts from introduced species, no inter-basin transfers (discharge) of hydrostatic test water will occur.

The discharge operation will be monitored and water samples will be taken prior to the beginning of the discharge to ensure that it complies with the Project and permit requirements. If required by state permits, additional water quality testing will be conducted during discharge, in accordance with permit conditions.

The Contractor shall calculate, record, and provide to Keystone the day, date, time, location, total volume, maximum rate, and methods of all water discharged to the ground or to surface water in association with hydrostatic testing.

The Contractor shall regulate the pig velocity discharge rate (3000 gpm maximum), use energy dissipation devices, and install sediment barriers, as necessary, to prevent erosion, streambed scour, suspension of sediments, or excessive stream flow. Water must be disposed of using good engineering judgment so that all federal, state, and local environmental standards are met. Dewatering lines shall be of sufficient strength and be securely supported and tied down at the discharge end to prevent whipping during this operation.

To reduce the velocity of the discharge, The Contractor shall utilize an energy-dissipating device described as follows:

8.4.1 Splash Pup

A splash pup consists of a piece of large diameter pipe (usually over 20" outside diameter) of variable length with both ends partially blocked that is welded perpendicularly to the discharge pipe. As the discharge hits against the inside wall of the pup, the velocity is rapidly reduced and the water is allowed to flow out either end. A variation of the splash pup concept, commonly called a diffuser, incorporates the same design, but with capped ends and numerous holes punched in the pup to diffuse the energy.

8.4.2 Splash Plate

The splash plate is a quarter section of 36-inch pipe welded to a flat plate and attached to the end of a 6-inch discharge pipe. The velocity is reduced by directing the discharge stream into the air as it exits the pipe. This device is also effective for most overland discharge.

8.4.3 Plastic Liner

In areas where highly erodible soils exist or in any low flow drainage channel, it is a common practice to use layers of Visqueen (or any of the new construction fabrics currently available) to line the receiving channel for a short distance. One anchoring method may consist of a small load of rocks to keep the fabric in place during the discharge. Additional best management practices, such as the use of plastic sheeting or other material to prevent scour, will be used as necessary to prevent excessive sedimentation during dewatering.

8.4.4 Straw Bale Dewatering Structure

Straw bale dewatering structures are designed to dissipate and remove sediment from the water being discharged. Straw bale structures are used for on land discharge of wash water and hydrostatic test water and in combination with other energy dissipating devices for high volume discharges. A straw bale dewatering structure is shown In Detail 6. A dewatering filter bags may be sued as an alternative to show bale dewatering structures. A dewatering filter bag is shown in Detail 5.

THESE ARE TYPICAL DRAWINGS; ACTUAL SITE CONDITIONS MAY VARY FROM THE SITE GRAPHICALLY REPRESENTED.

Typical Drawing Index

Detail 1	Typical Silt Fence Barrier
Detail 2	Typical Straw or Hay Bail Barrier
Detail 3	Temporary/Permanent Slope Breaker Detail (Water Bars)
Detail 4	Erosion Control Matting Installation
Detail 5	Typical Dewatering Filter Bag
Detail 6	Typical Straw Bale Dewatering Structure
Detail 7	Typical Permanent Trench Breakers
Detail 8	"Dry" Wetland Crossing Method
Detail 9	Standard Wetland Crossing Method
Detail 10	Push/Pull Wetland Crossing Method
Detail 11	Typical Open Cut Wet Crossing Method Non-Flowing Waterbody
Detail 12	Typical Open Cut Wet Crossing Method Flowing Waterbody
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Detail 13a	Typical Dry Flume Crossing Method - Construction Procedures
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Detail 19	Flexible Channel Liner Installation
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Detail 22	Streambank Reclamation - Brush Layer in Cross Cut Slope
Detail 23	Streambank Reclamation - Log Wall
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Detail 27	Relocate/Replace Drainage Header/Main
Detail 28	Temporary Drain Tile Repair
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Detail 30	Equipment Cleaning Station Detail
Detail 31	Equipment Wash Station Detail
Detail 67	Topsoil Conservation Ditch & Spoil Stripping Triple Ditch
Detail 67A	Topsoil Conservation Ditch & Spoil Stripping Triple Ditch

NOTE: **The following typical drawings are included for ease of reference.**

- Details 1 through 31 can be found in the Construction Mitigation and Reclamation Plan

REVISIONS
01 2008-11-05 REVISED TITLES, ADDED/DEL. DETAILS
02 2010-10-08 REVISED TITLES
03 2010-10-11 REVISED TITLE BLOCK

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The new identity of Trow Engineering Consultants, Inc.

DESIGNER: JMP (NAME) 2010-10-21 (DATE)
CHECKED BY: WSF
DESIGN CHECKER: RW P7100

KEYSTONE XL PROJECT
FIA # 4359 | CHAINAGE: | DISCIPLINE # 03
TITLE: DETAIL INDEX
SCALE: N.T.S. | DWG No 4359-03-ML-00-700 | REV 03

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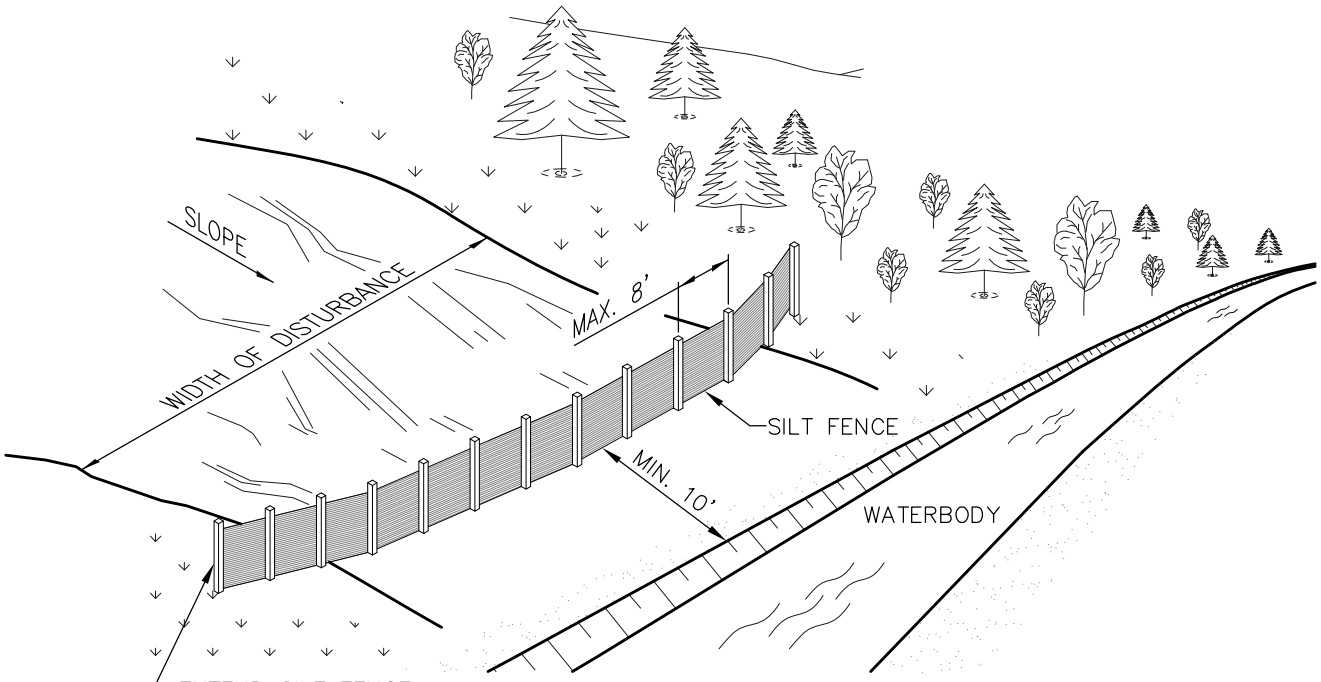

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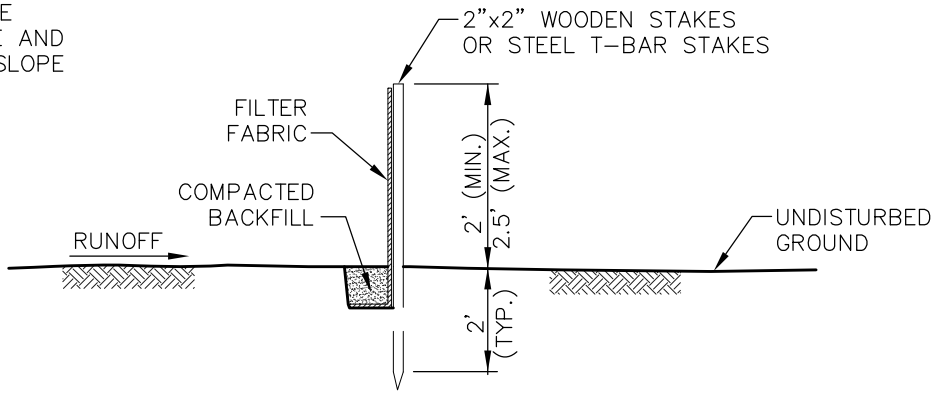

SECTION "A-A"

NOTES:

1. MATERIAL SHOULD BE WOVEN GEOTEXTILE FABRIC SUCH AS EXXON GTF 180 OR MIRAFI 600X, OR AN APPROVED EQUIVALENT. SECONDARY REINFORCEMENT, SUCH AS A CONSTRUCTION BARRIER FENCE OR WIRE MESH CAN ALSO BE USED BEHIND THE FILTER FABRIC.
2. SILT FENCE TO BE REINFORCED WITH 2"x2" WOODEN STAKES OR STEEL T-BAR STAKES PLACED EVERY 8' OR CLOSER AS CONDITIONS REQUIRE.
3. ATTACH FILTER FABRIC AT EACH POST AT A MINIMUM OF 3 LOCATIONS.
4. THE FILTER FABRIC MINIMUM LENGTH OF 1' IS TO BE ANCHORED IN A TRENCH WITH WELL COMPACTED BACKFILL OVER THE FABRIC TO PREVENT UNDERMINING.
5. TO ELIMINATE POSSIBLE END FLOW, BOTH ENDS OF THE SILT FENCE SHALL BE TURNED AND EXTENDED UPSLOPE.
6. SILT FENCES ARE TO BE CHECKED AND MAINTAINED ON A REGULAR BASIS. REMOVE ANY BUILD-UP OF SEDIMENT. REPLACE DAMAGED OR INEFFECTIVE SILT FENCE AS SOON AS POSSIBLE.
7. WHERE ANCHORING CONDITIONS FOR THE SILT FENCE ARE POOR, PLACE STRAW BALES ON DOWNSTREAM SIDE OF THE SILT FENCE.
8. INSTALLATION TO BE MODIFIED BY THE PROJECT AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

REVISIONS
01 2008-11-04 UPDATED DRAWING NOTES
02 2010-10-08 UPDATED DRAWING NOTES
03 2010-10-11 REVISED TITLE BLOCK

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CHECKED BY: WSF

DESIGN CHECKER: RW P7100

KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE: DETAIL 1 TYPICAL SILT FENCE BARRIER

SCALE: N.T.S. | DWG No 4359-03-ML-05-701 | REV 03

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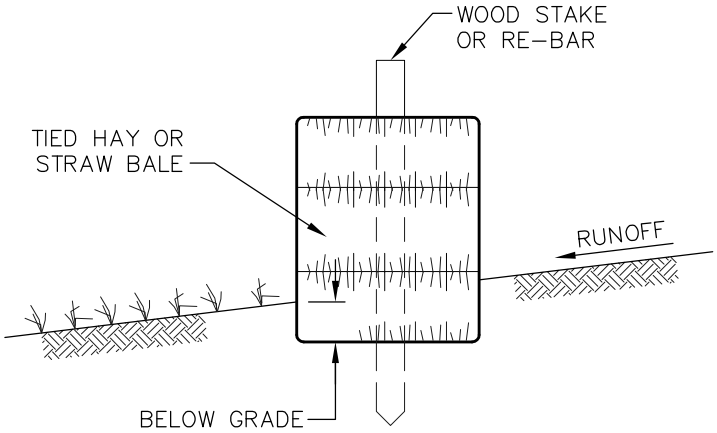
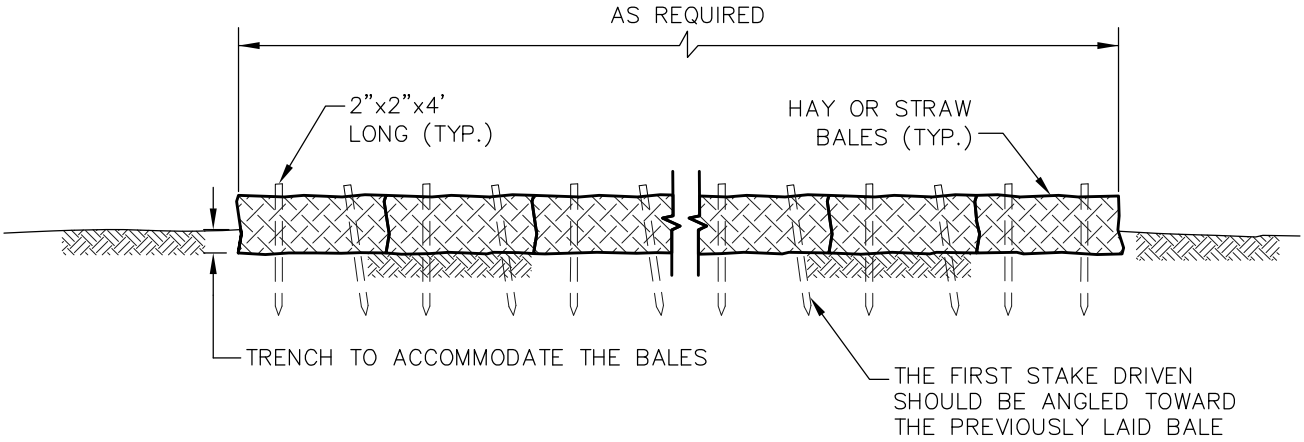


SECTION



SECTION

NOTES:

1. TO ELIMINATE POSSIBLE END FLOW, BOTH ENDS OF THE STRAW BALE BARRIER SHOULD BE TURNED AND EXTENDED UPSLOPE.
2. EACH BALE SHOULD BE SECURED BY AT LEAST 2 STAKES. THE FIRST STAKE IN EACH BALE SHALL BE DRIVEN TOWARD THE PREVIOUSLY LAID BALE TO FORCE THE BALES TOGETHER. ANY GAPS CAN BE FILLED IN BY WEDGING LOOSE STRAW BETWEEN THE BALES. STAKES SHOULD BE DRIVEN. REBAR OR STANDARD "T" OR "U" STEEL POSTS CAN BE USED AS STAKES, BUT IT SHOULD BE NOTED THAT THEY MAY POSE A HAZARD TO EQUIPMENT IF THE BALES DISINTEGRATE.
3. COMPACT THE EXCAVATED SOIL AGAINST THE UPHILL SIDE OF THE BARRIER TO PREVENT PIPING.
4. STRAW OR HAY BALE BARRIERS REQUIRE CONTINUAL MAINTENANCE TO REMOVE COLLECTED SEDIMENT AND REPLACE DAMAGED BALES AS SOON AS POSSIBLE. PAY CLOSE ATTENTION TO THE REPAIR OF DAMAGED BALES, END RUNS AND UNDERCUTTING BENEATH BALES.
5. INSTALLATION TO BE MODIFIED BY THE PROJECT AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

REVISIONS
01 2008-11-04 UPDATED DRAWING NOTES
02 2010-10-08 UPDATED DRAWING NOTES
03 2010-10-11 UPDATED DRAWING NOTES

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	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
	TITLE: DETAIL 2 TYPICAL STRAW OR HAY BALE BARRIER		
CHECKED BY: WSF	DESIGN CHECKER: RW P7100	SCALE N.T.S.	DWG No 4359-03-ML-05-702 REV 03

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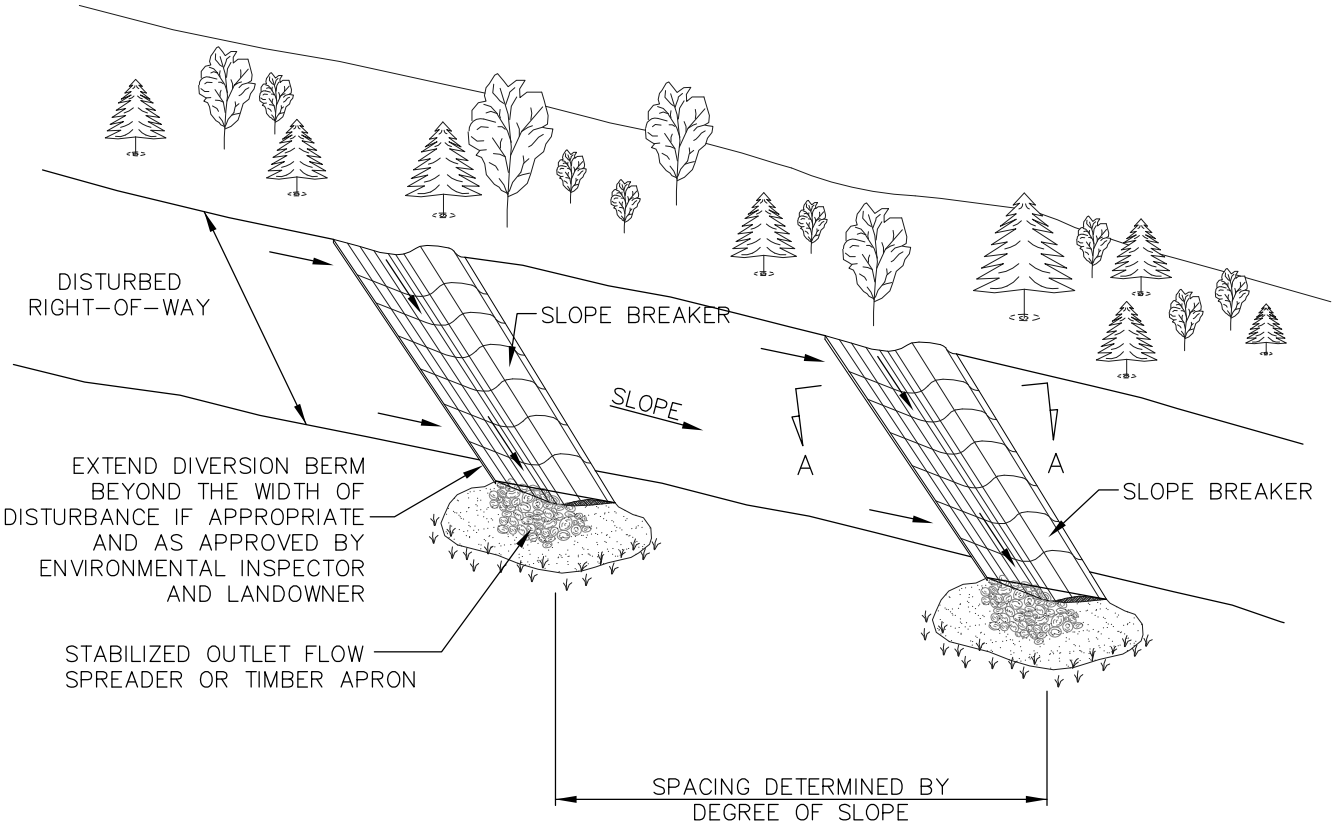

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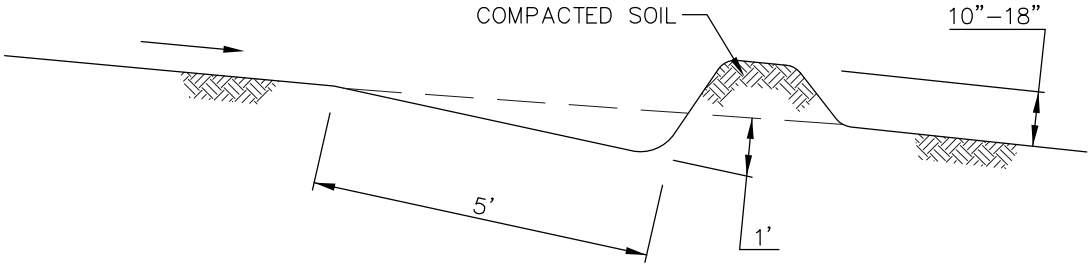

NOTES:

1. PERMANENT SLOPE BREAKERS TO PROVIDE POSITIVE DRAINAGE TO A STABILIZED OUTLET.
2. INSTALLATION SPECIFICATIONS TO BE MODIFIED BY THE PROJECT AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.
3. THE CONTRACTOR SHALL INSTALL TEMPORARY AND PERMANENT SLOPE BREAKERS ON SLOPES GREATER THAN APPROXIMATELY 5% ON ALL DISTURBED LANDS AT THE FOLLOWING RECOMMENDED SPACING:

SLOPE (%)	SPACING (FEET)
5–15	300
>15–30	200
>30	100

REVISIONS
01 2008–11–04 MODIFIED DRAWING NOTES
02 2010–10–08 UPDATED DRAWING NOTES
03 2010–10–11 REVISED TITLE BLOCK

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KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE: DETAIL 3
TEMPORARY/PERMANENT SLOPE BREAKER DETAIL
(WATER BARS)

SCALE N.T.S. | DWG No 4359–03–ML–05–703 | REV 03

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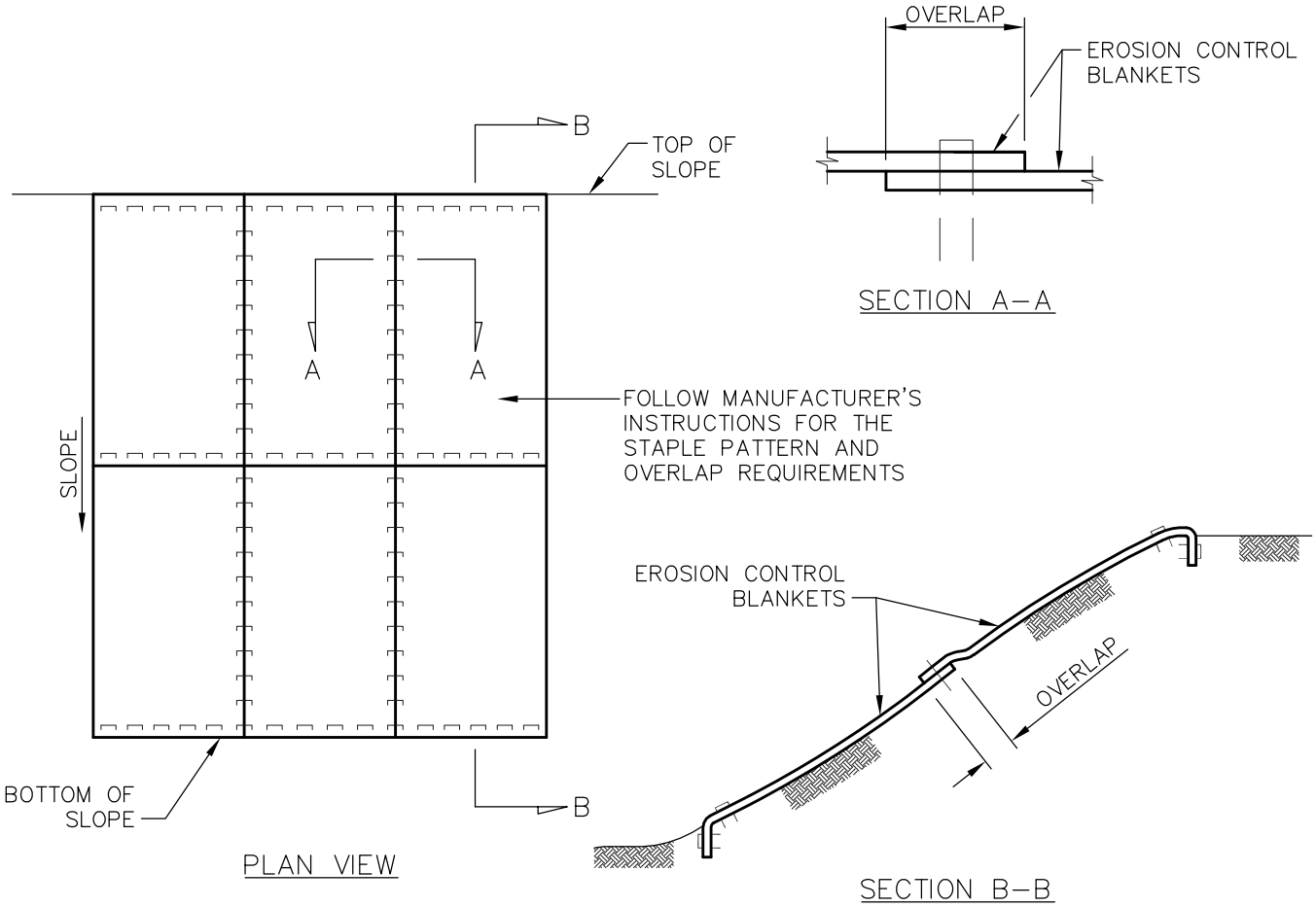

NOTES:

1. INSTALL MATTING IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
2. PREPARE SOIL BEFORE INSTALLING MATTING, INCLUDING GRADING, REMOVAL OF LARGE ROCKS AND DEBRIS, AND THE APPLICATION OF SEED AND FERTILIZER IF NOT USING PRE–SEEDED MATTING.
3. EROSION CONTROL MATTING SHALL EXTEND COMPLETELY ACROSS DISTURBED AREAS TO PROTECT ERODIBLE SURFACES.
4. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE MATTING IN A TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
5. ROLL THE MATTING DOWN THE SLOPE IN THE DIRECTION OF THE WATER FLOW.
6. AS AN ALTERNATIVE TO STAPLES, WOODEN STAKES OR BIO–DEGRADEABLE PINS CAN BE USED WHERE SPECIFIED BY THE COMPANY.
7. ENSURE COMPLETE CONTACT BETWEEN THE MATTING AND THE SLOPE FACE. ADDITIONAL STAPLES CAN BE USE TO ELIMINATE GAPS.
8. INSTALLATION SPECIFICATIONS TO BE MODIFIED BY THE PROJECT AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

REVISIONS
01 2008–11–04 MODIFIED DRAWING NOTES
02 2010–10–08 UPDATED DRAWING NOTES
03 2010–10–11 REVISED TITLE BLOCK

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CHECKED BY: WSF

DESIGN CHECKER: RW P7100

KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE
DETAIL 4
EROSION CONTROL MATTING INSTALLATION

SCALE N.T.S. | DWG No 4359–03–ML–05–704 | REV 03

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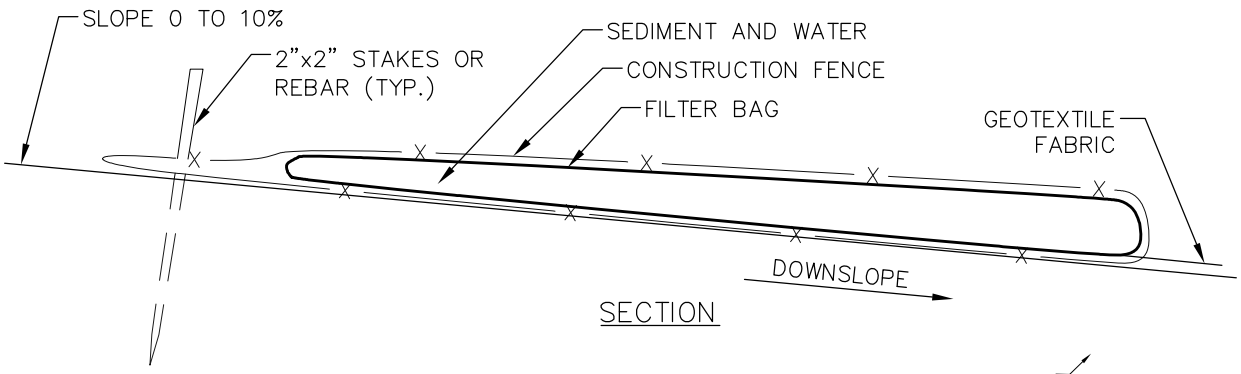
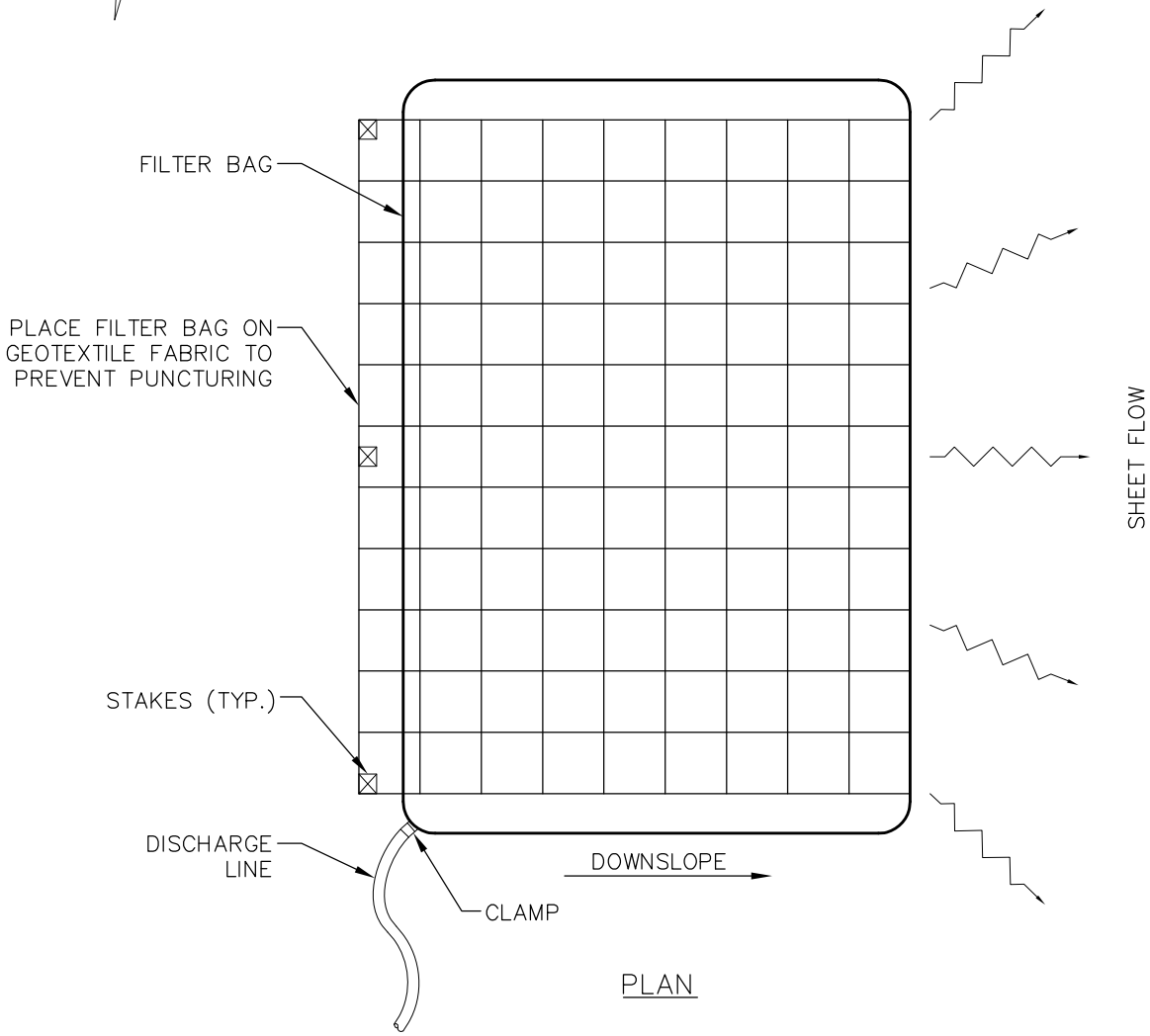


SECTION



PLAN

NOTES:

1. MANUFACTURED NONWOVEN (FELT) FILTER BAGS ARE A SUITABLE ALTERNATIVE TO STRAW BALE STRUCTURES FOR TRENCH DEWATERING. FILTER BAGS SHALL BE INSTALLED AS SPECIFIED BY THE MANUFACTURER.
2. INSTALLATION SPECIFICATIONS TO BE MODIFIED AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

REVISIONS
01 2008-11-04 MODIFIED DRAWING NOTES
02 2010-10-11 REVISED TITLE BLOCK

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JMP (NAME)	2010-10-21 (DATE)	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
		TITLE: DETAIL 5 TYPICAL DEWATERING FILTER BAG		
CHECKED BY: WSF	DESIGN CHECKER: RW P7100	SCALE N.T.S.	DWG No 4359-03-ML-05-705	REV 02

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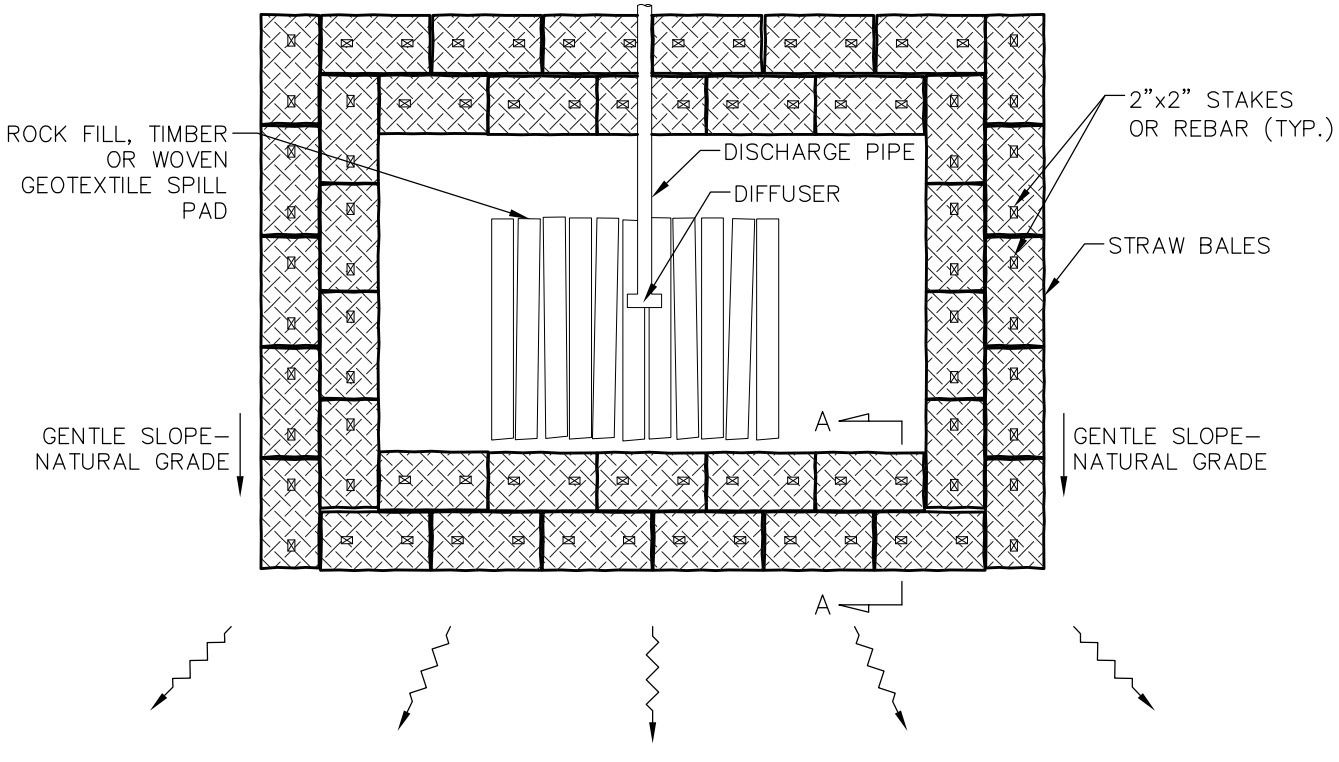
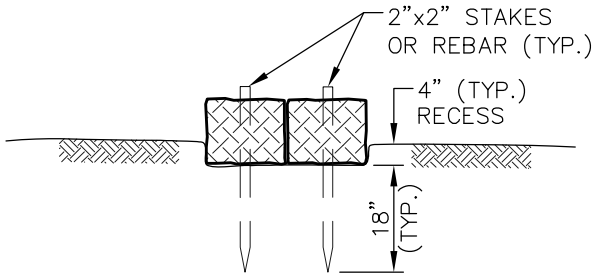


PLAN



SECTION A–A

NOTES:

1. INSTALL A STRAW BALE DEWATERING STRUCTURE WHEREVER IT IS NECESSARY AND AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR TO PREVENT THE FLOW OF HEAVILY SILT LADEN WATER INTO WATERBODIES OR WETLANDS.
2. DISCHARGE SITE SHOULD BE WELL VEGETATED AND LOCATED AT LEAST 50 FEET FROM ANY WATERBODY. THE TOPOGRAPHY OF THE SITE SHOULD BE SUCH THAT WATER WILL FLOW INTO THE DEWATERING STRUCTURE AND AWAY FROM ANY WORK AREAS. THE AREA DOWNSLOPE FROM THE DEWATERING SITE MUST BE REASONABLY FLAT OR STABILIZED BY VEGETATION OR OTHER MEANS TO ALLOW THE FILTERED WATER TO CONTINUE AS SHEET FLOW.
3. DIRECT THE PUMPED WATER ONTO A STABLE SPILL PAD CONSTRUCTED OF ROCKFILL, WEIGHTED TIMBERS, OR A WOVEN GEOTEXTILE STAKED TO THE GROUND SURFACE, SUCH AS MIRAFI 600X, TERRAFIX 400W, OR A COMPANY APPROVED EQUIVALENT. BEYOND THE SPILL PAD FORCE THE DISCHARGE WATER INTO SHEET FLOW USING STRAW BALES AND THE NATURAL TOPOGRAPHY.
4. DISCHARGE RATES SHOULD BE SUCH THAT THE CAPACITY OF THE STRUCTURE WILL NOT BE EXCEEDED.
5. DISCHARGE WATER SHALL BE FORCED INTO SHEET FLOW IMMEDIATELY BEYOND THE SPILL PAD USING A COMBINATION OF STRAW BALES AND THE NATURAL TOPOGRAPHY. RECESS STRAW BALES. DRIVE TWO (2) STAKES OR REBAR INTO EACH BALE TO ANCHOR THEM IN PLACE.
6. INSTALLATION SPECIFICATIONS TO BE MODIFIED AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

REVISIONS
01 2008–11–04 MODIFIED DRAWING NOTES
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03 2010–10–11 UPDATED DRAWING NOTES

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	TITLE: DETAIL 6 TYPICAL STRAW BALE DEWATERING STRUCTURE		
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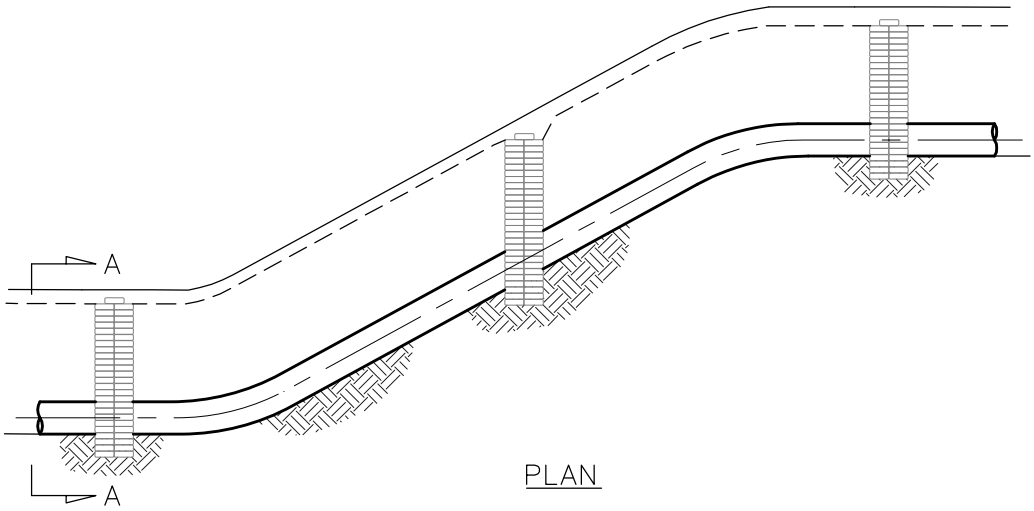
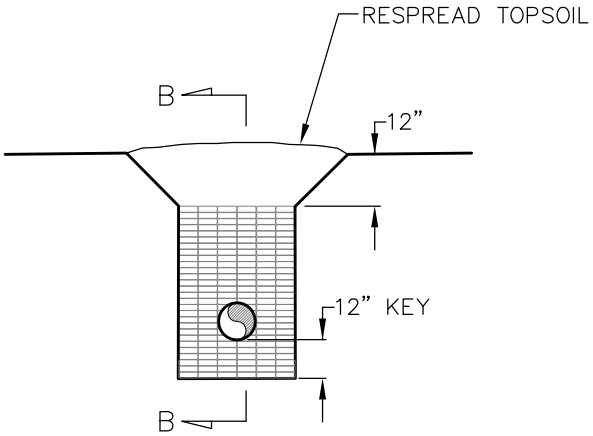
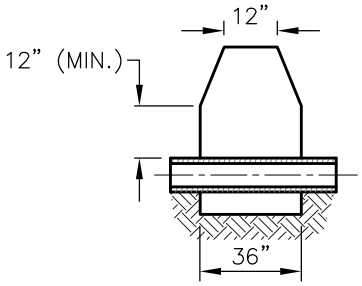


PLAN



SECTION A–A



SECTION B–B

NOTES:

1. TRENCH BREAKERS TO BE INSTALLED AS SHOWN ON THE CONSTRUCTION DRAWINGS, WHERE DESCRIBED IN THE PLAN, AND AS DIRECTED.
2. OPEN WEAVE HEMP OR JUTE SACKS SHALL BE FILLED WITH AN AVERAGE 55 LBS. MIXTURE OF:
   1) ONE (1) PART CEMENT AND SIX (6) PARTS SAND OR SUBSOIL, OR
   2) ONE (1) PART CEMENT, THREE (3) PARTS FLYASH, AND FIVE (5) PARTS SAND OR SUBSOIL
   3) SAND WITH JUST SUFFICIENT WATER TO PERMIT MIXTURE TO EXUDE AND BOND SACKS TOGETHER. TOPSOIL IS NOT TO BE USED IN SACKS.
3. KEY EACH TRENCH BREAKER A MINIMUM OF ONE (1) FT. INTO BOTTOMS AND SIDES OF TRENCH.
4. FOAM TRENCH BREAKERS MAY BE USED IN LIEU OF SAND SACK TRENCH BREAKERS.
5. INSTALLATION SPECIFICATIONS TO BE MODIFIED AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.
6. TRENCH BREAKERS SHALL BE INSTALLED SUCH THAT THE TOP OF EACH DOWNSLOPE BREAKER IS ABOVE THE BOTTOM OF THE NEXT UPSLOPE BREAKER.

REVISIONS
01 2008–11–04 UPDATED DRAWING NOTES
02 2010–10–11 UPDATED PLAN DETAIL

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KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE

DETAIL 7
TYPICAL PERMANENT TRENCH BREAKER

SCALE N.T.S. | DWG No 4359–03–ML–05–707 | REV 02

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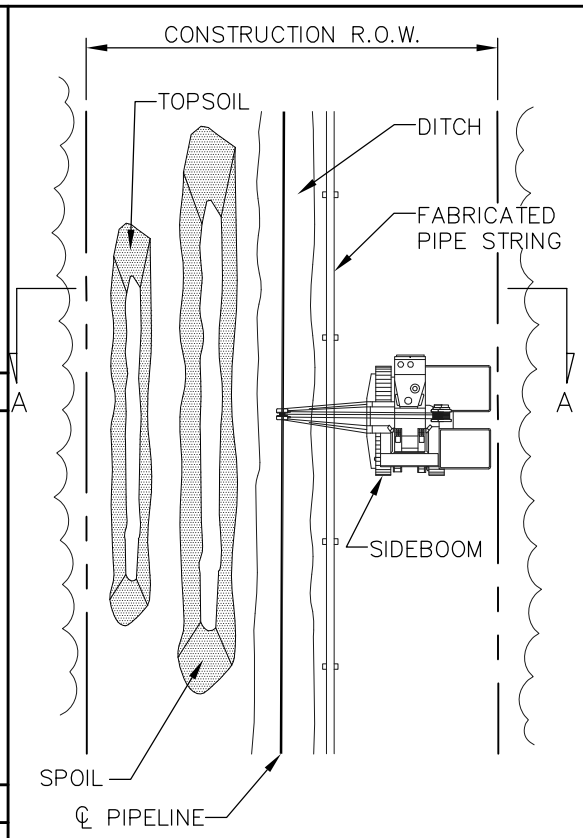
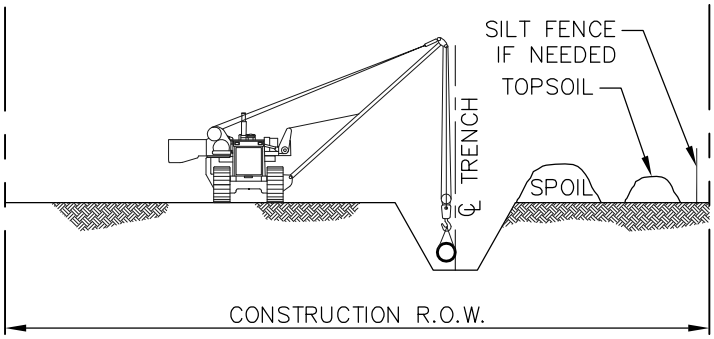


PLAN VIEW



SECTION "A–A"

CONSTRUCTION PROCEDURES:

1. IF THE WETLAND IS BEING CULTIVATED AND FARMED, NO WETLAND CONSTRUCTION PROCEDURES ARE REQUIRED.
2. FLAG WETLAND BOUNDARIES PRIOR TO CLEARING.
3. NO REFUELING OF MOBILE EQUIPMENT IS ALLOWED WITHIN 100 FEET OF WETLAND. PLACE "NO FUELING" SIGN POSTS APPROXIMATELY 100 FEET BACK FROM WETLAND BOUNDARY. REFUEL STATIONARY EQUIPMENT AS PER THE PROJECT'S SPILL PREVENTION PROCEDURES.
4. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY IF DIRECTED BY THE PROJECT.
5. DO NOT TRENCH WETLAND UNTIL PIPE IS READY TO INSTALL.
6. CONSTRUCT WHEN DRY, IF POSSIBLE. IF SITE BECOMES WET AT TIME OF TRENCHING, AVOID SOIL COMPACTION BY UTILIZING TIMBER RIP–RAP OR PREFABRICATED EQUIPMENT MATS.
7. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS (STRAW BALES AND/OR SILT FENCE) AT DOWN SLOPE EDGE OF RIGHT–OF–WAY ALONG WETLAND EDGE IF NEEDED TO CONTAIN SPOIL WITHIN RIGHT–OF–WAY.
8. RESTRICT ROOT GRUBBING TO ONLY THAT AREA OVER THE DITCHLINE AND REMOVE STUMPS FROM WETLAND FOR DISPOSAL.
9. CONDUCT TRENCH LINE TOPSOIL STRIPPING (IF TOPSOIL IS NOT SATURATED). SALVAGE TOPSOIL TO ACTUAL DEPTH OR A MAXIMUM DEPTH OF 12 INCHES.
10. TRENCH THROUGH WETLANDS.
11. PIPE SECTION TO BE FABRICATED WITHIN THE WETLAND AND ADJACENT TO ALIGNMENT, OR IN STAGING AREA OUTSIDE THE WETLAND AND WALKED IN.
12. LOWER–IN PIPE. PRIOR TO BACKFILLING TRENCH, IF REQUIRED, TRENCH PLUGS SHALL BE INSTALLED AS REQUIRED. BACKFILL TRENCH.
13. RESTORE GRADE TO NEAR PRE–CONSTRUCTION TOPOGRAPHY, REPLACE TOPSOIL AND INSTALL PERMANENT EROSION CONTROL.
14. IF UTILIZED, REMOVE TIMBER MATS OR PRE–FABRICATED MATS FROM WETLANDS UPON COMPLETION.
15. IN THE ABSENCE OF A DETAILED REVEGETATION PLANS, APPLY A TEMPORARY COVER CROP AS DIRECTED BY KEYSTONE.

REVISIONS
01 REVISED NOTES 3 & 4
02 2010–10–08 UPDATED DRAWING NOTES
03 2010–10–11 UPDATED DRAWING NOTES

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DESIGN CHECKER: RW

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KEYSTONE XL PROJECT

FIA # 4359	CHAINAGE:	DISCIPLINE # 03

TITLE

DETAIL 8
"DRY" WETLAND CROSSING METHOD

SCALE N.T.S.	DWG No 4359–03–ML–03–701	REV 03

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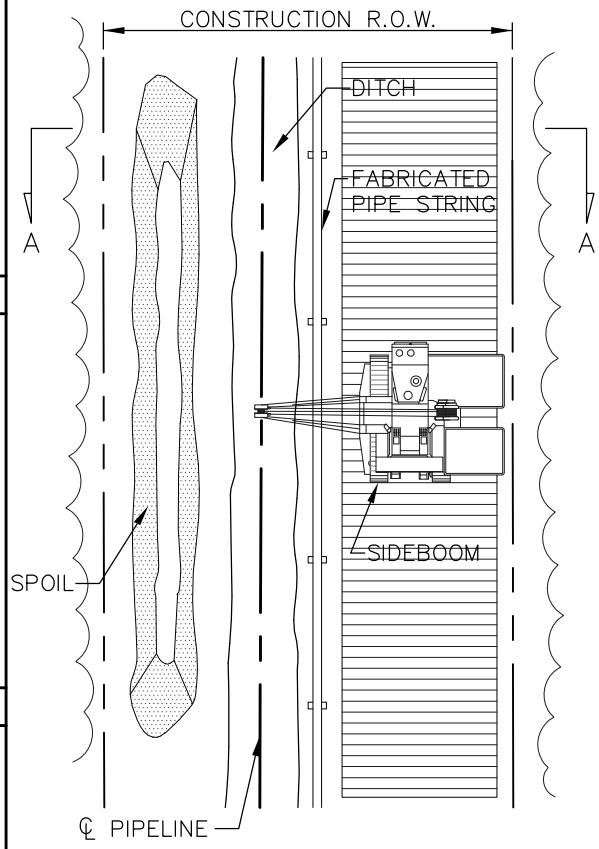
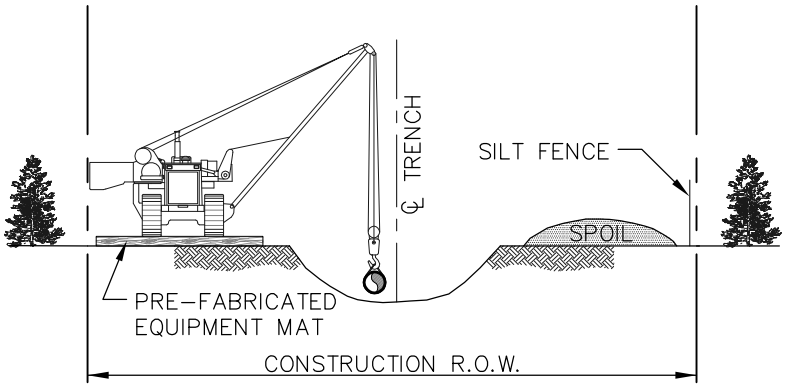


PLAN VIEW



SECTION A–A

CONSTRUCTION PROCEDURES:

1. FLAG WETLAND BOUNDARIES PRIOR TO CLEARING.
2. NO REFUELING OF MOBILE EQUIPMENT IS ALLOWED WITHIN 100 FEET OF WETLAND. PLACE "NO FUELING" SIGN POSTS 100 FEET BACK FROM WETLAND BOUNDARY. REFUEL STATIONARY EQUIPMENT AS PER THE PROJECT'S SPILL PREVENTION PROCEDURES.
3. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY IF DIRECTED BY THE PROJECT.
4. INSTALL TIMBER MATS/RIPRAP THROUGH ENTIRE WETLAND AREA. EQUIPMENT NECESSARY FOR RIGHT–OF–WAY CLEARING MAY MAKE ONE (1) PASS THROUGH THE WETLAND BEFORE MATS ARE INSTALLED.
5. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS (STRAW BALES AND/OR SILT FENCE) AT DOWNSLOPE EDGE OF RIGHT–OF–WAY AND ALONG WETLAND EDGE AS REQUIRED.
6. RESTRICT ROOT GRUBBING TO ONLY THAT AREA OVER THE DITCHLINE AND DITCH SPOIL AREAS AND REMOVED FROM WETLAND FOR DISPOSAL.
7. DO NOT TRENCH WETLAND UNTIL PIPE IS READY TO INSTALL.
8. TOPSOIL STRIPPING SHALL NOT BE REQUIRED IN SATURATED SOIL CONDITIONS.
9. LEAVE HARD PLUGS AT EDGE OF WETLAND UNTIL JUST PRIOR TO TRENCHING.
10. PIPE SECTION MAY BE FABRICATED WITHIN THE WETLAND AND ADJACENT TO ALIGNMENT, OR IN STAGING AREA OUTSIDE THE WETLAND AND WALKED IN.
11. TRENCH THROUGH WETLANDS.
12. LOWER–IN PIPE, INSTALL TRENCH PLUGS AT WETLAND EDGES AS REQUIRED AND BACKFILL IMMEDIATELY.
13. REMOVE TIMBER MATS OR PRE–FABRICATED MATS FROM WETLAND UPON COMPLETION.
14. RESTORE GRADE TO NEAR PRE–CONSTRUCTION TOPOGRAPHY, REPLACE TOPSOIL IF SALVAGED AND INSTALL PERMANENT EROSION CONTROL.

REVISIONS
01 REVISED NOTES 2 & 3
02 2010–10–11 UPDATED DRAWING NOTES

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		TITLE: DETAIL 9 STANDARD WETLAND CROSSING METHOD		
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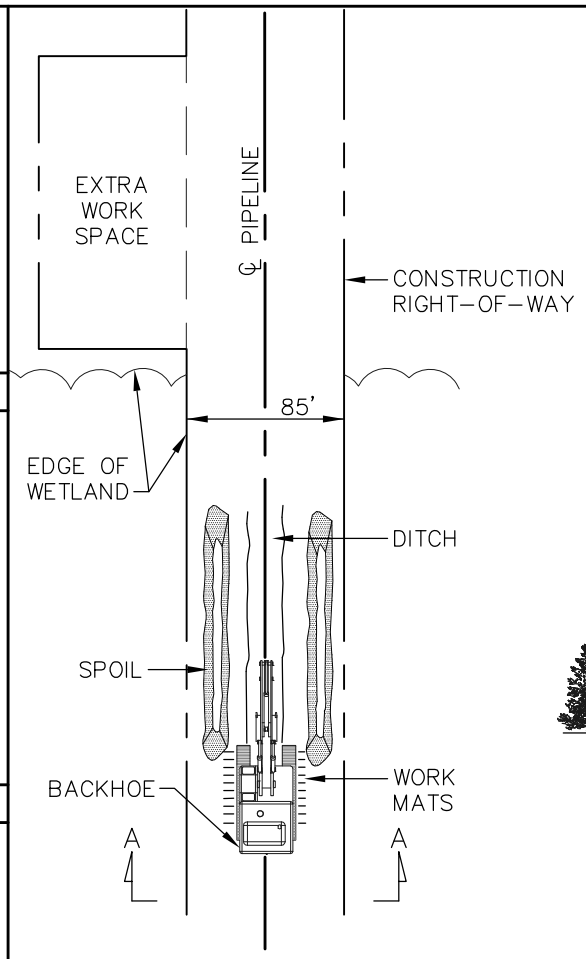
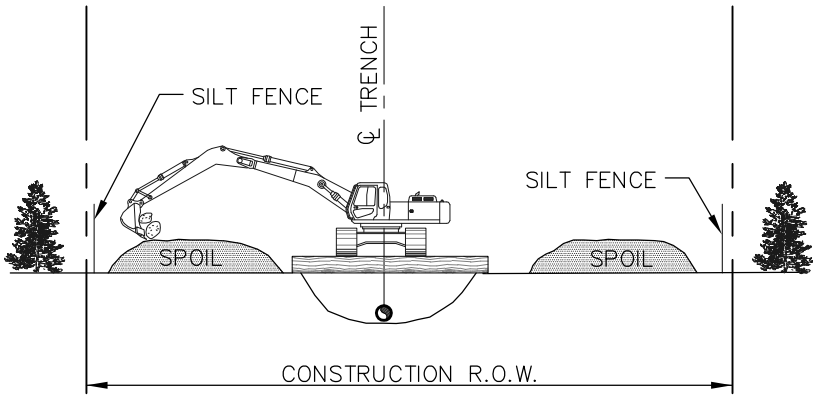


PLAN VIEW



SECTION A-A

CONSTRUCTION PROCEDURES:

1. FLAG WETLAND BOUNDARIES PRIOR TO CLEARING.
2. NO REFUELING OF MOBILE EQUIPMENT IS ALLOWED WITHIN 100 FEET OF WETLAND. PLACE "NO FUELING" SIGN POSTS 100 FEET BACK FROM WETLAND BOUNDARY. REFUEL STATIONARY EQUIPMENT AS PER THE PROJECT'S SPILL PREVENTION PROCEDURES.
3. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY AS DIRECTED BY THE PROJECT.
4. RESTRICT ROOT GRUBBING TO ONLY THE AREA OVER THE DITCHLINE.
5. DO NOT TRENCH WETLAND UNTIL PIPE IS READY TO INSTALL.
6. TOPSOIL STRIPPING SHALL NOT BE REQUIRED IN SATURATED SOIL CONDITIONS.
7. UTILIZE AMPHIBIOUS EXCAVATORS (PONTOON MOUNTED BACKHOES) OR TRACKED BACKHOES SUPPORTED BY FABRICATED TIMBER MATS OR FLOATS TO EXCAVATE TRENCH. IF FABRICATED TIMBER MATS ARE USED FOR STABILIZATION, THE BACKHOE SHALL GRADUALLY MOVE ACROSS THE WETLAND BY MOVING THE MAT FROM IMMEDIATELY BEHIND TO IMMEDIATELY IN FRONT OF THE BACKHOE'S PATH.
8. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS (STRAW BALES AND/OR SILT FENCE) AT EDGE OF RIGHT-OF-WAY AND ALONG WETLAND EDGE IF PRACTICAL.
9. FABRICATE PIPE IN STAGING AREA OUTSIDE THE WETLAND IN THE EXTRA WORK SPACE AS INDICATED ON THE CONSTRUCTION DRAWINGS.
10. LEAVE HARD PLUGS AT THE EDGE OF THE WETLAND UNTIL JUST PRIOR TO PIPE PLACEMENT.
11. FLOAT PIPE IN PLACE, LOWER-IN, INSTALL TRENCH PLUGS AT WETLAND EDGES WHERE REQUIRED AND BACKFILL IMMEDIATELY.
12. REMOVE TIMBER MATS OR PRE-FABRICATED MATS OF NON-NATIVE MATERIAL FROM WETLANDS UPON COMPLETION.
13. RESTORE GRADE TO NEAR PRE-CONSTRUCTION TOPOGRAPHY AND INSTALL PERMANENT EROSION CONTROL.
14. THE CONSTRUCTION RIGHT-OF-WAY FOR THIS TYPE OF CONSTRUCTION SHALL BE 85 FEET.

REVISIONS
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	TITLE: DETAIL 10 PUSH/PULL WETLAND CROSSING METHOD		
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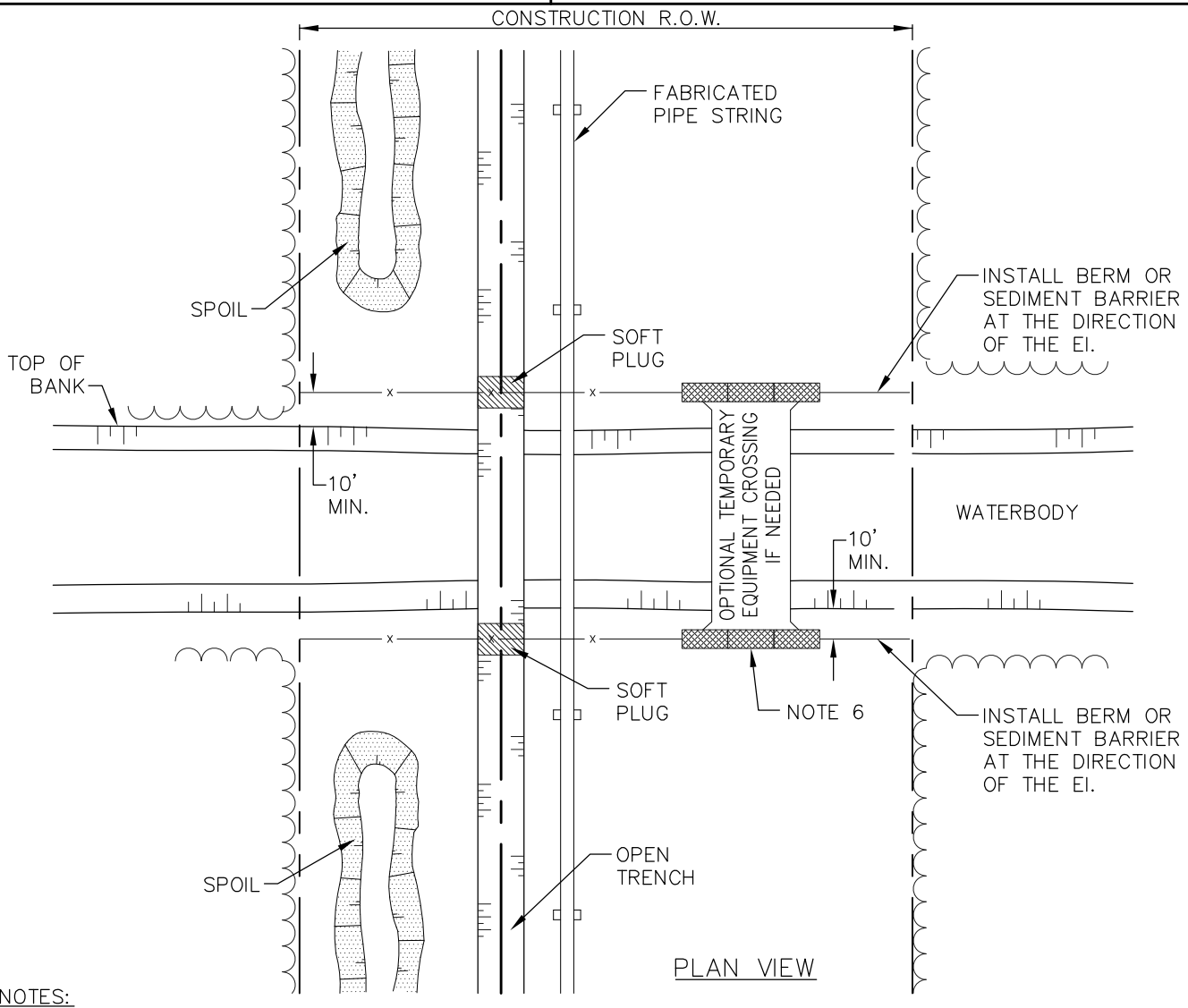

NOTES:

1. THIS METHOD APPLIES TO DRY WASHES, SWALES, INCISED DRAINAGES AND DITCHES WITH NO PERCEPTIBLE FLOW AT TIME OF CROSSING. IF FLOWS ARE PRESENT DURING CONSTRUCTION REFER TO DETAIL 12. CLEARING AND GRADING, TOPSOIL SALVAGE AND TOPSOIL STRIPPING DEPTHS SHALL BE THE SAME AS INDICATED FOR ADJACENT UPLAND UNLESS OTHERWISE DIRECTED BY KEYSTONE.
2. EI TO FLAG THE ORDINARY HIGH WATER MARK (OHWM) PRIOR TO CLEARING.
3. INSTALL SILT FENCE OR A BERM AT DIRECTION OF KEYSTONE EI TO PREVENT RUNOFF FROM ROW TO ADJACENT, UNDISTURBED DRAINAGE.
4. STOCKPILE TOPSOIL AND SPOIL SEPARATELY. TOPSOIL SHALL NOT BE STOCKPILED ACROSS THE DRAINAGE CHANNEL AND SHALL BE PLACED A MINIMUM OF 15 FEET FROM THE OHWM OR TO SUIT CONDITIONS AND PROTECT THE DRAINAGE AS DETERMINED BY KEYSTONE.
5. INSTALL TEMPORARY SLOPE BREAKERS WHERE IDENTIFIED BY THE EI.
6. TRENCH, STRING PIPE, AND BACKFILL USING STANDARD UPLAND CONSTRUCTION PROCEDURES UNLESS OTHERWISE DIRECTED BY KEYSTONE.
7. RESTORE WATERCOURSE CHANNEL AND BANKS (EXCEPT TRAVEL LANE IF USED) TO APPROXIMATE PRE-CONSTRUCTION PROFILE IMMEDIATELY AFTER PIPE IS LOWERED IN AND BACKFILLED. INSTALL PERMANENT EROSION CONTROLS WHERE DIRECTED BY KEYSTONE.
8. REMOVE ANY TEMPORARY CROSSING STRUCTURES AND/OR GRAVEL.

REVISIONS 01 UPDATED DRAWING NOTES 02 2010-10-08 UPDATED DRAWING NOTES 03 2010-10-11 UPDATED DRAWING NOTES

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	TITLE: DETAIL 11 TYPICAL OPEN CUT WET CROSSING METHOD NON-FLOWING WATERBODY		
CHECKED BY: WSF / DESIGN CHECKER: RW P7100	SCALE N.T.S.	DWG No 4359-03-ML-03-704	REV 03

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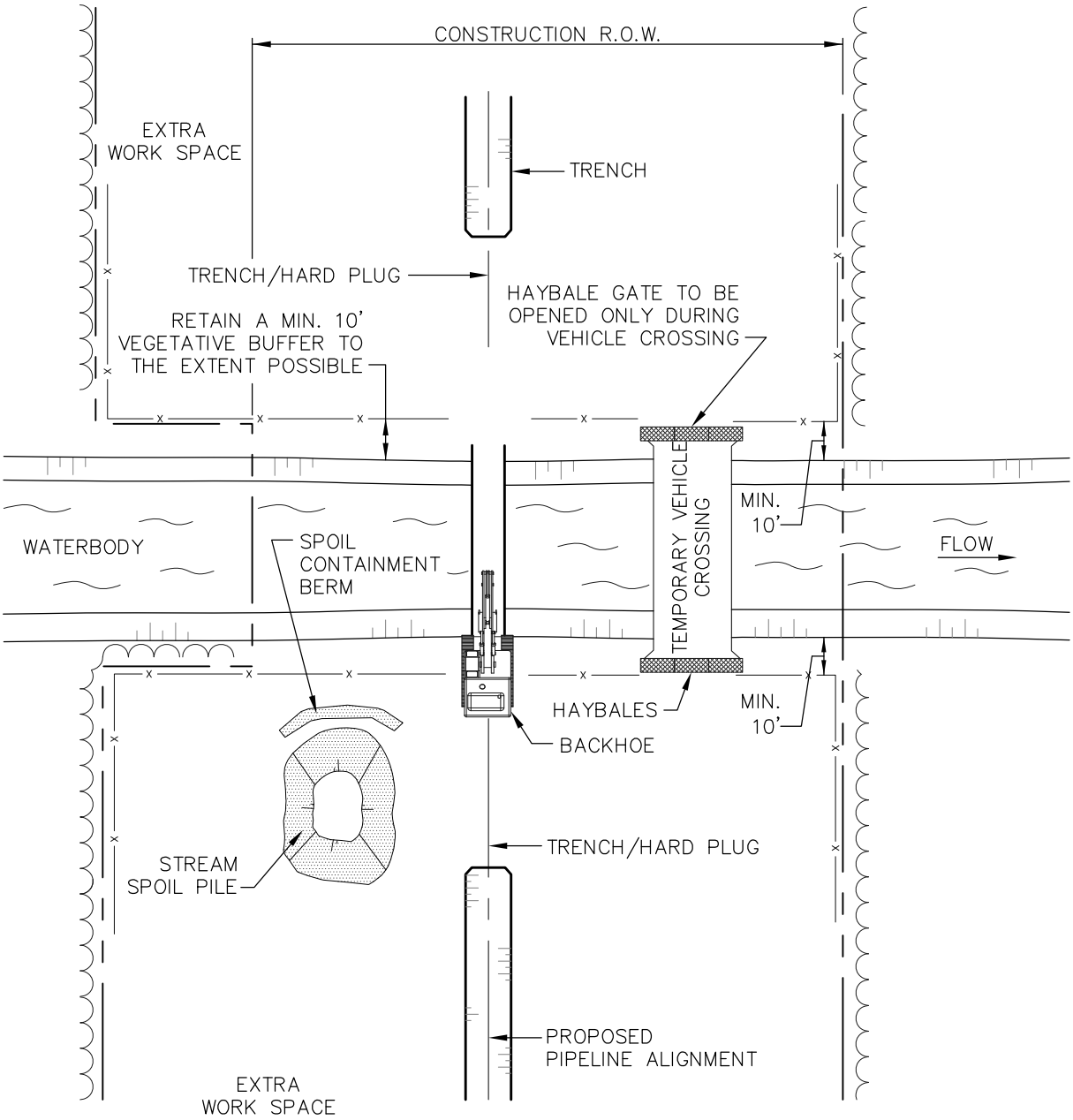

PLAN VIEW

REVISIONS | 01 UPDATED DRAWING NOTES | 02 2010-10-11 REVISED TITLE BLOCK

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DESIGNER:		KEYSTONE XL PROJECT		
JMP (NAME)	2010-10-21 (DATE)	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
		TITLE: DETAIL 12 TYPICAL OPEN CUT WET CROSSING METHOD FLOWING WATERBODY		
CHECKED BY: WSF	DESIGN CHECKER: RW P7100	SCALE N.T.S.	DWG No 4359-03-ML-03-705	REV 02

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CONSTRUCTION PROCEDURES:

1. RIGHT-OF-WAY BOUNDARIES AND WORK SPACE LIMITS SHALL BE CLEARLY DELINEATED. STAGING FOR MAKEUP SHALL BE LOCATED A MINIMUM OF 10 FEET FROM WATERBODY.

2. CLEARING LIMITS WILL BE CLEARLY DELINEATED AND 10 FOOT VEGETATIVE BUFFER STRIP BETWEEN DISTURBED AREA AND THE WATERBODY SHALL BE MAINTAINED TO THE EXTENT POSSIBLE. ALL CLEARING SHALL BE MINIMIZED TO THE EXTENT POSSIBLE AND TO ONLY THAT NECESSARY FOR CONSTRUCTION. WOODY VEGETATION SHALL BE CUT AT GROUND LEVEL AND THE STUMPS/ROOTS LEFT IN PLACE TO THE EXTENT POSSIBLE.

3. TOPSOIL SHALL BE STRIPPED FROM THE DITCH LINE IN ALL WETLANDS RIPARIAN.

4. CONTRACTOR SHALL INSTALL SIGNS APPROXIMATELY 100 FEET MINIMUM FROM EACH WATERBODY AND WETLAND TO IDENTIFY THE HAZARDOUS MATERIALS EXCLUSION AREA.

5. EROSION AND SEDIMENT CONTROL
   a. CONTRACTOR SHALL SUPPLY, INSTALL AND MAINTAIN SEDIMENT CONTROL STRUCTURES, AS DEPICTED OR ALONG DOWN GRADIENT SIDES OF WORK AREAS AND STAGING AREAS SUCH THAT NO HEAVILY SILT LADEN WATER ENTERS WATERBODY OR WETLAND.

   b. NO HEAVILY SILT LADEN WATER SHALL BE DISCHARGED DIRECTLY OR INDIRECTLY INTO THE WATERBODY. ALL EROSION AND SEDIMENT CONTROL STRUCTURE LOCATIONS AS DEPICTED ARE APPROXIMATE AND MAY BE ADJUSTED AS DIRECTED BY THE COMPANY INSPECTOR TO SUIT ACTUAL SITE CONDITIONS. SILT FENCE OR STRAW BALE INSTALLATIONS SHALL INCLUDE REMOVABLE SECTIONS TO FACILITATE ACCESS DURING CONSTRUCTION.

   c. SEDIMENT LADEN WATER FROM TRENCH DEWATERING SHALL BE DISCHARGED TO A WELL VEGETATED UPLAND AREA INTO A STRAW BALE DEWATERING STRUCTURE OR GEOTEXTILE FILTER BAG. SEDIMENT CONTROL STRUCTURES MUST BE IN PLACE AT ALL TIMES ACROSS THE DISTURBED CONSTRUCTION RIGHT-OF-WAY EXCEPT DURING EXCAVATION/INSTALLATION OF THE CROSSING PIPE.

   d. SOFT DITCH PLUGS MUST REMAIN IN PLACE AT CONVENIENT LOCATIONS TO SEPARATE MAINLINE DITCH FROM THE WATERBODY CROSSING UNTIL THE WATER CROSSING IS INSTALLED AND BACKFILLED.

   e. TRENCH BREAKERS ARE TO BE INSTALLED AT THE SAME SPACING AND IMMEDIATELY UPSLOPE OF PERMANENT SLOPE BREAKERS, OR AS DIRECTED BY THE COMPANY.

6. CONTRACTOR SHALL MAINTAIN HARD PLUGS IN THE DITCH AT THE WATERBODY UNTIL JUST PRIOR TO PIPE INSTALLATION. CONTRACTOR SHALL EXCAVATE TRENCH AND INSTALL PIPE AS EXPEDIENTLY AS PRACTICAL TO REDUCE THE DURATION OF WORK ACTIVITIES IN THE WATERBODY BED.

7. CONTRACTOR SHALL PLACE TRENCH SPOIL ONLY IN CERTIFICATED WORK SPACE AND A MINIMUM OF 10 FEET FROM THE WATERBODY BANKS TO PREVENT ENTRY OF SPOIL INTO THE WATERBODY. SPOIL SHALL BE CONTAINED AS NECESSARY USING EITHER A STRAW BALE BARRIER OR AN EARTH/ROCK BERM.

8. CONTRACTOR SHALL RESTORE THE WATERBODY AND BANKS TO APPROXIMATE PRE-CONSTRUCTION CONTOURS, UNLESS OTHERWISE APPROVED BY THE COMPANY. CONTRACTOR SHALL INSTALL PERMANENT EROSION AND SEDIMENT CONTROL STRUCTURES AS INDICATED. ANY MATERIALS PLACED IN THE WATERBODY TO FACILITATE CONSTRUCTION SHALL BE REMOVED DURING RESTORATION. BANKS SHALL BE STABILIZED AND TEMPORARY SEDIMENT BARRIERS INSTALLED AS SOON AS POSSIBLE AFTER CROSSING, BUT WITHIN 24 HOURS OF COMPLETING THE CROSSING. MAINTAIN A SILT FENCE OR STRAW BALE BARRIER ALONG THE WATERBODY AND WETLAND BOUNDARIES UNTIL VEGETATION IS ESTABLISHED IN ADJACENT DISTURBED AREAS.

9. VEHICLE CROSSING CAN BE CONSTRUCTED USING EITHER A FLUME CROSSING OR A TEMPORARY BRIDGE. VEHICLE CROSSING ONLY REQUIRED IF STREAM SUPPORTS A STATE DESIGNATED FISHERY.

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KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE: DETAIL 12A
TYPICAL OPEN CUT WET CROSSING METHOD
FLOWING WATERBODY – CONSTRUCTION PROCEDURES

SCALE N.T.S. | DWG No 4359-03-ML-03-706 | REV 01

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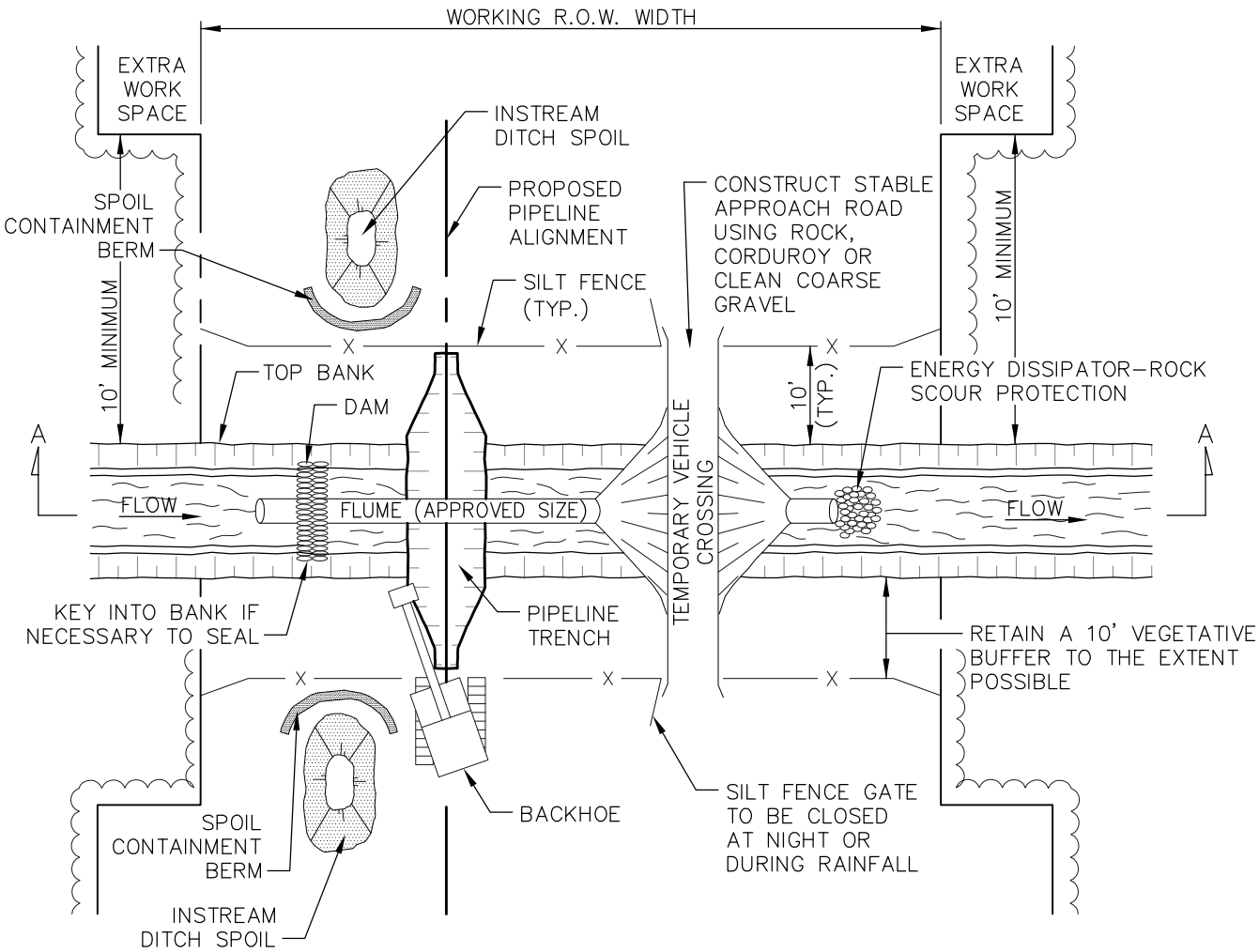
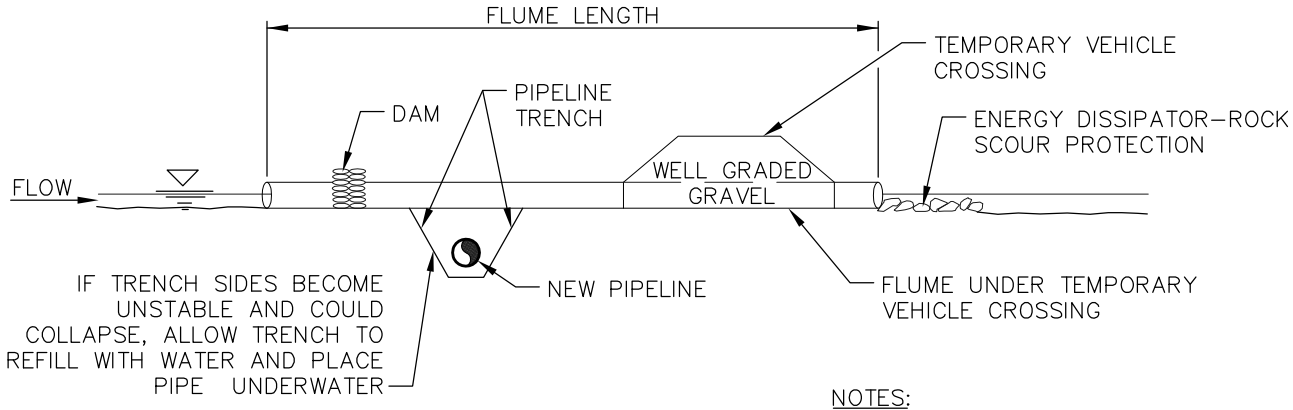


PLAN VIEW



SECTION A–A

NOTES:

1. PIPELINE PLACEMENT WITHIN RIGHT–OF–WAY CONCEPTUAL ONLY.
2. SEE DETAIL 13A FOR CONSTRUCTION PROCEDURES.

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KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE: DETAIL 13 TYPICAL DRY FLUME CROSSING METHOD

SCALE: N.T.S. | DWG No 4359–03–ML–03–707 | REV 01

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CONSTRUCTION PROCEDURES:

1. MARK OUT AND MAINTAIN LIMITS OF AUTHORIZED WORK AREAS WITH FENCING OR FLAGGING TAPE TO AVOID UNNECESSARY DISTURBANCE OF VEGETATION. ENSURE EQUIPMENT OPERATORS WORKING ON THE CROSSING HAVE BEEN BRIEFED ABOUT THIS PLAN AND THE MEASURE NEEDED TO PROTECT WATER QUALITY.
2. ALL NECESSARY EQUIPMENT AND MATERIALS TO BUILD THE FLUME MUST BE ON-SITE OR READILY AVAILABLE PRIOR TO COMMENCING IN-WATER WORK.
3. TO THE EXTENT POSSIBLE, MAINTAIN A MINIMUM 10 FT. VEGETATIVE BUFFER STRIP BETWEEN DISTURBED AREAS AND THE WATERCOURSE. INSTALL AND MAINTAIN A SILT FENCE OR STRAW BALE BARRIER UPSLOPE OF THE BUFFER STRIP ON EACH SIDE OF THE WATERCOURSE.
4. CONTRACTOR SHALL SUPPLY, INSTALL AND MAINTAIN SEDIMENT CONTROL STRUCTURES, AS DEPICTED OR ALONG DOWN GRADIENT SIDES OF WORK AREAS AND STAGING AREAS SUCH THAT NO HEAVILY SILT LADEN WATER ENTERS STREAM.
   a. NO HEAVILY SILT LADEN WATER SHALL BE DISCHARGED DIRECTLY INTO THE STREAM.
   b. EROSION AND SEDIMENT CONTROL STRUCTURE LOCATIONS AS DEPICTED ARE APPROXIMATE AND MAY BE ADJUSTED AS DIRECTED BY THE COMPANY INSPECTOR TO ACTUAL SITE CONDITIONS.
   c. SILT FENCE OR STRAW BALE INSTALLATIONS SHALL INCLUDE REMOVABLE SECTIONS TO FACILITATE ACCESS DURING CONSTRUCTION. UTILIZE STRAW BALE BARRIERS ONLY IN LIEU OF A SILT FENCE WHERE FREQUENT ACCESS IS REQUIRED.
   d. SEDIMENT LADEN WATER FROM TRENCH DEWATERING SHALL BE DISCHARGED TO A WELL VEGETATED UPLAND AREA INTO A STRAW BALE DEWATERING STRUCTURE OR GEOTEXTILE FILTER BAG.
   e. SEDIMENT CONTROL STRUCTURES MUST BE IN PLACE AT ALL TIMES ACROSS THE DISTURBED PORTIONS OF THE RIGHT-OF-WAY EXCEPT DURING EXCAVATION/INSTALLATION OF THE CROSSING PIPE.
   f. SOFT DITCH PLUGS MUST REMAIN IN PLACE AT CONVENIENT LOCATIONS TO SEPARATE MAINLINE DITCH FROM THE RIVER CROSSING UNTIL THE RIVER CROSSING IS INSTALLED AND BACKFILLED.
5. PIPE SHALL BE STRUNG AND WELDED FOR READY INSTALLATION PRIOR TO WATERCOURSE TRENCHING.
6. FLUME CAPACITY DURING DRY CROSSING SHALL BE SUFFICIENT TO ACCOMMODATE 1.5 TIMES THE FLOW MEASURED AT THE TIME OF CONSTRUCTION PROVIDED THAT THE FLUMES WILL BE IN PLACE NOT MORE THAN 96 HOURS AND NO PRECIPITATION IS FORECAST. FLUME CAPACITY FOR VEHICLE ACCESS SHALL BE SUFFICIENT TO PASS THE 2 YEAR DESIGN FLOW OR THE FLOW REASONABLY EXPECTED TO OCCUR DURING THE INSTALLATION. EXCESS FLUMES REQUIRED FOR LONGER TERM ACCESS SHALL BE CAPPED DURING DRY CROSSING PROCEDURES.
7. ENSURE THAT THE DAMS AND VEHICLE CROSSING ARE LOCATED FAR ENOUGH APART TO ALLOW FOR A WIDE EXCAVATION.
8. FLUMES ARE TO BE SET WITH 10 PERCENT OF THEIR DIAMETER BELOW STREAMBED LEVEL WHERE SOIL CONDITIONS PERMIT (OTHERWISE INSTALLED AT STREAM GRADE AND SLOPE.)
9. PLACE IMPERVIOUS DAMS AT EACH END OF THE FLUME, UPSTREAM FIRST, THEN DOWNSTREAM. ACCEPTABLE ALTERNATIVES INCLUDE GRAVEL WITH RIP-RAP PROTECTION, SAND BAGS, STEEL PLATE AND ROCKFILL. DURING INSTALLATION, INSTALL AN IMPERVIOUS MEMBRANE, IF NECESSARY, TO LIMIT LEAKAGE. DAMS MAY NEED KEYING INTO THE BANK AND STREAMBED.
   EXCAVATE TRENCH THROUGH PLUGS AND UNDER FLUME FROM BOTH SIDES. WORK IS TO BE COMPLETED AS QUICKLY AS POSSIBLE.
   a. LOWER IN PIPE BY PASSING UNDER FLUME AND BACKFILL IMMEDIATELY WITH SPOIL MATERIAL.
   b. IT IS NOT NECESSARY TO DEWATER THE IN-STREAM TRENCH, HOWEVER, DISPLACED WATER SHALL BE PUMPED TO A STABLE UPLAND AREA TO AVOID OVERTOPPING OF DAMS DURING PIPE PLACEMENT.
   c. IF THE SPOIL MATERIAL IS NOT SUITABLE, USE IMPORTED CLEAN GRANULAR MATERIAL.
   d. IF BLASTING IS REQUIRED, USE CONTROLLED BLASTING TECHNIQUES TO PREVENT DAMAGE TO THE FLOW CONVEYANCE SYSTEM. ALTERNATIVELY, BLASTING MAY BE ACCOMPLISHED PRIOR TO THE FLUME INSTALLATION BY DRILLING THROUGH THE OVERBURDEN.
10. EXCAVATED MATERIAL MUST NOT BE STOCKPILED WITHIN 10 FT. OF THE WATERCOURSE. THIS MATERIAL SHALL BE CONTAINED TO PREVENT SATURATED SOIL FROM FLOWING BACK INTO THE WATERCOURSE.
11. DEWATERING OF THE ONLAND TRENCH SHOULD OCCUR IN A STABLE VEGETATED AREA A MINIMUM OF 50 FT. FROM ANY WATERBODY. THE PUMP DISCHARGE SHOULD BE DIRECTED ONTO A STABLE SPILL PAD CONSTRUCTED OF ROCKFILL OR TIMBERS TO PREVENT LOCALIZED EROSION. THE DISCHARGE WATER SHOULD ALSO BE FORCED INTO SHEET FLOW IMMEDIATELY BEYOND THE SPILL PAD BY USING STRAW BALES AND THE NATURAL TOPOGRAPHY.
12. FLUMES SHOULD BE REMOVED AS SOON AS POSSIBLE, WHEN NO LONGER REQUIRED FOR PIPE LAYING OR FOR ROAD ACCESS, IN THE FOLLOWING MANNER:
   a. REMOVE THE VEHICLE CROSSING RAMP. BANKS ARE TO BE RESTORED TO A STABLE ANGLE AND PROTECTED WITH EROSION RESISTANT MATERIAL COMPATIBLE WITH THE FLOW CONDITIONS (E.G., EROSION CONTROL BLANKETS, CRIBBING, ROCK RIP-RAP, ETC.) TO THE MAXIMUM EXTENT POSSIBLE BEFORE REMOVING THE DAMS.
   b. REMOVE DOWNSTREAM DAM.
   c. REMOVE UPSTREAM DAM.
   d. REMOVE FLUME.
   e. COMPLETE BANK TRIMMING AND EROSION PROTECTION. IF SANDBAGS ARE USED FOR THE DAMS, PLACE AND REMOVE BY HAND TO AVOID EQUIPMENT BREAKING BAGS.
13. RESTORE THE STREAMBED AND BANKS TO APPROXIMATE PRE-CONSTRUCTION CONTOURS, BUT NOT TO EXCEED 2 HORIZONTAL TO 1 VERTICAL.
   a. INSTALL PERMANENT EROSION AND SEDIMENT CONTROL STRUCTURES AS INDICATED ON A SITE SPECIFIC BASIS. IN THE ABSENCE OF SITE SPECIFIC INFORMATION, A FLEXIBLE CHANNEL LINER SUCH AS NAG C125 OR C350 WHICH IS CAPABLE OF WITHSTANDING ANTICIPATED FLOW SHALL BE INSTALLED. ALTERNATIVELY, ROCK RIP-RAP SHALL BE INSTALLED.
   b. ANY MATERIALS PLACED IN THE STREAM TO FACILITATE CONSTRUCTION SHALL BE REMOVED DURING RESTORATION. BANKS SHALL BE STABILIZED AND TEMPORARY SEDIMENT BARRIERS INSTALLED AS SOON AS POSSIBLE AFTER CROSSING, BUT WITHIN 24 HOURS OF COMPLETING THE CROSSING.
   c. MAINTAIN A SILT FENCE OR STRAW BALE BARRIER ALONG THE WATER COURSE UNTIL VEGETATION IS ESTABLISHED IN ADJACENT DISTURBED AREAS.

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JMP (NAME)	2010-10-21 (DATE)	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
		TITLE: DETAIL 13A TYPICAL DRY FLUME CROSSING METHOD – CONSTRUCTION PROCEDURES		
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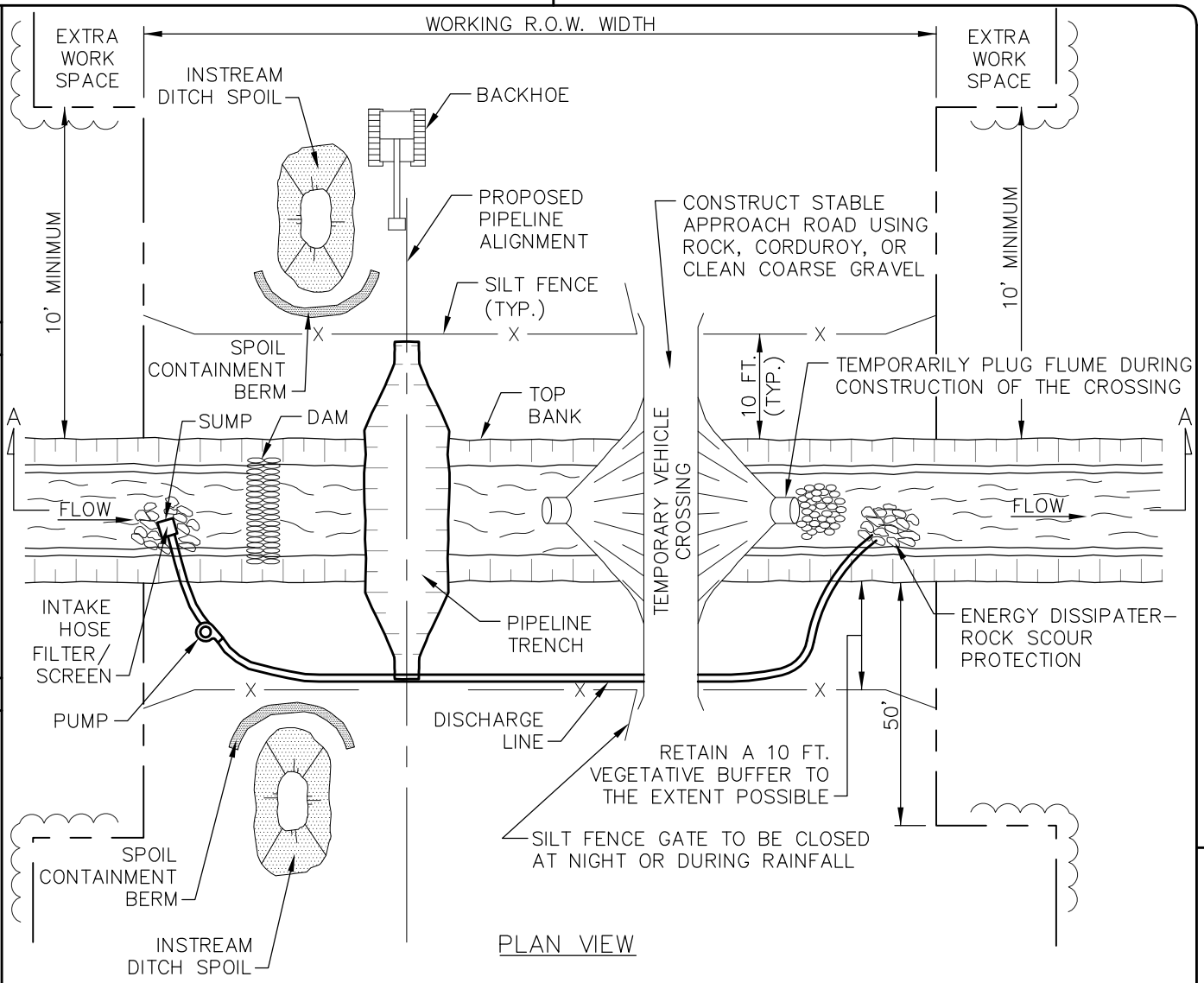
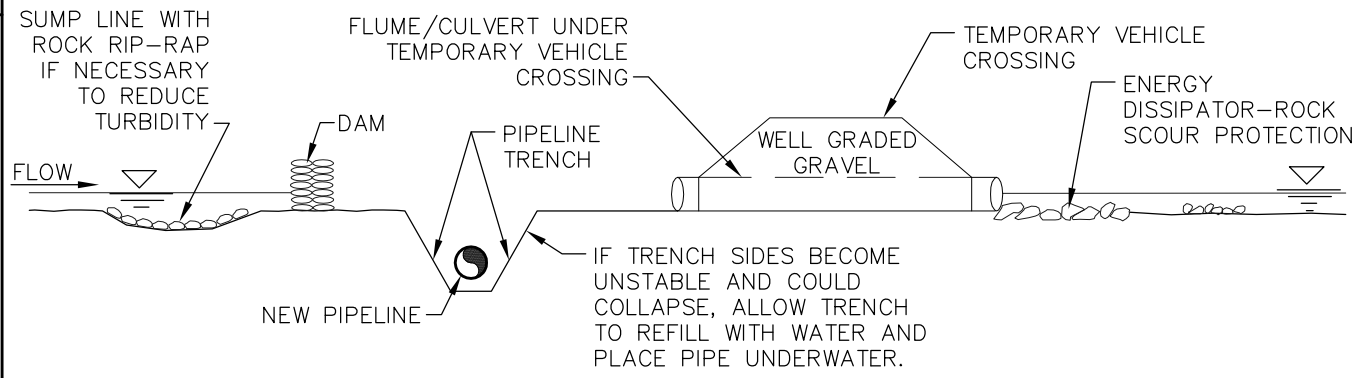


PLAN VIEW



SECTION A-A

NOTES:

1. PIPELINE PLACEMENT WITHIN RIGHT-OF-WAY CONCEPTUAL ONLY.
2. SEE DETAIL 14A FOR CONSTRUCTION PROCEDURES.

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FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE

DETAIL 14
TYPICAL DAM AND PUMP CROSSING

SCALE N.T.S. | DWG No 4359-03-ML-03-709 | REV 01

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CONSTRUCTION PROCEDURES:

1. WHERE NECESSARY, OBTAIN PRIOR APPROVAL BEFORE USING THE DAM AND PUMP METHOD.
2. IF THERE IS ANY FLOW IN THE WATERCOURSE, INSTALL PUMPS TO MAINTAIN STREAMFLOW AROUND THE BLOCKED OFF SECTIONS OF CHANNEL. THE PUMP IS TO HAVE 1.5 TIMES THE PUMPING CAPACITY OF ANTICIPATED FLOW. A SECOND STANDBY PUMP OF EQUAL CAPACITY IS TO BE READILY AVAILABLE AT ALL TIMES. AN ENERGY DISSIPATER IS TO BE BUILT TO ACCEPT PUMP DISCHARGE WITHOUT STREAMBED OR STREAMBANK EROSION. IF THE CROSSING IS PROLONGED BEYOND ONE DAY THE OPERATION NEEDS TO BE MONITORED OVERNIGHT.
3. SCHEDULE INSTREAM ACTIVITY FOR LOW FLOW PERIODS IF POSSIBLE.
4. MARK OUT AND MAINTAIN LIMITS OF AUTHORIZED WORK AREAS WITH FENCING OR FLAGGING TAPE TO AVOID UNNECESSARY DISTURBANCE OF VEGETATION. ENSURE EQUIPMENT OPERATORS WORKING ON THE CROSSING HAVE BEEN BRIEFED ABOUT THIS PLAN AND THE MEASURES NEEDED TO PROTECT WATER QUALITY. INSTALL PRE-WORK SEDIMENT CONTROL MEASURES AS SPECIFIED IN THE PLAN. ALL NECESSARY EQUIPMENT AND MATERIALS TO BUILD THE DAMS AND TO PUMP WATER MUST BE ON SITE OR READILY AVAILABLE PRIOR TO COMMENCING IN-WATER CONSTRUCTION. PIPE SHOULD BE STRUNG, WELDED AND COATED AND READY FOR INSTALLATION PRIOR TO WATERCOURSE TRENCHING.
5. CONTRACTOR SHALL SUPPLY, INSTALL AND MAINTAIN SEDIMENT CONTROL STRUCTURES, AS DEPICTED AND ALONG DOWN GRADIENT SIDES OF WORK AREAS AND STAGING AREAS SUCH THAT NO HEAVILY SILT LADEN WATER ENTERS STREAM.
   a. NO HEAVILY SILT LADEN WATER SHALL BE DISCHARGED DIRECTLY INTO THE STREAM.
   b. EROSION AND SEDIMENT CONTROL STRUCTURE LOCATIONS AS DEPICTED ARE APPROXIMATE AND MAY BE ADJUSTED AS DIRECTED BY THE COMPANY INSPECTOR TO ACTUAL SITE CONDITIONS.
   c. SILT FENCE OR STRAW BALE INSTALLATIONS SHALL INCLUDE REMOVABLE SECTIONS TO FACILITATE ACCESS DURING CONSTRUCTION. UTILIZE STRAW BALE BARRIERS ONLY IN LIEU OF A SILT FENCE WHERE FREQUENT ACCESS IS REQUIRED.
   d. SEDIMENT LADEN WATER FROM TRENCH DEWATERING SHALL BE DISCHARGED TO A WELL VEGETATED UPLAND AREA INTO A STRAW BALE DEWATERING STRUCTURE OR GEOTEXTILE FILTER BAG.
   e. SEDIMENT CONTROL STRUCTURES MUST BE IN PLACE AT ALL TIMES ACROSS THE DISTURBED PORTIONS OF THE RIGHT-OF-WAY EXCEPT DURING EXCAVATION/INSTALLATION OF THE CROSSING PIPE.
   f. SOFT DITCH PLUGS MUST REMAIN IN PLACE AT CONVENIENT LOCATIONS TO SEPARATE MAINLINE DITCH FROM THE RIVER CROSSING UNTIL THE RIVER CROSSING IS INSTALLED AND BACKFILLED.
6. TO THE EXTENT POSSIBLE, MAINTAIN A MINIMUM 10 FEET VEGETATIVE BUFFER STRIP BETWEEN DISTURBED AREAS AND THE WATERCOURSE. INSTALL AND MAINTAIN A SILT FENCE UPSLOPE OF THE BUFFER STRIP ON EACH SIDE OF THE WATERCOURSE. THE SILT FENCE SHOULD INCORPORATE REMOVABLE "GATES" AS REQUIRED TO ALLOW ACCESS WHILE MAINTAINING EASE OF REPLACEMENT FOR OVERNIGHT OR DURING PERIODS OF RAINFALL.
7. CONSTRUCT A TEMPORARY SUMP UPSTREAM OF THE DAM AND LINE WITH ROCKFILL IF A NATURAL POOL DOES NOT EXIST. INSTALL THE PUMP OR PUMP INTAKE IN THE POOL OR SUMP. DISCHARGE WATER ONTO AN ENERGY DISSIPATER DOWNSTREAM OF THE WORK AREA.
8. EXCAVATED MATERIAL MUST NOT BE STOCKPILED WITHIN 10 FT. OF THE WATERCOURSE. THIS MATERIAL MUST BE CONTAINED WITHIN BERM CONTAINMENT, WITH SECONDARY SILT FENCE PROTECTION TO PREVENT SATURATED SOIL FROM FLOWING BACK INTO THE WATERCOURSE.
9. CHEMICALS, FUELS, LUBRICATING OILS SHALL NOT BE STORED AND EQUIPMENT REFUELED WITHIN 100 FT. OF THE WATERBODY. PUMPS ARE TO BE REFUELED AS PER THE SPCC PLANS.
10. STAGING AREAS ARE TO BE LOCATED AT LEAST 10 FT. FROM THE WATER'S EDGE (WHERE TOPOGRAPHIC CONDITIONS PERMIT) AND SHALL BE THE MINIMUM SIZE NEEDED.
11. DAMS ARE TO BE MADE OF STEEL PLATE, INFLATABLE PLASTIC DAM, SAND BAGS, COBBLES, WELL GRADED COARSE GRAVEL FILL, OR ROCK FILL. DAMS MAY NEED KEYING INTO THE BANKS AND STREAMBED. ENSURE THAT THE DAM AND VEHICLE CROSSING ARE LOCATED FAR ENOUGH APART TO ALLOW FOR A WIDE EXCAVATION. CAP FLUMES USED UNDER VEHICLE CROSSING DURING DRY CROSSING.
12. DEWATER AREA BETWEEN DAMS IF POSSIBLE. DEWATERING SHOULD OCCUR IN A STABLE VEGETATIVE AREA A MINIMUM OF 50 FT. FROM ANY WATERBODY. THE PUMP DISCHARGE SHOULD BE DISCHARGED ONTO A STABLE SPILL PAD CONSTRUCTED OF ROCKFILL SANDBAGS, OR TIMBERS TO PREVENT LOCALIZED EROSION. THE DISCHARGE WATER SHOULD ALSO BE FORCED INTO SHEET FLOW IMMEDIATELY BEYOND THE SPILL PAD BY USING STRAW BALES AND THE NATURAL TOPOGRAPHY DISCHARGED WATER SHALL NOT BE ALLOWED TO FLOW INTO ANY WATERCOURSE OR WETLAND. IF IT IS NOT POSSIBLE TO DEWATER THE EXCAVATION DUE TO SOILS WITH A HIGH HYDRAULIC CONDUCTIVITY, THE EXCAVATION AND PIPE PLACEMENT IS TO BE CARRIED OUT IN THE STANDING WATER. PUMP ANY DISPLACED WATER AS DESCRIBED ABOVE TO PREVENT OVERTOPPING OF DAMS.
13. EXCAVATE TRENCH THROUGH PLUGS AND STREAMBED FROM BOTH SIDES, RE-POSITIONING DISCHARGE HOSE AS NECESSARY. LOWER THE PIPE IN THE TRENCH AND BACKFILL IMMEDIATELY. DURING THIS OPERATION WORK IS TO BE COMPLETED AS QUICKLY AS POSSIBLE.
14. CONTRACTOR SHALL RESTORE THE STREAM BED AND BANKS TO APPROXIMATE PRE-CONSTRUCTION CONTOURS, BUT NOT TO EXCEED 2 HORIZONTAL TO 1 VERTICAL.
   a. CONTRACTOR SHALL INSTALL PERMANENT EROSION AND SEDIMENT CONTROL STRUCTURES AS INDICATED ON A SITE SPECIFIC BASIS. IN THE ABSENCE OF SITE SPECIFIC INFORMATION, A FLEXIBLE CHANNEL LINER SUCH AS NAG C125 OR C350 WHICH IS CAPABLE OF WITHSTANDING ANTICIPATED FLOW SHALL BE INSTALLED. ALTERNATIVELY, ROCK RIP-RAP SHALL BE INSTALLED.
   b. ANY MATERIALS PLACED IN THE STREAM TO FACILITATE CONSTRUCTION SHALL BE REMOVED DURING RESTORATION. BANKS SHALL BE STABILIZED AND TEMPORARY SEDIMENT BARRIERS INSTALLED AS SOON AS POSSIBLE AFTER CROSSING, BUT WITHIN 24 HOURS OF COMPLETING THE CROSSING.
   c. MAINTAIN A SILT FENCE OR STRAW BALE BARRIER ALONG THE WATER COURSE UNTIL VEGETATION IS ESTABLISHED IN ADJACENT DISTURBED AREAS.
15. WHEN THE STREAMBED HAS BEEN RESTORED, THE CREEK BANKS ARE TO BE CONTOURED TO A STABLE ANGLE AND PROTECTED WITH EROSION RESISTANT MATERIAL COMPATIBLE WITH FLOW VELOCITY BETWEEN DAMS (E.G., EROSION CONTROL BLANKETS, CRIBBING, ROCK RIP-RAP, ETC.). THE DAMS ARE TO BE REMOVED DOWNSTREAM FIRST. KEEP PUMP RUNNING UNTIL NORMAL FLOW IS RESUMED. COMPLETE BANK TRIMMING AND EROSION PROTECTION. IF SANDBAGS ARE USED FOR THE DAMS, PLACE AND REMOVE BY HAND TO AVOID EQUIPMENT BREAKING BAGS.

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CHECKED BY: WSF	DESIGN CHECKER: RW P7100	TITLE: DETAIL 14A TYPICAL DAM AND PUMP CROSSING – CONSTRUCTION PROCEDURES		
		SCALE N.T.S.	DWG No 4359-03-ML-03-710	REV 02

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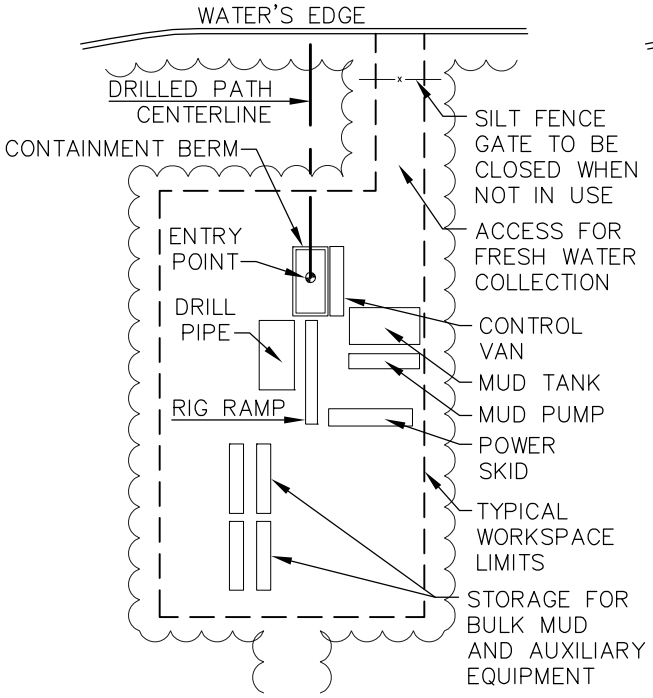

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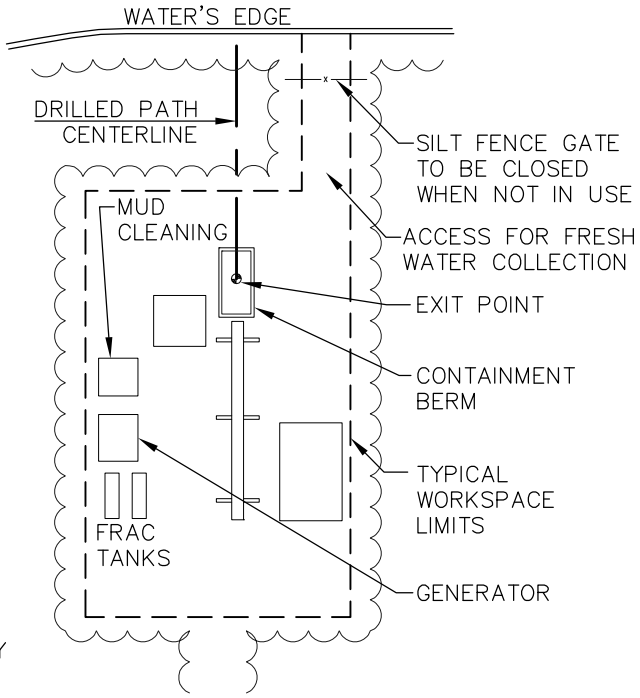
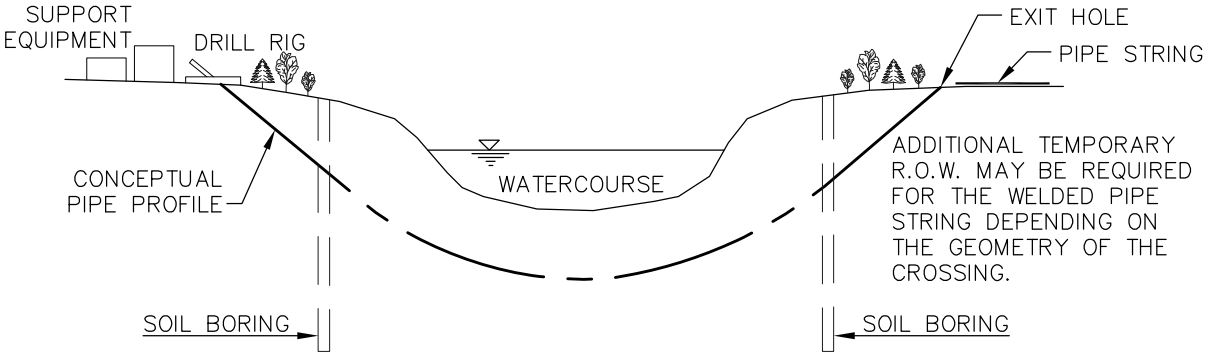
ENTRY SIDE



SITE PLAN
EXIT SIDE



PROFILE

NOTES:

1. SET UP DRILLING EQUIPMENT A MINIMUM OF 100 FEET FROM THE EDGE OF THE WATERCOURSE. LIMIT CLEARING BETWEEN DRILL ENTRY AND EXIT POINT TO HAND CUTTING BRUSH FOR TRACKING WIRES.
2. ENSURE THAT ONLY BENTONITE-BASED DRILLING MUD IS USED.
3. INSTALL SUITABLE DRILLING MUD TANKS OR SUMPS TO PREVENT CONTAMINATION OF WATERCOURSE.
4. INSTALL BERMS DOWNSLOPE FROM THE DRILL ENTRY AND ANTICIPATED EXIT POINTS TO CONTAIN ANY RELEASE OF DRILLING MUD.
5. DISPOSE OF DRILLING MUD IN ACCORDANCE WITH THE APPROPRIATE REGULATORY AUTHORITY REQUIREMENTS.

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01 UPDATED DRAWING NOTES
02 2010-10-11 REVISED TITLE BLOCK

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	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
	TITLE: DETAIL 15 TYPICAL HORIZONTAL DRILL (HDD) SITE PLAN & PROFILE		
CHECKED BY: WSF	DESIGN CHECKER: RW P7100	SCALE N.T.S.	DWG No 4359-03-ML-03-711 REV 02

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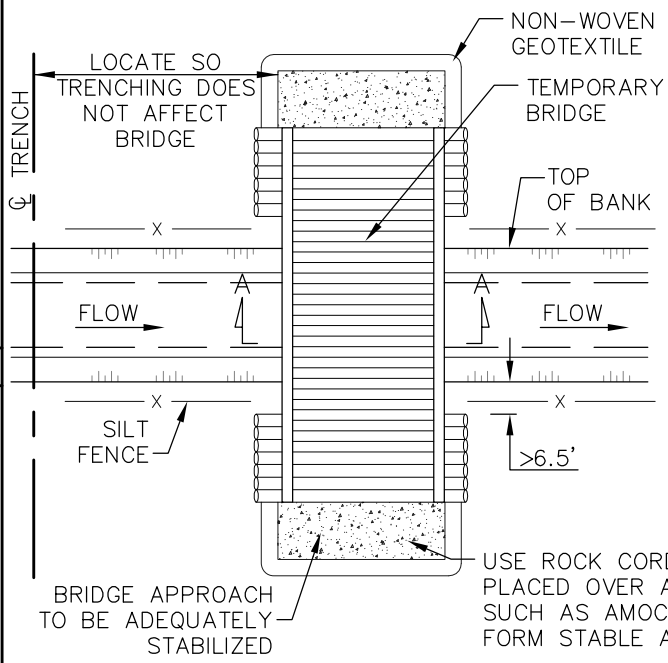
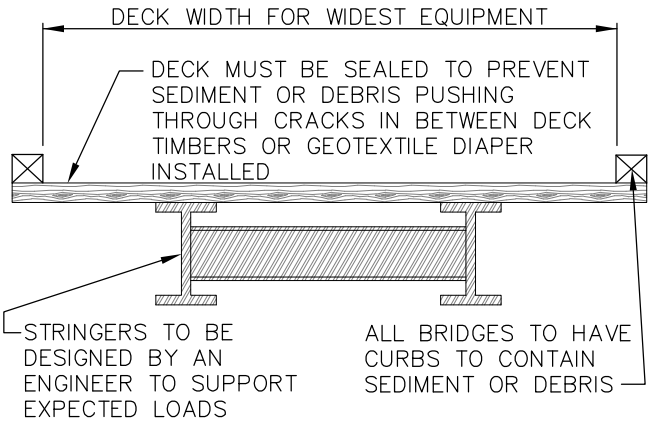
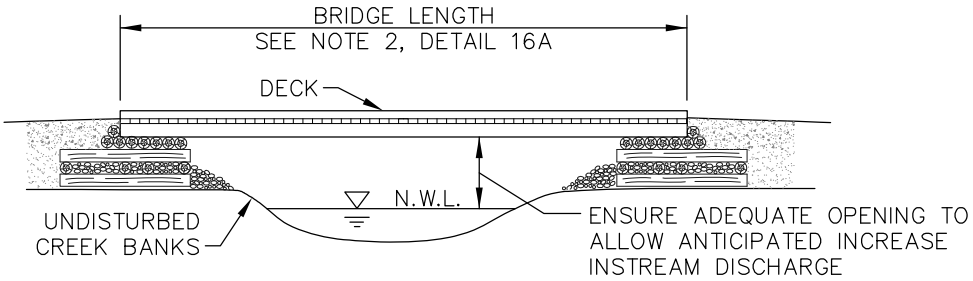


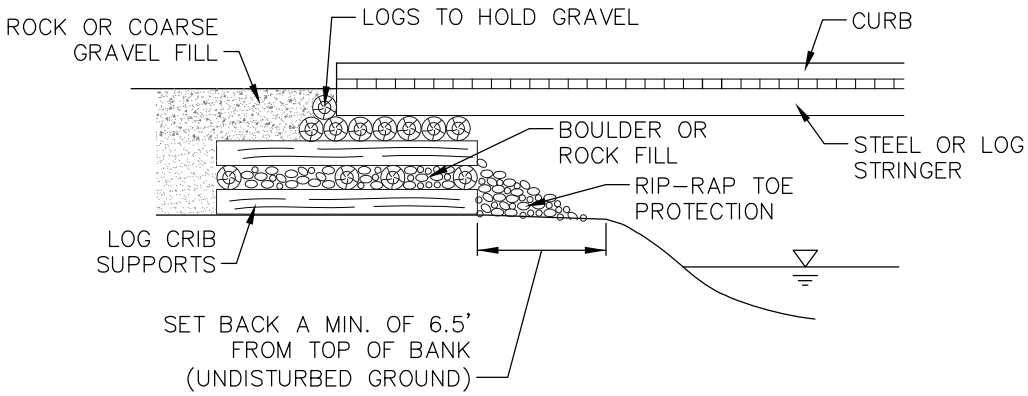
PLAN VIEW



SECTION A–A



BRIDGE PROFILE



TYPICAL TEMPORARY CRIB ABUTMENT

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JMP (NAME)	2010-10-21 (DATE)	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
		TITLE: DETAIL 16 TYPICAL TEMPORARY BRIDGE CROSSING		
CHECKED BY: WSF	DESIGN CHECKER: RW P7100	SCALE N.T.S.	DWG No 4359-03-ML-03-712	REV 01

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CONSTRUCTION PROCEDURES:

IN GENERAL TERMS, THE FOLLOWING IS A SEQUENCE OF CONSTRUCTION PROCEDURES THAT ARE RECOMMENDED TO BE FOLLOWED FOR TEMPORARY BRIDGE CROSSINGS:

1. A PORTABLE BRIDGE, FLEXI-FLOAT OR FLUMED VEHICLE CROSSING MAY BE SUBSTITUTED FOR THE TEMPORARY BRIDGE. IT IS IMPORTANT THAT THE SIZE OF THE TOTAL OPENING BE SELECTED SO THE STRUCTURE CAN SAFELY PASS FLOOD FLOWS THAT CAN REASONABLY BE EXPECTED TO OCCUR DURING THE LIFE OF THE CROSSING.

2. DETERMINE BRIDGE LENGTH REQUIRED AND FOLLOW EITHER METHOD A) OR B) FOR DETERMINING THE OPENING SIZE. IF A) IS FOLLOWED, A MINIMUM 6.5 FT. SETBACK FROM TOP OF BANK MUST BE PRESERVED AS A "NO DISTURBANCE AREA". IF ABUTMENTS OR PIERS IN THE STREAMBED ARE REQUIRED, METHOD B) IS TO BE FOLLOWED.

3. INSTALL THE BRIDGE IN A MANNER THAT WILL MINIMIZE SEDIMENT ENTERING THE WATER. STRINGERS MUST BE DESIGNED TO SUPPORT THE LOADS EXPECTED ON THE BRIDGE. CURBS MUST BE INSTALLED ALONG THE EDGE OF THE DECK TO CONTAIN SEDIMENT AND DEBRIS ON THE BRIDGE. FASTENERS CONNECTING COMPONENTS MUST BE STRONG ENOUGH TO HOLD THEM IN POSITION DURING THE LIFE OF THE BRIDGE. CRIBS ARE TO BE FILLED WITH ROCK OR COBBLE. RIP-RAP EROSION PROTECTION IS TO BE PLACED AROUND THE CRIBS AND ON ANY FILL SLOPES PROJECTING INTO THE WATERBODY.

4. ROAD APPROACHES LEADING TO THE BRIDGE MUST BE RAISED AND STABLE SO EQUIPMENT LOADS ARE SUPPORTED A SUFFICIENT DISTANCE BACK FROM THE WATER TO REDUCE SEDIMENT AND DEBRIS ENTERING THE WATERBODY FROM EQUIPMENT TRACKS. THIS MAY REQUIRE USING MATERIALS SUCH AS GRAVEL, ROCK OR CORDUROY. DO NOT USE SOIL TO CONSTRUCT OR STABILIZE EQUIPMENT BRIDGES. IF CUTS ARE NEEDED TO OBTAIN A SATISFACTORY GRADE, THEY ARE TO BE DUG WITH SIDE DITCHES AND STABLE SLOPES. EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE INSTALLED TO KEEP SEDIMENT ON LAND (E.G., SILT FENCING, FILTER CLOTH, RIP-RAP, SEED AND MULCH, ETC.)

5. MAINTAIN A SILT FENCE ON EACH SIDE OF THE WATERBODY EXTENDING A MINIMUM OF 10 FEET BEYOND THE WIDTH OF DISTURBANCE UNTIL VEGETATION HAS BEEN ESTABLISHED IN UPSLOPE AREAS.

6. PERIODICALLY CHECK BRIDGE INSTALLATION AND REMOVE ANY BUILD-UP OF SEDIMENT OR DEBRIS ON THE BRIDGE. DISPOSE OF THIS MATERIAL IN A LOW LYING AREA AT LEAST 100 FEET FROM THE WATERBODY.

7. REMOVE TEMPORARY CROSSINGS AS SOON AS POSSIBLE AFTER FINAL CLEAN-UP. MATERIALS PLACED ALONG THE WATERBODY SHOULD BE COMPLETELY REMOVED DURING FINAL CLEAN-UP. REMOVAL SHOULD NOT OCCUR OUTSIDE THE CONSTRUCTION WINDOWS. SURPLUS GRAVEL IS TO BE SPREAD ON THE RIGHT-OF-WAY AS GRAVEL SHEETING, IF GRADATION IS SUITABLE, OR MOVED AT LEAST 100 FEET FROM TOP OF BANK FOR DISPOSAL. BRIDGE MATERIALS ARE TO BE REMOVED FROM THE CROSSING AREA. THE WATERBODY BED AND BANKS ARE TO BE RESTORED TO A STABLE ANGLE AND PROTECTED WITH EROSION RESISTANT MATERIAL COMPATIBLE WITH THE EXPECTED FLOW CONDITIONS.

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		TITLE: DETAIL 16A TYPICAL TEMPORARY BRIDGE CROSSING – CONSTRUCTION PROCEDURES		
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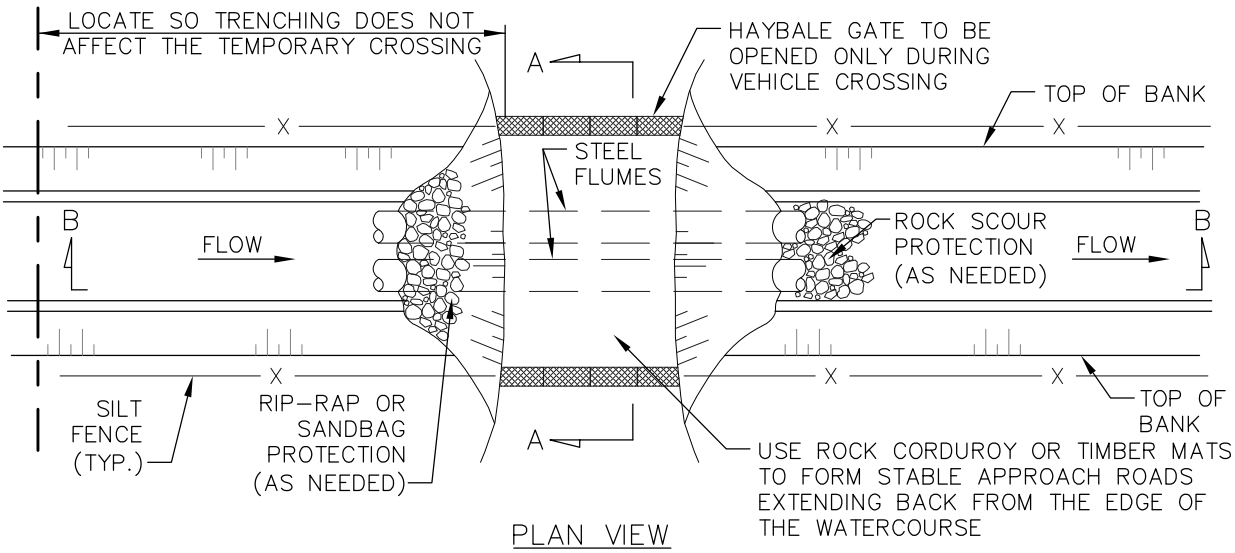
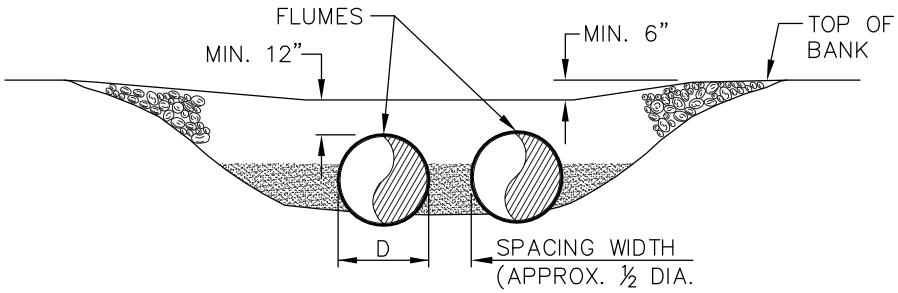
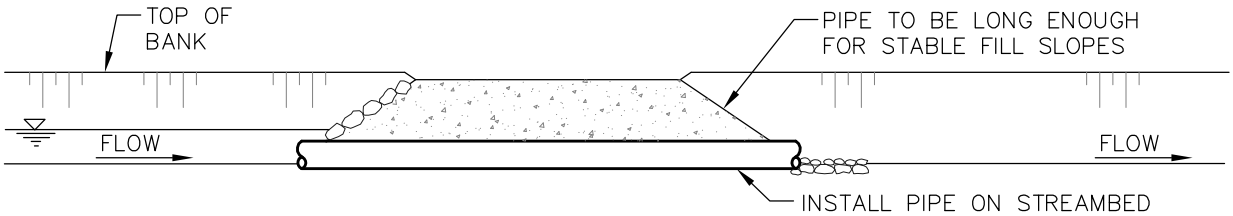


PLAN VIEW



SECTION A–A



SECTION B–B

CONSTRUCTION PROCEDURES:

THE FOLLOWING IS A SEQUENCE OF CONSTRUCTION AND PROCEDURES MEASURES TO BE FOLLOWED AT ALL TEMPORARY FLUME VEHICLE CROSSINGS.

1. A PORTABLE FLEXI–FLOAT, OR TEMPORARY BRIDGE MAY BE SUBSTITUTED FOR THE TEMPORARY FLUME CROSSING.
2. THE LENGTH OF THE FLUME SHALL BE SUFFICIENT TO SPAN THE ENTIRE AREA REQUIRED FOR VEHICULAR ACCESS, EXTENDING 4 FEET BEYOND TOE OF FILL MATERIAL, SO TRENCHING WILL NOT AFFECT THE ROAD CROSSING. A LONGER PIPE IS TO BE USED, IF NEEDED, TO MAINTAIN STABLE SIDE SLOPES. FLUME CAPACITY TO BE BASED ON THE 2–YEAR DESIGN FLOW OR MAXIMUM FLOW ANTICIPATED TO OCCUR DURING INSTALLATION, AS SPECIFIED IN CONSTRUCTION DOCUMENTS.
3. WHERE PRACTICAL, BACKFILL AROUND THE PIPES AT THE ROAD WITH CLEAN, COARSE ROCK FILL MATERIAL. IF SCOUR IS POSSIBLE, RIP–RAP IS TO BE PLACED ON THE WATERBODY BED DOWNSTREAM OF THE PIPE OUTLET EXTENDING A MINIMUM OF TWO PIPE DIAMETERS. ALTERNATIVELY, TIMBER EQUIPMENT MATS, SAND BAGS OR TIMBER CORDUROY MAY BE USED TO FORM THE TRAVEL SURFACE.
4. TO REDUCE DEBRIS ENTERING THE WATERBODY FROM EQUIPMENT TRACKS, THE APPROACH ROAD LEADING TO THE CULVERT CROSSING MUST BE RAISED AND STABLE SO EQUIPMENT LOADS ARE SUPPORTED A SUFFICIENT DISTANCE BACK FROM THE WATER. IF CUTS ARE NEEDED TO OBTAIN A SATISFACTORY GRADE, THEY ARE TO BE DUG WITH SIDE DITCHES AND STABLE SLOPES. EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE INSTALLED TO LIMIT THE POTENTIAL FOR SEDIMENT TO ENTER THE WATERBODY (E.G., CHECK DAMS, SILT FENCE, RIP–RAP, SEED AND MULCH, SEDIMENT TRAPS, ETC.).
5. PERIODICALLY CHECK THE TEMPORARY CROSSING INSTALLATION AND REMOVE ANY BUILD–UP OF SEDIMENT OR DEBRIS ON THE BRIDGE. DISPOSE OF THIS MATERIAL AT LEAST 100 FEET FROM THE WATERBODY AND ABOVE THE HIGH WATER LEVEL.
6. FOLLOWING COMPLETION OF THE CROSSING, REMOVE ROCKFILL IN/OR AROUND FLUME PIPES FROM THE WATERBODY OR WETLAND.
7. RESTORE STREAM BANKS AND WATERBODY BOTTOM.

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		TITLE: DETAIL 17 TYPICAL FLUME BRIDGE CROSSING		
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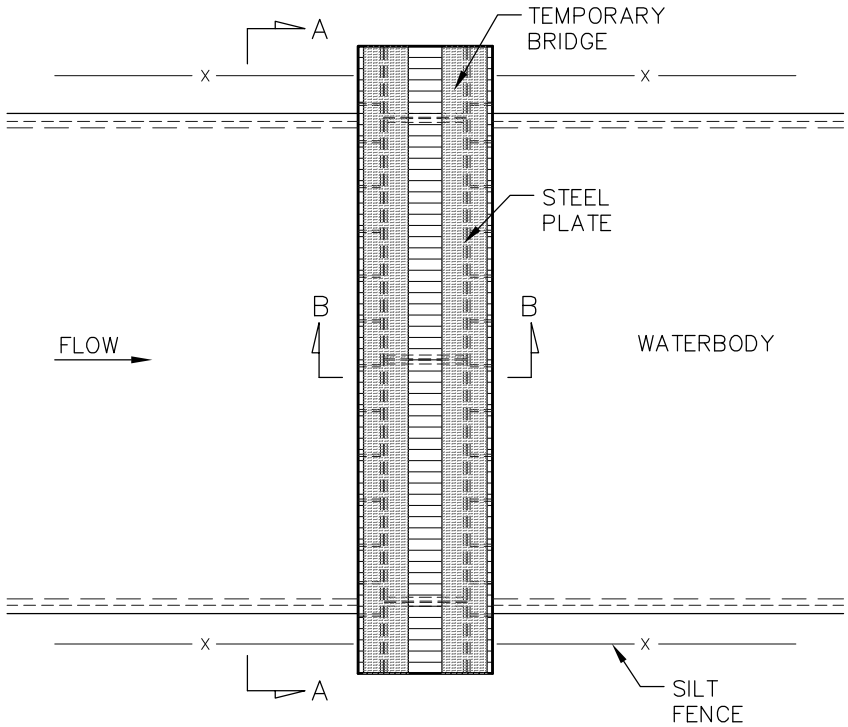
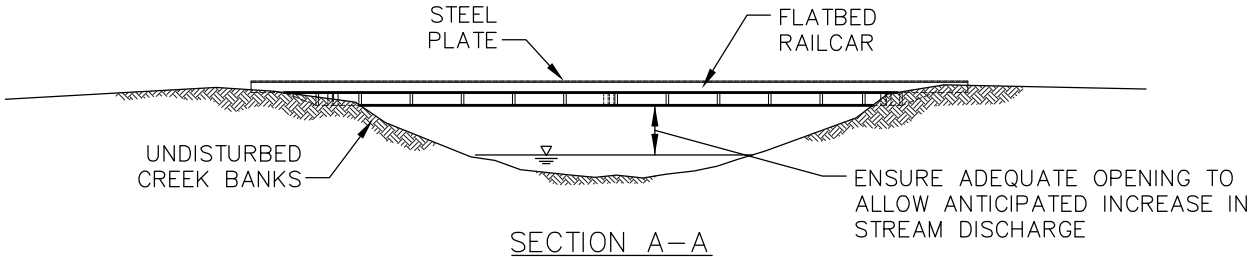
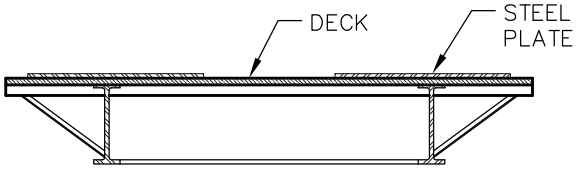


PLAN VIEW



SECTION A–A



SECTION B–B

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		TITLE: DETAIL 18 TYPICAL RAILCAR BRIDGE CROSSING		
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CONSTRUCTION PROCEDURES:

1. THIS TYPICAL DRAWING PROVIDES FOR A RAILCAR BRIDGE EQUIPMENT CROSSING.

2. BRIDGE SHOULD BE A MINIMUM OF 12 FEET LONGER THAN BANK TO BANK WIDTH.

3. BEST MANAGEMENT PRACTICES UTILIZING EROSION CONTROL DEVICES, SUCH AS HAY BALES AND SILT FENCE ARE REQUIRED TO PREVENT SEDIMENTATION OF THE STREAM. EROSION PROTECTION SHALL BE PLACED ON THE STREAM BANKS.

4. DURING FINAL CLEAN-UP, REMOVE TEMPORARY EQUIPMENT CROSSINGS AS SOON AS POSSIBLE. INSTALLED MATERIALS, SUCH AS HAY BALES AND SILT FENCE MUST BE REMOVED AND DISPOSED IN ACCORDANCE WITH STATE AND LOCAL REGULATIONS AND REQUIREMENTS. THE STREAMBED, BANKS AND AREAS AFFECTED BY CONSTRUCTION OF THE TEMPORARY EQUIPMENT CROSSING SHOULD BE RESTORED TO A STABLE CONDITION. IF REQUIRED TO PREVENT TRANSPORT OF SEDIMENTATION TO THE STREAM, SILT FENCE SHOULD BE INSTALLED AT THE TOP OF THE BANKS.

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TITLE: DETAIL 18A
TYPICAL RAILCAR BRIDGE CROSSING – CONSTRUCTION PROCEDURES

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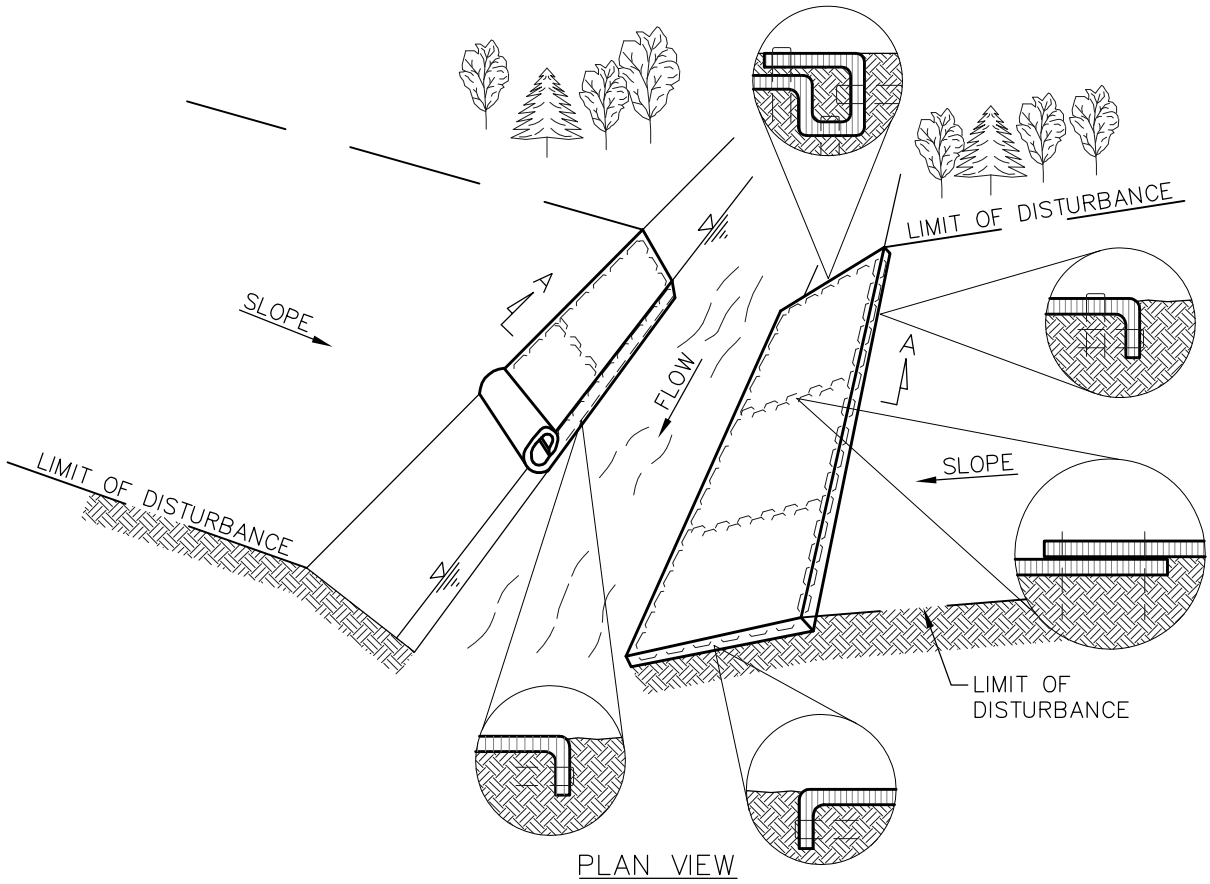

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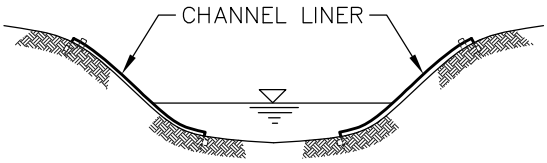

SECTION A–A

NOTES:

1. INSTALL AND ANCHOR LINERS FOLLOWING MANUFACTURER'S INSTRUCTIONS.
2. PREPARE SOIL BEFORE INSTALLING CHANNEL LINER, INCLUDING THE APPLICATION OF
3. SEED. CHANNEL LINERS SHOULD EXTEND COMPLETELY ACROSS DISTURBED BANK AREAS TO PROTECT ERODIBLE SURFACES.
4. BEGIN AT THE END OF THE CHANNEL BY ANCHORING THE LINER IN A TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
5. ROLL LINER IN DIRECTION OF WATER FLOW.
6. INSTALL LINERS END–OVER–END (SHINGLE STYLE) WITH OVERLAP USING A DOUBLE ROW OF STAGGERED STAPLES 4 INCHES BELOW THE FIRST ROW IN A STAGGERED PATTERN.
7. IN HIGH FLOW CHANNEL APPLICATIONS, A STAPLE CHECK SLOT IS RECOMMENDED AT 30 TO 40 FEET INTERVALS. USE A ROW OF STAPLES 4 INCHES BELOW THE FIRST ROW IN A STAGGERED PATTERN.
8. INSTALL CHANNEL LINER TO THE TOP OF THE DEFINED CHANNEL SECTION. TWO OR MORE ROWS OF BLANKETS MAY BE NECESSARY, THESE LINERS MUST BE OVERLAPPED 4 INCHES AND STAPLED.
9. THE CHANNEL LINER SHOULD EXTEND TO THE BASE OF THE CHANNEL AND STAPLED. FOR CHANNELS WITH VERY LITTLE OR NO FLOW, EXTEND A MINIMUM OF 1 FOOT BELOW THE LOW WATER LEVEL AND STAPLE IN PLACE.
10. INSTALLATION SPECIFICATIONS TO BE MODIFIED AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

REVISIONS
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TITLE

DETAIL 19
FLEXIBLE CHANNEL LINER INSTALLATION

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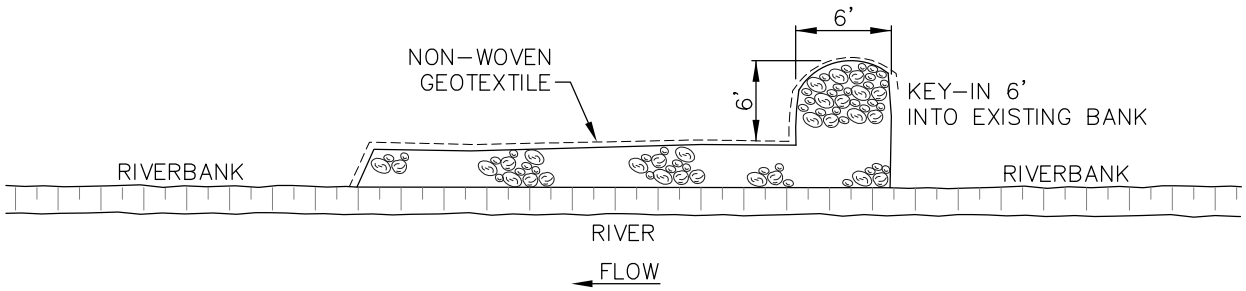
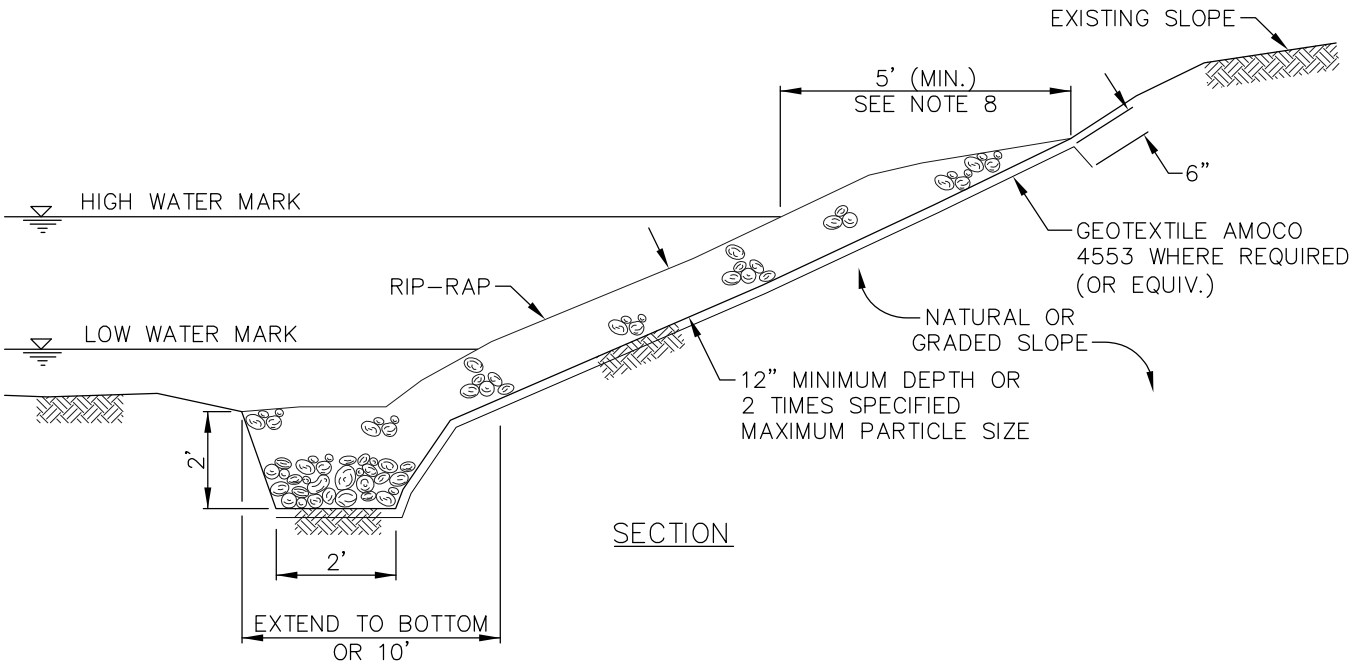


PLAN



SECTION

NOTES:

1. REMOVE ALL STUMPS, ORGANIC MATERIAL AND PREPARE BANKS TO A STABLE CONFIGURATION TO A MAXIMUM SLOPE OF 2 HORIZONTAL TO 1 VERTICAL.
2. CONSTRUCT TOE TRENCH TO KEY IN BOTTOM OF RIP-RAP PROTECTION.
3. INSTALL FILTER CLOTH (GEOTEXTILE), SUCH AS AMOCO 4553 OR EQUIVALENT, UNDER ROCK WHERE SPECIFIED OR AS DIRECTED BY THE COMPANY. ADJOINING EDGES OF CLOTH SHALL OVERLAP A MINIMUM OF 12".
4. ROCK UTILIZED FOR RIP-RAP SHALL CONSIST OF SOUND, DURABLE ROCK, AND RESISTANT TO WEATHERING. INDIVIDUAL PIECES SHOULD BE ANGULAR, BLOCK SHAPED AND HAVE A MINIMUM SPECIFIC GRAVITY OF 2.2.
5. INSTALL RIP-RAP TO A THICKNESS OF APPROXIMATELY 2 TIMES THE MAXIMUM EQUIVALENT DIAMETER OF THE RIP-RAP. EACH LOAD SHOULD BE WELL GRADED. A WELL GRADED MIXTURE IS COMPOSED 60% (MINIMUM) OF LARGER SIZES WITH 40% OF SMALLER SIZES TO FILL THE VOIDS.
6. SIZE OF RIP-RAP IS DEPENDENT UPON THE PREDICTED FLOW CONDITIONS.
7. KEY IN THE EDGES OF THE RIP-RAP AND FILTER CLOTH TO NATURAL GROUND CONTOURS SO THAT UNDERMINING DOES NOT OCCUR.
8. RIP-RAP IS TO BE INSTALLED TO 2 FEET. ABOVE THE NORMAL HIGH WATER MARK OR 5 FEET ALONG THE SLOPE, WHICHEVER IS LESS.
9. INSTALLATION SPECIFICATIONS TO BE MODIFIED TO SUIT ACTUAL SITE CONDITIONS.

REVISIONS
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		TITLE: DETAIL 20 TYPICAL ROCK RIP-RAP		
CHECKED BY: WSF	DESIGN CHECKER: RW P7100	SCALE N.T.S.	DWG No 4359-03-ML-05-709	REV 02

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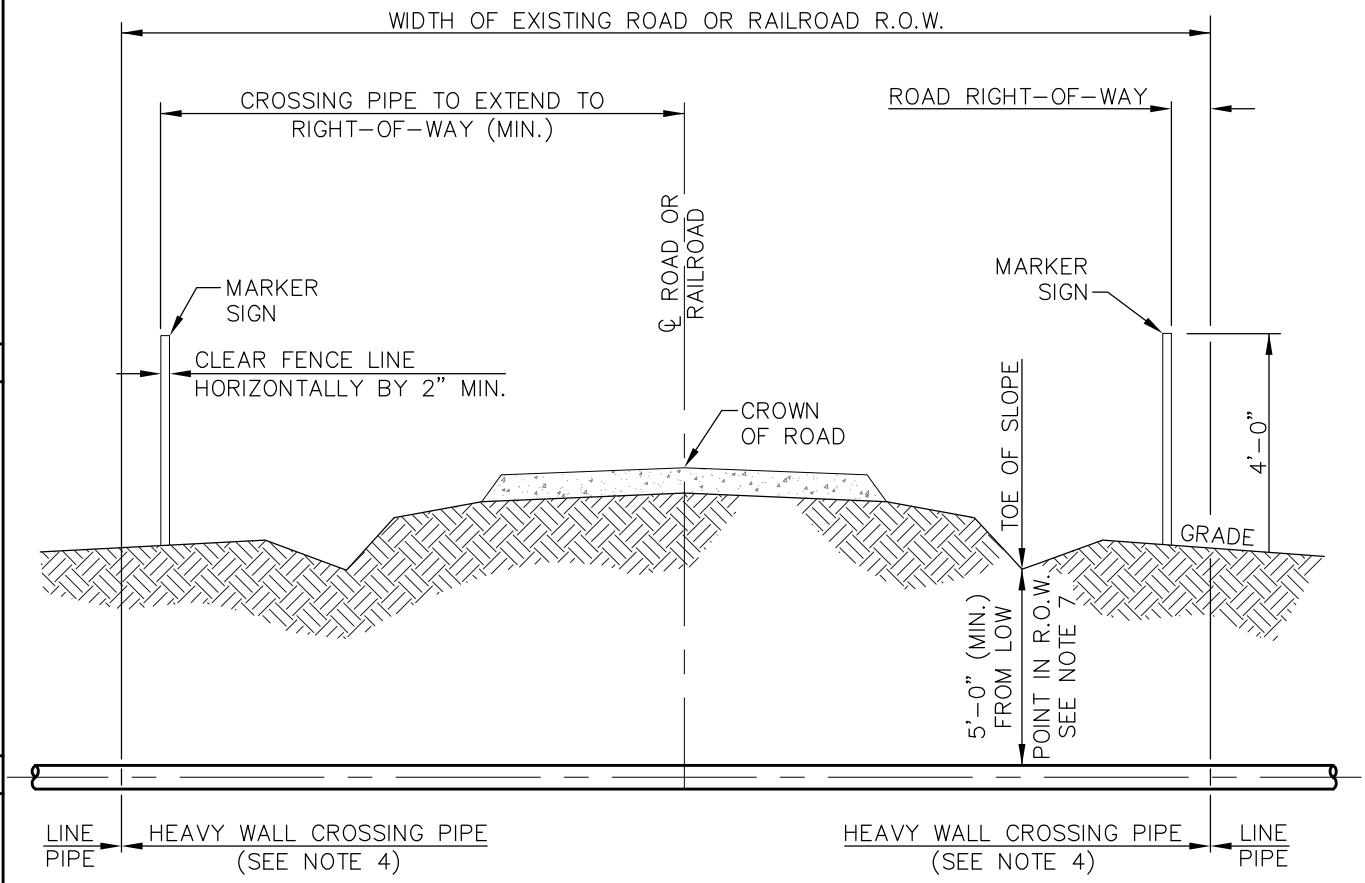

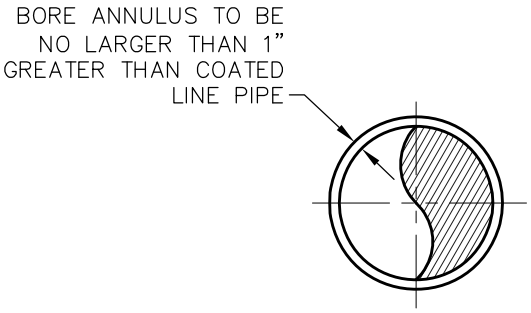

NOTES:

1. CROSSINGS SHALL BE IN ACCORDANCE WITH APPLICABLE PERMIT.
2. ROAD CROSSING PIPE SHALL EXTEND AT MINIMUM TO RIGHT-OF-WAY LINE UNLESS OTHERWISE SPECIFIED.
3. THE TYPE AND MINIMUM REQUIRED LENGTH OF PIPE FOR CROSSINGS OF ROADS SHALL BE AS SPECIFIED ON ALIGNMENT SHEETS.
4. PIPE FOR BORED CROSSINGS TO INCLUDE ABRASION-RESISTANT (ARB) COATING.
5. PIPELINE MARKER AND TEST STATIONS TO BE INSTALLED ON RIGHT-OF-WAY LINE NEXT TO FENCE IF POSSIBLE.
6. THE CROSSING PIPE SHALL BE STRAIGHT WITH NO VERTICAL OR HORIZONTAL BENDS WITHIN ROAD RIGHT-OF-WAY.
7. MINIMUM PIPELINE COVER IN DRAINAGE DITCHES AT PUBLIC ROADS IS 60 INCHES; 36 INCHES IN CONSOLIDATED ROCK.

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		TITLE: DETAIL 21 TYPICAL UNCASED ROAD/RAILROAD CROSSING BORE DETAIL		
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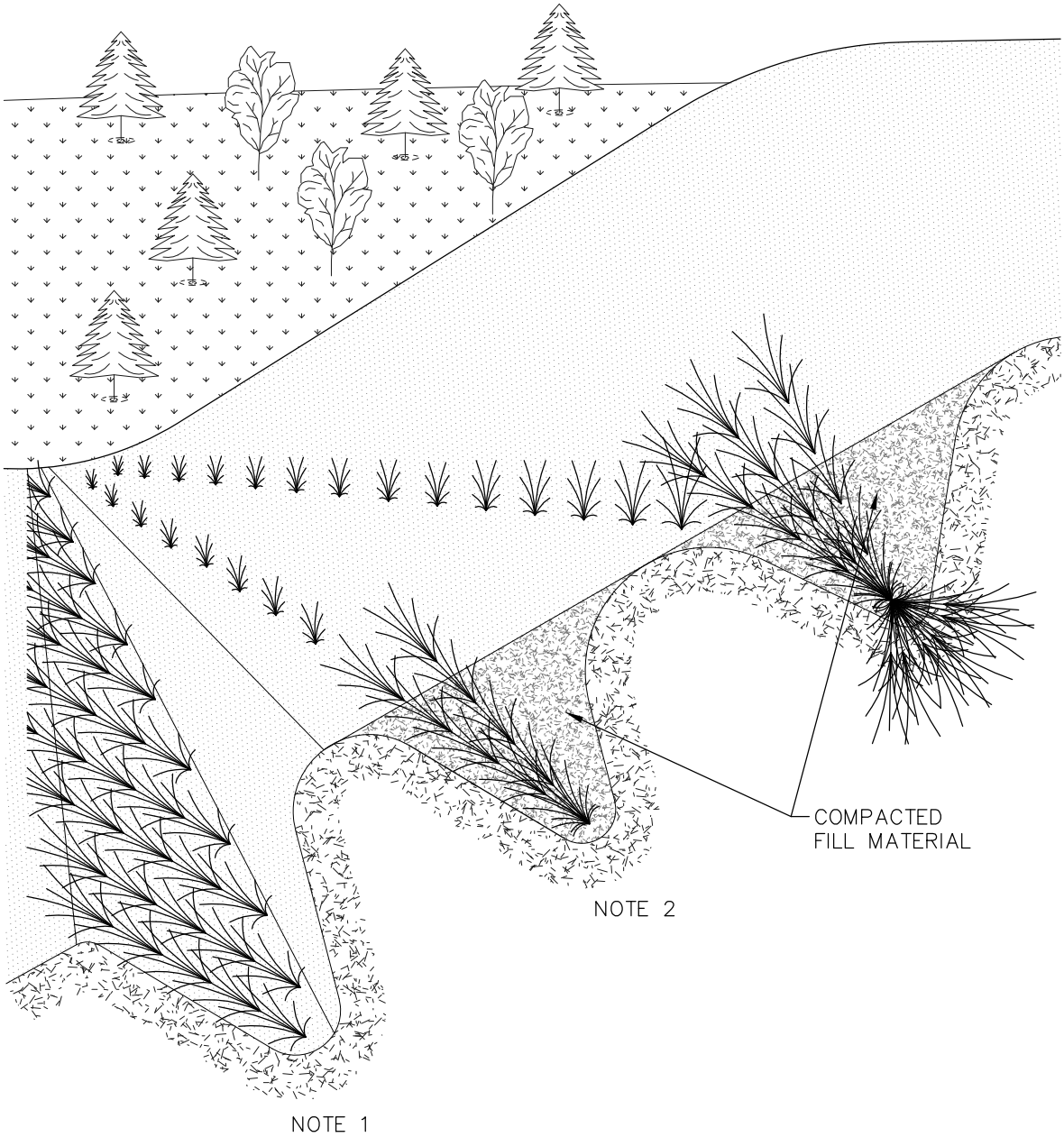

NOTES:

1. CUT TRENCH ACROSS SLOPE. FILL WITH DORMANT WOODY PLANT MATERIAL.
2. FILL IS PLACED ON TOP OF BRANCH LAYER AND COMPACTED.
3. INSTALLATION SPECIFICATIONS TO BE MODIFIED AS NECESSARY TO SUIT SITE CONDITIONS.

REVISIONS 01 2008-11-04 UPDATED DRAWING NOTES 02 2010-10-11 REVISED TITLE BLOCK

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DESIGNER: JMP (NAME) 2010-10-21 (DATE)

CHECKED BY: WSF

DESIGN CHECKER: RW P7100

KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE: DETAIL 22
STREAMBANK RECLAMATION –
BRUSH LAYER IN CROSS CUT SLOPE

SCALE: N.T.S. | DWG No: 4359-03-ML-05-710 | REV: 02

TC_A4_BR.DWG 8.5X11

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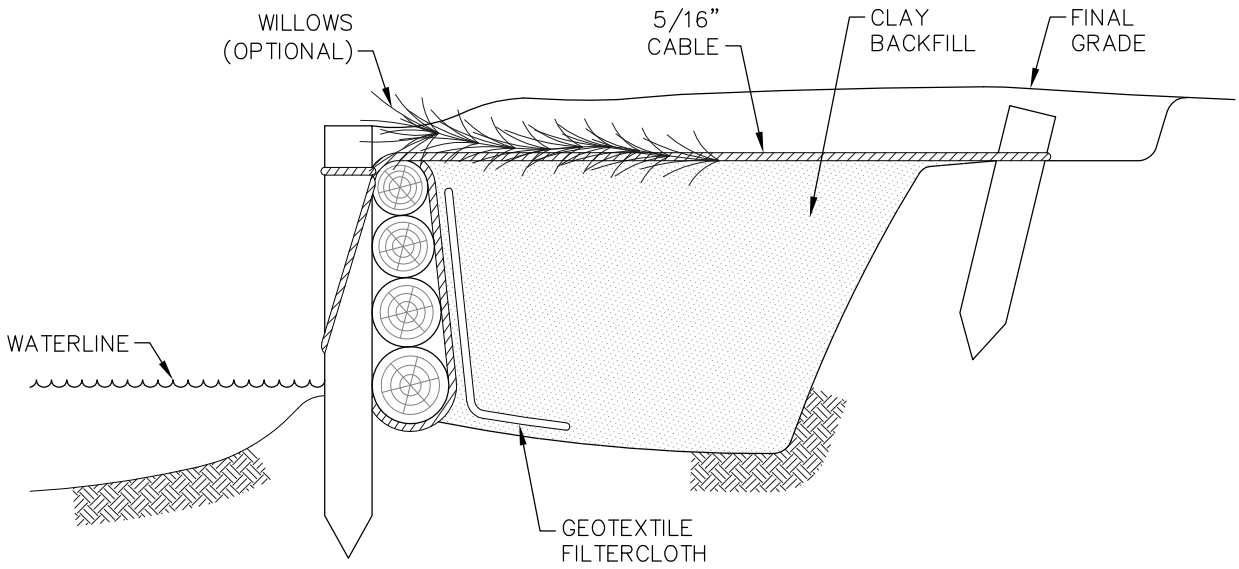

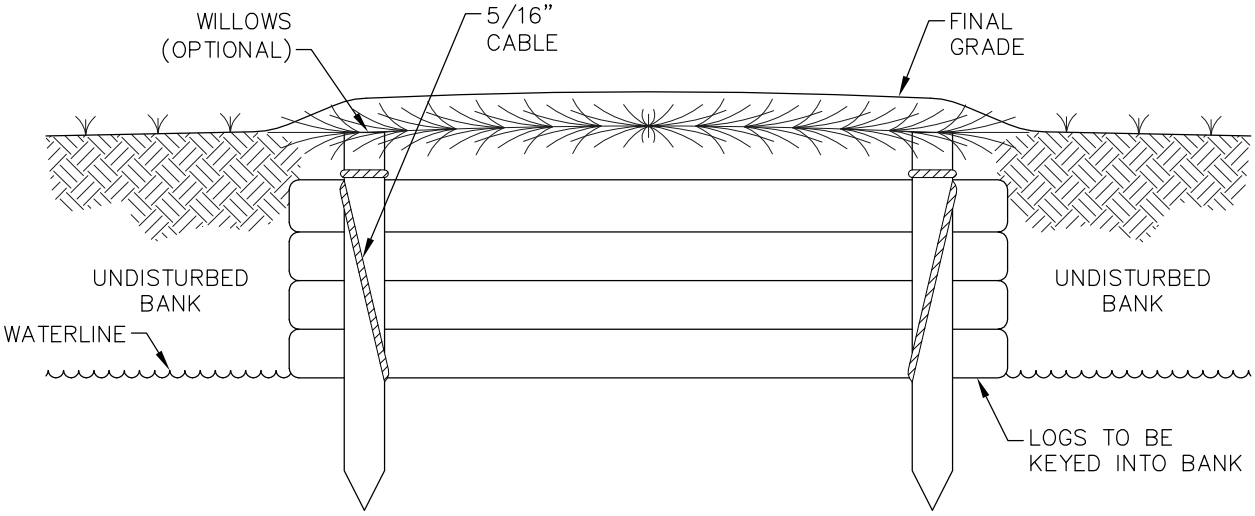

NOTES:

1. LOG WALLS TO BE CONSTRUCTED USING CONIFEROUS MATERIAL.
2. NATURE BACKFILL OR LOOSE GRADE MATERIAL SHOULD BE USED AS FILL MATERIAL.
3. ANCHOR PILINGS OR DEADMAN ANCHORS TO BE USED TO SECURE CABLE IN BANK.
4. NON-WOVEN FILTER CLOTH (NYLEX C34 OR EQUIVALENT) TO BE USED TO LINE LOG WALL.
5. INSTALLATION SPECIFICATIONS TO BE MODIFIED AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

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DESIGNER: JMP (NAME) 2010-10-21 (DATE)	KEYSTONE XL PROJECT		
	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
	TITLE: DETAIL 23 STREAMBANK RECLAMATION – LOGWALL		
CHECKED BY: WSF / DESIGN CHECKER: RW P7100	SCALE N.T.S.	DWG No 4359-03-ML-05-711	REV 02

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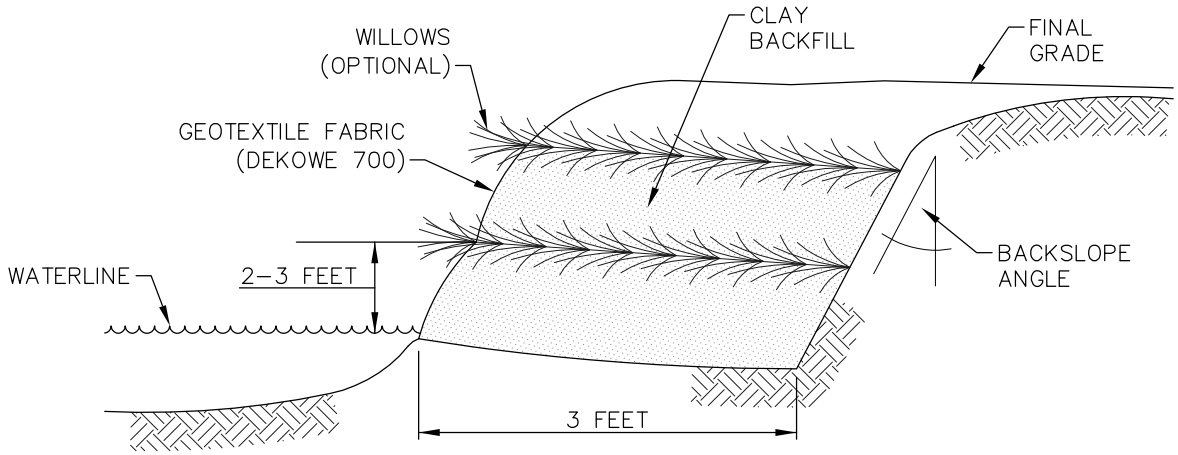

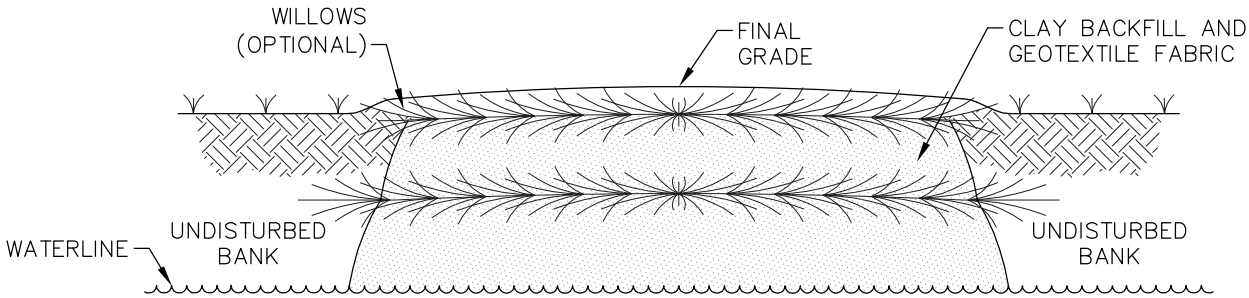

NOTES:

1. NATURE BACKFILL OR LOOSE GRADE MATERIAL SHOULD BE USED TO MINIMIZE AIR SPACES. THIS ALLOWS PROPER SOIL FABRIC CONTACT, WHICH MINIMIZES STEELING AND SCOURING DURING RUNOFF AND ENSURES SURVIVAL OF THE WILLOW CUTTINGS.
2. PLYWOOD FORMS (8'x2') MAY BE REQUIRED TO HELP RECONSTRUCT STEEP OR VERTICAL BANKS.
3. GRID LAYERS SHOULD NOT EXCEED 3 FEET IN HEIGHT WITH A MINIMUM OF 3 FEET SET IN BANK.
4. WILLOWS SHOULD BE HARVESTED AS CLOSE TO INSTALLATION AS POSSIBLE, PREFERABLY THE PREVIOUS DAY BUT NO MORE THAN 2 DAYS EARLY.
5. WILLOWS SHOULD BE 0.5 TO 1 INCH IN DIAMETER AND 2 TO 3 FEET LONG WITH NO MORE THAN 10 INCHES LEFT EXPOSED.
6. PLANTING RATE SHOULD BE APPROXIMATELY 1 STEM PER 6 INCHES.
7. INSTALLATION TO BE MODIFIED AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

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JMP (NAME)	2010-10-21 (DATE)	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
		TITLE: DETAIL 24 STREAMBANK RECLAMATION – VEGETATED GEOTEXTILE INSTALLATION		
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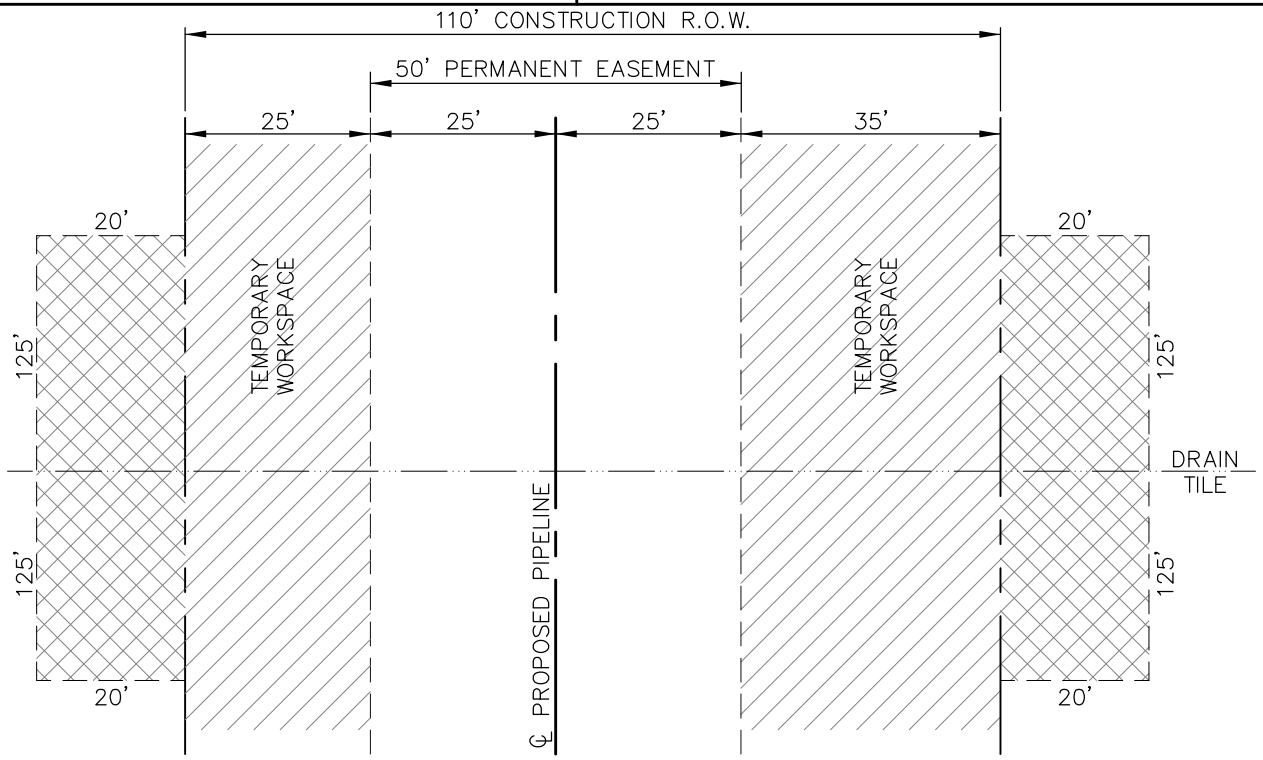
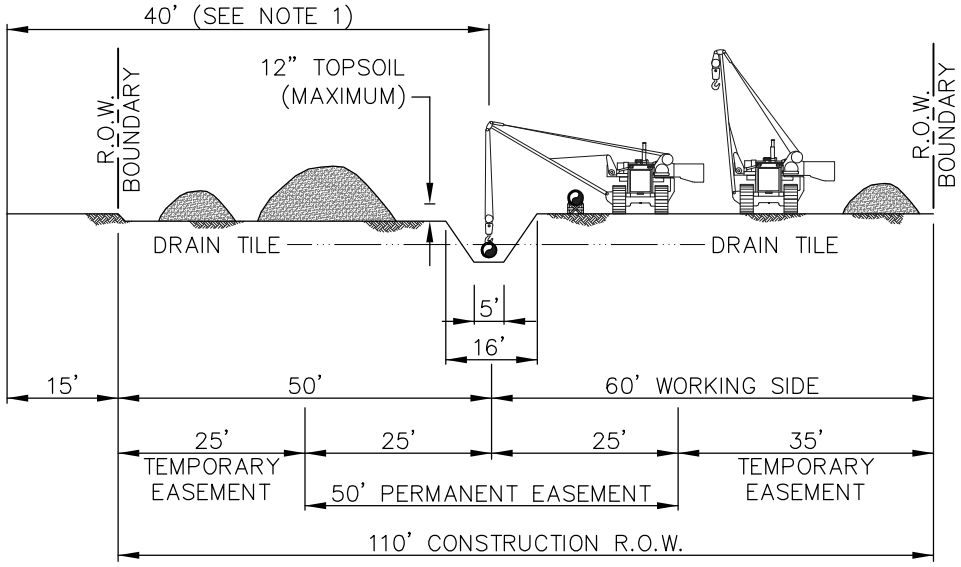


PLAN VIEW



ELEVATION

NOTES:

1. THE OFFSET FROM A FOREIGN PIPELINE, WHERE APPLICABLE, WILL BE 40' FOR MOST LOCATIONS, BUT MAY BE INCREASED OR DECREASED DEPENDING ON THE SITE SPECIFIC CONSTRUCTION REQUIREMENTS.
2. THE MINIMUM CLEARANCE BETWEEN THE TOP OF PIPE AND THE BOTTOM OF DRAIN TILE WILL BE 12 INCHES.
3. INSTALLATION SPECIFICATIONS TO BE MODIFIED AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

REVISIONS
01 REVISED NOTE 3; DELETED DIMENSION
02 2010-10-11 REVISED TITLE BLOCK

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JMP (NAME)	2010-10-21 (DATE)	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
		TITLE: DETAIL 25 TYPICAL R.O.W. LAYOUT/SOIL HANDLING 110' CONSTRUCTION R.O.W. 50' EASEMENT DRAIN TILE CROSSING		
CHECKED BY: WSF	DESIGN CHECKER: RW P7100	SCALE N.T.S.	DWG No 4359-03-ML-03-718	REV 02

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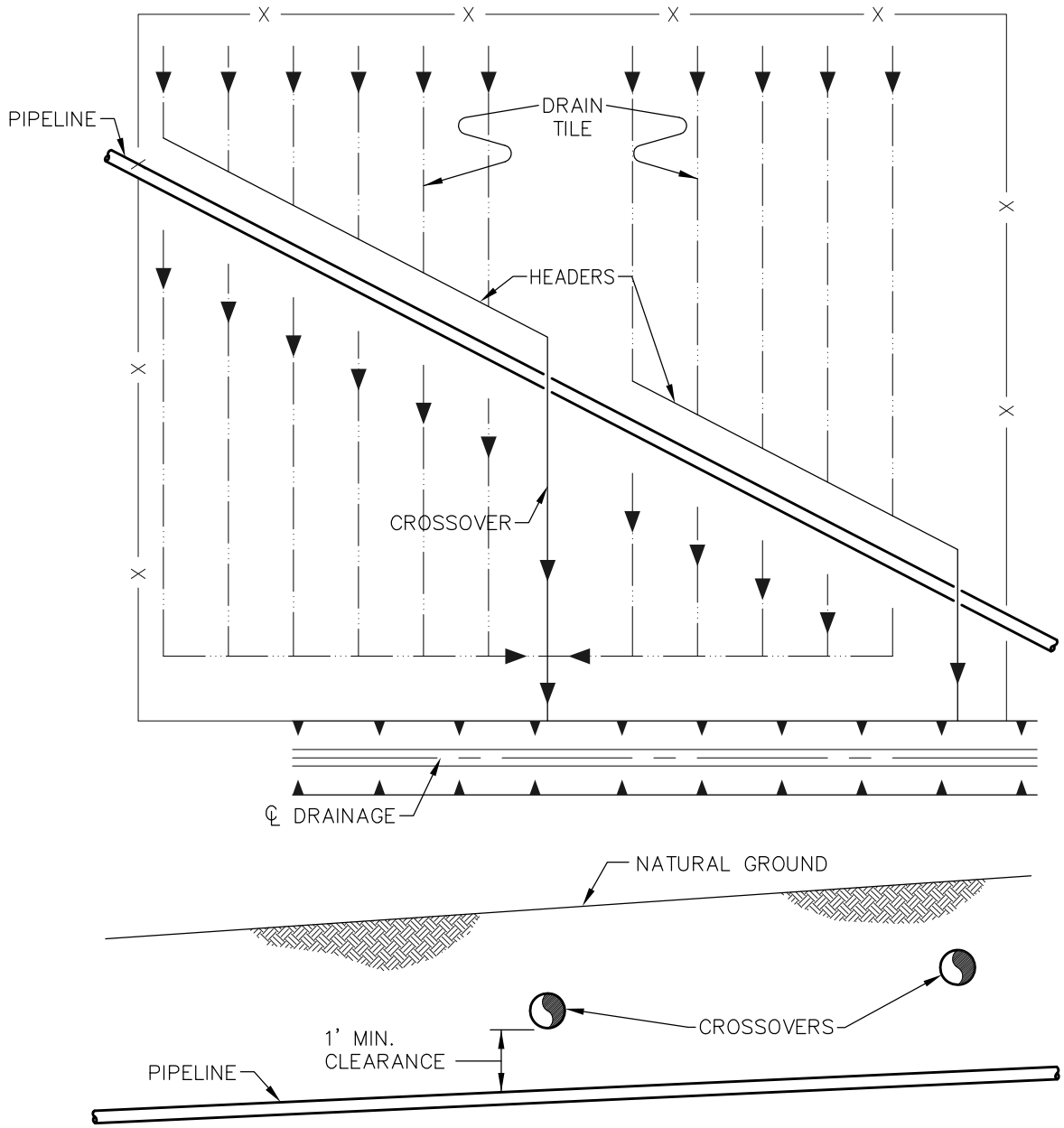

PROFILE

REVISIONS		
01	ADDED DIMENSION	
02	2010-10-11	REVISED TITLE BLOCK

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KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE: DETAIL 26 HEADER/MAIN CROSSOVERS OF PIPELINE

SCALE: N.T.S. | DWG No: 4359-03-ML-03-719 | REV: 02

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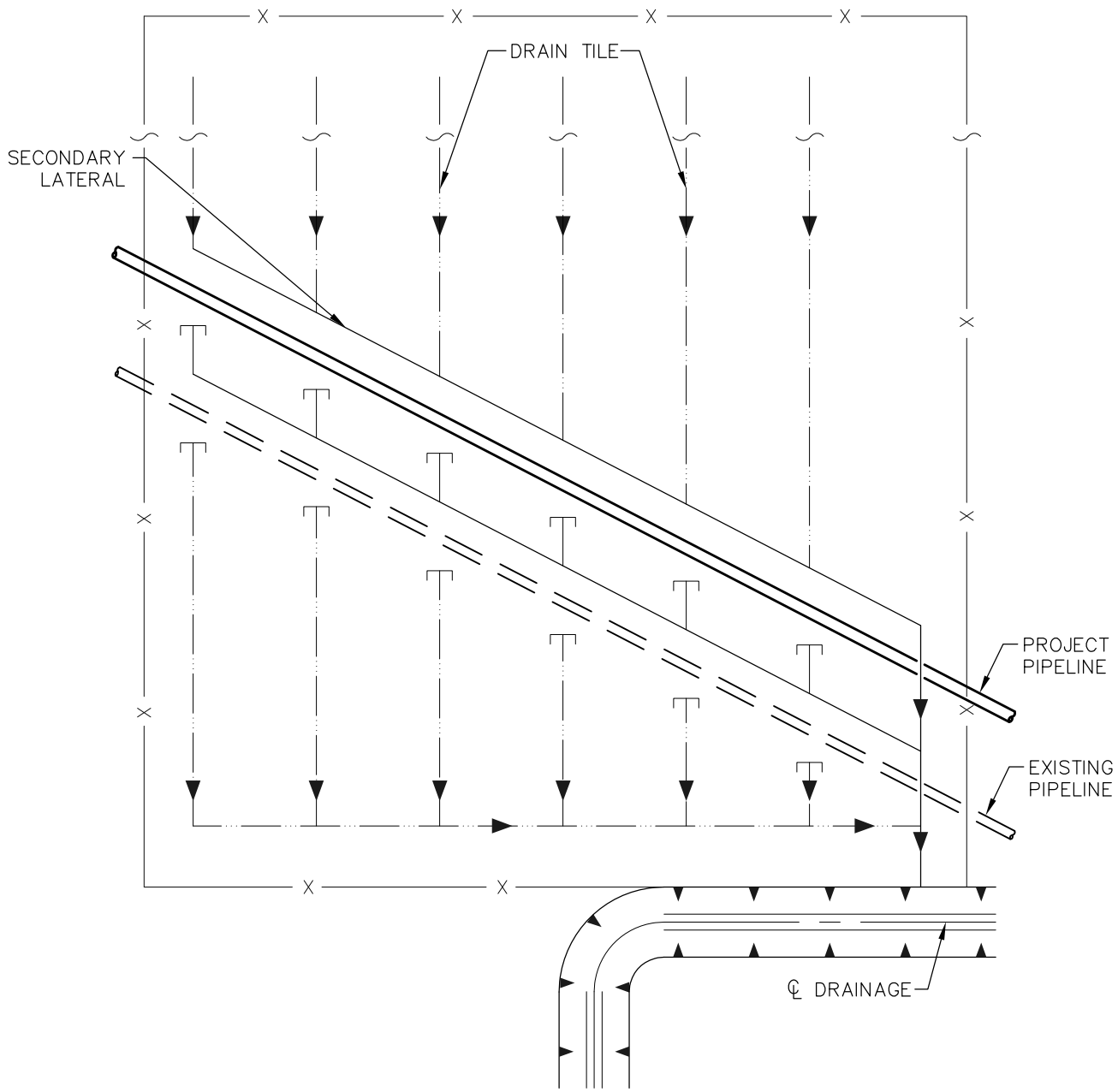
RELOCATE/REPLACE DRAINAGE HEADER/MAIN



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		TITLE: DETAIL 27 HEADER/MAIN CROSSOVERS OF PIPELINE		
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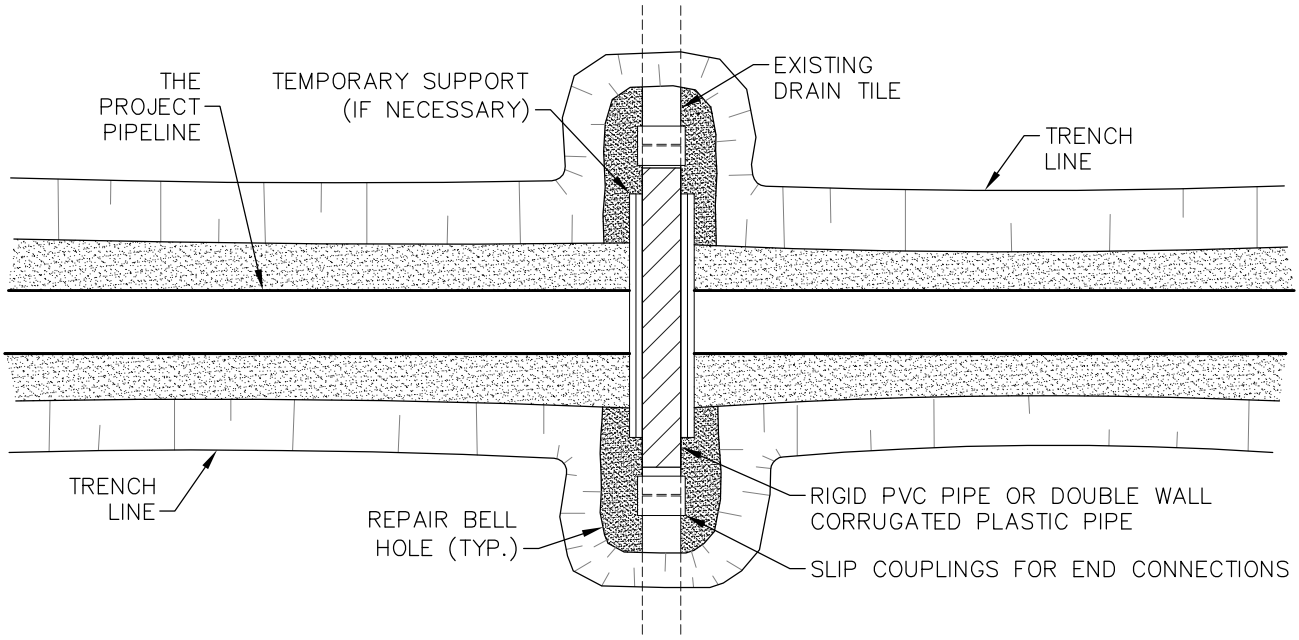
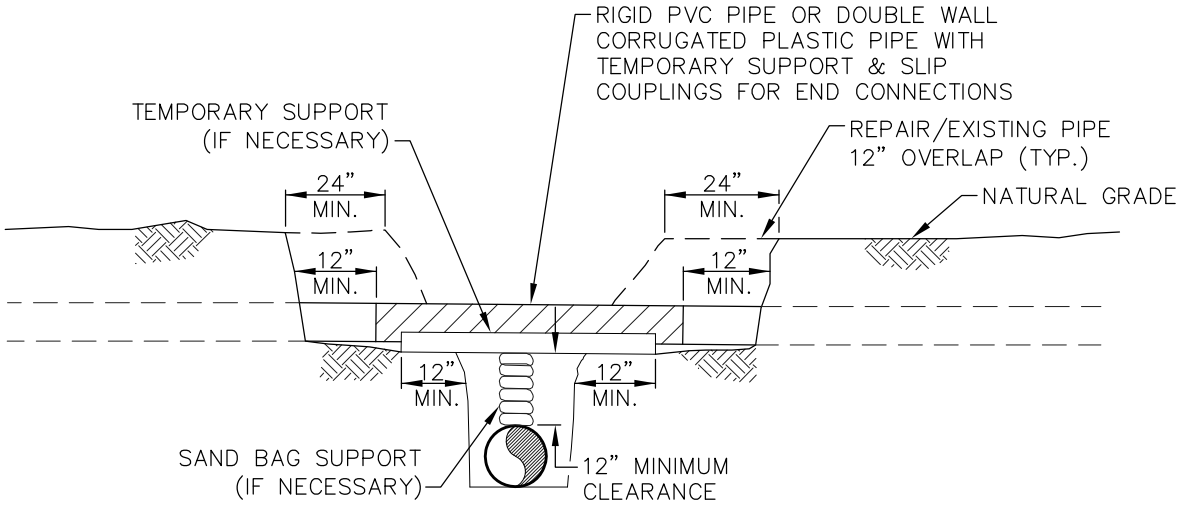


PLAN



PROFILE

NOTES:

1. IMMEDIATELY REPAIR TILE IF WATER IS FLOWING THROUGH TILE AT TIME OF TRENCHING.
2. SCREEN ALL EXPOSED ENDS OF TILE LINES.

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01 2008-11-04 UPDATED DRAWING NOTES
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	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
	TITLE: DETAIL 28 DRAINAGE AND IRRIGATION TEMPORARY DRAIN TILE REPAIR		
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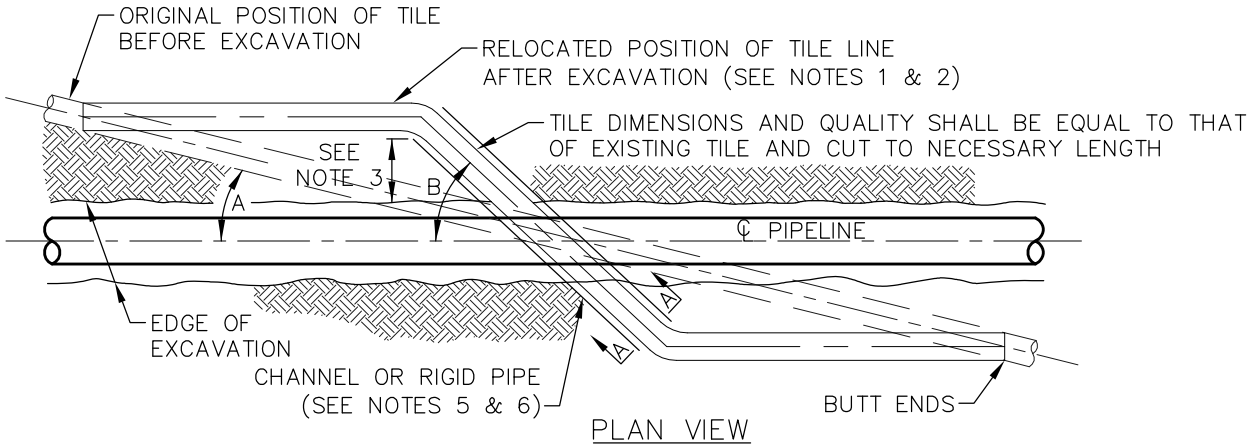
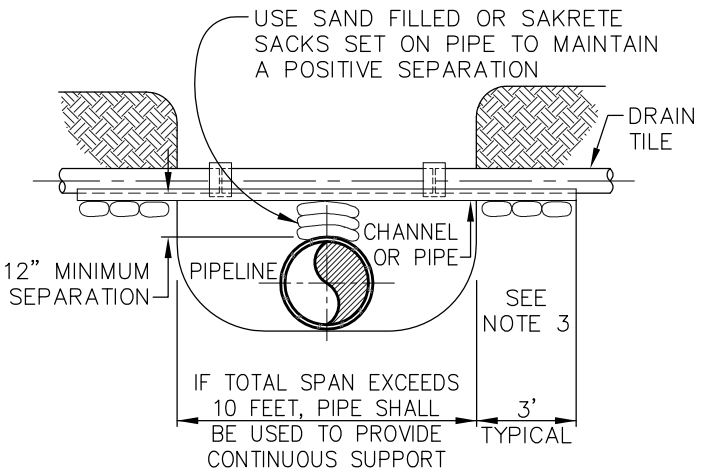
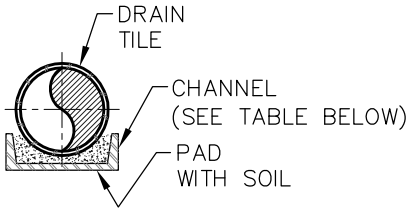
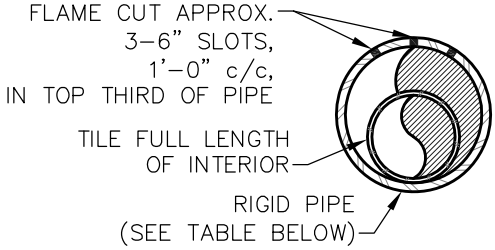


PLAN VIEW





SECTION "A–A" CHANNEL (SPANS < 10 FEET)



END VIEWS

SECTION "A–A" RIGID PIPE (SPANS > 10 FEET)

NOTES:

1. TILE REPAIR SHALL MAINTAIN ORIGINAL ALIGNMENT AND GRADIENT WHEN ANGLE "A", BETWEEN PIPELINE AND ORIGINAL TILE, IS MORE THAN 20 FEET UNLESS OTHERWISE DIRECTED BY THE PROJECT REPRESENTATIVE.
2. WHEN ANGLE "A" IS LESS THAN 20 FEET, UNLESS OTHERWISE DIRECTED BY COMPANY, ANGLE "B" SHALL BE 45° FOR USUAL WIDTHS OF TRENCH. FOR EXTRA WIDTHS, IT MAY BE GREATER AS DIRECTED BY THE PROJECT REPRESENTATIVE.
3. 3 FOOT MINIMUM LENGTH OF CHANNEL OR RIGID PIPE SHALL BE SUPPORTED BY UNDISTURBED SOIL, OR IF CROSSING IS NOT AT RIGHT ANGLES TO GAS PIPELINE, EQUIVALENT LENGTH PERPENDICULAR TO TRENCH. SHIM WITH SAKRETE, SAND BAGS OR CONCRETE BLOCKS TO UNDISTURBED SOIL FOR SUPPORT AND DRAINAGE GRADIENT MAINTENANCE (TYPICAL BOTH SIDES).
4. DRAINAGE TILE SHALL BE REPLACED SO THAT ITS FORMER GRADIENT AND ALIGNMENT ARE RESTORED.
5. DIAMETER OF RIGID PIPE SHALL BE OF ADEQUATE SIZE TO ALLOW FOR THE INSTALLATION OF THE TILE FOR THE FULL LENGTH OF THE RIGID PIPE.
6. OTHER METHODS OF SUPPORTING DRAIN TILE MAY BE USED IF THE ALTERNATE PROPOSED IS EQUIVALENT IN STRENGTH TO THE CHANNEL/PIPE SECTIONS SHOWN AND IF APPROVED BY THE PROJECT REPRESENTATIVE IN ADVANCE. SITE SPECIFIC ALTERNATE SUPPORT SYSTEM TO BE DEVELOPED BY THE PROJECT REPRESENTATIVE AND FURNISHED TO CONTRACTOR FOR SPANS IN EXCESS OF 20 FEET, TILE GREATER THAN 10 INCHES DIAMETER, AND FOR HEADER SYSTEMS.
7. ALL MATERIAL TO BE FURNISHED BY CONTRACTOR.
8. PRIOR TO REPAIRING TILE, CONTRACTOR SHALL PROBE INTO THE EXISTING TILE TO THE FULL WIDTH OF THE RIGHT–OF–WAY TO DETERMINE IF ADDITIONAL DAMAGE HAS OCCURRED. ALL DAMAGED/DISTURBED TILE SHALL BE REPAIRED AS NEAR AS PRACTICABLE TO ITS ORIGINAL OR BETTER CONDITION.
9. "NIGHT CAP" OPEN ENDS OF PIPE AND/OR DRAIN TILES IF REPAIRS ARE NOT COMPLETED BY END OF WORK DAY.

MINIMUM SUPPORT TABLE

TILE SIZE	CHANNEL SIZE	PIPE SIZE
3"	4" @ 5.4 #/FT.	4" STD. WT
4"–5"	5" @ 6.7 #/FT.	6" STD. WT
6"–9"	7" @ 9.8 #/FT.	8"–10" STD. WT
10"	10" @ 15.3 #/FT.	12" STD. WT

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KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE: DETAIL 29 DRAINAGE AND IRRIGATION PERMANENT DRAIN TILE REPAIR

SCALE: N.T.S. | DWG No 4359–03–ML–03–722 | REV 02

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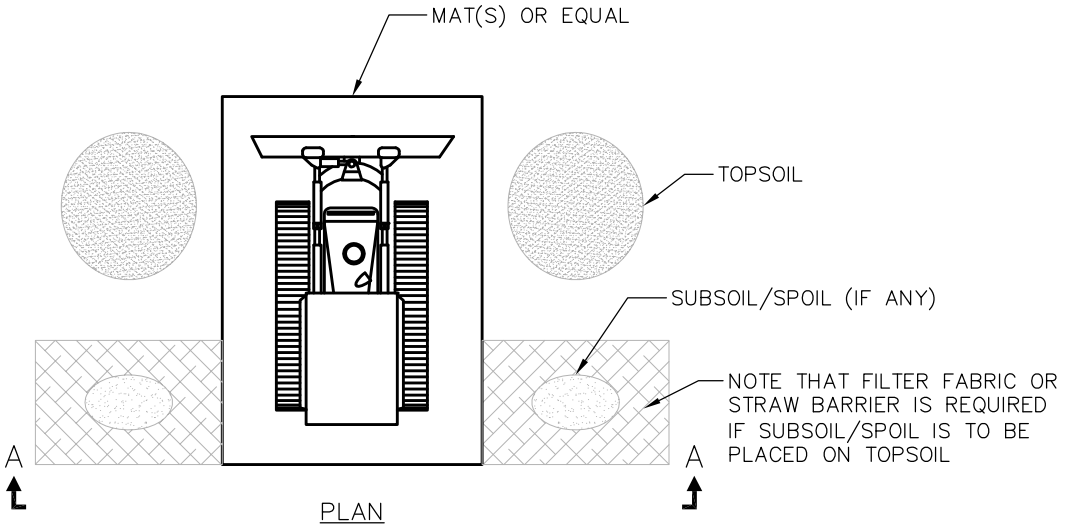
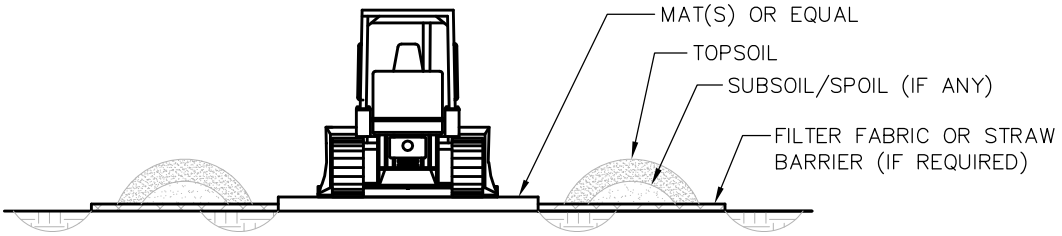


PLAN



SECTION A–A

CLEANING STATION NOTES:

1. ALL EQUIPMENT WILL BE REQUIRED TO BE CLEANED AT EQUIPMENT CLEANING STATIONS LOCATED AS SHOWN ON THE CONSTRUCTION DRAWINGS OR AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR.
2. STOCKPILE TOPSOIL/SUBSOIL AS SHOWN OR IN ANY CONFIGURATION APPROVED BY THE ENVIRONMENTAL INSPECTOR.
3. SHOVELS OR OTHER HAND TOOLS AND/OR COMPRESSED AIR WILL BE USED TO REMOVE AS MUCH AS MUCH SOIL AS PRACTICAL FROM TRACKED EQUIPMENT. EFFORT WILL BE FOCUSED ON TRACKS AND BLADES.
4. IF CONDITIONS ARE MUDDY, WHEELED EQUIPMENT WILL ALSO BE CLEANED USING HAND TOOLS TO REMOVE EXCESS SOIL FROM TIRES AND WHEEL WELLS.
5. CLEANING WILL BE CONDUCTED ON CONSTRUCTION MATS OR OTHER RAISED SURFACE TO MINIMIZE REATTACHMENT OF SOIL THAT HAS BEEN PREVIOUSLY REMOVED.
6. MATS WILL BE CLEANED BETWEEN EACH PIECE OF EQUIPMENT.
7. SOIL COLLECTED DURING THE CLEANING PROCESS WILL BE STOCKPILED AT A CONVENIENT LOCATION NEAR THE CLEANING STATION AND DISPOSED OF IN AN ACCEPTABLE LAND FILL.
8. IF THE SOIL HAS A SIGNIFICANT COMPONENT OF SUBSOIL, IT WILL BE PLACED OVER THE BACKFILLED TRENCH OR IN THE ADJACENT SPOIL STORAGE AREA, AND SUBSEQUENTLY COVERED WITH TOPSOIL. IF THE LAND OWNER DIES NOT APPROVE OF ON–SITE DISPOSAL, THE SOIL WILL BE TAKEN TO AN APPROVED DISPOSAL SITE.
9. SOILS CONTAMINATED WITH OIL OR GREASE WILL BE REMOVED AND DISPOSED OF IN ACCORDANCE PROJECT SPCCC PLAN.

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DESIGN CHECKER: RW P7100

KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE

DETAIL 30
EQUIPMENT CLEANING STATION DETAIL

SCALE N.T.S. | DWG No 4359–03–ML–05–713 | REV 02

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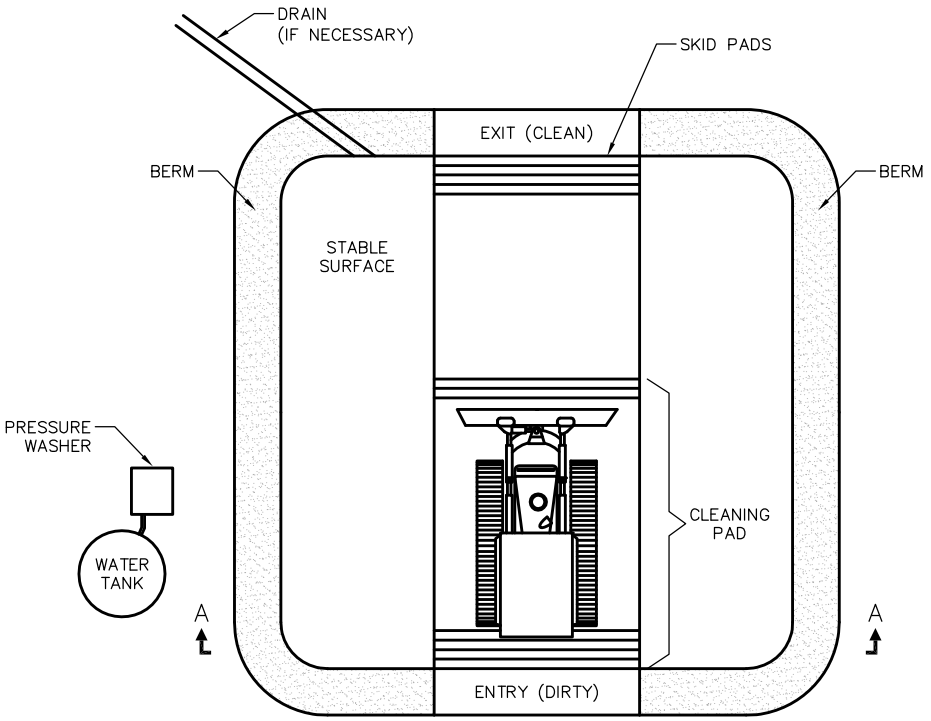
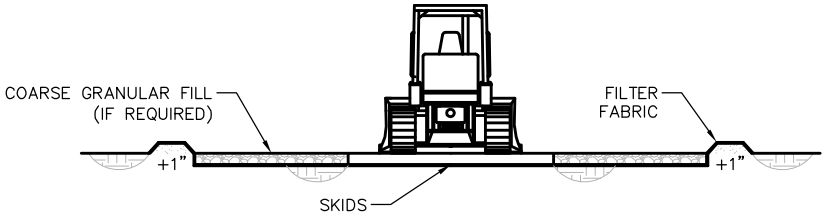


PLAN



SECTION A–A

WASH STATION NOTES:

1. ALL EQUIPMENT AND VEHICLES ARE REQUIRED TO BE CLEANED AT WASH STATION LOCATIONS SHOWN ON THE CONSTRUCTION DRAWINGS OR AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR. WASH STATIONS WILL BE CONSTRUCTED BY THE CONTRACTOR. WASHINGS WILL BE CARRIED OUT UNDER THE SUPERVISION AND TO SATISFACTION OF THE ENVIRONMENTAL INSPECTOR.
2. WASH WATER USED FOR CLEANING WILL NOT BE ALLOWED TO ENTER ANY WATERBODY, WETLAND, OR IRRIGATION CANAL/DITCH. ANY SOILS CONTAMINATED BY PETROLEUM–BASED, OR OTHER UNDESIRABLE MATERIALS FROM WASH STATIONS WILL BE REMOVED.
3. THE SIZE OF STATION WILL BE ADEQUATE TO ACCOMMODATE THE MAXIMUM SIZE OF EQUIPMENT EXPECTED.
4. EQUIPMENT WILL CONSISTENTLY ENTER THE "DIRTY END" AND EXIT THE "CLEAN END."
5. STABLE DRAINAGE FROM THE SITE WILL BE PROVIDED (IF NECESSARY). NO DISCHARGE TO STREAMS OR WETLANDS WILL BE ALLOWED.
6. WASH STATIONS WILL BE EQUIPPED WITH SKID PADS OR WASH RACKS TO PREVENT SOIL FROM BEING CARRIED ON TRACKS OR TIRES AS EQUIPMENT AND VEHICLES EXIT THE WASH STATION. SKIDS ARE TO BE CLEANED EACH TIME A PIECE OF EQUIPMENT IS CLEANED.
7. GRAVEL FILL (IF REQUIRED) AND FILTER FABRIC WILL BE REMOVED AND DISPOSED OF IN AN ACCEPTABLE LAND FILL.
8. THE DEPRESSION WILL BE BACKFILLED WITH BERMED MATERIAL.
9. CLEANING SITES WILL BE MONITORED DURING THE POST CONSTRUCTION MONITORING PROGRAM AND WEEDS WILL BE CONTROLLED PER THE NOXIOUS WEED MANAGEMENT PLAN.

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DESIGNER:		KEYSTONE XL PROJECT		
JMP (NAME)	2010–10–21 (DATE)	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
		TITLE: DETAIL 31 EQUIPMENT WASH STATION DETAIL		
CHECKED BY: WSF	DESIGN CHECKER: RW P7100	SCALE N.T.S.	DWG No 4359–03–ML–05–714	REV 02

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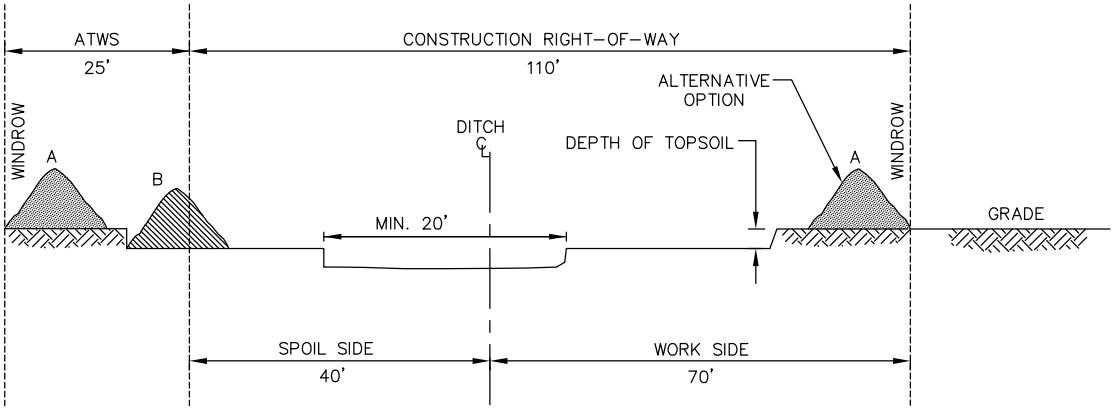
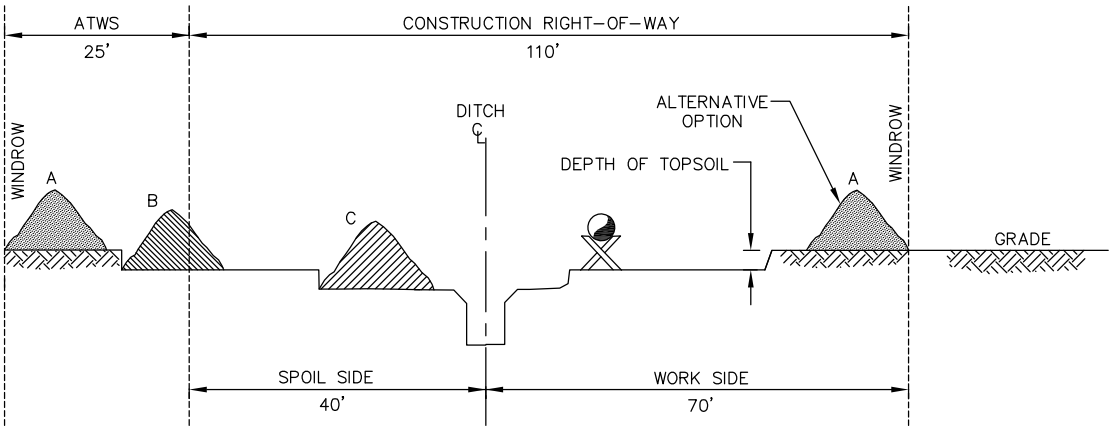
THESE ARE TYPICAL DRAWINGS; ACTUAL SITE CONDITIONS MAY VARY FROM THE SITE GRAPHICALLY REPRESENTED.

1. POTENTIAL LOCATIONS WHERE TRIPLE DITCH TOPSOIL CONSERVATION MAY BE COMPLETED ARE SHOWN ON THE ALIGNMENT SHEETS. KEYSTONE WILL DIRECT THE ACTUAL LOCATIONS WHERE TRIPLE DITCH WILL BE COMPLETED DURING, OR IMMEDIATELY PRIOR TO, TOPSOILING THE ROW. KEYSTONE MAY MODIFY TRIPLE DITCH PROCEDURES FROM THOSE DESCRIBED HERE TO ADDRESS SITE-SPECIFIC, OR SOIL-SPECIFIC, CONDITIONS.

2. STRIP TOPSOIL ("A" HORIZON) ACCORDING TO THE "A" HORIZON DEPTHS AND CONSTRUCTION DETAILS SHOWN ON CONSTRUCTION ALIGNMENT SHEETS. PLACE "A" HORIZON IN THE ADDITIONAL TEMPORARY WORKSPACE OR THE WINDROW WITHIN THE WORKING SIDE OF THE CONSTRUCTION RIGHT-OF-WAY. IN AREAS OF THICKER "A" HORIZON'S, "A" HORIZON MAY BE SPLIT TO BOTH SIDES OF THE RIGHT-OF-WAY.
REMOVE "B" HORIZON (2ND DITCH) TO DEPTHS SPECIFIED BY KEYSTONE AND STOCKPILE ON SPOIL SIDE. THE "B" HORIZON SHOULD BE REMOVED IN A STRIP AT LEAST 20 FEET WIDE OVER THE TRENCH TO ALLOW FOR STORAGE OF THE TRENCH SPOIL MATERIALS. MAINTAIN A MINIMUM OF 2 FEET BETWEEN "A" HORIZON AND "B" HORIZON STOCKPILES.



3. EXCAVATE TRENCH. ENSURE THE DIFFERENT SOIL HORIZONS ("B" HORIZON AND "C" HORIZON) ARE IN SEPARATE STOCKPILES. THE VISUAL DISTINCTION OF EACH PILE MUST BE POSSIBLE AT ALL TIMES. THE STOCKPILING SHALL ALLOW FOR RE-PLACEMENT OF THE SOIL HORIZONS BACK TO THEIR ORIGINAL SEQUENCE WITHOUT LOSS OF SOIL. MAINTAIN A MINIMUM OF 2 FEET BETWEEN "B" HORIZON AND "C" HORIZON STOCKPILES.



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KEYSTONE XL PROJECT

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TITLE: DETAIL 67 TOPSOIL CONSERVATION DITCH & SPOIL STRIPPING TRIPLE DITCH

SCALE N.T.S. | DWG No 4359-03-ML-05-724 | REV 03

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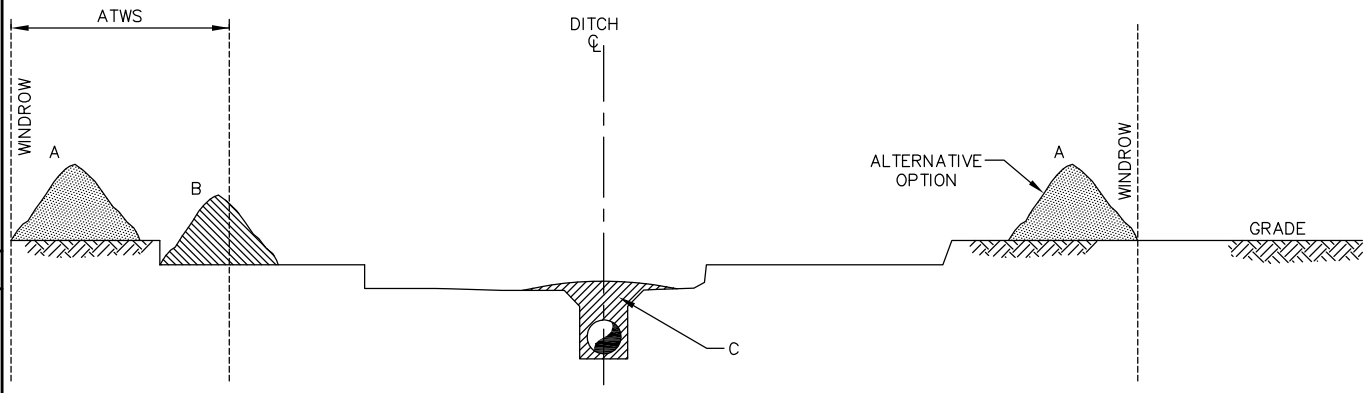
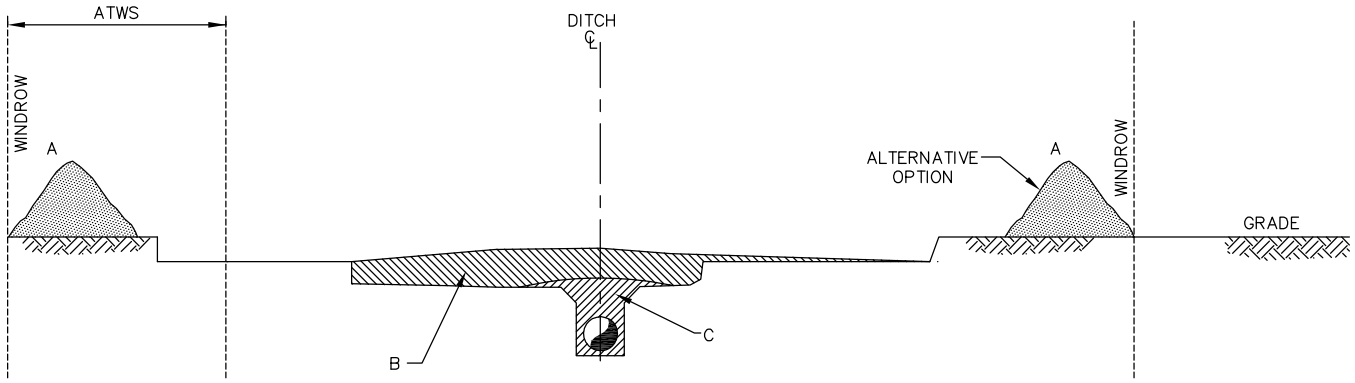
THESE ARE TYPICAL DRAWINGS; ACTUAL SITE CONDITIONS MAY VARY FROM THE SITE GRAPHICALLY REPRESENTED.

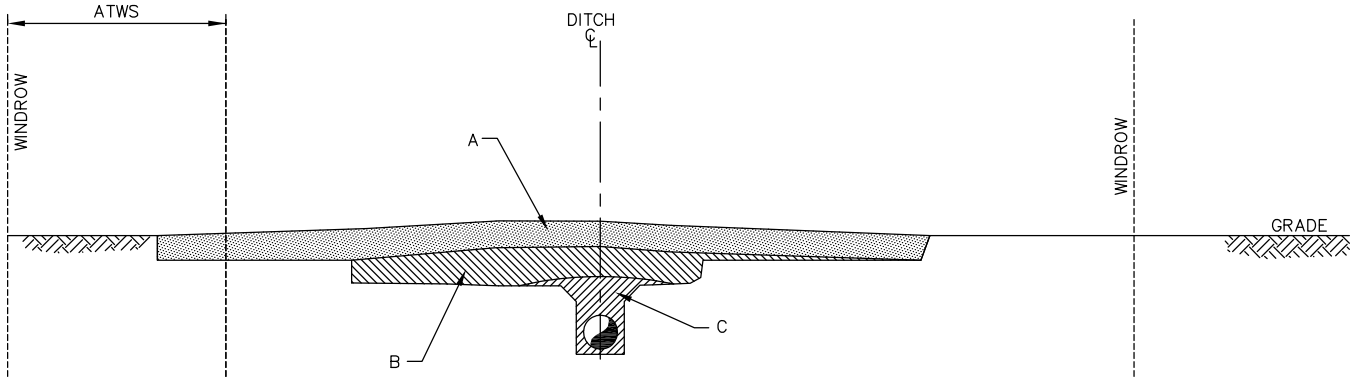
4. BACKFILL TRENCH AND COMPACT AS PER APPROVED PROCEDURE.. PLACE THE SOIL HORIZONS BACK IN THEIR ORIGINAL SEQUENCE IN THE TRENCH.



5. RELIEVE AREAS OF COMPACTION AND FEATHER (B) MATERIAL EVENLY OVER STRIPPED AREA.



6. REPLACE "A" HORIZON PILE EVENLY OVER STRIPPED AREA.



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TITLE: DETAIL 67A
TOPSOIL CONSERVATION DITCH & SPOIL STRIPPING TRIPLE DITCH

SCALE: N.T.S. | DWG No 4359-03-ML-05-725 | REV 03

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Additional Commitments from Keystone 10/18/2012

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TransCanada
In business to deliver

October 18, 2012

TransCanada PipeLines Limited
450 – 1st Street SW
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Mike Linder
Director
Nebraska Department of Environmental Quality
1200 "N" Street, Suite 400
PO Box 98922
Lincoln, Nebraska 68509

Dear Mr. Linder:

In connection with the on-going review of the proposed reroute of the Keystone XL Pipeline Project (Project) in Nebraska, TransCanada Keystone Pipeline, LP (Keystone) hereby advises the Nebraska Department of Environmental Quality (NDEQ) that it will implement certain additional commitments and mitigation measures as part of the construction and operation of the Project. These commitments and mitigation measures would be in addition to all of the commitments that Keystone has made in its Supplemental Environmental Report (SER) filed September 5, 2012, and its responses to information requests, as well as commitments and mitigation measures reflected in applicable portions of the U.S. Department of State's (DOS) August 2011 Final Environmental Impact Statement (FEIS) and the Supplemental Environmental Impact Statement (SEIS) that DOS is currently preparing. Further, Keystone will adhere to all permit and approval conditions.

1. ADDITIONAL COMMITMENTS

Public Liaison Officer

Prior to construction, Keystone would select, subject to NDEQ approval, and pay for, a public liaison officer to facilitate the exchange of information between Keystone and landowners, local communities, and residents. The purpose of the public liaison officer would be to respond to questions or concerns and to resolve promptly any complaints or problems that may develop as a result of the pipeline's construction. The public liaison officer would report to NDEQ or as otherwise directed by NDEQ. Keystone will consider agricultural extension agents, as well as other qualified individuals, in selecting a public liaison officer.

Water Well Testing

Keystone would conduct baseline water quality testing for domestic and livestock water wells within 300 ft of the final centerline of the approved route in Nebraska, upon the request of individual landowners who provide the necessary access to perform the testing. These baseline samples would be collected prior to placing the pipeline in service. Subsequently, in the event of a significant spill in the area, Keystone would conduct water well testing

as required by NDEQ pursuant to Title 118, Nebraska Administrative Code. Keystone would also provide an alternate water supply for any well where water quality was found to be compromised by a spill.

Leak Detection

Keystone would commit to keep abreast of the latest developments in external leak detection technologies (above and beyond those already proposed to be implemented on the Project, as described in the August 2011 Final Environmental Impact Statement), that could be installed along the pipeline at sensitive locations. Keystone would report to, and discuss with, the Department of Environmental Quality the status of innovation in such pipeline leak detection equipment and methods on or before January 1, 2014, and at such additional times thereafter until 2024 as the DEQ shall specifically request, but in no case more frequently than once every three years.

Emergency Response

Once a final Project route is determined in Nebraska, Keystone will conduct a detailed spill risk assessment for the section of the Keystone XL Pipeline system in the State. Utilizing that assessment, Keystone will determine the optimal location of spill response equipment and resources, taking into account response times to sensitive areas and receptors. These spill response locations will be reflected in the Emergency Response Plan that Keystone will submit to the federal Pipeline and Hazardous Materials Safety Administration for review and approval.

Assurance – Spill Clean-up

Keystone is committed to ensuring the safe operation of its pipeline system and to prevent any incidents from occurring. Should a release occur from the Keystone XL pipeline, Keystone is committed to clean up any releases that may occur. Keystone is also legally required to clean up spills under Title 118 and OPA 90. In addition to all of the above, and in response to public concern, Keystone would commit to file annually with Nebraska DEQ, by May 1 of each year:

(a) A certificate of insurance as evidence that it is carrying a minimum of $200 million in third party liability insurance as adjusted by calculating the GDP-IPD from the date a Presidential Permit is issued for the Project and adjusting the amount of the third party liability insurance policy by this percentage. The third party liability insurance shall cover sudden and accidental pollution incidents from Keystone XL Pipeline in Nebraska; and

(b) A copy of Keystone's SEC Form 10-K and Annual Report.

2. ADDITIONAL MITIGATION MEASURES – BY RESOURCE

The commitments noted below are either in addition to, or clarifications to, commitments previously made in various documents already filed.

Surface Water

As outlined in Keystone's Construction Mitigation and Reclamation Plan (CMRP), trenches through water bodies that are dry or contain non-moving water at the time of crossing will not be left open for more than 24 hours, except in extenuating circumstances, to reduce chances of sediment discharge from a sudden storm event resulting

in runoff. This commitment would not apply where excavation of rock by blasting or mechanical means may be required in the water body.

Keystone will also abide by mitigation measures outlined in applicable water withdrawal and discharge permits to protect sensitive receptors, such as fisheries.

As a standard procedure and as part of its water withdrawal and discharge permits, Keystone identifies water rights that could be affected by temporary interruptions of water flow.

As the pump station location and design for Pump Station 24 is finalized, Keystone will develop an access plan for this pump station given its location near the Loup River that takes into account access issues during flood conditions.

Wetlands and Waterbodies

Keystone would develop compensation for impacts for forested wetlands impacted by the construction right-of-way through the U.S. Army Corps of Engineers (USACE) Clean Water Act Section 404 and 401 permitting program. Keystone would mitigate for impacts to non-jurisdictional, as well as jurisdictional forested wetlands.

To assure its compliance with CWA Section 404, TransCanada will consult with the USACE Pursuant to CWA section 404(e), USACE has issued general Nationwide Permits that authorize categories of activities for which USACE has made a determination of no significant impacts and for which no individual section 404 permit is required. Nationwide Permit (NWP) 12 authorizes activities "required for the construction, maintenance, repair, and removal of utility lines and associated facilities in waters of the United States, provided the activity does not result in the permanent loss of greater than a ½ acre of waters of the United States" and "there is no change in pre-construction contours."

TransCanada will submit the requisite pre-construction notifications (PCN) for the Project seeking verifications that the Project may proceed under Nationwide Permit 12 to USACE. Keystone's Construction, Mitigation and Reclamation Plan (CMRP) will also be included with the USACE permit application. The CMRP will, therefore be part of USACE's regulatory review process. The CMRP provides detailed requirements governing the construction, operation, maintenance and reclamation of the Project including uplands, wetlands, and waterbodies and riparian areas. The CMRP also contains environmental provisions that will minimize potential construction impacts of the Project. As the CMRP explains, the Project will be designed, constructed, operated and maintained in a manner that meets or exceeds all federal, state, and local permits, applicable industry standards and regulatory requirements.

The CMRP includes general conditions covering a wide variety of construction activities including training, inspection, notification, access, minimum depth of cover, hazardous and non-hazardous waste disposal, noise, weed, and dust control. It also addresses spill prevention and containment provisions, and provides details on methods and environmental protection measures associated with the construction of wetland and waterbody crossings and associated riparian areas, and hydrostatic testing. The CMRP includes drawings and figures demonstrating the types of typical crossing methods and environmental protection measures used for various waterbodies, reclamation of streambanks, and topsoil conservation.

For waterbodies and riparian areas, the CMRP includes specific requirements to minimize impacts from extra work areas, vehicle access and equipment crossings. The CMRP identifies six types of waterbody crossing

methods and environmental protection requirements for minimizing potential impacts associated with each crossing method. The CMRP further provides specific requirements for clearing, grading, temporary erosion and sediment control, trenching, pipe installation, backfilling, stabilization and restoration of stream banks and slopes, and hydrostatic testing (including filling and dewatering the pipeline).

Terrestrial Vegetation

Keystone would work with landowners and the NRCS to determine appropriate seed mixes.

Prior to construction, Keystone will mark all areas of the right-of-way which contain infestations of noxious, invasive species or soil-borne pests. Keystone will implement Best Management Practices (BMPs) for conducting vegetation control where necessary before and after construction. Agricultural herbicides used would be developed in consultation with county or state regulatory agencies. All herbicides applied prior to or during construction will be non-residual. Herbicides will not be used in or within 100 feet of a wetland or waterbody.

Where appropriate, Keystone will retain a local rangeland expert to coordinate area-specific seed mixes.

Wildlife

The following measures to mitigate habitat loss and wildlife mortality and are part of best practice measures that Keystone has in place through its CMRP, permit conditions, and landowner agreements:

- To prevent unauthorized access, and to the extent permitted by landowners, Keystone would secure / lock temporary gates when construction activities are not occurring in the area where access is through that gate. Also to the extent permitted by landowners, Keystone would make reasonable efforts to restrict access to the pipeline corridor via access roads after construction to minimize alteration of human activity patterns in formerly inaccessible areas.

The following additional measures would be implemented to manage habitat alteration:

- The use of soil additives such as fertilizers and pH modifiers in native rangelands to minimize the potential spread of non-native and invasive species would be discussed with agricultural extension agents / rangeland experts as required to assess suitability;
- Keystone would request landowners to discourage intensive grazing in the construction ROW during the first five growing seasons where forested areas will be reclaimed.

Agriculture and Other Land Uses

Keystone would commit to the following mitigation measures to address potential impacts to agriculture in Nebraska:

- If construction were to adversely affect wetlands in NRCS conservation lands (such as the Wetland Reserve Program) Keystone would follow applicable NRCS procedures in addition to other federal permit requirements;

- When agricultural (tilled) fields are disturbed, Keystone would work with the landowner regarding the type of vegetation that would be reestablished.
- Where Keystone is made aware of the presence of certified organic farms along the Project route prior to construction, Keystone would work with those organic farm operations to ensure that pipeline construction does not impair the farm's organic status. Keystone would take reasonable steps to identify organic farms along the Project route.
- If the Project crosses an organic farm, Keystone will work with the landowner to take reasonable steps to avoid mixing organic soil and non-organic soil.

Public Services

Before construction begins, Keystone's contractors develop detailed traffic plans that address all applicable laws, regulations and ordinances. Keystone would take into account minimizing impacts to school bus routes in developing these traffic plans.

Keystone would ensure that underground and overhead utilities are located and that Keystone avoids contact and damage during construction.

Keystone would ensure that contractors will have Site Specific Safety Plans in place before commencing work that will address locating, avoiding and protecting utilities.

Keystone would dispose of construction camp trash (solid waste) by hauling to a licensed disposal facility.

Noise

To the extent practicable, Keystone will not site pump stations close to noise-sensitive receptors.

For all pump stations, Keystone will observe the U.S. Environmental Protection Agency standard of 55 dBA Ldn measured at the nearest noise sensitive receptor. Keystone will complete a Noise Impact Assessment (NIA) study for each pump station in Nebraska once their location is finalized. Where it is determined by this study that predicted noise levels might be higher than 55 dBA Ldn measured at the nearest noise sensitive receptor, Keystone will implement mitigation measures prior to the start-up. Noise abatement options considered are: above-ground pipe lagging, pump blankets, motor air intake enclosures, and engineered sound barriers. Keystone will conduct noise surveys in the event of noise complaints from nearby noise sensitive receptors.

Energy

During construction of the pipeline, to the extent practicable, Keystone would avoid relocating existing electric transmission lines and would avoid existing distribution lines.

Where line relocation can not be avoided, Keystone would coordinate with the local public power district to temporarily or permanently relocate lines.

To the extent practicable, Keystone would coordinate, and has been coordinating, with the local public power district to minimize potential impacts to landowners resulting from the construction of new transmission lines to pump stations. It should be noted that any new transmission lines are subject to a separate regulatory / permitting process.

Hazardous Sites and Materials

During construction, Keystone would make individuals available who are trained in identifying and disposing of hazardous materials.

If tanks or contamination are found, they would be managed according to federal, State, and/or local regulations.

If an unregistered well is found, Keystone would provide the landowner with technical assistance to register the well.

If you have any questions regarding this letter, please contact me at (403) 920.2546.

Very truly yours,

Corey Goulet
Vice President, Keystone Pipeline Project

Appendix D

NDEQ Field Activities

Appendix D.1

Gulf Coast Segment Field Visit

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Attachment A. Abbreviations and Acronyms

APPENDIX D.1

GULF COAST SEGMENT FIELD VISIT

D.1.1 INTRODUCTION

Representatives from the Nebraska Department of Environmental Quality (NDEQ) toured the Gulf Coast Segment of the proposed Keystone XL Pipeline in northeastern Texas on September 25, 2012. NDEQ was accompanied by representatives from the TransCanada Keystone Pipeline, LP (Keystone), team. The purpose of the trip was to show NDEQ the different stages of construction and the proposed construction measures that could be used in the Nebraska portion of the proposed pipeline. The construction contractor for the Gulf Coast Segment of the Keystone XL Pipeline is Michel's Corporation.

Before leaving for the construction area, the participants (Keystone and NDEQ) met in Mt. Pleasant, Texas, to discuss personnel, construction, safety hazards, and safety requirements and protocols for the day. At each new construction site on the tour, participants reviewed and signed a job safety analysis.

The figures below show several different construction methods observed during the tour. All sites were visited on the same day.

D.1.2 PIPE STORAGE

Pipe is brought in by train and truck to a storage yard before it is strung along the pipeline right-of-way (ROW). Figure D.1-1 and Figure D.1-2 were taken at the Winfield pipe storage yard on Highway 67. The pipe is stacked in the prepared yard. Figure D.1-2 shows the construction equipment stacking pipe.

Figure D.1-1. Pipe Storage Yard (1 of 2)

Figure D.1-2. Pipe Storage Yard (2 of 2)

D.1.3 STRINGING

Pipeline is strung out along the cleared ROW before the trench-digging construction crew arrives (Figure D.1-3).

Figure D.1-3. Pipeline Stringing

D.1.4 LOWERING IN PIPE

After the trench has been dug and prepared, the pipe is lowered in using a sideboom (Figure D.1-4). All of the lowering-in construction equipment is located on one side of the cleared ROW.

Figure D.1-4. Lowering In

D.1.5 WELDING

The contractor used a mechanized welding system which employs welding tents or shacks to house the specialized equipment (Figure D.1-5). There is a series of five tents moving along a pipeline segment, each performing a different phase of welding. A manual system would not be using welding tents or shacks.

Figure D.1-5. Welding Hut

Welding equipment inside the tent is shown in Figure D.1-6.

Figure D.1-6. Inside Welding Hut

Figure D.1-7 shows the heat coating process around a weld. The coater wraps around the pipeline and is moved to each weld with the equipment.

Figure D.1-7. Heat Coating

Each weld is tested for imperfections. Figure D.1-8 shows the ultrasound tester used on the pipeline. The tester is shown mounted on a truck with a test piece of pipe. The tester is placed on the pipeline with brackets, then it runs around the outside of the pipe scanning for imperfections in the weld and pipe.

Figure D.1-8. Ultrasonic Tester

D.1.6 CONSTRUCTION IN AN AGRICULTURAL FIELD

Agriculture is an important part of the economy in many places that would be crossed by the Keystone XL pipeline. Figure D.1-9 shows the construction ROW through an agricultural field, approaching a cotton crop. The construction equipment is staying within the cleared ROW.

Figure D.1-9. Construction through an Agricultural Field

D.1.7 CONSTRUCTION ACROSS AN EPHEMERAL STREAM

Figure D.1-10 shows the pipe in the trench and the construction at the ephemeral stream crossing. Preparations for the stream crossing were completed before excavating the stream. Pipe installation and trench backfill was completed in a 24-hour period. The steam crossing operations are independent of mainline work at either side of the stream.

Figure D.1-10. Start of Ephemeral Stream Crossing

The pipe shown in Figure D.1-11 has been lowered into the prepared trench at an approach to a dry ephemeral stream crossing. The trench (4 feet of overburden) allows for the angle of crossing under the ephemeral stream. This figure also shows an adjacent spoil pile being used to backfill.

Figure D.1-11. Trench with Pipeline Leading Up to Ephemeral Stream Crossing

The construction contractor followed Keystone's Construction, Mitigation, and Reclamation Plan (CMRP) for crossing a dry ephemeral stream in less than 24 hours. Minimizing crossing time reduces impacts on the stream and reduces the likelihood of rain causing erosion and sedimentation while the stream crossing is being constructed.

Figure D.1-12. Ephemeral Stream Crossing Construction

At the ephemeral stream crossing (Figure D.1-12 and Figure D.1-13), the trench was dug on both sides of the stream before digging began in the stream. Timber mats were placed under equipment in and near the streambed to reduce impacts on soil and vegetation.

Figure D.1-13. Ephemeral Stream Crossing Construction with Timber Mat in Foreground

D.1.8 CONSTRUCTION NEAR A WETLAND AND HDD

Figure D.1-14 was taken facing a forested wetland that was being crossed with the horizontal directional drilling (HDD) method. The edge of the wetland and edges of the construction ROW were staked, flagged, and marked. This figure also shows an existing pipeline ROW that was cleared through the forested area adjacent and parallel to the Keystone XL pipeline ROW.

Figure D.1-14. Forested Wetland Crossing Using HDD

Figure D.1-15 shows the HDD equipment being used to bore under the wetland. The control shack is shown on the right on a timber mat. The drill pipe runs through the mud pit shown in the bottom of the figure.

Figure D.1-15. HDD Equipment at Entry Hole

The mud pit (Figure D.1-16) is enclosed by orange safety fences, hay bales, and silt fences. The drilling mud is circulated through the drill bit to help remove cuttings and stabilize the borehole.

Figure D.1-16. HDD Mud Pit

D.1.9 PIPE JACKING (INTERSTATE 30 CROSSING)

Keystone chose to cross under Interstate 30 by using a jack and bore to drill under the roadway. Figure D.1-17 shows the orange center stake on top of the ground, the pipe being placed under the highway, the backhoe removing dirt around the pipe, and the jack behind the pipe.

Figure D.1-17. Highway Crossing, Looking toward Pipe Jack

Figure D.1-18 shows the jack and bore, the pipe, the jack track, and the highway being crossed.

Figure D.1-18. Highway Crossing, Looking toward Highway

D.1.10 CONSTRUCTION NEXT TO A PARALLEL PIPELINE

Additional safety precautions must be taken during construction when crossing or near an existing pipeline. Figure D.1-19 shows an air bridge over an existing parallel pipeline. The air bridge, indicated by the arrow, keeps construction equipment from compacting the soil or damaging the existing pipeline buried below while accessing the construction ROW (top left side of the figure). The figure also shows holes dug to the existing pipeline marked with orange fences and stakes to confirm the pipeline's location and size.

Figure D.1-19. Construction next to an Existing Pipeline

When constructing next to an existing parallel pipeline, the owner/operator of the existing pipeline will typically provide a representative to observe construction and ensure the protection

of the existing pipeline and construction crew. Figure D.1-20 shows an adjacent maintained pipeline ROW and inspector from the company that owns the existing pipeline.

Figure D.1-20. Construction Adjacent to an Existing Pipeline ROW

Attachment A

Abbreviations and Acronyms

Abbreviation or Acronym	Definition
HDD	horizontal directional drilling
Keystone	TransCanada Keystone Pipeline, LP
NDEQ	Nebraska Department of Environmental Quality
ROW	right-of-way

Appendix D.2

Field Observation of Keystone Data Collection Technical Memorandum

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APPENDIX D.2

FIELD OBSERVATION OF KEYSTONE DATA COLLECTION

D.2.1 INTRODUCTION

D.2.1.1 Project Overview

TransCanada Keystone Pipeline, LP (Keystone), proposes to construct, operate, and maintain a crude oil pipeline and ancillary facilities from Hardisty, Alberta to Steele City, Nebraska, referred to as the Keystone XL Pipeline project. The original Keystone XL Pipeline project would have crossed the northeastern portion of the Sand Hills, an environmentally sensitive region in northcentral Nebraska. Based on concerns expressed by Nebraska citizens, the Nebraska Legislature, and the Nebraska Governor, Keystone agreed to avoid the Sand Hills by proposing a new route (Nebraska Reroute). Legislative Bill (LB) 4 and LB 1161 directed Nebraska Department of Environmental Quality (NDEQ) to analyze the environmental, economic, social, and other impacts of a pipeline in Nebraska. The field data collection discussed in this report is directed toward identification of resources which could be adversely affected by Keystone's proposed Nebraska Reroute.

D.2.2 FIELD OBSERVATION

D.2.2.1 Purpose of Field Observation

NDEQ visited the field to observe Keystone field crews and provide an independent verification that data collected by Keystone was done in a methodical and professional manner. Keystone was collecting data in three disciplines:

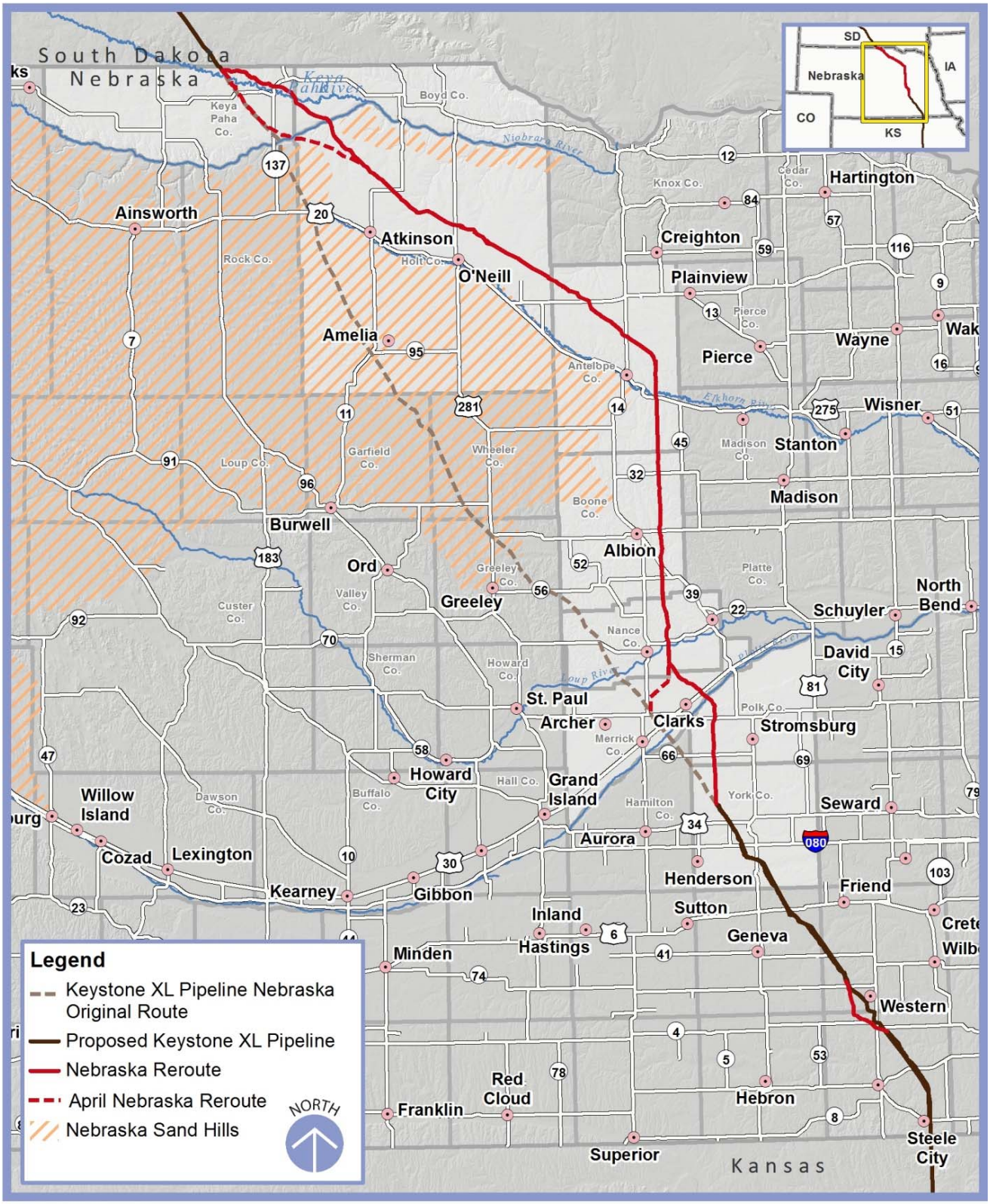
1) Construction Reclamation
2) Wetland Identification and Delineation
3) Cultural Resources

Additionally, Keystone has conducted or will be conducting American burying beetle surveys and collecting additional fisheries, geotechnical, and civil engineering data. However, this technical memorandum addresses only the three disciplines identified above.

D.2.2.2 Purpose of Data Collection

Keystone collected field data to identify environmental and cultural resources within the proposed Nebraska Reroute pipeline corridor (see Figure D.2-1). Field data collection is a critical step in pipeline routing in order to properly identify and manage sensitive resources prior to finalizing design and construction planning. Data collection is also necessary to identify potential mitigation measures if resources would be adversely affected by the proposed Nebraska Reroute.

Figure D.2-1. Study Area



Source: NDEQ 2012

Construction Reclamation field crews identified the different vegetative and soil types within the Study Area for the purposes of determining the appropriate installation and restoration techniques following construction. In addition, the Construction Reclamation crews identified habitat or populations of threatened or endangered species for potential routing options and mitigation measures. Invasive species were also documented so that Keystone is aware of the presence of invasive species and can prevent the spread of an invasive species due to soil disturbance if appropriate.

Wetland Scientist field crews identified, delineated, and mapped wetlands and other waters of the United States. Keystone would use this information for routing, Section 404 of the Clean Water Act permitting, and identification of construction methods. Wetland and saturated soil areas also determine other pipeline installation techniques that would be required.

Cultural Resources field crews identified cultural sites within the right-of-way for either documentation prior to disturbance or avoidance. The data collected during the cultural resources surveys allow for coordination with the Nebraska State Historic Preservation Office (SHPO) to identify the significance of the survey findings and to identify measures to avoid or mitigate impacts on cultural resources.

Geotechnical field crews drilled and logged test holes, and collected sediment samples at select HDD sites for analysis to determine the geology associated with the river crossings.

D.2.2.3 Keystone Methods

Safety

Keystone personnel managed safety and environmental issues for the proposed Nebraska Reroute. Keystone personnel always ensured that its field crews were adequately equipped with the required safety gear, including type II side impact hard hat; safety glasses; a safety vest; snake leggings; and steel-toe boots. Certain safety precautions were also required while driving to field observation locations. Amber warning lights were placed on top of the vehicles when they parked along the side of a road, and crews were required to place safety cones or triangles in front of and behind the vehicles on the side that was nearer the road. Vehicles also had an emergency supply kit in the event crews were stranded in an isolated area. Emergency supply kits included blankets, candles, a flashlight, water, and energy bars. A contact sheet was supplied in the event of an emergency, and an emergency contact was made available 24 hours a day. NDEQ field observers were required to follow the same safety procedures as the field crews.

Each morning, field crews were required to attend a tailgate meeting at a designated location before going into the field. This meeting facilitated coordination among land agents, land coordinators, and field crews. Tailgate meetings also included a safety briefing and addressed various field safety concerns. Examples of topics included snake bite avoidance, poisonous plants, heat exposure, and first aid. The tailgate meeting also allowed lead personnel to ensure that everyone going into the field was equipped with proper safety gear. All personnel traveling to the field (including NDEQ field observers) were required to sign a tailgate meeting form documenting that they had attended the meeting and understood the safety precautions discussed.

Access to Survey Corridor

Land agents under the direction of Keystone were responsible for obtaining permission from the landowners for site access. Access to the survey corridor was ultimately determined by the landowner. To prevent damage to the terrain (that is, to crop fields and gravel roads), Keystone did not allow crews—even with permission—to enter properties during bad weather, such as rain.

Where access was permitted, land agents communicated the locations of the accessible parcels and when those parcels would be accessible to the field crews every morning at the tailgate meeting.

Field Crew Structure

The composition of field crews responsible for construction reclamation, wetland identification and delineation, and cultural resources surveys is shown below in Table D.2-1.

Table D.2-1. Composition of Field Crews

Crew	Member and Responsibility
Construction Reclamation	***Construction reclamation specialist*** Identified land use, observations on anticipated level of effort for restoration after construction
	Botanist Identified vegetation types, noxious weeds, and threatened and endangered plant species; located centerline and mapped identified features with use of GPS
Wetland Identification and Delineation	***Wetland specialist*** Completed wetland delineations (in accordance with the U.S. Army Corps of Engineers [USACE] 1987 Wetlands Delineation and regional supplements) and identified waterways
	Dedicated GPS technician Located the centerline and mapped wetland areas
Cultural Resources	***Crew chief and crew members (up to six members total), including at times, tribal monitors*** Surveyed to identify cultural materials as approved by the design plan submitted to SHPO
	Dedicated GPS technician Located the centerline and mapped cultural resource features

Crew	Member and Responsibility
Geotechnical	***Drilling Contractor*** Operated the drilling rig to collect core samples
	Geologist Logged and preserved the core samples for analysis

Field Team Deployment

The Keystone survey team consisted of up to 12 crews, 4 crews per discipline, active at a given time. As land access became limited, crews decreased to two per discipline.

Once the daily tailgate meeting had adjourned, crews organized themselves in preparation for deployment to their survey area. Land coordinators were responsible for taking crews to their survey location. Crews moved at different speeds, as necessary, so it was often impossible for the land coordinator to take each crew to its location. In these cases, crew leads were responsible for identifying the point of access.

D.2.2.4 NDEQ Observations

Based on environmental concerns raised by the public and NDEQ, Keystone developed three route refinements and referred to them as the Northern, Clarks, and Western Alternatives. Keystone field crews surveyed all areas along these alternatives and the Nebraska Reroute where Keystone had obtained permission from the landowner to enter the property. NDEQ observed the field crews at various locations along the proposed route. The observations of field crews occurred during two periods, from May 24 to June 12, 2012, and October 1 to October 19, 2012. An additional geotechnical observation by NDEQ took place on August 16, 2012. During the May/June period, 25 separate field observations were conducted along the Nebraska Reroute. During the October survey period, 18 separate field observations were conducted along the Northern, Clarks, and Western Alternatives. Table D.2-2 identifies the date, discipline, and general location of field observations. Mileposts were only available for locations shown in the table. Attachment A contains an example field observation data form, Attachment B provides figures displaying the field observation locations, and Attachment C includes selected photographic documentation of data collection and field observations.

Observed survey crews were equipped with the required safety gear, appropriate data sheets, a sub-meter–accurate GPS unit (Wetland Identification and Delineation and Cultural Resources), and screens and shovels for shovel testing (Cultural Resources). All observed crews worked with a Keystone land manager to ensure field personnel surveyed only properties to which Keystone had negotiated access. Field observations of each discipline are summarized in the subsections below.

Table D.2-2. Field Observations

Date (all are 2012)	Discipline	General Location	Milepost	Photo Number (photos located in Attachment C)
May 24	Cultural Resources	S08 T24N R05W[a]	—	N/A
May 24	Construction Reclamation	S23 T26N R06W	—	N/A
May 24	Wetland Identification and Delineation	S23 T26N R06W	—	N/A
May 30	Construction Reclamation	S32 T22N R05W	—	N/A
May 30	Construction Reclamation	S29 T22N R05W	—	N/A
May 30	Wetland Identification and Delineation	S24 T15N R06W	—	N/A
May 30	Wetland Identification and Delineation	S25 T15N R06W	—	1-4
May 30	Wetland Identification and Delineation, Cultural Resources	S29 T19N R05W	—	5
May 30	Construction Reclamation	S29 T22N R05W	—	6
May 30	Wetland Identification and Delineation	S32 T19N R05W	—	N/A
May 31	Wetland Identification and Delineation	S05 T21N R05W	—	N/A
May 31	Wetland identification and Delineation	S08 T21N R05W	—	N/A
May 31	Wetland Identification and Delineation	S29 T19N R05W	—	N/A
May 31	Wetland Identification and Delineation	S32 T19N R05W	—	N/A

Date (all are 2012)	Discipline	General Location	Milepost	Photo Number (photos located in Attachment C)
June 1	Wetland Identification and Delineation	S04 T15N R05W	—	7
June 5	Cultural Resources	S21 T16N R05W	—	N/A
June 6	Cultural Resources	S01 T29N R11W	—	N/A
June 6	Wetland Identification and Delineation	S01 T29N R11W	—	N/A
June 6	Wetland Identification and Delineation	S12 T29N R11W	—	N/A
June 6	Wetland Identification and Delineation	S07 T29N R10W	—	N/A
June 6	Wetland Identification and Delineation	S08 T29N R10W	—	N/A
June 6	Wetland Identification and Delineation	S17 T29N R10W	—	N/A
June 7	Wetland Identification and Delineation	S26 T33N R17W	—	8–12
June 12	Wetland Identification and Delineation	S06 T32N R15W	—	13–15
June 12	Cultural Resources	confidential	confidential	16
August 16	Geotechnical	S04 T16N R05W	—	N/A
October 1	Wetland Identification and Delineation	S15, S22–24 T04N R02E	—	N/A
October 2	Construction Reclamation, Cultural Resources, Wetland Identification and Delineation	S15 04N 02E	853.98, 858.94, 874.48	17–18

Date (all are 2012)	Discipline	General Location	Milepost	Photo Number (photos located in Attachment C)
October 3	Construction Reclamation, Wetland Identification and Delineation	S29-30, 32–33 34N 16W	619.00–621.90	19–20
October 4	Cultural Resources, Wetland Identification and Delineation	S02–03 33N 16W	621.90–623.66	21
October 4	Cultural Resources, Wetland Identification and Delineation	S19, 30 34N 16W	618.30–619.00	22–25
October 5	Cultural Resources, Wetland Identification and Delineation	S23–25 35N 19W	602.25–604.75	26–28
October 6	Cultural Resources, Wetland Identification and Delineation	S28–29 35N 18W	604.75 – 606.70	29–31
October 8	Wetland Identification and Delineation	S34–35 35N 18W	607.00–608.34	32
October 8	Construction Reclamation	S09–10 34N 17W	612.90–613.90	N/A
October 9	Wetland Identification and Delineation	S35 35N 18W; S01 34N 18W; S06 34N 17W	608.60–610.84	33–34
October 10	Construction Reclamation	S28–29 33N 15W; S24 T30N R12W; S8 T30N R12W	628.50–629.38, 654.00, 658.00	35
October 11	Wetland Identification and Delineation	S11, 14 32N 15W	658.46, 633.19–634.51	36
October 12	Construction Reclamation, Wetland Identification and Delineation	S01, 12 33N 16W; S07 33N 15W	624.00–626.00	37–38

Date (all are 2012)	Discipline	General Location	Milepost	Photo Number (photos located in Attachment C)
October 15	Wetland Identification and Delineation	S12–13 15N 05W; S18 15N 04W; S34 16N 05W; S03, 11 15N 05W	766.80–769.40, 770.00–771.20	39–40
October 16	Wetland Identification and Delineation	S17–18, 20–21, 28, 35 15N 04W	771.20–773.85, 775.90–776.50	41
October 17	Wetland Identification and Delineation	S02, 11, 26, 35 14N 04W	777.40–778.65, 780.85–781.85, 781.85–782.85	42–43
October 18	Construction Reclamation	S12–13 15N 5W; S28 15N 4W; S11, 14 13N 04W	769.50–770.40, 773.90, 784.60, 785.60	44–45
October 19	Construction Reclamation	S02, 11, 14, 23 12N 04W	788.85–793.00	46–48

[a] Section-Township-Range

Construction Reclamation

Several Construction Reclamation crew leads were either qualified botanists familiar with the flora of the region or had significant botanical resources experience. Their method of data collection provided an adequate record of field findings.

Wetland Identification and Delineation

The Wetland Scientist crew leads were qualified and experienced in application of the 1987 USACE Wetland Delineation Manual and Great Plains and Midwest Regional Supplements (see Attachment A). They used standard data forms for wetland data collection. They also collected data on other waterbodies (for example, streams and ponds) and recorded their findings on a standardized form (see Attachment A). Data collection provided an adequate record of field findings.

Cultural Resources

The Cultural Resources crew leads were qualified cultural resources specialists. The research design as submitted and approved by Nebraska SHPO was followed. Their recording of sites was thorough. The results of archaeological survey should be considered reliable and a contribution to knowledge of Nebraska's prehistoric and historic archaeological resources.

Geotechnical

The crew lead and drilling contractor were qualified in their respective fields. The methods of data collection were consistent with industry standards.

D.2.3 SUMMARY

D.2.3.1 Overall Analysis of Data Collection Effort

Data collected by Keystone field crews were observed to have been gathered and handled following systematic and comprehensive protocols, with experienced field personnel using proper equipment, having received adequate training, and employing appropriate safety considerations. The subcontractors were knowledgeable and experienced. Methods for standardized data collection were established by each discipline for consistency in data collection among multiple field crews. Some resources, such as invasive species data, were captured by multiple teams to provide redundancy for accuracy and quality control. Data collected by the survey crews are considered accurate and reliable.

D.2.3.2 Suitability of and Purpose for Data Use

Based on the methods and personnel used for data collection and observation of the data being collected in the field, the data collected are appropriate for use in environmental and cultural resources analysis.

Attachment A

Field Observation Data Form Templates

Keystone XL Pipeline NDEQ Evaluation		
Field Activities - Data Collection		
Field Crew Personnel TransCanada: Field Crew Personnel NDEQ/HDR:		Date:
Survey Type:	Time Start:	Time End:
Location:	Landowner Present: (Yes / No)	
Safety Briefing:	Landowner Discussions:	
Observations:		
Comments:		

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: _____ City/County: _____ Sampling Date: _____

Applicant/Owner: _____ State: _____ Sampling Point: _____

Investigator(s): _____ Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____

Slope (%): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ___ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No ___	**Is the Sampled Area within a Wetland?** Yes ___ No ___
Hydric Soil Present?	Yes ___	No ___	
Wetland Hydrology Present?	Yes ___	No ___	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

Herb Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	0 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)

Total Number of Dominant Species Across All Strata: _____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	0 (A)	(B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: _____

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 5 cm Mucky Peat or Peat (S3)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ Coast Prairie Redox (A16)
- ☐ Dark Surface (S7)
- ☐ Iron-Manganese Masses (F12)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◯ No ◯

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Gauge or Well Data (D9)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ◯ No ◯ Depth (inches): _____

Water Table Present? Yes ◯ No ◯ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ◯ No ◯ Depth (inches): _____

Wetland Hydrology Present? Yes ◯ No ◯

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Waterbody Data Form

☐ Centerline ☐ Re-Route ☐ Access Road ☐ Ancillary Facility ☐ Transmission Line ☐ Other

Centerline ID:	Project Designated Name:	
Date:	Client/Project Name:	Milepost Enter/Exit:
Team:	State/County:	Quad Name:
Logbook No.:	Logbook Page No.:	Tract No.:

Drawing (Please provide orientation arrow, all features identified, location to centerline, etc.)

Waterbody Type:	☐ Lake ☐ Pond ☐ Borrow Pit ☐ Stream ☐ Ag. Ditch ☐ Other
Stream Flow:	☐ Fast ☐ Moderate ☐ Slow ☐ Very Slow ☐ None
Flow Type:	☐ Perennial (Flows year round) ☐ Intermittent (Flows <3 month ☐ None ☐ Seasonal (Continuous flow ≥ 3 months) ☐ Ephemeral (Flows only in response to rainfall)
Direction of Flow:	☐ N ☐ NE ☐ E ☐ SE ☐ S ☐ SW ☐ W ☐ NW ☐ No Flow
OHWM Width (ft.):	
Sinuosity:	☐ Braided ☐ Meandering ☐ Straight ☐ N/A
Stream Width (ft.):	Water Surface (At Crossing Location)
Stream Depth (ft.):	☐ 0 ☐ 1-3 ☐ 3-6 ☐ 6-12 ☐ 12-18 ☐ 18-24 ☐ 24-36 ☐ 36-48 ☐ 48-60 ☐ 60+
OHWM Indicators:	
Bank Height (ft.): (Looking Downstream)	Left: ☐ 0-2 ☐ 2-4 ☐ 4-6 ☐ 6-8 ☐ 8+ Right: ☐ 0-2 ☐ 2-4 ☐ 4-6 ☐ 6-8 ☐ 8+
Bank Slope: (Looking Downstream)	Left: ☐ 4:1 ☐ 3:1 ☐ 2:1 ☐ 1:1 ☐ Vertical Right: ☐ 4:1 ☐ 3:1 ☐ 2:1 ☐ 1:1 ☐ Vertical

Qualitative Attributes

Water Appearance:

☐ Clear ☐ Turbid ☐ Sheen on Surfac ☐ Floating Algalmats
☐ Slightly Turbid ☐ Very Turbid ☐ Greenish Color ☐ Obvious Surface Scum
☐ No Flow ☐ Other:

Stream Substrate %:

Aquatic Habitats:

☐ Sand Bar ☐ Gravel Riffle ☐ In-stream Emergent Plant % Cover:
☐ Gravel Bar ☐ Deep Pools ☐ In-stream Submerged Plant % Cover:
☐ Mud Bar ☐ Bank Root Systems ☐ Fringing Wetlands Characteristics:
☐ Undercut Banks ☐ Overhanging Trees/Shrubs ☐ None

Aquatic Organisms Observed:

Riparian Zone:

Width of Natural Vegetation Zone from Edge of Active Channel out to Flood Plain (ft): Left - Right -

Vegetative Layers: ☐ Herbs ☐ Shrubs ☐ Trees ☐ Multiple

Significant Bare Areas Within Riparian Zone ☐ Yes ☐ No ☐ Unknown

Evidence Of Non-Buffered Concentrated Flows: ☐ Yes ☐ No ☐ Unknown

Tributary Condition: ☐ Natural ☐ Artificial (Man-Made) ☐ Manipulated

Channel Condition: ☐ Channelization/Braiding ☐ Unnatural Straightening ☐ Downcutting
☐ Dikes/Berms ☐ Excessive Bank Erosion ☐ N/A

Disturbances: ☐ Livestock Access to Riparian Zone ☐ Manure In Stream or On Banks
☐ Waste Discharge Pipes Present
☐ Other:

Habitat Characteristics, Aquatic, and Terrestrial Diversity Description:

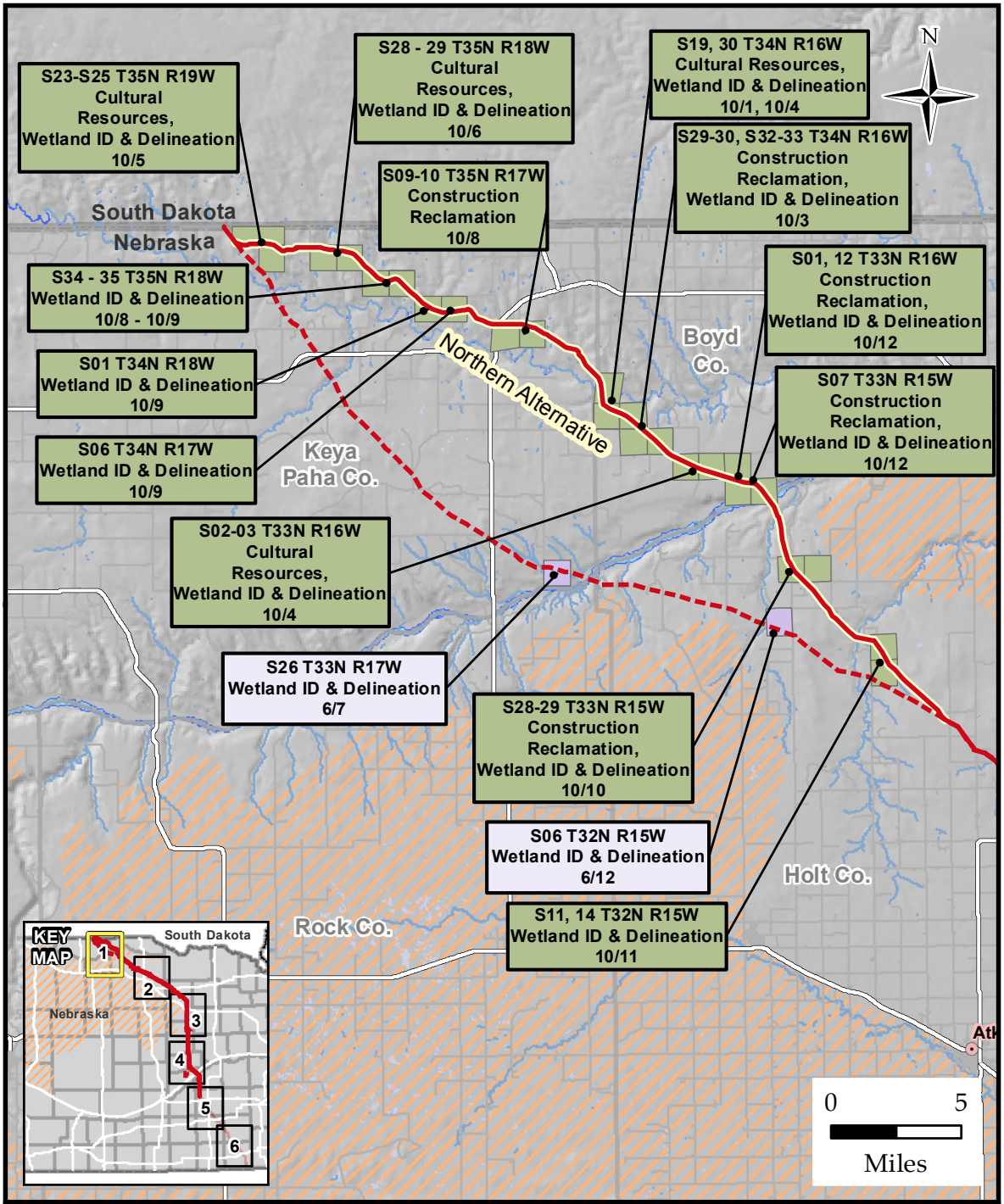
Habitat ID Number:

Comments:

Stream Quality: ☐ High ☐ Moderate ☐ Low

Attachment B

Field Observation Locations



Nebraska's Keystone XL Pipeline Evaluation

Nebraska Reroute, September 2012

Nebraska Reroute, April 2012

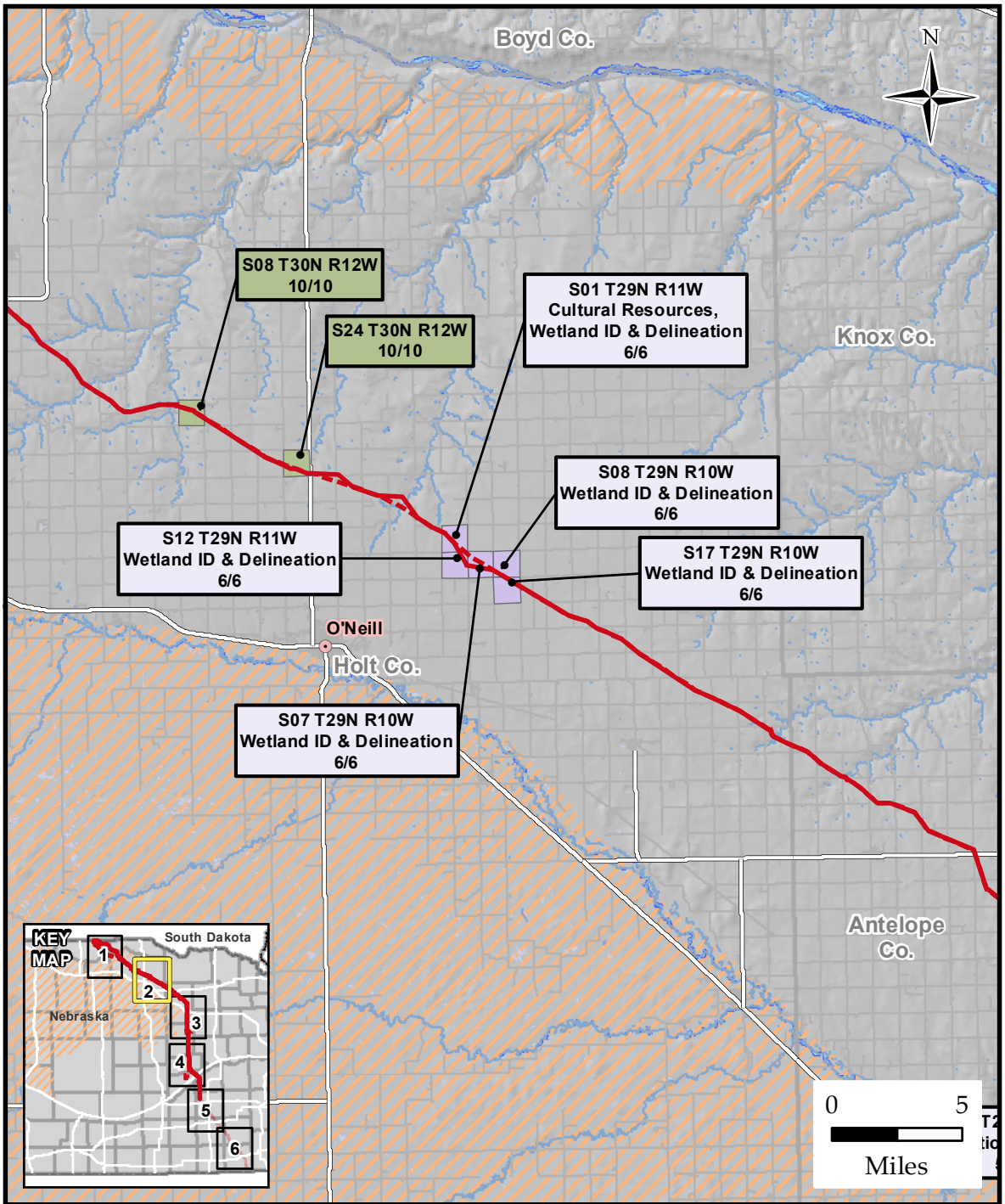
Nebraska Sand Hills

Sections Visited - Spring 2012

Sections Visited - Fall 2012

Field Observation by NDEQ/HDR General Locations*

*Keystone field crews surveyed all areas along the identified routes where permission to enter had been granted



Nebraska's Keystone XL Pipeline Evaluation

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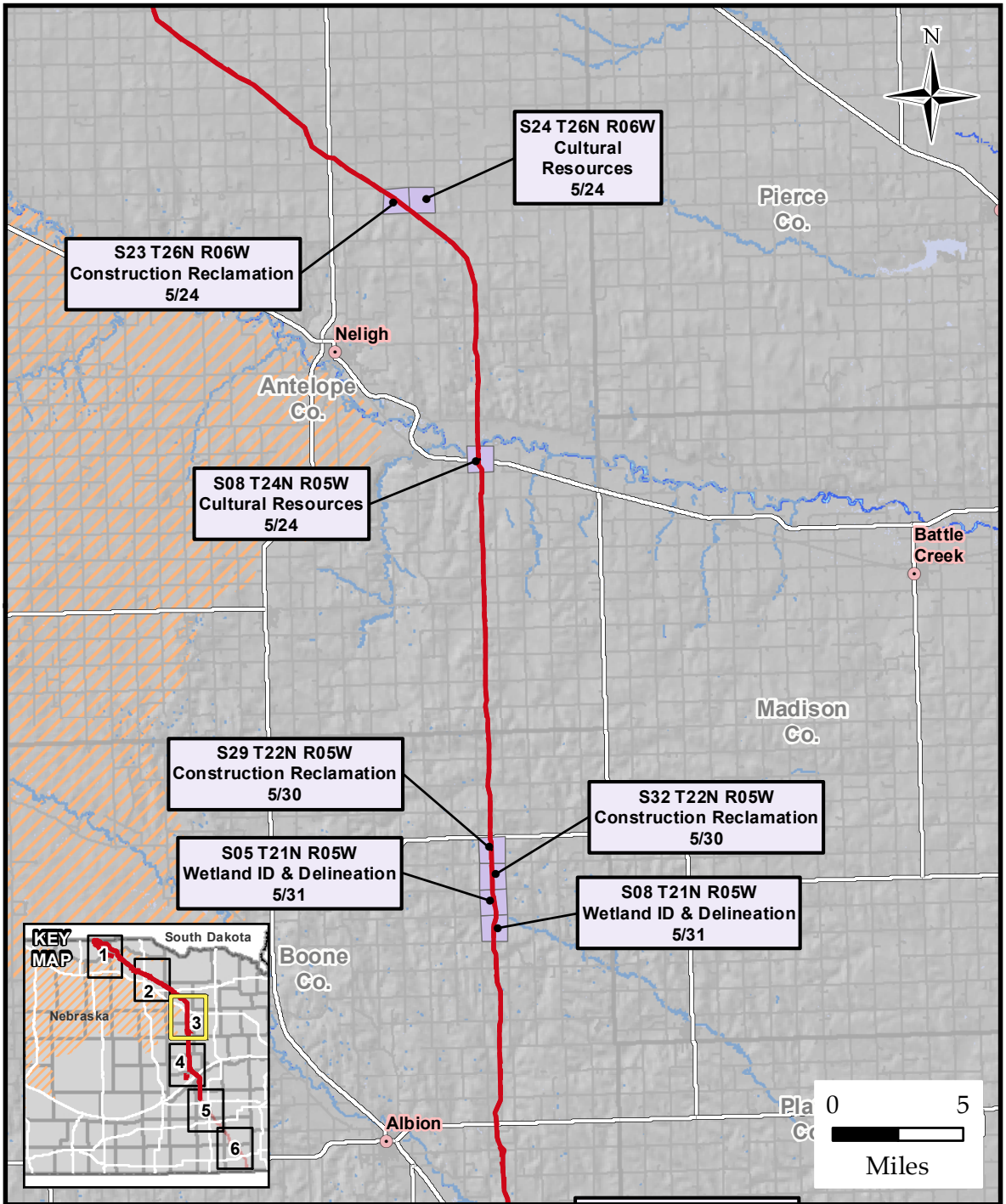
Nebraska Sand Hills

Sections Visited - Spring 2012

Sections Visited - Fall 2012

Field Observation by NDEQ/HDR General Locations*

*Keystone field crews surveyed all areas along the identified routes where permission to enter had been granted



Nebraska's Keystone XL Pipeline Evaluation

Nebraska Reroute, September 2012

Nebraska Reroute, April 2012

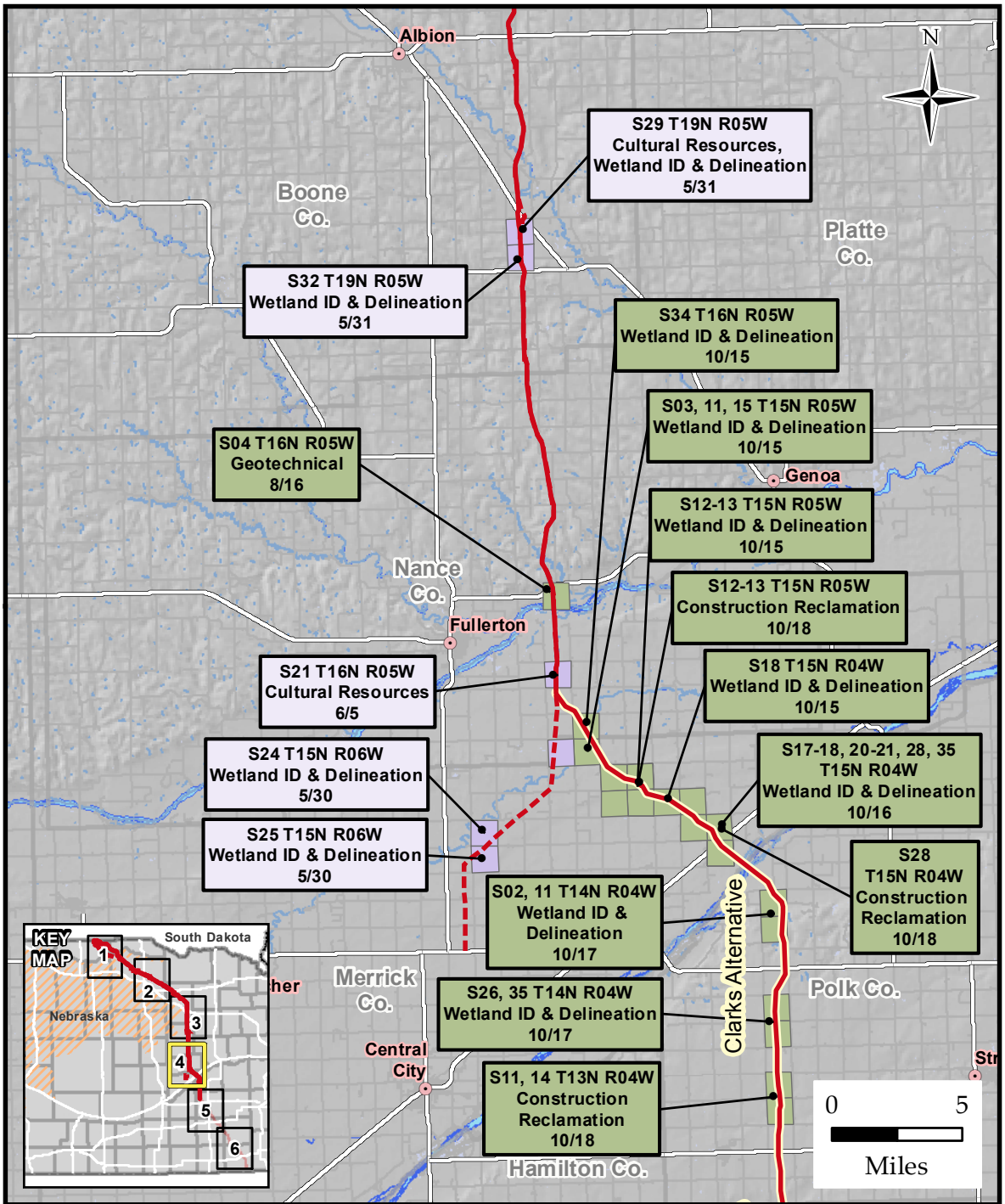
Nebraska Sand Hills

Sections Visited - Spring 2012

Sections Visited - Fall 2012

Field Observation by NDEQ/HDR General Locations*

*Keystone field crews surveyed all areas along the identified routes where permission to enter had been granted



NEBRASKA's Keystone XL Pipeline Evaluation

Nebraska Reroute, September 2012

Nebraska Reroute, April 2012

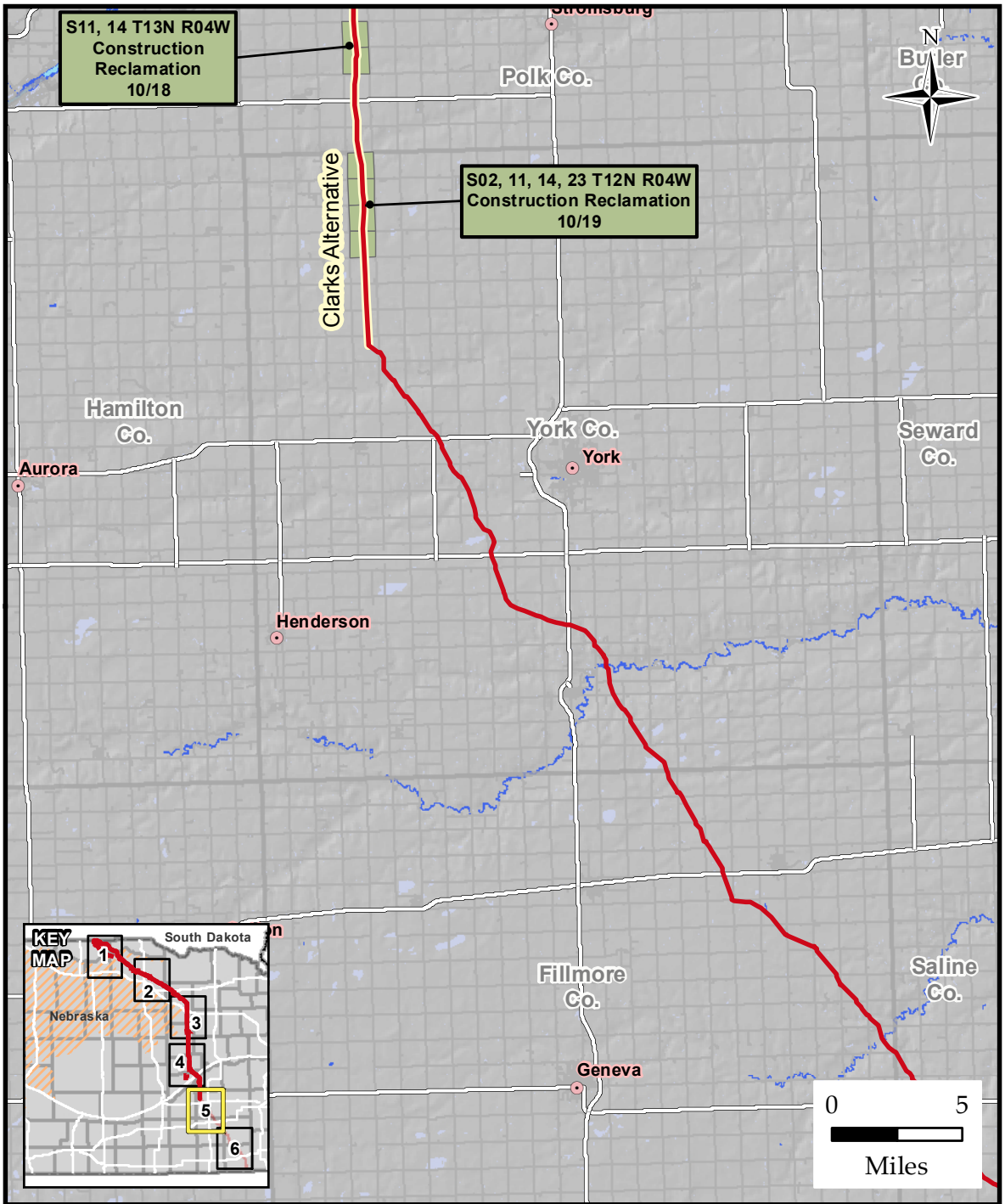
Nebraska Sand Hills

Sections Visited - Spring 2012

Sections Visited - Fall 2012

Field Observation by NDEQ/HDR General Locations*

*Keystone field crews surveyed all areas along the identified routes where permission to enter had been granted



Nebraska's Keystone XL Pipeline Evaluation

Nebraska Reroute, September 2012

Nebraska Reroute, April 2012

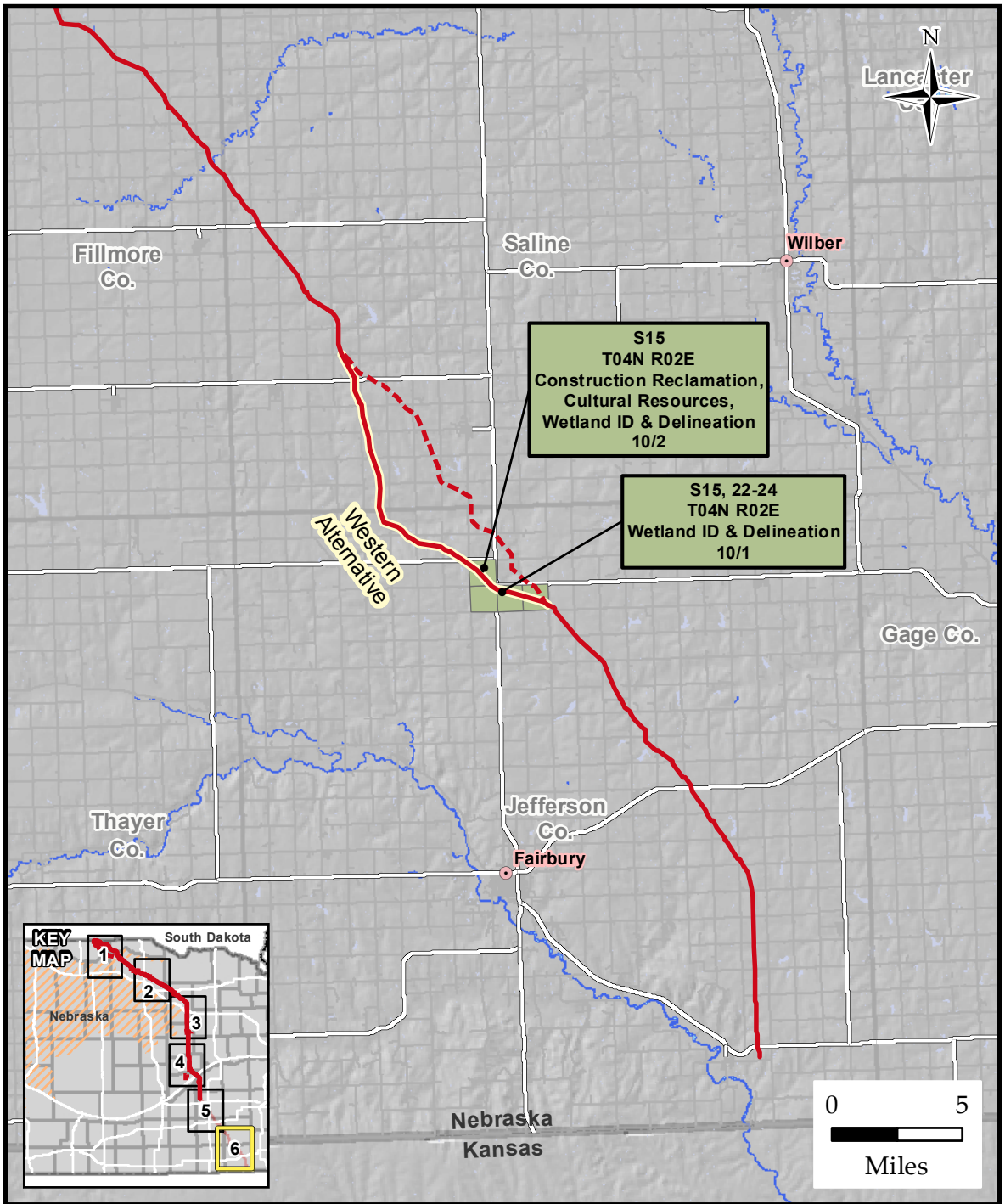
Nebraska Sand Hills

Sections Visited - Spring 2012

Sections Visited - Fall 2012

Field Observation by NDEQ/HDR General Locations*

*Keystone field crews surveyed all areas along the identified routes where permission to enter had been granted



Nebraska's Keystone XL Pipeline Evaluation

Nebraska Reroute, September 2012

Nebraska Reroute, April 2012

Nebraska Sand Hills

Sections Visited - Spring 2012

Sections Visited - Fall 2012

Field Observation by NDEQ/HDR General Locations*

*Keystone field crews surveyed all areas along the identified routes where permission to enter had been granted

Attachment C

Photo Documentation

The following is a sampling of observation photos of Keystone field crews who were collecting data for Construction Reclamation, Wetland Identification and Delineation, and Cultural Resources.

These field crews surveyed all areas along the proposed route where permission had been granted by the landowner. HDR field observers performed spot checks while the Keystone crews were working and therefore visited only a subset of the total length surveyed.

Each photo can be cross referenced by photo number to Table D.2-2, Field Observations, in the technical memo body. Locations are given as either "Section, Township, Range," Milepost along the route, or by geographical feature. Not all sites visited by the observation personnel are documented by a photo in this report.

<u>Photo 1</u>: May 30 - Wetland Identification and Delineation
Location: S25 T15N R06W
Description: roadside ditch wetland

<u>Photo 2</u>: May 30 - Wetland Identification and Delineation
Location: S25 T15N R06W
Description: potential roadside ditch wetland

Photo 3: May 30 - Wetland Identification and Delineation
Location: S25 T15N R06W
Description: soybean field

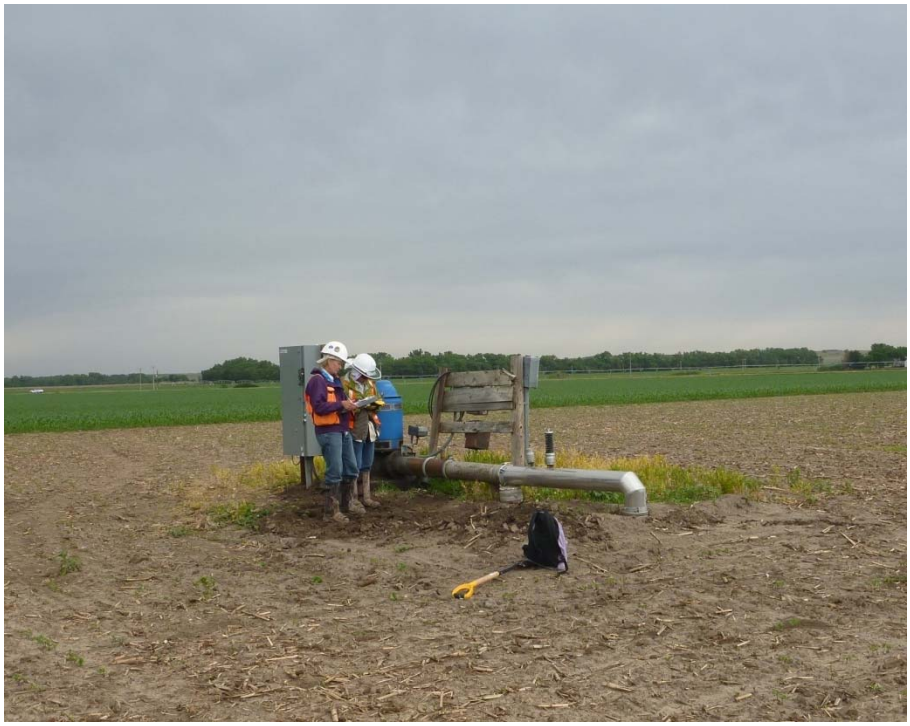


Photo 4: May 30 - Wetland Identification and Delineation
Location: S25 T15N R06W
Description: irrigation wellhead

Photo 5: May 30 - Cultural Resources
Location: S29 T19N R05W
Description: corn field, cultural crew investigating a potential farmstead

Photo 6: May 30 - Construction Reclamation
Location: S29 T22N R05W
Description: typical pasture, looking north to State Highway 32**.**

Photo 7: June 1 - Wetland Identification and Delineation
Location: S04 T15N R05W
Description: northeast side of Loup River, potential wetland habitat, it is a backwater area and floods during high events

Photo 8: June 7 - Wetland Identification and Delineation
Location: S26 T33N R17W
Description: wetland delineation

Photo 9: June 7 - Wetland Identification and Delineation
Location: S26 T33N R17W
Description: county road potentially used for pipe maintenance, looking south

Photo 10: June 7 - Wetland Identification and Delineation
Location: S26 T33N R17W
Description: county road, looking east

Photo 11: June 7 - Wetland Identification and Delineation
Location: S26 T33N R17W
Description: county road stream crossing

Photo 12: June 7 - Wetland Identification and Delineation
Location: S26 T33N R17W
Description: county road stream crossing

Photo 13: June 12 - Wetland Identification and Delineation
Location: S6 T32N R15W
Description: wet sedge, rush meadow, drains west and feeds into a USGS waterway, possibly groundwater fed, looking northeast

Photo 14: June 12 - Wetland Identification and Delineation
Location: S6 T32N R15W
Description: man-made impoundment, looking west

Photo 15: June 12 - Wetland Identification and Delineation
Location: S6 T32N R15W
Description: Beaver Creek, looking north

Photo 16: June 12 - Cultural Resources
Location: confidential
Description: arrowhead unearthed

Photo 17: October 2 - Wetland Identification and Delineation/Cultural Resources/Construction Reclamation
Location: MP 853.84
Description: agricultural fields, future access road, looking east

Photo 18: October 2 - Wetland Identification and Delineation/Construction Reclamation
Location: MP 874.48
Description: pastureland, looking east

Photo 19: October 3 - Wetland Identification and Delineation
Location: MP 619.00
Description: pasture land, agricultural field, looking northwest

Photo 20: October 3 - Wetland Identification and Delineation
Location: MP 621.25
Description: Big Creek, looking northeast (upstream)

Photo 21: October 4 - Wetland Identification and Delineation/Cultural Resources
Location: MP 621.10
Description: stock tank, looking north

Photo 22: October 4 - Wetland Identification and Delineation/Cultural Resources
Location: MP 618.75
Description: bluff heading north into oak woodland at Oak Creek, looking north

Photo 23: October 4 - Wetland Identification and Delineation/Cultural Resources
Location: MP 618.65
Description: Interior of oak woodland at Oak Creek, looking northwest

Photo 24: October 4 - Wetland Identification and Delineation/Cultural Resources
Location: MP 618.30
Description: Keya Paha River looking east (downstream)

Photo 25: October 4 - Wetland Identification and Delineation/Cultural Resources
Location: MP 618.30
Description: Keya Paha River looking west (upstream)

Photo 26: October 5 - Wetland Identification and Delineation
Location: MP 604.25
Description: pasture land, hills, looking east

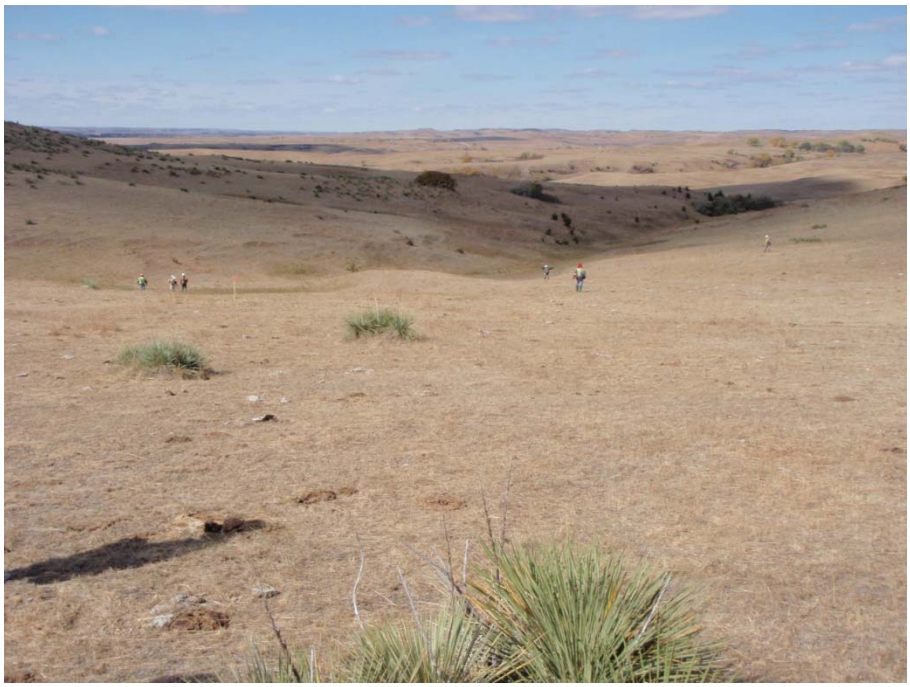


Photo 27: October 5 - Wetland Identification and Delineation/Cultural Resources
Location: MP 602.60
Description: pasture land, hills, looking west; potential reroute in area

Photo 28: October 5 - Wetland Identification and Delineation/Cultural Resources
Location: MP 602.25
Description: pasture land, hills, looking east

Photo 29: October 6 - Wetland Identification and Delineation/Cultural Resources
Location: MP 605.32
Description: wetland, stock pond, looking southeast

Photo 30: October 6 - Wetland Identification and Delineation/Cultural Resources
Location: MP 605.70
Description: Indian Creek, looking north (upstream)

Photo 31: October 6 - Wetland Identification and Delineation/Cultural Resources
Location: 606.50
Description: Pasture land, stock tank, looking south

Photo 32: October 8 - Wetland Identification and Delineation
Location: MP 607.75
Description: Shingle Creek, looking south

Photo 33: October 9 - Wetland Identification and Delineation
Location: MP 610.20
Description: near Wolf Creek Cemetery, looking southeast

Photo 34: October 9 - Wetland Identification and Delineation
Location: MP 610.55
Description: Wolf Creek, looking north

Photo 35: October 10 - Construction Reclamation
Location: MP 629.20
Description: access road, looking east

Photo 36: October 11 - Wetland Identification and Delineation
Location: MP 633.19
Description: Corn field, looking northwest

Photo 37: October 12 - Construction Reclamation/Wetland Identification and Delineation
Location: MP 625.20
Description: mapped wetland, looking west

Photo 38: October 12 – Construction Reclamation/Wetland Identification and Delineation

Location: MP 625.90
Description: Niobrara River looking southwest

Photo 39: October 15 - Wetland Identification and Delineation/Cultural Resources
Location: MP 768.40
Description: agricultural field, road crossing

Photo 40: October 15 - Wetland Identification and Delineation
Location: MP 770.20
Description: ephemeral stream through cropland, looking southwest

Photo 41: October 16 - Wetland Identification and Delineation
Location: Silver Creek
Description: intermittent stream through pasture, looking southwest

Photo 42: October 17 - Wetland Identification and Delineation/Construction Reclamation
Location: MP 777.80
Description: pasture land, looking north

Photo 43: October 17 - Wetland Identification and Delineation/Cultural Resources
Location: MP 778.20
Description: forested drainage gully, looking northwest

Photo 44: October 18 - Wetland Identification and Delineation/Cultural Resources
Location: MP 770.10
Description: pasture land with ephemeral drainage, looking northeast

Photo 45: October 18 - Construction Reclamation
Location: MP 784.80
Description: pasture land with ephemeral drainage, looking northwest

Photo 46: October 19 - Construction Reclamation
Location: Big Blue River
Description: riparian corridor, looking downstream

Photo 47: October 19 - Construction Reclamation
Location: MP 792.75
Description: "Erosion control" riprap, avian cover habitat, facing northwest

Photo 48: October 19 Construction Reclamation
Location: MP 792.75
Description: "Erosion control" riprap, avian cover habitat, facing northeast

Appendix F

Safety and Spill Information

Appendix F.1

Keystone XL Pipeline Presidential Permit Application, Exhibit C Only

Submitted to U.S. Department of State 6/2012

TRANSCANADA KEYSTONE PIPELINE, LP
KEYSTONE XL PIPELINE PROJECT
PRESIDENTIAL PERMIT APPLICATION
EXHIBIT C

Pipeline Specification

The following summarizes pipeline specifications for the Keystone XL Pipeline Project.

1.0 DESIGN FORMULA

The design parameters for steel pipe shall be determined in accordance with the following equation: (See 49 CFR 195.106-Internal Design Pressure)

$$P = 2St/D \times F \times E$$

where:

P = Internal Design Pressure, psig
S = Specified minimum yield strength, psi
D = Nominal outside diameter of the pipe, inches
t = Specified wall thickness of the pipe, inches
F = Design Factor
E = Seam joint factor

2.0 DESIGN FACTOR DETERMINATION

The design factor (F) will be determined as a result of conditions or a combination of conditions such as crossings, fabrications, station piping, and special areas.

2.1 Mainline and Facilities

The pipeline will be designed consistent with the 57 Special Conditions included in the Department of State's August 26, 2011 Final Environmental Impact Statement (FEIS) for the Keystone XL Pipeline Project (Appendix C to FEIS) and to specifications sufficient to support a potential future application for a special permit from the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA) to operate at a higher pressure and greater throughput than would otherwise obtain under the current PHMSA regulations.

The design factor of 0.8 will be used for the mainline in all areas where normal installation methods and cross country conditions prevail with exceptions to areas as stipulated in the PHMSA Special Condition #14 with a reduced operating pressure equivalent to a maximum 0.72 design factor such as pump station and intermediate mainline valve facilities.

2.2 Crossings

Though a lower design factor is not specified by 49 CFR Part 195 or the PHMSA Special Permit for selected crossings and fabricated assemblies, a

conservative design practice is applied. Pipe installed at all highway crossings, bored road and cased rail road crossings shall be design to equate to a 0.60 design factor. Directionally drilled crossings, and uncased railroad crossings shall be designed using a design factor of 0.50.

3.0. LINE PIPE REQUIREMENTS

Line pipe for the Keystone XL Project shall be double submerged arc welded in accordance with API 5L Steel Pipe, 44th Edition

New steel pipe for the mainline shall be mill inspected by an authorized TransCanada inspector and mill tested to API specification requirements, and Company specifications.

If shipped by rail, the shipment shall be made in accordance with API Recommended Practice 5L1 specification latest edition, if shipped by barge or marine transport, the shipment must be in accordance with API Recommended Practice 5LW.

4.0 MINIMUM WALL THICKNESS AND YIELD STRENGHT

Mainline pipe nominal wall thickness (w.t.) will be determined by the design formula, included in Section 1.0:

The pipeline will operate at a Maximum Operating Pressure of 1308 psig with an operating specified minimum yield strength up to 72 percent. Nonetheless, as noted, the pipeline will be designed to specifications sufficient to support a potential future application for a special permit at a Maximum Operating Pressure of 1440psig. Accordingly, the design will reflect the following minimum wall thicknesses:

36" O.D. x 0.465" w.t., API 5LPSL2 X-70M (0.80 design factor)
36" O.D. x 0.515" w.t., API 5LPSL2 X-70M (0.72 design factor)
36" O.D. x 0.618" w.t., API 5LPSL2 X-70M (0.60 design factor)
36" O.D. x 0.748" w.t., API 5LPSL2 X-70M (0.50 design factor)

Design Pressure of 1600 psig at locations downstream of pump stations where the elevation is lower than the station:
36" O.D. x 0.572" w.t., API 5LPSL2 X-70M (0.72design factor)

5.0 PIPE WALL THICKNESS TRANSITIONS

End preparation will be done in accordance with API 1104 20th Edition.

6.0 MINIMUM PIPE LENGTH

Minimum pipe length to be installed on pipeline construction will be five (5) feet. This does not apply to fabricated assemblies or transition pieces.

7.0 PIPE BENDING

The U.S. portion of the Keystone pipeline will utilize both field bending and 3D forged fittings in the construction of the pipeline. The pipeline will allow for 100% passage of in-inspection tools.

8.0 COATING CONSIDERATIONS

A. Below Ground Piping

The primary coating for the exterior surface of below ground line pipe shall be fusion bonded epoxy (FBE) with a nominal 16 mil thickness and with a minimum five inch (5") coating cutback at each end of the pipe joint. Welded field joints shall be protected with two part liquid epoxy. Internal coating is not required for this project. Line pipe installed in a bored or directional drill crossing shall be coated with FBE and an over coat of abrasion resistant coating.

Line pipe installed in marshes and wetlands subject to flooding for extended periods of time and beneath uncased drainage canals and ditches, and rivers and streams installed by the open-cut method will be externally coated over FBE coating with reinforced concrete, concrete weights or geotextile bag weights installed to provide the pipe with a minimum specific gravity of 1.10 in fresh water.

B. Above Ground Piping

All above grade, uncoated piping and appurtenances shall be sandblasted clean, primed and painted in accordance with Keystone painting specifications. Colors shall be specified by Keystone.

Appendix F.2

Keystone XL Pipeline 57 Special Conditions

Final PHMSA Recommended Conditions for Keystone XL State Dept. Presidential Permit

Document version February 10, 2011

The Pipeline and Hazardous Materials Safety Administration (PHMSA) recommends that the U.S. Department of State impose the following conditions if a Presidential Permit will be granted to TransCanada Keystone Pipeline, LP ("Keystone") to construct and operate the Keystone XL Pipeline ("Keystone XL" or the "pipeline"). Specifically, the State Department should require Keystone to include all of the following in its written design, construction, and operating and maintenance plans and procedures:

I. Material Requirements

1) Steel Properties: The skelp/plate must be micro-alloyed, fine grain, fully killed steel with calcium treatment and continuous casting.

2) Manufacturing Standards: Pipe must be manufactured according to American Petroleum Institute Specification 5L, Specification for Line Pipe (API 5L 44th Edition), product specification level 2 (PSL 2), supplementary requirements (SR) for maximum operating pressures and minimum operating temperatures. Pipe carbon equivalents must be at or below 0.23% based on the material chemistry parameter, carbon equivalent (CE) (Pcm) formula (Ito-Bessyo formula) or 0.40% based on the C-IIW formula (International Institute of Welding formula).

3) Fracture Control: API 5L and other specifications and standards addressing the steel pipe toughness properties needed to resist crack initiation, crack propagation and to ensure crack arrest during a pipeline failure caused by a fracture must be followed. Keystone must prepare and implement a fracture control plan addressing the steel pipe properties necessary to resist crack initiation and crack propagation. The plan must include acceptable Charpy Impact and Drop Weight Tear Test values, which are measures of a steel pipeline's toughness and resistance to fracture. The fracture control plan must be in accordance with API 5L (44th Edition) and include the following tests:

a) Fracture Toughness Testing for Shear Area: Test results must indicate at least 85% minimum average shear area per test for all X- 70 heats and 85% minimum shear area for all X- 80 heats with a minimum result of 80% shear area for any single test. The test results must also ensure a ductile fracture and arrest;
b) Fracture Toughness Testing for Absorbed Energy in accordance with Annex G and a minimum of 50 ft-lbs per heat on a full sized specimen at -5 degrees C/23 degrees F; and
c) Fracture Toughness Testing by Drop Weight Tear Test for All New Pipeline Segments or Pipe Replacements: Test results must be at least 85% of the average shear area for all heats with a minimum result of 60% of the shear area for any single test. The test results must also ensure a ductile fracture and arrest.

The above fracture control plan must account for the entire range of pipeline operating temperatures, pressures and product compositions planned for the pipeline diameter, grade and operating stress levels, including maximum pressures and minimum temperatures for shut-in conditions. Where the use of stress factors, pipe grade, operating temperatures and product composition make fracture toughness calculations non-conservative, correction factors must be used.

4) Steel – Plate, Coil or Skelp Quality Control and Assurance: Keystone must prepare and implement an internal quality management program at all mills involved in producing steel plate, coil, skelp, and pipe to be operated in the pipeline. These programs must be structured to detect and eliminate defects, inclusions, non-specification yield strength, and tensile strength properties, and chemistry as affecting pipe quality.
   a) A mill inspection program or internal quality management program must include the following:
      (i) Non-destructive test of the ends and at least 35 percent of the surface of the plate, coil or pipe shall be performed to identify imperfections such as laminations, cracks, and inclusions that may impair serviceability. 100 percent of the pipe sections must be tested. Surface ultrasonic shall be done in accordance with American Society of Testing and Materials (ASTM) A578/A578M Level B or

equivalent, to acceptance Level B. Pipe ends shall be inspected by ultrasonic, magnetic particle or liquid penetrant methods, with acceptance criteria as outlined in Clause 9.10.4 or API 5L (44th Edition).

(ii) A macro etch test or other equivalent method to identify inclusions that may form centerline segregation during the continuous casting process shall be performed. Use of sulfur prints is not an equivalent method. The test must be carried out on a slab from the first heat of each sequence, and graded with an acceptance criteria of one or two on the Mannesmann scale or equivalent;

(iii) A quality assurance monitoring program implemented by the operator shall include evaluations of:

a. all steelmaking and casting facilities;
b. quality control plans and manufacturing procedure specifications;
c. equipment maintenance and records of conformance;
d. procedures for controls on superheat and casting speeds, steel rolling temperatures and cooling temperatures;
e. additional mechanical and chemical properties tests based upon steel grade, plate or coil, and must be selected based upon knowledge of patterns of property variability in the coils and plate based upon the steel making process and rolling and cooling temperatures to assure that steel properties are not variable;
f. A verification program to ensure the pipe mill is taking into account all yield and tensile strength losses that may occur in the coiling and pipe rolling processes to ensure that the finished pipe has yield and tensile strengths that meet API 5L specifications;
g. Coils and plate with casting and rolling process deviations that may affect steel properties must have a re-verification of

mechanical and chemical properties on the pipe heat conducted at pipe location to ensure there are no variability in the pipe;

h. The pipe supplier must notify Keystone of all instances that do not meet the above items prior to supplying the pipe to Keystone; and

i. Procedures for centerline segregation monitoring to ensure mitigation of centerline segregation during the continuous casting process.

(iv) Pipe end tolerances must be applied so that there are no flat spots on the pipe that could affect welding quality. From each pipe mill, the end tolerances on pipe diameter must not exceed the range given in API 5L, Forty-Fourth (44th) Edition, Table 10, for any given pipe wall thickness. Keystone must demonstrate compliance with API 5L 44th Edition Table 10 by providing to the appropriate PHMSA Region Director(s), Central, Western, and Southwest Region, a histogram of end tolerance and wall thickness data representing physical evidence of compliance for a minimum of 10% of the pipe manufactured by each pipe mill facility.

(v) During construction, if pipe supplied from varying pipe mills cannot be preferentially strung, histograms and field weldability tests should be conducted to ensure that excessive high low is not in production/field welds.

5) Pipe Seam Quality Control: Keystone must prepare and implement a quality assurance program for pipe weld seams. The pipe weld seam tests must meet the minimum requirements for tensile strength in API 5L for the appropriate pipe grade properties. A pipe weld seam hardness test using the Vickers hardness testing of a cross-section from the weld seam must be performed on one length of pipe from each heat. The maximum weld seam and heat affected zone hardness must be a maximum of 280 Vickers hardness (Hv10). The hardness tests must include a minimum of three (3) readings for each heat

affected zone, three (3) readings in the weld metal and two (2) readings in each section of pipe base metal for a total of thirteen (13) readings. The pipe weld seam must be 100% UT inspected after expansion and hydrostatic testing per APL 5L.

6) Monitoring for Seam Fatigue from Transportation: Keystone must inspect the double submerged arc welded seams of the delivered pipe using properly calibrated manual or automatic ultrasonic testing techniques. For each lay down area, a minimum of one (1) pipe section from the bottom layer of pipes of the first five (5) rail car shipments from each pipe mill must be inspected. For longitudinal weld seams, the entire seam must be tested. For helical seam submerged arc welded pipe, the weld seam in the area along the transportation bearing surfaces and all other exposed welded areas during the test must be tested. All the results must be appropriately documented. Each pipe section test record must be traceable to the pipe section tested.

7) Puncture Resistance: Steel pipe must be puncture resistant to an excavator weighing up to 65 tons with a general purpose tooth size of 3.54 inches by 0.137 inches. Puncture resistance will be calculated based on industry established calculations such as the Pipeline Research Council International's *Reliability Based Prevention of Mechanical Damage to Pipelines* calculation method.

8) Mill Hydrostatic Test: The pipe must be subjected to a mill hydrostatic test pressure of 95% SMYS or greater for 10 seconds. The 95% stress level may be achieved using a combination of internal test pressure and the application of end loads imposed by the hydrostatic testing equipment as allowed by API 5L, Clause 10.2.6.6.

9) Pipe Coating: The application of a corrosion resistant coating to the steel pipe must be performed according to a coating application quality control program. The program must address pipe surface cleanliness standards, blast cleaning, application temperature control, adhesion, cathodic disbondment, moisture permeation, bending, minimum coating thickness, coating imperfections and coating repair. All pipe must be protected against external corrosion by non-shielding: coatings, repair coatings and protective

material used to protect the pipe from rock damage. Holiday detection must include appropriate calibration of jeeping equipment on a holiday that extends through the coating to the metal of the pipe to be jeeped prior to use each working day. Jeeping voltages must be set at a minimum of twenty-five hundred Volts (2500 V) for fusion bond epoxy (FBE), with higher voltages to be considered based on the coating type, thickness (maximum and minimum), grounding and field conditions that day. For other coatings, minimum voltage settings need to be established by determining the nominal coating thicknesses and coating type. The pipe should be free of any excess debris prior to running the jeeping equipment over the area. Visual inspection for holidays and coating damage should complement the use of jeeping equipment.

All pipe coating must be checked by usage of holiday detection equipment prior to backfill and FBE coated pipe must be checked with holiday detection equipment set at a minimum of twenty-five hundred Volts (2500 V) prior to backfill. All coating defects must be repaired and re-checked prior to backfill. To the extent practicable, Keystone shall jeep the coating at the same voltage in the coating mill as in the field.

II. Construction Requirements

10) Field Coating: Keystone must implement field girth weld joint coating application specification and quality standards to ensure pipe surface cleanliness, application temperature control, adhesion quality, cathodic disbondment, moisture permeation, bending, minimum coating thickness, holiday detection and repair quality. Field joint coatings must be non-shielding to cathodic protection (CP). Field coating applicators must use valid qualified coating procedures and be trained to use these procedures. Holiday detection must include appropriate calibration of jeeping equipment on a holiday that extends through the coating to the metal of the pipe to be jeeped prior to use each working day. Jeeping voltages must be set at a minimum of twenty-five hundred Volts (2500 V) for FBE, with higher voltages to be considered based on the grounding and field conditions that day. For other coatings such as for girth weld coatings, minimum voltage settings need to be established by determining the nominal coating thicknesses (maximum and minimum) and type coating used for application. The pipe should be free

of any excess debris prior to running the jeeping equipment over the area. Visual inspection for holidays and coating damage should complement the use of jeeping equipment.

11) Coatings for Trenchless Installation: Coatings used for directional bore, slick bore and other trenchless installation methods must be capable of resisting abrasion and other damage that may occur due to rocks and other obstructions encountered in this installation technique.

12) Bends Quality: Keystone must obtain and retain certification records of factory induction bends and factory weld bends. All bends, flanges and fittings must have carbon equivalents (CE) equal to or below 0.42 or a pre-heat procedure must be applied prior to welding for CE above 0.42 on the CE-II W Formula (International Institute of Welding formula).

13) Fittings: All pressure rated fittings and components (including flanges, valves, gaskets, pressure vessels and pumps) must be rated for a pressure rating commensurate with the Maximum Operating Pressure (MOP) of the pipeline.

14) Pipeline Design Factor - Pipelines: Pipe installed must comply with the 0.72 design factor in 49 CFR § 195.106.

    a) At least six (6) months prior to beginning construction of the Keystone XL pipeline, Keystone must review with the appropriate PHMSA Regional Directors in Central, Western, and Southwest Regions how High Consequence Areas (HCAs) which could be affected, as defined in 49 CFR § 195.450, were determined (including commercial navigable waterways, high population areas, other populated areas, and unusually sensitive areas, including aquifers as defined in 49 CFR §195.6) were determined, and the design of the pipeline associated with those segments. Keystone must identify piping and the design of piping located within pump stations, mainline valve assemblies, pigging facilities, measurement facilities, road crossings, railroad crossings, and

segments operating immediately downstream and at lower elevations than a pump station. Keystone must also provide any overland spread analyses in accordance with § 195.452(f) to support could affect determinations for water bodies more than 100 feet wide from high-water mark to high-water mark.

b) Post construction, Keystone must conduct a yearly survey, not to exceed fifteen (15) months, to identify any changes on the pipeline system that would impact its designation or design.

15) Temperature Control: Normal pump discharge temperatures should remain at or below 120° Fahrenheit (°F). If the temperature exceeds 120° F, Keystone must prepare and implement a coating monitoring program in these areas, using ongoing Direct Current Voltage Gradient (DCVG) surveys or Alternating Current Voltage Gradient (ACVG) surveys, or other testing to demonstrate the integrity of the coating. Non-continuous discharge temperature "spikes" above 120 °F for less than ½ day duration will not be a cause for implementing the procedure, but Keystone must inform the appropriate PHMSA Regional Director if regular operation above 120 °F at pump station discharges will occur. Under no circumstances may the pump station discharge temperatures exceed 150° Fahrenheit (°F) without sufficient justification that Keystone's long-term operating tests show that the pipe coating will withstand the higher operating temperature for long-term operations, and approval from the appropriate PHMSA region(s).

Pump Station Discharge Temperature – operating above 120° F and up to 150° F maximum, fusion bond epoxy (FBE) coating:

a) Keystone must monitor coating performance in areas where operating temperatures have exceeded or will exceed 120° F to provide additional data on the long-term durability and integrity of FBE coatings at these temperatures. Cathodic protection (CP) current requirements and coating surveys with DCVG (soil cover) and ACVG (pavement cover) will indicate if there is deterioration in the coating at the higher temperatures.

b) For DCVG and ACVG coating evaluation survey results will be addressed as follows:

The threshold survey indication values are thirty-five percent (35%) IR for DCVG and 50dBμV for ACVG. These values represent the mid range of the "Minor" category in the severity classification used to characterize survey indications in an ECDA program.

c) Keystone shall excavate and remediate all indications found above the threshold values – Minor, Moderate and Severe categories.

d) Keystone shall conduct a calibration dig on at least two anomalies of each classification that are classified as minor, moderate and severe to ensure findings that are not in the remediation plan are not detrimental to the pipeline.

e) Keystone shall perform Holiday voltage tests (jeep), coating adhesion and coating cure tests at excavations.

f) Keystone shall remove disbonded or blistered coating (with cracking and other damage that will compromise cathodic protection) found during excavations and shall apply new coating.

g) Keystone shall perform baseline DCVG two and a half (2-1/2) years and five (5) years after operating above 120° F, and in concert with future in-line inspection (ILI) and close-interval (CIS) surveys, both initial and second ILI tool runs, not to exceed 90 days before or past the schedule interval.

h) Keystone shall monitor surface temperatures of the pipe during winter and summer operating conditions at '0' miles and at a downstream mileage to assure that the surface temperatures do not exceed 120° F. If it is determined that the temperature at this point exceeds 120° F, the survey distance will be increased to the point where the temperature is below 120° F. Keystone must survey based upon temperature measurements or a minimum of twenty (20) miles downstream of each pump station operating above 120° F.

i) Keystone shall make repairs to FBE coatings with a compatible coating system that will bond together, be resistant to soil stresses, and not shield cathodic protection.

16) Overpressure Protection Control: Keystone must limit mainline pipeline overpressure protection to a maximum of 110% maximum operating pressure (MOP) during surge events consistent with 49 CFR § 195.406(b). Before commencing operation, Keystone

must perform a surge analysis showing how the pipeline will be operated to be consistent with these overpressure protection conditions. Keystone shall equip the pipeline with field devices to prevent overpressure conditions. Remotely actuated valves should be fitted with devices that will stop the transit (intentional or uncommanded) of the mainline valve should an overpressure condition occur or an impending overpressure condition is expected. Sufficient pressure sensors, on both the upstream and downside side of valves, must be installed to ensure that an overpressure situation does not occur. Sufficient pressure sensors shall be installed along the pipeline to conduct real time hydraulic modeling, and which can be used to conduct a surge analysis to determine whether pipeline segments have experienced an overpressure condition.

17) Construction Plans and Schedule: At least ninety (90) days prior to the anticipated construction start date, Keystone must submit its construction plans and schedule to the appropriate PHMSA Directors in Central, Western, and Southwest Regions for review. Subsequent plans and schedule revisions must also be submitted to the appropriate Directors, PHMSA Central, Western, and Southwest Regions on a monthly basis.

18) Welding Procedures for All New Pipeline Segments or Pipe Replacements: For automatic or mechanized welding, Keystone shall use the 20th Edition of American Petroleum Institute 1104 (API 1104), *"Welding of Pipelines and Related Facilities"* for welding procedure qualification, welder qualification and weld acceptance criteria. Keystone shall use the 20th Edition of API 1104 for all other welding processes. At least twenty-one (21) days prior to the beginning of any welding procedure qualification activities, Keystone shall notify the appropriate PHMSA Directors in Central, Western, and Southwest Regions. Keystone shall submit automated or manual welding procedure documentation to the same PHMSA regional office.

a) Should non-destructive testing of field girth welds be conducted by usage of automated ultrasonic testing (AUT) API 1104, Appendix A, Keystone must conduct stress analysis for the welding procedures as required in API 1104, Appendix A, Paragraph A.2.

b) Should API 1104, Appendix A, be used for welding, Keystone must conduct

individual procedure tests for each steel supplier and for each girth weld with mixed steel suppliers.

c) All welding procedures, AUT procedures and pipe lifting procedures for field construction crews must be documented in construction procedures and field construction crews must be trained in the procedure requirements prior to conducting welding and girth weld AUT in accordance with API 1104, Appendix A.

d) Keystone shall nondestructively test all girth welds in accordance with 49 CFR §§ 195.228, 195.230 and 195.234.

19) Depth of Cover: Keystone shall construct the pipeline with soil cover at a minimum depth of forty-eight (48) inches in all areas, except in consolidated rock. The minimum depth in consolidated rock areas is thirty-six (36) inches. Keystone shall maintain a depth of cover of 48 inches in cultivated areas and a depth of 42 inches in all other areas. In cultivated areas where conditions prevent the maintenance of forty-eight (48) inches of cover, Keystone must employ additional protective measures to alert the public and excavators to the presence of the pipeline. The additional measures shall include:

a) Placing warning tape and additional line-of-sight pipeline markers along the affected pipeline segment,

b) In areas where threats from chisel plowing or other activities are threats to the pipeline, the top of the pipeline must be installed and maintained at least one foot below the deepest penetration above the pipeline, not to be less than 42-inches of cover.

If a routine patrol (ground and/or aerial) or other observed conditions during maintenance, where farming, excavation, or construction activities are ongoing, or after weather events occur, indicate the possible loss of cover over the pipeline, Keystone must perform a depth of cover study and replace cover as soon as practicable, not to exceed six (6) months, to meet the minimum depth of cover requirements specified herein.

In addition to any depth of cover maintenance activities that may take place as a result of routine patrols, Keystone must perform a detailed depth of cover survey along the entire Keystone XL pipeline as frequently as practicable, not to exceed once every ten (10) years, and replace cover as soon as practicable, not to exceed six (6) months, to meet the minimum depth of cover requirements specified herein.

20) Construction Tasks: Keystone must prepare and follow an Operator Qualification (OQ) Program for construction tasks that can affect pipeline integrity. The Construction OQ program must comply with 49 CFR § 195.501 and must be followed throughout the construction process for the qualification of individuals performing tasks on the pipeline.

If the performance of a construction task can affect the integrity of the pipeline segment, the operator must treat that task as a "covered task," notwithstanding the definition in 49 CFR § 195.501(b), and must implement the requirements of Subpart G. Keystone shall retain qualification records for each individual performing covered tasks during and after the construction of the pipeline, whether company or contract employee.

Keystone must prepare and follow a construction quality assurance plan, to ensure quality standards and controls of the pipeline, throughout the construction phase. Such a plan shall include, at a minimum, provisions for the following: pipe inspection (at the last pipe shipping or storage location prior to stringing on the construction right of way, whether rail yard or pipe storage yard), hauling and stringing, field bending, welding, non-destructive examination of girth welds, applying and testing field applied coating, lowering of the pipeline into the ditch, padding and backfilling, and hydrostatic testing. These tasks can affect the integrity of the pipeline segment and must be treated as covered tasks. The individuals driving the pipe stringing trucks to the pipeline ROW would not need to be OQ qualified, unless they are responsible for the pipe unloading.

Other tasks that can affect pipeline integrity which must be treated as covered tasks include, but are not limited to, surveying, locating foreign lines, one call notifications, ditching, alternating current (AC) interference mitigation and mitigation, cathodic protection (CP) system surveys, mitigation and installation, conducting directional drills,

anomaly evaluations and repairs, right of way clean up (including installation of line markers), and quality assurance monitoring.

Keystone must provide its construction OQ plan to the appropriate PHMSA Regional Director for review prior to beginning construction.

All girth welds must be inspected, repaired and non-destructively examined in accordance with 49 CFR §§ 195.228, 195.230 and 195.234. The NDE examiner must have all required and current certifications.

21) Interference Currents Control: Control of induced AC from parallel electric transmission lines and other interference issues that may affect the pipeline must be incorporated into the design of the pipeline and addressed during the construction phase. Issues identified and not originally addressed in the design phase must be brought to the attention of the applicable PHMSA Director(s) in Central, Western, and Southwest Regions. Within six (6) months after placing the pipeline in service, Keystone must develop and implement an induced AC program to protect the pipeline from corrosion caused by stray currents.

22) Pressure Test Level: The pre-in service hydrostatic test must be to a pressure producing a hoop stress of a minimum 100% SMYS for mainline pipe and 1.39 times MOP for pump stations for eight (8) continuous hours. The hydrostatic test results from each test must be submitted in electronic format to the applicable PHMSA Director(s) in PHMSA Central, Western and Southwest Regions after completion of each pipeline.

23) Assessment of Test Failures: Any pipe failure occurring during the pre-in service hydrostatic test must undergo a root cause failure analysis to include a metallurgical examination of the failed pipe. The results of this examination must preclude a systemic pipeline material issue and the results must be reported to PHMSA headquarters and the applicable PHMSA Director(s) in Central, Western, and Southwest Regions within 60 days of the failure.

III. Operations and Maintenance

24) Supervisory Control and Data Acquisition (SCADA) System: Keystone must develop and install a SCADA system to provide remote monitoring and control of the entire pipeline system.

25) SCADA System – General:

a) Scan rate shall be fast enough to minimize overpressure conditions (overpressure control system), provide very responsive abnormal operation indications to controllers and detect small leaks within technology limitations.

b) Must meet the requirements of regulations developed as a result of the findings of the National Transportation Safety Board (NTSB), *Supervisory Control and Data Acquisition (SCADA) in Liquid Pipelines,* Safety Study, NTSB/SS-05/02 specifically including:

i) Operator displays shall adhere to guidance provided in American Petroleum Institute Recommended Practice 1165 (API 1165 - *First Edition)*, *Recommended Practice for Pipeline SCADA Displays.* This shall be implemented and performed at any location on the Keystone XL system where a SCADA system is used and where an individual is assigned the responsibility to monitor and respond to SCADA information (tanks terminals or facilities also).

ii) Operators must have a policy for the review and audit of alarms for false alarm reduction and near miss or lessons learned criteria. This alarm review shall be implemented and performed at any location on the Keystone XL system where a SCADA system is used and where an individual(s) is assigned the responsibility to monitor and respond to alarm information (tanks terminals or facilities also).

iii) SCADA controller training shall include simulator for controller recognition of abnormal operating conditions, in particular leak events. A generic simulator or simulation shall not be allowed by itself as a means to meet this requirement. A full simulator (console screens respond and react as actual console screens) shall be required and used for training of abnormal operating conditions (AOC's) wherever possible.

iv) See item 29(b) below on fatigue management.

v) Install computer-based leak detection system on all lines unless an engineering analysis determines that such a system is not necessary.

c) Develop and implement shift change procedures for controllers that are scientifically based, sets appropriate work and rest schedules, and consider circadian rhythms and human sleep and rest requirements in-line with guidance provided by NTSB recommendation P-99-12 issued June 1, 1999.

d) Verify point-to-point display screens and SCADA system inputs before placing the line in service. This shall be implemented and performed at any location on the Keystone XL system where a SCADA system is used and where an individual(s) is assigned the responsibility to monitor and respond to alarm information (tanks terminals or facilities also).

e) Implement individual controller log-in provisions.

f) Establish and maintain a secure operating control room environment.

g) Establish and maintain the ability to make modifications and test these modifications in an off-line mode. The pipeline must have controls in-place and be functionally tested in an off-line mode prior to any changes being implemented after the line is in service and prior to beginning the line fill stage.

h) Provide SCADA computer process load information tracking.

26) SCADA – Alarm Management: Alarm Management Policy and Procedures shall address:

a) Alarm priorities determination.

b) Controllers' authority and responsibility.

c) Clear alarm and event descriptors that are understood by controllers.

d) Number of alarms.

e) Potential systemic system issues.

f) Unnecessary alarms.

g) Controller's performance regarding alarm or event response.

h) Alarm indication of abnormal operating conditions (AOCs).

i) Combination AOCs or sequential alarms and events.

j) Workload concerns.

k) This alarm management policy and procedure review shall be implemented and performed at any location on the Keystone XL system where a SCADA system is used and where an individual(s) is assigned the responsibility to monitor and respond to alarm information (such as for tanks, terminals, or other associated facilities).

27) SCADA – Leak Detection System (LDS): The LDS Plan shall include provisions for:

a) Implementing applicable provisions in American Petroleum Institute Recommended Practice 1130, *Computational Pipeline Monitoring for Liquid Pipelines,* (API RP 1130, 1st Edition 2007).

b) Addressing the following leak detection system testing and validation issues:

(1) Routine testing to ensure degradation has not affected functionality

(2) Validation of the ability of the LDS to detect small leaks and modification of the LDS as necessary to enhance its accuracy to detect small leaks.

(3) Conduct a risk analysis of pipeline segments to identify additional actions that would enhance public safety or environmental protection.

c) Developing data validation plan (ensure input data to SCADA is valid)

d) Defining leak detection criteria in the following areas:

(1) Minimum size of leak to be detected regardless of pipeline conditions (slack, transient, etc., as related to the Keystone XL pipeline configuration.

(2) Leak location accuracy for various pipeline conditions.

(3) Response time for various pipeline conditions.

e) Providing redundancy plans for hardware and software and a periodic test requirement for equipment to be used live (also applies to SCADA equipment).

28) SCADA – Pipeline Model and Simulator: The Thermal-Hydraulic Pipeline Model/ Simulator including pressure control system shall include a Model Validation/Verification Plan.

29) SCADA – Training: The training and qualification plan (including simulator training) for controllers shall:

a) Emphasize procedures for detecting and mitigating leaks.

b) Include a fatigue management plan and implementation of a shift rotation schedule that minimizes possible fatigue concerns and is scientifically based, sets appropriate work and rest schedules, and consider circadian rhythms and human sleep and rest requirements in-line with NTSB recommendation P-99-12 issued June 1, 1999.

c) Define controller maximum hours of service limitations.

d) Meet the requirements of regulations developed as a result of the guidance provided in the American Society of Mechanical Engineers Standard B31Q, *Pipeline Personnel Qualification Standard* (ASME B31Q), September 2006, for developing qualification program plans.

e) Include and implement a full training simulator capable of replaying for training purposes near miss or lesson learned scenarios.

f) Implement tabletop and field exercises no less than five (5) times per year that allow controllers to provide feedback to the exercises, participate in exercise scenario development and be active participants in the exercise.

g) Include field visits for controllers accompanied by field personnel who will respond to call outs for that specific facility location.

h) Provide facility specifics in regard to the position certain equipment devices will default to upon power loss.

i) Include color blind and hearing provisions and testing if these are required to identify alarm priority or equipment status. This review shall be implemented and performed at any location on the Keystone XL system where a SCADA system is used and where an individual(s) is assigned the responsibility to monitor and respond to alarm information (such as for tanks, terminals, or other associated facilities).

j) Task specific abnormal operating conditions and generic abnormal operating conditions training components.

k) If controllers are required to respond to “800” calls, include a training program conveying proper procedures for responding to emergency calls, notification of other pipeline operators in the area when affecting a common pipeline corridor

and education on the types of communications supplied to emergency responders and the public using API Recommended Practice 1162, *Public Awareness Programs for Pipeline Operators,* (API RP 1162 (1st edition, December 2003) or the most recent version incorporated in 49 CFR § 195.3).

l) Implement on-the-job training component intervals established by performance review to include thorough documentation of all items covered during oral communication instruction.

m) Implement a substantiated qualification program for re-qualification intervals addressing program requirements for what circumstances will result in qualifications being revoked; implementing procedure documentation regarding how long a controller can be absent before a period of review; shadowing, retraining, or re-qualification is required, and addressing interim performance verification measures between re-qualification intervals.

30) SCADA – Calibration and Maintenance: The calibration and maintenance plan for the instrumentation and SCADA system shall be developed using guidance provided in American Petroleum Institute Recommended Practice 1130, *Computational Pipeline Monitoring for Liquid Pipelines,* (API RP 1130, 1st Edition 2007). Instrumentation repairs shall be tracked and documentation provided regarding prioritization of these repairs. Controller log notes shall periodically be reviewed for concerns regarding mechanical problems. This information shall be tracked and prioritized. Maintenance of field related instrumentation repairs affecting SCADA data (local or remote) shall also be tracked, prioritized and documented at any location on the Keystone XL system where a SCADA system is used and where an individual(s) is assigned the responsibility to monitor and respond to alarm information (such as for tanks, terminals, or other associated facilities).

31) SCADA – Leak Detection Manual: The Leak Detection Manual shall be prepared using guidance provided in Canadian Standards Association (CSA), *Oil and Gas Pipeline Systems*, CSA Z662-03, Annex E, Section E.5.2, Leak Detection Manual.

32) Mainline and Check Valve Control: Keystone must design and install mainline block valves and check valves on the Keystone XL system based on the worst case discharge as calculated by 49 CFR § 194.105. Keystone shall locate valves in accordance with 49 CFR § 195.260 and by taking into consideration elevation, population, and environmentally sensitive locations, to minimize the consequences of a release from the pipeline. Mainline valves must be placed based on the analysis above or no more than twenty (20) miles apart, whichever is smaller. Mainline valves must contain transit inhibit switches that prevent the valves from shutting at a rate (and in conjunction with pumps being shutdown) so that no pressure surges can occur, or other damage caused by unintended valve closures or too fast of a closure.

Valves must be remotely controlled and actuated, and the SCADA system must be capable of closing the valve and monitoring the valve position, upstream pressure and downstream pressure so as to minimize the response time in the case of a failure. Remote power backup is required to ensure communications are maintained during inclement weather. Mainline valves must be capable of closure at all times. If it is impracticable to install a remote controlled valve, Keystone must submit a valve design and installation plan to the appropriate PHMSA Region Director(s), Central, Western, and Southwest Region to confirm the alternative approach provides an equivalent level of safety. For any valves that cannot be remotely actuated, Keystone must document on a yearly basis, not to exceed fifteen (15) months that personnel response time to these valves will not take over one hour.

33) Pipeline Inspection: The entire Keystone XL pipeline (not including pump stations and tank farms) must be capable of passing In-line Inspection (ILI) tools. Keystone shall prepare and implement a corrosion mitigation and integrity management plan for segments that do not allow the passage of an ILI device.

34) Internal Corrosion: Keystone shall limit basic sediment and water (BS&W) to 0.5% by volume and report BS&W testing results to PHMSA in the annual report. Keystone shall also report upset conditions causing BS&W level excursions above the limit.

a) Keystone must run cleaning pigs twice in the first year and as necessary in succeeding years based on the analysis of oil constituents, liquid test results, weight loss coupons located in areas with the greatest internal corrosion threat and other internal corrosion threats. At a minimum in the succeeding years following the first year Keystone must run cleaning pigs once a year, with intervals not to exceed 15 months.

b) Liquids collected during cleaning pig runs, such as BS&W, must be sampled, analyzed and internal corrosion mitigation plans developed based upon lab test results.

c) Keystone shall review the program at least quarterly based upon the crude oil quality and implement adjustments to monitor for, and mitigate the presence of, deleterious crude oil stream constituents.

35) Cathodic Protection: The initial CP system must be operational within six (6) months of placing a pipeline segment in service.

36) Interference Current Surveys: Keystone must perform interference surveys over the entire Keystone XL pipeline within six months of placing the pipeline in service to ensure compliance with applicable NACE International Recommended Practices 0169 (2002 or the latest version incorporated by reference in § 195.3) and 0177 (2007 or the latest version referenced through the appropriate NACE standard incorporated by reference in 49 CFR § 195.3) (NACE RP 0169 and NACE RP 0177) for interference current levels. If interference currents are found, Keystone shall determine if there have been any adverse effects on the pipeline and mitigate such effects as necessary. Keystone shall report the results of any finding of adverse effects and the associated mitigative efforts to the applicable Director(s), PHMSA Central, Western, and Southwest Regions within 60 days of the finding.

37) Corrosion Surveys: Keystone must complete corrosion surveys within six (6) months of placing the respective CP system(s) in operation to ensure adequate external corrosion protection per NACE RP 0169. The survey shall also address the proper number and

location of CP test stations as well as alternating current (AC) interference mitigation and AC grounding programs per NACE RP 0177. At least one (1) CP test station must be located within each HCA with a maximum spacing between test stations of one-half mile. If placement of a test station is not practical within an HCA, the test station must be placed at the nearest practical location. If any annual test station reading fails to meet 49 CFR 195, Subpart H requirements, remedial actions must occur within six (6) months. Remedial actions must include a CIS on each side of the affected test station to the next test station and all modifications to the CP system necessary to ensure adequate external corrosion control.

38) Initial Close Interval Survey (CIS): A CIS must be performed on the pipeline within one year of the pipeline in-service date. The CIS results must be integrated with the baseline ILI to determine whether further action is needed. Keystone must remediate any anomalies indicated by the CIS data including improvements to CP systems and coating remediation within six (6) months of completing the CIS surveys. CIS along the pipeline must be conducted with current interrupted to confirm voltage drops in association with periodic ILI assessments under 49 CFR § 195.452(j)(3).

39) Coating Condition Survey: Keystone must perform a Direct Current Voltage Gradient (DCVG) survey or an Alternating Current Voltage Gradient (ACVG) survey within six (6) months after operation to verify the pipeline coating conditions and to remediate any integrity issues. Keystone must remediate any damaged coating indications found during these assessments that are classified as minor (i.e. 35% IR and above for DCVG or 50 dBμV and above for ACVG), moderate or severe based on NACE International Recommended Practice 0502-2002 (NACE RP 0502-2002) Pipeline External Corrosion Direct Assessment Methodology, or the latest version incorporated by reference in § 195.3. A minimum of two (2) coating survey assessment classifications must be excavated, classified and/or remediated per each survey crew and pump station discharge section.

40) Pipeline Markers: Keystone must install and maintain line-of-sight markings on the

pipeline except in agricultural areas or large water crossings such as lakes where line of sight signage is not practical. The marking of pipelines may also be subject to environmental permits and local restrictions. Additional markers must be placed along the pipeline in areas where the pipeline is buried less than forty-eight (48) inches. Keystone must replace removed or damaged line-of-sight markers, during pipeline patrols and maintenance on the right-of-way. Keystone, at a minimum, must identify and replace any missing or damaged line-of-sight markers during pipeline patrols (Condition 41). If pipeline patrolling for Condition 41 is performed via aerial patrolling and cannot consistently identify areas with missing or damaged line-of-sight markers, then Keystone must on a calendar year basis, not to exceed fifteen (15) months, conduct ground patrols.

41) Pipeline Patrolling: Patrol the right-of-way at intervals not exceeding three (3) weeks, but at least twenty-Six (26) times each calendar year, to inspect for excavation activities, ground movement, unstable soil, wash outs, leakage, or other activities or conditions affecting the safety operation of the pipeline.

42) Initial ILI: Within three (3) years of placing a pipeline segment in service, Keystone must perform a baseline ILI using a high-resolution Magnetic Flux Leakage (MFL) tool. Keystone must perform a baseline geometry tool run after completion of the hydrostatic strength test and backfill of the pipeline but no later than six (6) months after placing the pipeline in service.

43) Deformation Tool: Keystone must run a deformation tool through all mainline piping prior to putting the product in the pipeline and remediate all expanded pipe in accordance with PHMSA's "Interim Guidelines for Confirming Pipe Strength in Pipe Susceptible to Low Yield Strength for Liquid Pipeline" dated October 6, 2009 or any subsequent PHMSA update to this guideline.

44) Future ILI: Future ILI inspection must be performed on the entire pipeline on a frequency consistent with 49 CFR § 195.452(j)(3) assessment intervals or on a frequency determined by fatigue studies of actual operating conditions.

a) Conduct periodic close interval surveys (CIS) along the entire pipeline with current interrupted to confirm voltage drops in association with periodic ILI assessments under § 195.452(j)(3).
b) CIS must be conducted within three (3) months of running ILI surveys when using a five (5) year ILI frequency, not to exceed sixty-eight (68) months, in accordance with 49 CFR § 195.452 (j) (3) assessment intervals.
c) CIS findings must be integrated into ILI Tool findings.

45) Verification of Reassessment Interval: Keystone must submit a new fatigue analysis to validate the pipeline reassessment interval annually for the first five (5) years after placing the pipeline into service. The analysis must be performed on the segment experiencing the most severe historical pressure cycling conditions using actual pipeline pressure data. The fatigue analysis must be submitted to the appropriate PHMSA Director(s) in Central, Western, and Southwest Regions.

46) Flaw Growth Assessment: Two (2) years after the pipeline in-service date, Keystone shall use all data gathered on pipeline section experiencing the most severe historical pressure cycling conditions to determine effect on flaw growth that passed manufacturing standards and installation specifications. This study shall be performed by an independent party agreed to upon by Keystone and PHMSA. Furthermore, Keystone shall share this study with PHMSA and the appropriate Director(s), PHMSA Central, Western, and Southwest Regions within sixty (60) days of its completion, and before baseline assessment is begun. These findings shall determine if an ultrasonic crack detection tool must be launched in that pipeline section to confirm crack growth. The study must also define when follow-up review and analysis will occur, not to exceed five (5) years, or sooner as determined by the study.

47) Direct Assessment Plan: Headers, mainline valve bypasses and other sections that cannot accommodate ILI tools must be part of a Direct Assessment (DA) plan or other acceptable integrity monitoring method using External and Internal Corrosion Direct Assessment criteria.

48) Damage Prevention Program: Keystone must incorporate the Common Ground Alliance's damage prevention best practices applicable to pipelines into its damage prevention program.

49) Anomaly Evaluation and Repair: Anomaly evaluations and repairs must be performed based upon the following:

a) Immediate Repair Conditions: Follow 49 CFR § 195.452(h)(4)(i) except designate the calculated remaining strength failure pressure ratio (FPR) ≤ 1.16 for anomaly repairs;

b) 60-Day Conditions: Follow 49 CFR §195.452(h)(4)(ii) except designate a FPR ≤ 1.25 for anomaly repairs;

c) 180-Day Conditions: Follow 49 CFR §195.452(h)(4)(iii) with exceptions for the following conditions which must be scheduled for repair within 180 days:

(1) Calculated FPR = < 1.39;

(2) Areas of corrosion with predicted metal loss greater than 40%;

(3) Predicted metal loss is greater than 40% of nominal wall that is located at a crossing of another pipeline; and

(4) Gouge or groove greater than 8% of nominal wall.

d) Each anomaly not repaired under the immediate repair requirements must have a corrosion growth rate and ILI tool tolerance assigned per the Integrity Management Program (IMP) to determine the maximum re-inspection interval.

e) Anomaly Assessment Methods: Keystone must confirm the remaining strength (R-STRENG) effective area method, R-STRENG - 0.85dL, and ASME B31G assessment methods are valid for the pipe diameter, wall thickness, grade, operating pressure, operating stress level and operating temperature. Keystone must also use the most conservative method until confirmation of the proper method is made to PHMSA headquarters.

f) Flow Stress: Remaining strength calculations for X-80 pipe must use a flow stress equal to the average of the ultimate (tensile) strength and SMYS.

g) Dents: For initial construction and the initial geometry tool run, Keystone must remove any dent with a depth greater than two percent (2%) of the nominal pipe diameter unless the dent is repaired by a method that reliable engineering tests and analyses show can permanently restore the serviceability of the pipe. For the purposes of this condition, a "dent" is a depression that produces a gross disturbance in the curvature of the pipe wall without reducing the pipe wall thickness. The depth of the dent is measured as the gap between the lowest point of the dent and the prolongation of the original contour of the pipe.

IV. Reporting, Records Retention, and Senior Level Certification Requirements

50) Reporting - Immediate: Keystone must provide immediate notification of all reportable incidents in accordance with 49 CFR Part 195, and shall notify the appropriate PHMSA regional office within twenty-four (24) hours of any non-reportable leaks occurring on the pipeline.

51) Reporting – 180 Day: Within 180 days of the pipeline in-service date, Keystone shall report on its compliance with all of these conditions to the PHMSA Associate Administrator and the appropriate PHMSA Directors in Central, Western, and Southwest Regions.

52) Annual Reporting: Keystone must annually report by February 15th each year the following to the PHMSA Associate Administrator and the appropriate Directors, PHMSA Central, Western, and Southwest Regions:

a) The results of any ILI run or direct assessment results performed on the pipeline during the previous year;

b) The results of all internal corrosion management programs including the results of:

(1) BS&W analyses

(2) Report of plant upset conditions where elevated levels of BS&W are introduced into the pipeline

(3) Corrosion inhibitor and biocide injection

(4) Internal cleaning program

(5) Wall loss coupon tests

c) Any new integrity threats identified during the previous year;

d) Any encroachment in the right-of-way, including the number of new residences or public gathering areas;

e) Any HCA changes during the previous year;

f) Any reportable incidents that occurred during the previous year;

g) Any leaks on the pipeline that occurred during the previous year;

h) A list of all repairs on the pipeline made during the previous year;

i) On-going damage prevention initiatives on the pipeline and an evaluation of their success or failure;

j) Any changes in procedures used to assess and monitor the pipeline; and

k) Any company mergers, acquisitions, transfers of assets, or other events affecting the regulatory responsibility of the company operating the pipeline.

53) Threat Identification and Evaluation: Keystone must develop a threat matrix consistent with 49 CFR § 195.452 to accomplish the following:

a) Identify and compare any increased risks of operating the pipeline; and

b) Describe and implement procedures used to mitigate the risk.

c) Where geotechnical threats exist that may impact operational safety, Keystone must run a geospatial tool and assess procedures to implement for conducting mitigative measures along the affected pipeline.

54) Right-of-Way Management Plan: Keystone must develop and implement a right-of-way management plan to protect the Keystone pipeline from damage due to excavation, third party and other activities. In any areas where increased activities or natural forces could lead to increased threats to the pipeline beyond the initial threat conditions, the management plan must include increased inspections. The management plan must also include right-of-way inspection activities to complement the following:

a) Depth of Cover (Condition 19);

b) Pipeline Markers (Condition 40);

c) Pipeline Patrolling (Condition 41) ;
d) Damage Prevention Program (Condition 48); and
e) Threat Identification and Evaluation (Condition 53)

The Right-of-Way Management Plan and all of the above listed right-of-way inspection activities, Conditions 19, 40, 41, 48, and 53, must be reviewed for effectiveness and procedures updated as required on a periodic basis as conditions change, but not longer than once per calendar year not to exceed 15 months.

55) Records: Keystone must maintain all records demonstrating compliance with all conditions herein for the useful life of the pipeline.

56) Certification: A senior executive officer of Keystone must certify in writing the following:
   a) That Keystone has met all of the conditions described herein;
   b) That the written design, construction, and operating and maintenance (O&M) plans and procedures for the Keystone pipeline have been updated to include all additional requirements herein;
   c) That Keystone has reviewed and modified its damage prevention program relative to the Keystone pipeline to include any additional elements required herein.

Keystone must send a copy of the certification with the required senior executive signature and date of signature to the PHMSA Associate Administrator and the Directors, PHMSA Central, Western, and Southwest Regions at least 90 days prior to operating the Keystone pipeline.

57) Within one (1) year of the in-service date, Keystone shall provide a detailed technical briefing, in person, to the appropriate PHMSA Directors in Central, Western, and Southwest Regions. The briefing shall cover the implementation of the requirements of all conditions herein, including all information required by Condition 52. On the basis of

PHMSA's review of the Condition 52 Annual Report and any additional information provided at the briefing, PHMSA may require additional information.

Appendix F.3

Responsive Portions from the Existing Keystone Oil Pipeline Emergency Response Plan

Submitted by Keystone to U.S. Department of State

September 3, 2010

United States Department of State 5.6.5

Reference: Keystone XL Project Environmental Report
Oil Risk Assessment and Environmental Consequences Analysis

Request:

We understand that under current regulations, Keystone will not be required to submit an Emergency Response Plan (ERP) until 6 months prior to Project operation. However, DOS has determined that it is appropriate to include a draft ERP in the EIS to provide the public with basic information on the likely procedures that would be followed in the event of an accidental release from Project facilities. As a result, Keystone should provide a draft ERP that reasonably describes the key procedures, coordination activities, anticipated contacts, equipment to be used, possible cleanup activities, and other information needed to understand how Keystone would respond to an accidental release of crude oil during operation of the Project. This draft could be developed using previously approved EPR's, such as the ERP for the Keystone Pipeline Project.

Response:

Attached are responsive portions of the Keystone Pipeline Emergency Response Plan. This plan will be updated to include Keystone XL-specific emergency preparedness and emergency response information prior to Keystone XL project commencing operations.

Prepared By: Niki Affleck, TransCanada

SECTION 1

NOTIFICATION PROCEDURES

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This Section is a guide for notification procedures that should be implemented immediately after discovering a discharge incident and, if possible, securing the source. Internal and external notifications are described separately for clarification purposes only. All notifications are of extreme importance and must be completed in a timely manner.

1.1 INTERNAL NOTIFICATION

The following internal notifications will be made for each emergency event (reference is provided in Figure 1.2). Internal notification protocols are developed and implemented to ensure effective communications between all internal parties and support provided by pre-determined on call corporate and business units. The notification protocol includes those responding to an emergency as well as notification to all senior management up to the Chief Executive Officer of the company.

Employee Discovering Discharge

- Immediately notify the Oil Control Center (contact information is listed in Figure 1.2).
- Notify the local fire department, police department, and rescue, as needed.

Oil Control Center

- Verify emergency.
- Immediately notify the Oil Control Center Manager.
- Notify Regional On-Call Manager.
- Notify Corporate Emergency Operations Manager.

Regional Manager On-Call

- Initiates the field response
  - Contacts employees to staff the Incident Command Post
  - Contacts employees to staff the Regional EOC

Regional EOC

- Completes local notifications
- Establishes an emergency communication line (conference line) for use between the Corporate and Regional EOC and the Incident Commander Post for information sharing and support

Corporate Emergency Operations Center Manager

- Contact Oil control Center and review emergency particulars
- Activate Corporate / Business support departments
  - Thirteen pre-determined departments on call 24/7 to provide tactical and strategic support
  - Departments implement their notification protocols advising their line management of the event
- Corporate Security is a Support Department

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Corporate Security

- Determine if incident meets the criteria of a crisis
- If criteria met – Notify the Chairman of the Crisis Management Team

Chairman of Crisis Management Team

- Notify members of the Crisis Management Team

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FIGURE 1.1
INTERNAL NOTIFICATION SEQUENCE

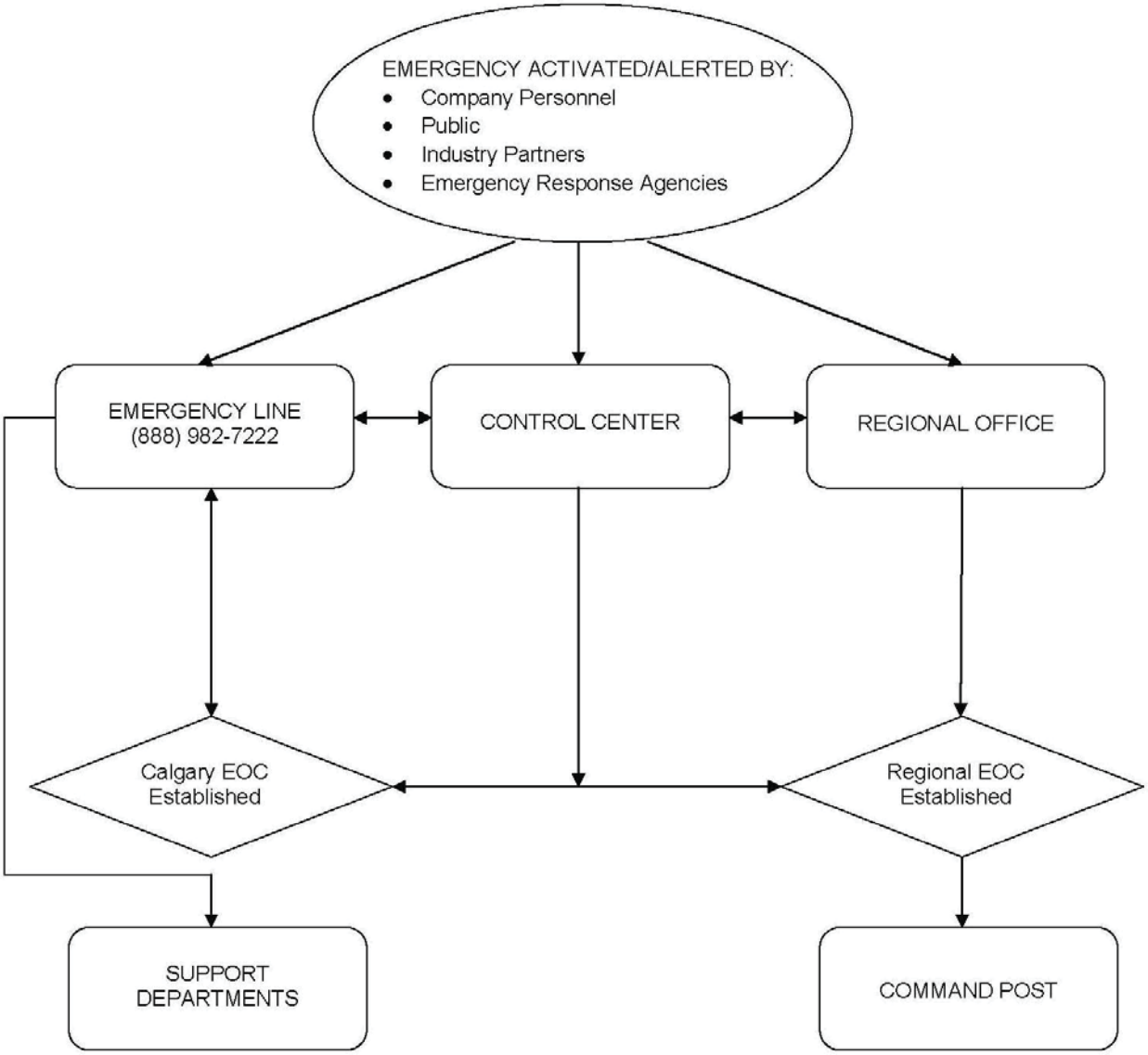

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FIGURE 1.2
INTERNAL NOTIFICATION REFERENCES

CORPORATE RESPONSE PERSONNEL / OTHER COMPANY CONTACTS INTERNAL NOTIFICATIONS					
POSITION/TITLE	NAME	OFFICE	HOME	CELL	PAGER
	Keystone Oil Control Center	(403) 920-8080			

There are no Field Personnel currently working on this proposed Pipeline.

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1.2 EXTERNAL NOTIFICATIONS

External notifications are those made to entities outside of the Company including Federal, Province/State and local regulatory agencies, railroad and utility companies and contractors. These notifications include both verbal and written requirements.

Employee Discovering the Discharge

- Notify local emergency services immediately.

Oil Control Center

- Notify the emergency response contractor if this has not been completed by the Regional Manager On-Call.

Regional Manager On-Call

- Notify the contracted Spill Management Team, the O'Brien's Group, and the Spill Response Contractor, National Response Corporation.

TransCanada Personnel

- Notify the U.S. National Response Center, the Cdn Transportation Safety Board, the National Response Corporation, Cdn National Energy Board, appropriate Federal agencies, County Emergency management, Province/State Environmental Agencies, and the Utilities One Call, as needed (notification requirements and contact information are listed in Figure 1.5).

Verbal Notification Requirements

Immediate internal notification is to be made in accordance with the Internal Notification Procedures found in Section 1.1 when a system operational failure or other type of incident occurs. This will allow immediate evaluation and classification of incidents and prompt immediate telephonic notification as detailed in Figure 1.4 and 1.5 to the Transportation Safety Board, National Response Center (NRC), Province/State agencies, local agencies, and other Federal agencies as required. The information found on the Notification Data Sheet, Figure 1.3, should be used to disseminate incident information to the appropriate agencies.

For the purpose of this procedure, immediate reporting means reporting the instant a person has knowledge of an actual or suspected leak, uncontrolled release of product, any unplanned spill or other pipeline system failure. Information that causes any employee to reasonably suspect a leak or uncontrolled release of product must be immediately reported, even when the actual existence or location of a leak or release cannot yet be confirmed.

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Written Notification Requirements

In addition to the verbal notification requirements, written notifications are required in both Canada and the United States. In the United States, a written report is to be filed as soon as practical, but not later than 30 days after discovery of the incident to the Information Resources Manager, Office of Pipeline Safety, Pipeline and Hazardous Materials Safety Administration, US Department of Transportation. Information concerning the event shall be reported on Pipeline and Hazardous Materials Safety Administration Form 7000-1 on-line on the Pipeline and Hazardous Materials Safety Administration website via log-in. Paper reports are not required. This report is to be filed for all incidents reported telephonically and other incidents required to be reported in accordance with the criteria listed below.

The information required for completing the 30-day written report will be furnished by the Area Offices to the Department of Transportation Regulatory Compliance Department for submission to the Department of Transportation. Any subsequent or additional information that was not reported on the initial written report must be reported to the Department of Transportation Regulatory Compliance Department by the Area Office. This information will be utilized in filing a supplemental written report to the Department of Transportation as soon as possible, but no later than 30 days after its discovery.

In Canada, a detailed written incident report is required as soon as practicable to the Transportation Safety Board (TSB) and National Energy Board (NEB).

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Transportation Safety Board of Canada Pipeline Occurrence Reporting	
Citation	**Description**
Extracts from Transportation Safety Board Regulations Sections 5(1) and 5 (5)	When a reportable pipeline accident or incident takes place, the operator and any employee of the operator having direct knowledge of the accident or incident shall report to the Board as soon as possible and by the quickest means available. Where any person mentioned above makes a report, no other person referred to is required to make such a report.
Transportation Safety Board Regulations Section 2(1)	A "reportable pipeline accident" is an accident resulting directly from the operation of a pipeline, where (a) a person sustains a serious injury or is killed as a result of being exposed to i. a fire, ignition or explosion, or ii. a commodity released from the pipeline, or (b) the pipeline i. sustains damage affecting the safe operation of the pipeline as a result of being contacted by another object or as a result of a disturbance of its supporting environment, ii. causes or sustains an explosion, or a fire or ignition that is not associated with normal operating circumstances, or iii. sustains damage resulting in the release of any commodity.
Transportation Safety Board Regulations Section 2(1)	A "reportable pipeline incident" means an incident resulting directly from the operation of a pipeline where (a) an uncontained and uncontrolled release of a commodity occurs, (b) the pipeline is operated beyond design limits, (c) the pipeline causes an obstruction to a ship or to a surface vehicle owing to a disturbance of its supporting environment, (d) any abnormality reduces the structural integrity of the pipeline below design limits, (e) any activity in the immediate vicinity of the pipeline poses a threat to the structural integrity of the pipeline, or (f) the pipeline, or a portion thereof, sustains a precautionary or emergency shut-down for reasons that relate to or create a hazard to the safe transportation of a commodity.

NOTE: Refer to Figure 1.5 for any additional Province/State written reporting requirements.

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FIGURE 1.3

NOTIFICATION DATA SHEET

Date: _____ *Time:* _____

INCIDENT DESCRIPTION

Reporter's Full Name: _____ *Position:* _____
Day Phone Number: _____ *Evening Phone Number:* _____
Company: _____ *Organization Type:* _____
Facility Address: _____ *Owner's Address:* _____
_____ _____
_____ _____
Facility Latitude: _____ *Facility Longitude:* _____
Spill Location: _____
(if not at Facility) _____
Responsible Party's Name: _____ *Phone Number:* _____
Responsible Party's Address: _____
Source and/or cause of discharge: _____
_____
Nearest City: _____
County: _____ *State:* _____ *Zip Code:* _____
Section: _____ *Township:* _____ *Range:* _____
Distance from City: _____ *Direction from City:* _____
Container Type: _____ *Container Storage Capacity:* _____
Facility Oil Storage Capacity: _____
Material: _____

Total Quantity Released	Water Impact (*YES or NO*)	Quantity into Water

RESPONSE ACTION(S)

Action(s) taken to Correct, Control, or Mitigate Incident: _____
_____
Number of Injuries: _____ *Number of Deaths:* _____
Evacuation(s): _____ *Number Evacuated:* _____
Damage Estimate: _____
More information about impacted medium: _____
_____
Possible hazards to human health or the environment outside of the Facility: _____
_____

CALLER NOTIFICATIONS

National Response Center (NRC): 1-800-424-8802 *Transportation Safety Board:* 819-997-7887
Additional Notifications (Circle all applicable): *USCG* *NEP* *EPA* *Province* *State* *Other*
National Response Center
Incident Assigned No. _____

ADDITIONAL INFORMATION

Any information about the incident not recorded elsewhere in this report including estimated quantity and disposition of recovered material: _____
_____

NOTE: DO NOT DELAY NOTIFICATION PENDING COLLECTION OF ALL INFORMATION.

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FIGURE 1.4
EXTERNAL NOTIFICATION FLOWCHART

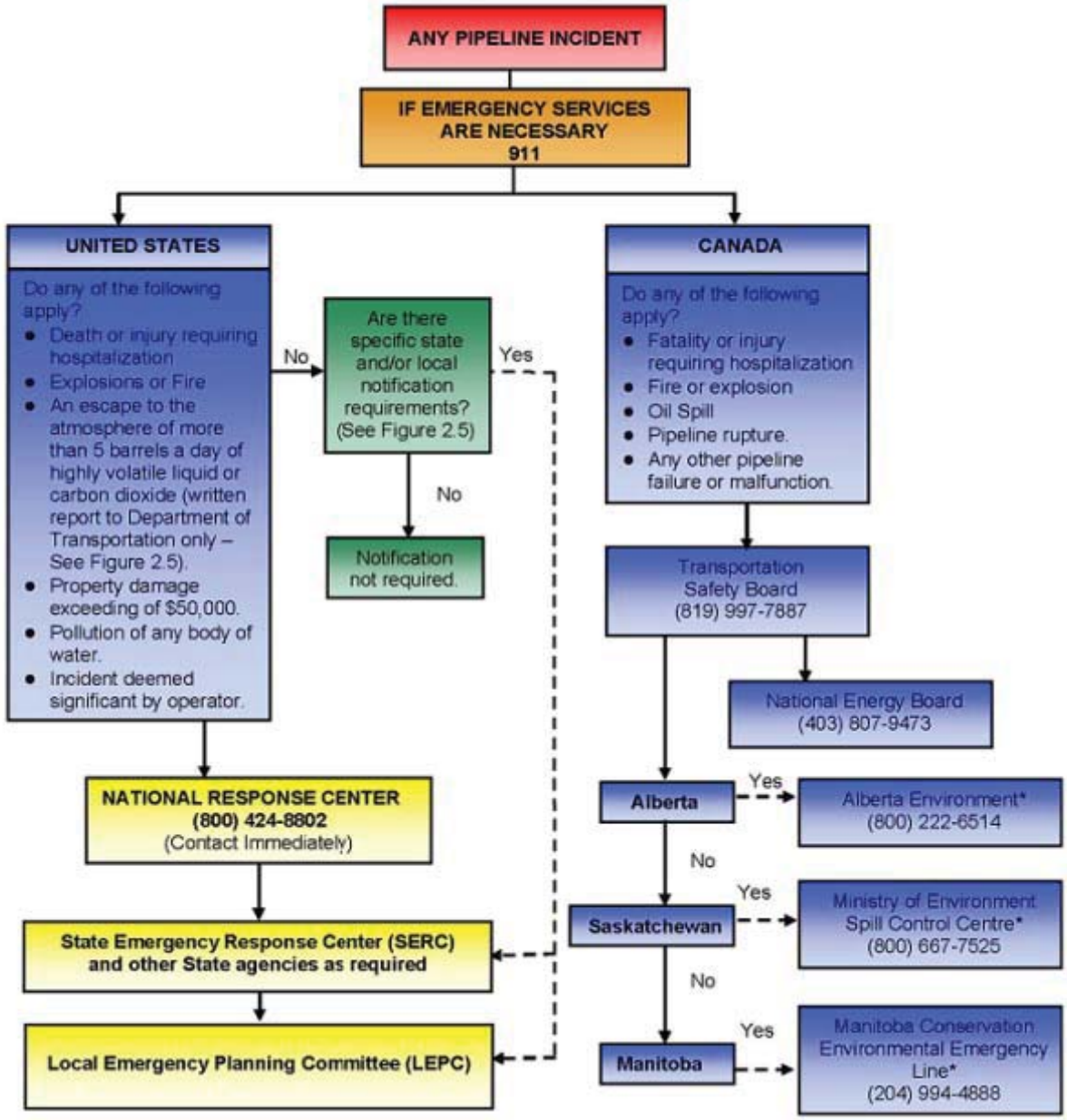

FIGURE 1.5
EXTERNAL NOTIFICATION REFERENCES

U.S. Federal Notification Requirements

National Response Center (NRC) c/o United States Coast Guard (CG-3RPF-2), 2100 2nd Street Southwest - Room 2111-B Washington, District Of Columbia 20593-0001	(800) 424-8802 (202) 267-2180 (800) 337-7455
REPORTING REQUIREMENTS TYPE: Any discharge or sighting of oil on navigable waters. VERBAL: Immediate notification required (within 2 hours). WRITTEN: If an RQ limit is reached, refer to state requirements for written report requirements. NOTE: A call to the NRC must also be made for spills or releases of hazardous substances that meet or exceed their RQ >5 Gal.	

Office of Pipeline Safety and Hazardous Materials U.S. Department of Transportation 1200 New Jersey Avenue SE-E-22-321 Washington, District Of Columbia 20590	(202) 366-4000
REPORTING REQUIREMENTS TYPE: In addition to the reporting of accidents to the NRC as noted below, a written accident report PHMSA Form 7000-1. VERBAL: Call to the NRC meets the required verbal notification under DOT reporting requirement. WRITTEN: Reported on PHMSA Form 7000-1 no later than 30 days, submit a report resulting from explosion/ fire/hospitalization, death, property damage greater than $50,000, or above reportable quantity. NOTE:	

U.S. Environmental Protection Agency, Region 8 999 18th Street Suite 500 Denver, Colorado 80202-246	(303) 312-6312
REPORTING REQUIREMENTS TYPE: Immediately for spills that impact or threaten navigable water or adjoining shoreline. VERBAL: Notification to the EPA is typically accomplished by the call to the NRC. WRITTEN: In accordance with the applicable SPCC regulations, within 60 days for a spill in excess of 1,000 gallons (24 bbls.) in a single event or two spill events within a twelve month period into or upon nav. water NOTE:	

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U.S. Environmental Protection Agency, Region 5 77 W. Jackson Blvd., 5th Floor Chicago, Illinois 60604	(312) 353-2318 (312) 353-2000
REPORTING REQUIREMENTS TYPE: Any oil discharge that has impacted or threatens to impact navigable waters or release of hazardous substances in an amount equal or greater than the reportable quantity. VERBAL: Notification to the EPA is typically accomplished by the call to the NRC. WRITTEN: For oil discharge within 60 days, in accordance with applicable SPCC RQ. NOTE:	

U.S. Environmental Protection Agency, Region 6 1445 Ross Avenue, Suite 1200 Dallas, Texas 75202	(214) 665-6595 (214) 665-2222 (866) 372-7745
REPORTING REQUIREMENTS TYPE: Immediately for all spills that impact or threaten navigable water or adjoining shoreline. VERBAL: Notification to the EPA is typically accomplished by the call to the NRC. WRITTEN: As the agency may request depending on circumstances. NOTE:	

Canadian Federal Notification Requirements

Transportation Safety Board (TSB) of Canada 200 Promenade du Portage, Place du Centre, 4th Floor Gatineau, Quebec 1K8	(819) 997-7887 (800) 387-3557
REPORTING REQUIREMENTS TYPE: All pipeline accidents with fatality or serious injury, fire or explosion, oil spill, pipeline rupture or any other pipeline failure or malfunction. VERBAL: Immediately. WRITTEN: Within 30 days. NOTE:	

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Canadian National Energy Board (CA NEB) 444 Seventh Avenue SW Calgary, Alberta T2P OX8	(403) 807-9473 (800) 899-1265
REPORTING REQUIREMENTS TYPE: All spills or discharges. VERBAL: Immediately. WRITTEN: As requested by the Agency. NOTE:	

U.S. State Notification Requirements

South Dakota Department of Environment and Natural PMB 2020 Joe Foss Building, 523 East Capitol Pierre, South Dakota 57501-3182	(605) 773-3151
REPORTING REQUIREMENTS TYPE: All spills or discharges VERBAL: Immediately. WRITTEN: As requested by the Agency. NOTE:	

Game, Fish and Parks South Dakota	(605) 345-3381
REPORTING REQUIREMENTS TYPE: VERBAL: Courtesy Reporting WRITTEN: NOTE:	

South Dakota DENR, Div of Environmental Services 523 East Capitol Ave. Pierre, South Dakota 57501-3182	(605) 773-3296 (605) 773-3231
REPORTING REQUIREMENTS TYPE: Any Spill or discharge greater than reportable quantity. VERBAL: Immediately. WRITTEN: Within 30 days. NOTE:	

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South Dakota DENR, Division of Oil and Gas South Dakota	(605) 394-2229
REPORTING REQUIREMENTS TYPE: VERBAL: Courtesy Reporting WRITTEN: NOTE:	

South Dakota Department of Environment and Natural South Dakota	(605) 773-6035
REPORTING REQUIREMENTS TYPE: VERBAL: Courtesy Reporting WRITTEN: NOTE:	

South Dakota Department of Transportation, RR	(605) 773-3046 (605) 773-3921
REPORTING REQUIREMENTS TYPE: VERBAL: Courtesy Reporting WRITTEN: NOTE:	

South Dakota Department of Transportation, ROW South Dakota	(605) 773-3710 (605) 773-4249
REPORTING REQUIREMENTS TYPE: VERBAL: Courtesy Reporting WRITTEN: NOTE:	

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South Dakota Division of Emergency Management South Dakota	(605) 773-3231
REPORTING REQUIREMENTS TYPE: VERBAL: Courtesy Reporting WRITTEN: NOTE:	

South Dakota Public Utilities Commission South Dakota	(605) 773-3201
REPORTING REQUIREMENTS TYPE: VERBAL: Courtesy Reporting WRITTEN: NOTE:	

Department of Environmental Quality 1200 N Street Suite 400 / PO Box 98922 Lincoln, Nebraska 68509-8922	(402) 471-2186 (402) 471-4545
REPORTING REQUIREMENTS TYPE: Any Discharge that leaves the Facility or threatens to impact navigable waters. VERBAL: Immediately, but not longer than 30 minutes. WRITTEN: As Requested by the Agency NOTE:	

Nebraska Emergency Management Agency Lincoln, Nebraska	(402) 471-7176
REPORTING REQUIREMENTS TYPE: VERBAL: Courtesy Reporting WRITTEN: NOTE:	

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Nebraska Game & Parks Commission Lincoln, Nebraska	(402) 471-5423 (402) 271-5440
REPORTING REQUIREMENTS TYPE: VERBAL: Courtesy Reporting WRITTEN: NOTE:	

Department of Natural Resources Nebraska	(402) 471-2363
REPORTING REQUIREMENTS TYPE: VERBAL: Courtesy Reporting WRITTEN: NOTE:	

Oklahoma Department of Environmental Quality 707 N Robinson Oklahoma City, Oklahoma 73102	(405) 702-1000
REPORTING REQUIREMENTS TYPE: VERBAL: Courtesy Reporting WRITTEN: NOTE:	

Texas Rail Road Commission / Oil and Gas Division 1701 N. Congress / P.O. Box 12967 Austin, Texas 78711-2967	(512) 463-6788 (915) 684-5581
REPORTING REQUIREMENTS TYPE: (16 TAC Section 3.20 (a)-(b)) In the case of a fire, spill or break causing loss of over (5) barrels. For Pipeline incidents reportable to the NRC, notify the TRRC Pipeline Safety Section's District VERBAL: Immediate notification to District Office WRITTEN: File Form H-8 in duplicate when appropriate measure have been taken, within 30 days following the date of the incident. NOTE:	

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Texas Commission on Environmental Quality 2800 S IH 35, Suite 100 Austin, Texas, 78704	(512) 463-7727 (713) 767-3500 (713) 767-3563
REPORTING REQUIREMENTS TYPE: All spills of oil or petroleum products into water and/or discharges onto land that meet or exceed 5 barrels VERBAL: As soon as possible, within 24 hours of discovery. WRITTEN: As the agency may request, depending on circumstances. NOTE:	

Montana Department of Environmental Quality	(406) 444-1420 (406) 841-3911
REPORTING REQUIREMENTS TYPE: Releases must be reported to the DEQ within 24 hours of being detected as required by ARM 17.56.501. VERBAL: Within 24 hours. Call the Leak Line at 1-800-457-0568, or after hours at (406) 841-3911.. WRITTEN: NOTE:	

State of Montana Department of Natural Resources	(406) 586-3136
REPORTING REQUIREMENTS TYPE: VERBAL: Courtesy Reporting WRITTEN: NOTE:	

Canadian Provincial Notification Requirements

Alberta Environment 9915 -108 Street 10th Floor, Petroleum Plaza South Tower Edmonton, Alberta T5K 2G8	(800) 222-6514
REPORTING REQUIREMENTS TYPE: All spills to water or exceeds a reportable quantity or emission level. VERBAL: Immediately. WRITTEN: Within 7 days. NOTE:	

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Saskatchewan Environment and Resource Management Box 3003, 800 Central Avenue. Prince Albert, Saskatchewan S5V 6G1	(800) 667-7525
REPORTING REQUIREMENTS TYPE: Any oil spill to water or oil spill greater than or equal to 50 L. to land. VERBAL: Immediately WRITTEN: Within 7 days. NOTE:	

LOCAL EMERGENCY AGENCIES

Montana	
Phillips County LEPC	(406)-654-2350
Valley County LEPC	(406) 228-6224
McCone County LEPC	(406)-485-2347
Dawson County LEPC	(406)-377-2361
Prairie County LEPC	(406)-635-5738
Fallon County LEPC	(406) 778-3223
Carter County LEPC	(406)-975-6416
South Dakota	
Harding County LEPC	(605) 375-3414
Butte County LEPC	(605) 892-4205
Perkins County LEPC	(605) 244-5243
Meade County LEPC	(605) 347-4222
Pennington County LEPC	(605) 394-2185
Haakon County LEPC	No number listed
Jones County LEPC	(605) 669-2362
Lyman County LEPC	(605) 869-2200
Tripp County LEPC	(605) 842-2306
Nebraska	
Keya Paha County LEPC	(402)- 376-2420
Holt County LEPC	(402)-336-4126
Garfield County LEPC	No number listed
Wheeler County LEPC	No number listed
Greeley County LEPC	No number listed
Boone County LEPC	(402)-395-6525
Nance County LEPC	(308)-536-2452

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Merrick County LEPC	(308)-946-2345
Hamilton County LEPC	(402)-694-5155
York County LEPC	(402)-363-2675
Fillmore County LEPC	(402)-759-4914
Saline County LEPC	(402)-821-3010
Jefferson County LEPC	(402)-656-3615

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Oklahoma	
Lincoln County LEPC	(405)-258-1285
Creek County LEPC	(918)-367-9489
Okfuskee County LEPC	(918)-623-1122
Seminole County LEPC	(405)-382-2499
Hughes County LEPC	(405)-379-2203
Coal County LEPC	(580)-927-2121
Atoka County LEPC	(580)-889-2221
Bryan County LEPC	(580)-924-3737
Texas	
Fannin County LEPC	(903)-583-2143
Lamar County LEPC	(903)-737-2400
Delta County LEPC	(903)-395-2146
Hopkins County LEPC	(903)-438-4040
Franklin County LEPC	(903)-537-4539
Wood County LEPC	(903)-763-5461
Upshur County LEPC	(903)-843-2541
Smith County LEPC	(903)-590-2653
Cherokee County LEPC	(903)-683-5947
Rusk County LEPC	(903)-657-3581
Nacogdoches County LEPC	(409)-560-7793
Angelina County LEPC	(936)-634-3331
Polk County LEPC	(936)-327-6810
Liberty County LEPC	(936)-336-4525
Hardin County LEPC	(409)-246-5100
Jefferson County LEPC	(409)-835-8411
Orange County LEPC	(409)-883-2612

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ADDITIONAL RESPONSE RESOURCES		
Planning and Incident Support		
COMPANY	**LOCATION**	**TELEPHONE**
National Response Corporation	3500 Sunrise Hwy Ste. T103 Great River, New York 11739	(800) 899-4672
O'Brien's Response Management Inc.	Slidell, Louisiana	(985) 781-0804
ENSR Corporation	Fort Collins, Colorado	(800) 722-2440
Western Canadian Spill Services Co-op	Calgary, Alberta	(403) 250-9606
Saskatchewan Co-op Area 1 Chairman	Saskatchewan	(780) 573-7350
Saskatchewan Co-op Area 1 Alt. Chairman	Saskatchewan	(306) 387-6449
Saskatchewan Co-op Area 2 Chairman	Box 1132 Kindersley, Saskatchewan S0L 1S0	(306) 968-2503
Saskatchewan Co-op Area 2 Co-Chairman	Box 5 Coleville, Saskatchewan S0L 0K0	(306) 965-2731
Saskatchewan Co-op Area 2 Custodian	Saskatchewan	(306) 834-7898
Saskatchewan Co-op Area 3 Chairperson	Saskatchewan	(306) 773-0234
Saskatchewan Co-op Area 3 Secretary	Saskatchewan	(306) 773-9381
Saskatchewan Co-op Area 3 Custodian	Saskatchewan	(306) 672-3723
Saskatchewan Co-op Area 4&5 Chair	Saskatchewan	(306) 842-1818
Saskatchewan Co-op Area 4&5 Vice-Chair	Saskatchewan	(306) 842-3088
Saskatchewan Co-op Area 6 Call-out	Saskatchewan	(306) 791-5058
Albert Coop Area 1S Regional Custodian	Lethbridge, Alberta	(403) 329-0427
Alberta Coop Area 1S Equip. Custodian	Brooks, Alberta	(403) 362-6551
Alberta Coop Area 2U Custodian	Hardisty, Alberta	(780) 888-3845
Euroway Industrial Svc Co. Ltd	Winnipeg, Manitoba	(204) 661-0500

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SECTION 2

RESPONSE ACTIONS

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2.1 INITIAL RESPONSE ACTIONS

Initial response actions are those taken by local personnel immediately upon becoming aware of a discharge or emergency incident, before the Initial Response Team (described in Section 3.0) is formed and functioning. Timely implementation of these initial steps is of the utmost importance because they can greatly affect the overall response operation.

The pages that follow discuss initial response actions for a variety of emergencies that have the possibility of occurring. These emergencies are discussed in the order listed below:

- Initial Response
- Line Break or Leak
- Fire
- Severe Thunderstorm/Flash Flooding/Landslide
- Tornadoes
- Earthquake
- Winter Storm
- Volcanic Eruptions
- Bomb Threat
- Release to Groundwater
- Abnormal Operations

It is important to note that these actions are intended only as guidelines. The appropriate response to a particular incident may vary depending on the nature and severity of the incident and on other factors that are not readily addressed. Note that without exception, employees and public safety is first priority.

The first Company person on scene will function as the Incident Commander (IC) until relieved by an authorized supervisor who will assume the IC position. Transfer of command will take place as more senior management respond to the incident. The role of IC will typically be assumed and retained by area management.

The person functioning as Incident Commander during the initial response period has the authority to take the steps necessary to control the situation and must not be constrained by these general guidelines.

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INITIAL RESPONSE ACTIONS -SUMMARY PERSONNEL AND PUBLIC SAFETY IS FIRST PRIORITY			
RESPONSE TIMES*			
US DOT Tier	1	2	3
High Volume Area	6 HR	30 HR	54 HR
All Other Areas	12 HR	36 HR	60 HR
CONTROL • **Eliminate sources of ignition** • **Isolate the source of the discharge, minimize further flow** **NOTIFY** • **Make internal and external notifications** • **Activate local Company personnel as necessary** • **Activate response contractors and other external resources as necessary** **CONTAIN** • **Begin spill mitigation and response activities** • **Monitor and control the containment and clean-up effort** • **Protect the public and environmental sensitive areas**			
* Response resources and personnel available to respond within time specified after discovery of a worst case discharge per US DOT 49 CFR Part 194.115			

In addition to the potential emergency events outlined in this Section, the Company has identified several "abnormal operations" that could be expected in the pipeline facilities. The Company has defined the events and established procedures to identify, eliminate or mitigate the threat of a worst case discharge due to these events. In compliance with 49 CFR 195.402(d), these procedures are defined in the Company's Operations Manual.

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FIRST COMPANY PERSON NOTIFIED / ON SCENE

- Verify emergency exists.
- Follow the appropriate "Specific Incident Response Checklist" in Figure 2.2 and "Product Specific Response Considerations" in Figure 2.3.
- Notify the Oil Control Center of the incident.
- Contact / Utilize local emergency services as necessary (police, fire, medical).

REGIONAL EMERGENCY OPERATION CENTER

- Ensure local emergency agencies have been contacted (police, fire, medical).
- Assign personnel immediately to the discharge site to assist with emergency response (QI) and spill containment.
- Activate additional company and response contractors to site as situation demands.
- Confirm safety aspects at site, including need for personal protective equipment, sources of ignition, and potential need for evacuation.
- Evaluate the severity, potential impact, safety concerns and response requirements based on the initial data provided by the first person on scene. Refer to the spill response evaluation Flowchart in this section.
- Perform notifications using Figure 1.1 as appropriate.

AREA MANAGEMENT -EMERGENCY SITE MANAGEMENT

- Proceed to spill site and coordinate response and clean-up operations.
- Assume the role of Incident Commander.
- Coordinate/perform activation of additional spill response contractors, as the situation demands (telephone reference is provided in Figure 1.5).
- Direct containment, dispersion, and/or clean-up operations in accordance with the "Product Specific Response Considerations" provided in Figure 2.3.
- Complete the "Product Release Report".

LOCAL COMPANY PERSONNEL

- Assigned personnel will immediately respond to a discharge from the Pipeline or Facility, as the situation demands.
- Assist as directed at the spill site.

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FIGURE 2.1
SPILL CLASSIFICATION

Spills/Releases to Environment:

Minor

- A spill/release, onsite, that poses no adverse affect to the environment nor impact neither to a water body nor to groundwater. The spill may or may not be reportable to a regulatory agency.

Serious

- A spill/release, onsite or off-site/off-right-of-way, that poses an adverse affect to the environment but no impact to a water body nor to groundwater.

Major

- A spill/release, onsite or off-site/off ROW, that poses an adverse affect to the environment including an impact to a water body or to groundwater.

Critical

- Emergency response for containment or clean up is required. A spill/release, onsite or off-site/off ROW, that poses an adverse affect to the environment including an impact to a water body or to groundwater.

Complaints -Health & Safety:

Minor

- Unverified community complaint from a Landowner, Police, Fire, Municipality, or a Ministry. Verified employee complaint where an investigation is required to obtain resolution.

Serious

- Verified community complaint likely to cause danger/risk to the public, employees or TransCanada facilities.

Major

- Employee work refusal based on belief of unhealthy or unsafe work conditions.

Critical

- Regulatory body notified of employee complaint (by employee) and investigates employee work refusal.

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FIGURE 2.2
SPECIFIC INCIDENT RESPONSE CHECKLIST

INITIAL RESPONSE

- Take appropriate personal protective measures.
- Secure site.
- Call for medical assistance if an injury has occurred.
- Notify the Oil Control Center and area management of the incident.
- Eliminate possible sources of ignition in the near vicinity of the spill.
- Take necessary fire response actions.
- Advise personnel or public in the area of any potential threat and/or initiate evacuation procedures.
- Identify/isolate the source and minimize the loss of product.
- Restrict access to the spill site and adjacent area as the situation demands. Take additional steps necessary to minimize any threat to health and safety.
- Verify the type of product and quantity released. (Material Safety Data Sheet(s) are available).

All personnel are reminded that outsiders other than emergency services will not be allowed in the area during the time of an emergency and that statements issued to the media or other interested parties should be given by designated Company Management. Be courteous with media representatives and direct them to the designated spokesperson.

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LINE BREAK OR LEAK, SPECIFIC RESPONSE (Including Piping Rupture/ Leak Valve Rupture/Leak and Manifold Failure)

- Shut down Pipeline.
- Close upstream and downstream block valves.
- Mitigate spreading of the product, as the situation demands. See Release to Groundwater, Specific Response for more detailed information. Potential containment land-based strategies include:
    - Earthen dike/berm
    - Ditching
    - Spreading sorbent material over the spill
- Prevent the spill from entering the waterways, sewer, etc. to the greatest extent possible.
- Determine the direction and expected duration of spill movement. Refer to the maps in this plan.
- Review the location of socio-economic and environmentally sensitive areas identified in this plan and the Area Contingency Plan (ACP). Determine which of these may be threatened by the spill and direct the response operation to these locations. Initiate protection and recovery actions.
- Response contractor under TransCanada direction utilizes Combustible Gas Indicator, Oxygen meter, proper colormetric indicator tubes and/or other air sampling measurements to assure that areas are safe to enter for continued response operations. Refer to Vapor Cloud Specific Response, later in this Figure, if flammable vapors are detected.
- Drain the line section, as the situation demands.
- Inform local operators of utilities such as the power company, telephone company, railway.
- Clean up spilled product to eliminate any possible environmental problems. Be alert for underground cables.
- Make all necessary repairs.
- Return the line to service when repairs are complete, if or when approved.
- Complete follow-up and written reporting, as the situation demands.

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FIRES (MINOR, MAJOR, EXPLOSION) SPECIFIC RESPONSE

Be aware of Fire Weather conditions.

- Watch -Critical fire weather conditions are forecast to occur.
- Red Flag Warning -Critical Fire weather conditions are either occurring or will shortly.

INDIVIDUAL DISCOVERING THE FIRE - (All Employees)

Call the Local Emergency Response Agency (911).

Note: Pipeline right-of-ways are used by Firefighters as a fire break (barrier) to isolate fires and prevent them from growing in size. Right-of-ways are commonly used to access to fire areas. Many times Firefighters will need to increase the size of the cleared space over the Pipeline right-of-way to prevent the fire from leaping from tree top to tree top. To do this, heavy equipment may be used to quickly increase the amount of cleared space between the fire area and unignited forest. The following are steps to consider when working with the local authority on creating these fire breaks.

- Use your best judgment to ensure the safety of staff, fire ground workers and the public when determining if this activity is safe to perform;
- Call and confirm with Asset Reliability if this activity is safe and implement any instructions provided by Asset Reliability. Asset Reliability's role is to provide directions to protect the health and safety of those involved as well as pipeline integrity;
- Be physically on site to coordinate the activities related to any pipeline crossings;
- Stake the pipeline to identify the location of the pipe(s) in the right-of-way.
- First preference is to use already existing pipeline crossing areas;
- Gather the appropriate information to complete a formal pipeline crossing agreement. In Canada, send required information to the Land Department in Calgary.
- Notify the Oil Control Center and area management.
- Shut off pumps.
- Coordinate with the Oil Control Center to close appropriate valves to isolate fire, if necessary.
- Isolate Pump Station from Mainline.
- Evacuate site as safety considerations dictates.
- Notify the Oil Control Center of evacuation route and final destination.
- Notify the Oil Control Center of safe arrival.
- Inspect pump station, equipment and controls after the fire is extinguished and safe to return.
- Evaluate pipeline, monitoring or control systems for evidence of heat damage.
- Notify engineering to conduct further investigation if damage is found.
- Make appropriate repairs and return Pipeline to service.

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SEVERE THUNDERSTORM (Flash Flooding/Landslide) SPECIFIC RESPONSE

Thunderstorms are a year round occurrence with lightning a major threat. The potential of flash flooding is also possible when one area is affected for an extended period.

- Be aware of changing weather conditions.
  - Severe Thunderstorm Watch -Conditions are favorable to the development of thunderstorms.
  - Severe Thunderstorm Warning -A severe thunderstorm has been observed or is imminent.
  - Flash Flood Watch-Flash flooding is possible within 6 hours after heavy rains have ended.
  - Flash Flood Warning -Flash flooding is occurring or imminent.
- Terminate outdoor work when lightning is occurring and move to shelter.
- Avoid areas subject to sudden flooding until the thunderstorm passes.
- Evaluate the situation after weather event.
  - Does standing water prevent visual inspection?
  - Have flood waters damaged the Pipeline?
  - Have flood waters exposed buried piping?
  - Has soil shifted that could lead to a landslide?
- Initiate appropriate pipeline patrol by the most expedient means possible to determine extent of damage.
- Make all necessary repairs.

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TORNADO/STRAIGHT LINE WINDS SPECIFIC RESPONSE

Although many disasters cannot be prevented or predicted, preparation can significantly reduce losses. In the event of a severe weather condition or a natural disaster, the Area Manager or assigned designee will be the Emergency Coordinator.

- **Be Aware of Changing Weather Conditions**
  - Tornado watch -Conditions are right for the formation of a tornado.
  - Tornado warning -A tornado has been sighted but is not in the area at this time.
  - Tornado alert -A tornado has been sighted in the immediate area, take cover immediately.
- **If Severe Weather Conditions Threaten**
  - Carry a battery operated portable radio and monitor conditions.
  - If a tornado is observed and time permits, evacuate the area.
  - If the tornado is approaching a pump station, notify the Oil Control Center to remotely isolate the station.
  - In vehicle, drive away from tornado at right angle. Get out of car and seek shelter if tornado cannot be avoided.
  - If outdoors, shelter in ditch, excavation or other low spot and lie flat, face down.
  - Make certain that all personnel are aware of the condition.
  - Stay in shelter until conditions are safe.
- **Immediately After the Storm**
  - Account for all personnel.
  - Survey for damages.
  - Initiate team for any repairs.
  - Refer to this Plan for additional response guidance regarding fires, spills, etc., as needed.

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EARTHQUAKE SPECIFIC RESPONSE

The actual movement of the ground in an earthquake is rarely the direct cause of death or injury. Most casualties result from falling objects and debris because the shocks can shake, damage or demolish buildings and other structures.

- **Stay calm. Don't panic.**
- If you are indoors, stay there. Do not run outside.
- If you are in a building, take cover under a heavy furniture or stand in an inside doorway away from windows. (A door frame or the inner core of a building is its strongest point and least likely to collapse.)
- Exit building as situation determines.
- If you are outside, stay there. Move away from buildings to avoid falling debris. Avoid damaged utility lines.
- If you are driving, stop quickly and stay in your car. If possible, do not stop on a bridge, overpass or where buildings can fall on you. Your car can provide protection from falling debris.
- Do not reenter damaged buildings. Walls may collapse after the original shaking has ceased.
- Evaluate the situation and initiate appropriate pipeline patrol by the most expedient means possible to determine extent of damage.
- Make all necessary repairs as resources and conditions allow.

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SEVERE WINTER STORM SPECIFIC RESPONSE

- Be aware of Changing Weather Conditions
  - Winter Storm Watch -Conditions are expected but not imminent.
  - Winter Storm Warning -A significant winter storm is occurring, imminent, or likely.
  - Blizzard Warning -Winds at least 35 mph, blowing snow frequently reducing visibility to 0.25 miles or less, and dangerous wind chills are expected.
- Listen to local radio stations for weather advisory and road condition reports, carry a survival kit, and start the trip with a full tank of gasoline.
- Inspect pump station, equipment, and controls after storm for damage.
- Make any repairs as necessary.

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VOLCANIC ERUPTIONS SPECIFIC RESPONSE

If a volcanic eruption ejects a large ash plume and the wind carries the ash to the pipeline facilities, this may cause a disruption of operations by making travel difficult or impossible due to reduced visibility.

- Begin gathering information from news media, field personnel, etc. to assess any ash cloud size, location, heading and speed as soon as news of an eruption breaks.
- Consider recalling crews prior to the expected arrival of the ash cloud while it is still clear to travel. If a crew is at a station when an ash fall begins, they should probably stay there for the duration and not travel until it is determined to be safe after the event.
- Advise contract aerial patrol service of the situation if contacted for the beginning of a pipeline patrol or if an aerial patrol is in progress.
- Inspect pump station, equipment and controls after eruption for damage.
- Make any repairs as necessary.

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BOMB THREATS SPECIFIC RESPONSE

The following pages provide guidelines for actions to be taken in the event a bomb threat is received. A bomb threat to the pipeline system or personnel may present itself in any of several ways:

- Phone
- E-mail
- Fax
- Radio
- Mail
- Word-of-mouth
- Increase in the Homeland Defense Status

Other threats to pipeline system or personnel are often treated in the same manner as bomb threats. These may include:

- Terrorist threats
- Workplace violence threats
- General threat to an industry
- Civil disturbances

The following steps should be used as guidance when responding to the above situations. Actions during a real event will vary based on differences in circumstances, response activities, good judgment, etc.

PHONE / WRITTEN (Fax, Letter, Telegram) THREATS

Person Receiving the Call

- Immediately open the Bomb Threat form, (this should be kept next to the phone), so you can use it during the conversation with the individual making the bomb threat call. If possible, complete the form during the call.
- Remain calm and be engaging when talking to the caller.
- Keep the caller on the line as long as possible in order to obtain as much information as possible. Ask him/her to repeat the message. Try to write down every word spoken by the person. If you have a small hand-held tape recorder available, try to tape the conversation.
- If the caller does not indicate the location of the bomb or the time of detonation/attack, ask for this information.
- Inform the caller that the incident could result in death or serious injury to innocent people.
- Pay particular attention to background noises, such as motors, music, and any other noise that may give a clue as to the location of the caller.
- Listen closely to the voice (male, female), voice quality (calm, excited), accents, and speech impediments.

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AFTER THE CALLER HANGS UP AND WRITTEN THREATS

- Immediately report the threat call to the Oil Control Center or the Company person designated by management to receive such information.

Pipelines and Pump Stations -Additional Guidance

- If the caller does not indicate the location of the bomb / substance or the time of possible detonation/attack, ask him / her for this information. Try to determine the Provice / State, pipeline system, and specific location involved if possible.
- For offices and control center, inform the caller that the building/facility is occupied and the incident could result in death or serious injury to innocent people.
- For pipeline and pump stations, inform the caller that an incident could result in death of the innocent general public or significant environmental impact.

Area Manager/Designee

- Based upon discussion with Corporate Security, determine if the threat is credible. Then decide what actions to take, which can include:
  - Do Nothing
  - Attempt to determine which facility(s) are at risk
  - Stay and Search
  - Partial Evacuation or Internal Evacuation (offices or control center)
  - External Evacuation to an offsite Command Post (offices or control center)
- If a full or partial facility evacuation is necessary, activate Building Evacuation Plan immediately. When in doubt, evacuate. Encourage personnel to be vigilant for suspicious or out-of-place objects as they evacuate and leave their workstations.
- Initiate operations "shut down" procedures, as necessary.
- Secure the location and limit access to essential personnel only.
- Call the appropriate local and/or government agencies (fire, police, etc.) listed in Figure 1.5 and inform them of the threat and your Command Post location.
- Set up a Command Post at a pre-determined offsite location. Ensure you have:
  - Emergency Response Plan
  - Facility maps
  - Access keys
  - Cell Phones, Pagers & Radios
- Direct all members of the press to the designated spokesperson.

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PIPELINES AND PUMP STATIONS SEARCH GUIDELINES

- Additional actions to consider taking upon credible threats against pipelines and pump stations:
  - Which if any system(s) should be shutdown
  - When any system(s) should be shutdown
- Survey from a distance with the aid of binoculars:
  - valves
  - station piping
- Due to the expanse of Pipeline facilities, aircraft should be considered to aid in the surveying pipeline ROW.
- Notify the appropriate local and/or government agencies listed in Figure 1.5 upon discovery of suspicious or out-of-place object(s).

SUSPICIOUS MAIL / DELIVERED PACKAGES

- Frequently seen explosive devices have been incorporated, hidden, or camouflaged in letters, soft cover pocketbooks, hard cover books, manila envelopes, and cardboard boxes. While many are delivered by Canadian or U.S. mail, they may arrive by private courier or express service. Be alert to recognize suspicious-looking or unexpected items especially those that have:
  - Special handling marks (special delivery, air mail, registered, certified)
  - Restrictive markings (personal, confidential, addressee only)
  - Excessive postage
  - Handwritten or poorly typed address
  - Incorrect title, or title but no names
  - Misspelling of common words
  - Oily stains, discolorations, or odor
  - No return address
  - Excessive weight
  - Lopsided, uneven, or ridged envelope
  - Protruding wires or tin foil
  - Excessive securing material (tape, string, etc.)
  - Any evidence that the envelope has been opened and re-glued
  - Mail item from a new or strange source

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- If you receive or find a suspicious-looking letter or package:
  - DO NOT TRY TO OPEN IT.
  - Isolate the area around the letter or package to the degree possible, and make emergency notifications as previously outlined, and evacuate personnel to a safe distance, as directed.
  - DO NOT MOVE NOR HANDLE unless absolutely necessary.
  - If opened, preserve, BUT DO NOT TOUCH FURTHER all original envelopes, twine, shipping documents, or packaging materials for evidence and release to the police as requested.
  - Report the call to the Regional Manager or their designee.

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RELEASE TO GROUNDWATER SPECIFIC RESPONSE

- Evaluate the topography and evidence of surface contamination.
- Establish containment, accounting for public safety, spill volume, terrain, and presence of surface water.
- Notify landowner and appropriate public agencies of potential groundwater contamination.
- Immediately retain an independent consultant with expertise in this area to evaluate impacts and remediation options.
- Consult with appropriate agencies regarding remediation, including water and soil cleanup levels, and need for groundwater monitoring.
- Notify and procure additional response equipment and personnel as necessary to address site-specific conditions.
- Dig intercept trench downgradient of release point.
- Line trench and stage vacuum truck to remove contaminated oil/water mixture.
- Excavate surface catchment upgradient of the intercept trench and near leading edge of visible contamination.
- Excavate until contaminated soil is completely removed and clean soil is encountered or conditions prohibit continued digging.
- Line the catchment to limit or prohibit further groundwater contamination.
- Move vacuum truck from intercept trench to catchment to recover oil and/or oily water.
- Line drop down area to stage contaminated soil as excavated.
- Segregate waste streams to minimize later disposal.
- Based on anticipated release, stage temporary storage and additional vacuum trucks to ensure recovery efforts continue without interruption.

  Options for Long term Remediation:

  - Air sparging
  - Vacuum extraction
  - Conventional pump and treat
  - Bioslurping
  - Excavation
  - Enhanced biodegradation/bioremediation
  - Chemical addition/oxidation
  - Natural Attenuation
- Enlist additional experts, as appropriate, for continuing remediation and coordination with appropriate agencies.

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ABNORMAL OPERATIONS SPECIFIC RESPONSE

- If operating design limits have been exceeded (increase or decrease pressure or flow) and no emergency condition exists, stop operations and immediately investigate the pipeline.
- Verify whether a true safety problem, equipment malfunction, or operator error is present. Note: In all cases, safety to operations, the general public, and property will govern actions taken.
- Make appropriate repairs before continuing operations. Note: Corrective action will only be done by qualified personnel to perform the type of work involved.
- Monitor affected systems until normal operations are resumed.
- Complete follow-up and written reporting, as the situation demands.

Note: It is the responsibility of the pipeline operator to carry out the response procedures for abnormal pipeline operations as outlined in their respective O&M Manual.

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2.2 DOCUMENTATION OF INITIAL RESPONSE ACTIONS

It is difficult, particularly during the first few minutes of an initial response operation, to think about the importance of documentation. A log should be maintained which documents the history of the events and communications that occur during the response. When recording this information, it is important to remember that the log may become instrumental in legal proceedings, therefore:

- Record only facts, do not speculate.
- Do not criticize the efforts and/or methods of other people/operations.
- Do not speculate on the cause of the spill.
- Do not skip lines between entries or make erasures. If an error is made, draw a line through it, add the correct entry above or below it, and initial the change.
- Record the recommendations, instructions, and actions taken by government/regulatory officials.
- Document conversations (telephone or in person) with government/regulatory officials.
- **Request that government/regulatory officials document and sign their recommendations or orders (especially if company personnel do not agree with the suggestions, instructions, or actions).**

2.3 OIL CONTAINMENT, RECOVERY AND DISPOSAL/WASTE MANAGEMENT

After initial response has been taken to stop further spillage and notifications made to the required agencies, the Company will begin spill containment, recovery, and disposal operations.

The Incident Commander will assess the size and hazards of the spill (see Figure 2.3). The type of product, the location of the spill, and the predicted movement of the spill will be considered.

Based on this assessment, additional clean-up personnel and equipment will be dispatched to the site and deployed to control and contain the spill. Boom may be deployed in waterways to contain the spill and to protect socio-economic and environmentally sensitive areas. Booms may also be used in waterways to deflect or guide the spill to locations where it can more effectively be cleaned up using skimmers, vacuum trucks, or sorbent material. Clean-up equipment and material will be used in the manner most effective for rapid and complete clean-up of all spilled product.

Response and clean-up will continue until all recoverable product is removed, the environment is returned to its pre-spill state, and the Unified Command of the Company Incident Commander and the Federal and/or State On-Scene Coordinators determine that further response and cleanup is no longer necessary.

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FIGURE 2.3

FLAMMABLE LIQUIDS (Non-Polar/Water-Immiscible)

The following information is intended to provide initial responder(s) with data that may be useful in making quick decisions and executing prompt response actions. The information is intended for guideline purposes only.

PRODUCTS: Crude Oil

HAZARD IDENTIFICATION / RECOGNITION

GUIDE NO. 128	**DANGERS** **1. HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames.** **2. Vapors may form explosive mixtures with air.** **3. Vapors may travel to source of ignition and flash back.** **4. Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).** **5. Vapor explosion hazard indoors, outdoors or in sewers.** **6. Those substances designated with a "P" may polymerize explosively when heated or involved in a fire.** **7. Runoff to sewer may create fire or explosion hazard.** **8. Containers may explode when heated.** **9. Many liquids are lighter than water.** **10. Substance may be transported hot.** **11. If molten aluminum is involved, refer to Emergency Response Guide No. 169.**

HEALTH

1. Move victim to fresh air. Call 911 or emergency medical service.
2. Apply artificial respiration if victim is not breathing. Administer oxygen if breathing is difficult.
3. Remove and isolate contaminated clothing and shoes.
4. In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
5. Wash skin with soap and water.
6. Keep victim warm and quiet.
7. Ensure that medical personnel are aware of the material(s) involved, and take precautions.

PUBLIC SAFETY

1. Isolate spill or leak area immediately for at least 50 meters (150 feet) in all directions.
2. Keep unauthorized personnel away.
3. Stay upwind.
4. Keep out of low areas.
5. Ventilate closed spaces before entering.

EVACUATION	**Large Spill 1. Consider initial downwind evacuation for at least 300 meters (1,000 feet). Fire 1. If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.**

Information provided by the Emergency Response Guidebook 2008.

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2.4 STORAGE/DISPOSAL

Strict rules designed to ensure safe and secure handling of waste materials govern the Company waste disposal activities. To ensure proper disposal of recovered oil and associated debris, the following guidelines should be considered:

- In the event of a product spill, Facilities have limited capacity to store recovered product and water. Separated product is pumped to frac tanks or to trucks to be carried to the Facility for processing.
- Oily debris will be segregated on site and containerized for temporary storage prior to disposal in accordance with hazardous waste regulations.
- Transportation of waste material will be performed in accordance with all applicable Federal and State Regulations.
- Waste associated with the spill will be disposed at sites that have the necessary permits to accept the type of waste to be discharged.

The Company's Community, Safety and Health Administration Dept. will coordinate activities and secure the permits to ensure proper disposal or recycling of recovered product and debris.

2.5 SAMPLING AND WASTE ANALYSIS PROCEDURE

The Company's sampling and waste analysis practices are governed by the regulations for the applicable Province/State and Federal agency. These regulations outline methods and procedures for determining the chemical and physical characteristics of wastes generated by the Facility, including waste associated with spills, so that they may be properly stored, treated, or disposed.

2.6 SAFETY AWARENESS

It is the corporate policy of the Company to provide a safe workplace for all workers. All employees and contractors are responsible for maintaining the safety and health of all workers on the pipeline and the response operations.

Prior to engaging in any spill response activity:

- All employees/contractors must have received orientation from the Company Safety Plan.
- All U.S. contractor response personnel must be in compliance with Occupational Safety and Health Administration training requirements.
- All other personnel will have completed appropriate training for their position as outlined in Section 3.0.
- No employee/contractor shall engage in activities which place them at risk without the appropriate protective equipment and training.

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Response Safety

All Company and contractor personnel are expected to comply with the Site Safety Plan for each spill incident.

- Any concern regarding health or safety issues should be immediately addressed.
- The First Responder must consider the spill site as dangerous and the local atmosphere explosive until air monitoring procedures prove that the area is safe.
- The First Responder must exit the area against or across the wind, if possible, and must also evacuate others who are working in the area.
- All injuries, no matter how minor, must be reported to the Incident Commander in a timely manner.
- Prior to entering a spill area, a qualified person must perform an initial safety and health evaluation of the site.

Air Monitoring

A Safety Monitor shall be designated who is trained in the operation of air monitoring equipment. The Incident Commander must ensure that Safety Monitors are trained and that their equipment is maintained and ready for use.

- The air monitoring equipment shall be activated and checked at the location in which it is stored.
- Calibration of instruments should be performed before use.
- Air monitoring measurements which are to be made prior to entry into the spill area include:
    - Oxygen content
    - Lower Explosive Limit (LEL)
    - Benzene level
- Lower Explosive Limit readings above 10% require immediate evacuation of the area and elimination of ignition sources.
- Oxygen readings below 19.5% require the use of air supplied respiratory protection.
- After assuring that there are no hazards relating to explosion or oxygen depletion, sampling for benzene or total petroleum hydrocarbons shall dictate the appropriate respiratory devices to be used by persons entering the area.
- Benzene levels must be below .5 ppm to work without respiratory protection. At a level of greater the.5 but less than 10 ppm a half face repirator may be used. When the level is between 50 and 100ppm a full face repirator must be used. Anything readings higher than 50 ppm, a supplied air or SCBA must be used.
- Hydrogen Sulfide is an extremely hazardous toxic compound that is present in most crude oils that are transported through the pipeline.

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- Passive air monitoring for Hydrogen Sulfide will be done by all personnel working on or near the pipeline and during any cleanup operation.
  - Hydrogen Sulfide is characterized by a rotten egg smell.
  - The gas causes rapid temporary paralysis of the olfactory system leading to the loss of the sense of smell.
  - Permissible exposure limits in many countries is 10 ppm.
- Symptoms of exposure to Hydrogen Sulfide are:
  - 0-10 ppm causes Irritation of the eyes, nose and throat
  - 10-50 ppm can cause headache, dizziness, nausea, vomiting and breathing difficulty
  - 50-100 ppm can cause severe respiratory irritation, shock, convulsions, coma and even death.
- The Incident Commander is responsible for industrial hygiene monitoring in the post discovery period.

Decontamination

Through training programs, Facility personnel know and understand the importance of the removal of hazardous substances from their person if they are contaminated. Eyewash stations and safety showers provide a means to quickly remove gross contamination of harmful agents, including gasoline. Personnel must immediately shower and remove any clothing which is wet or otherwise contaminated. Showers in the change room are to be used for thorough cleansing. Persons should inspect themselves thoroughly before donning a fresh change of clothing.

Contaminated clothing should be properly disposed. Contaminated personal protective equipment must be washed and sanitized before re-using. The washing of contaminated equipment is performed in a "contained area" to assure that the disposal of the wash water can be handled properly.

Establishing "Exclusion -Hot", "Decontamination - Decon", and "Support -Safe" Zones are required to prevent the removal of contaminants from the contaminated area as well as unauthorized entry into contaminated areas.

- Regardless of the decontamination facilities available, all efforts to minimize personnel exposure should be taken.
- Decontamination facilities should be positioned prior to employee/ contractor entrance to areas where the potential for exposure to contamination exists. The appropriate Material Safety Data Sheets (MSDS) are available to aid health professionals treating the injured parties. Material Safety Data Sheets are located in Appendix G.
- Decontamination facilities should be designed to prevent further contamination of the environment and should have a temporary storage area for items that will be reused in the contaminated area.
- Particular attention should be paid to personal hygiene prior to eating, drinking, or smoking.

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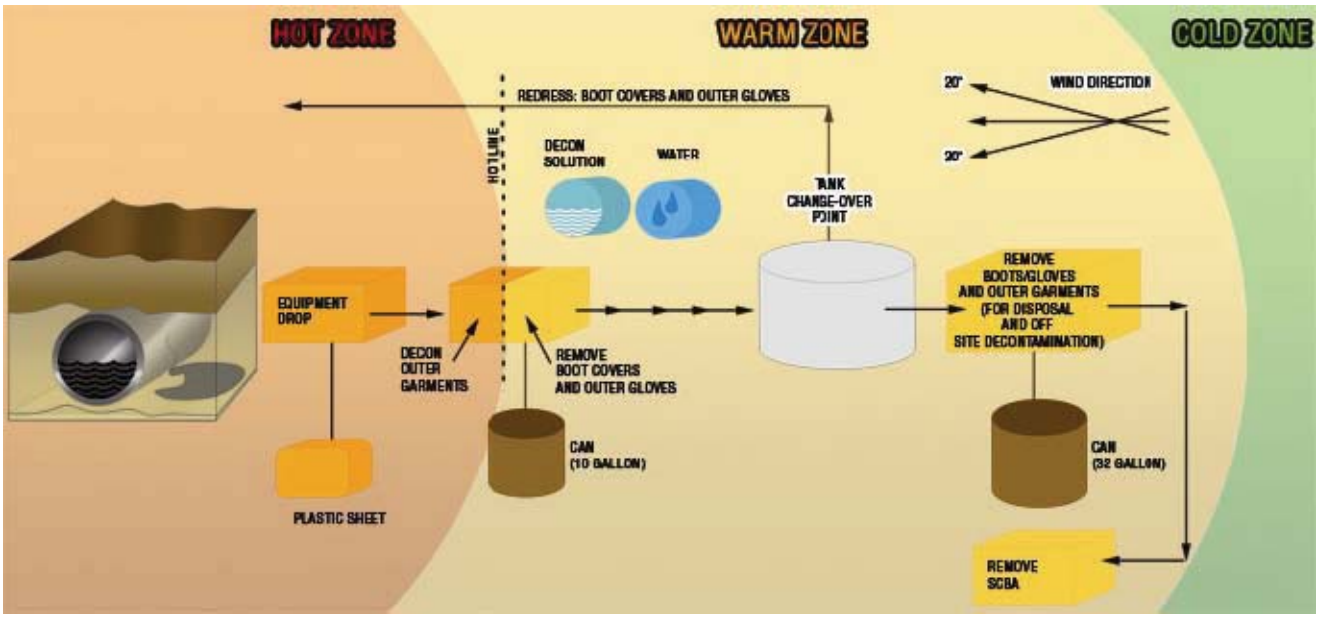
MINIMUM DECONTAMINATION LAYOUT
LEVELS A & B PROTECTION



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Personal Protective Equipment (PPE)

The following represents OSHA/USEPA designated PPE levels for responding to emergencies, post emergency cleanup sites, and/or Temporary Storage and Disposal (TSD) sites. The responder's PPE should be chosen based on his/her level of training and assigned job duties.

Personal Protective Equipment (PPE)	
LEVEL A ● **Self Contained Breathing Apparatus (SCBA) (worn inside suit)** ● **Encapsulated Chemical Protective Suit ● Chemical Protective Gloves** ● **Chemical Protective Boots** ● **Hard Hat** ● **Safety Toe Footwear** ● **Safety Glasses**	To be selected when the greatest level ok skin, respiratory, and eye protection is required.
LEVEL B ● **SCBA (worn outside suit)** ● **Chemical Protective Suit w/Hood** ● **Chemical Protective Boots** ● **Chemical Protective Gloves** ● **Hard Hat** ● **Safety Toe Footwear** ● **Safety Glasses**	To be selected when the highest level of respiratory protection is necessary but a lesser level ok skin is needed.
LEVEL C ● **Air Purifying Respirator (APR)** ● **APR a½ Face / Full Face** ● **Hard Hat** ● **Glasses (worn with a½ face APR)** ● **Chemical Protective Boots** ● **Chemical Protective Gloves** ● **Chemical Protective Suit/Tyvek** ● **Safety Toe Footwear** ● **Safety Glasses**	To be selected when the concentration and type of airborne substances is known and the criteria for using air purifying respirators are met.
MODIFIED LEVEL C **Same as Level C, except no APR requirements.**	To be selected when the concentration and type of airborne substances is known and the criteria for using air purifying respirators are met.
LEVEL D ● **Hard Hat** ● **Safety Glasses** ● **Work Uniform / Clothes** ● **Leather Gloves** ● **Safety Boots** ● **Nomex (if required by the Company)**	The atmosphere contains no known hazard and work functions preclude the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

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2.7 EMERGENCY MEDICAL TREATMENT AND FIRST AID

Call 911 immediately. On-site emergency medical response requires the same rapid assessment of the patient as any other situation, but requires the responders to be aware of other considerations that may affect the way they handle the patient. These considerations include the following:

- The potential for contamination of the patient, responders, and equipment should be addressed. Responders should arrange to treat all patients AFTER the injured party has been decontaminated according to the Site Safety Plan.
- Site personnel should make the initial assessment of the patient and determine the severity of the injury/illness.
- If the treatment needed is critical care or "life saving" treatment, rapid decontamination of the injured/ill party should be started. Refer to the Site Safety Plan for steps to be taken in an "abbreviated" decontamination for medical treatment.
- The need for full decontamination should be carefully weighed against the need for prompt medical treatment.
- The ambulance responding to medical emergencies shall be contacted as soon as possible and instructed exactly where to respond when needed and the nature of the contaminant. Telephone reference is provided in Annexes.
- Material Safety Data Sheet information will be available from the Incident Commander and should be provided to medical personnel to alert them of decontamination requirements.
- Report all injuries, incidents or close calls.
- If emergency medical treatment is needed, the Incident Commander, or his designated representatives, will request assistance from trained medical personnel.

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SECTION 3

RESPONSE TEAMS

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3.1 INTRODUCTION

This Section describes organizational features and duties of the local responders, the Regional Emergency Preparedness Team (EPT), and the broader Emergency Management Team (EMT) as defined in TransCanada's Incident Management System (IMS). The Incident Management System integrates Incident Management, Emergency Management and Crisis Management and is maintained separately.

The key to an effective emergency response is a rapid, coordinated, tiered response by the affected Facility, the Regional Emergency Operations Center, and the Corporate Emergency Operations Center, consistent with the magnitude of an incident.

First response to an incident at the Facility will be provided by the local responders. The Regional EOC will respond, to the degree necessary, to incidents exceeding local capability.

Our response teams will use the National Incident Management System (NIMS) Incident Command System (ICS) to manage the emergency response activities. Because Incident Commander System is a management tool that is readily adaptable to incidents of varying magnitude, it will typically be used for all emergency incidents. Staffing levels will be adjusted to meet specific response team needs based on incident size, severity, and type of emergency.

An explanation of Incident Commander System and the roles and responsibilities for primary members of the response teams are provided in Section 3.7 per CAN/CSA-2731-03. The USCG Incident Management Handbook (IMH) contains an in-depth description of all Incident Commander System positions, Incident Commander System development, response objectives and strategies, command responsibilities, Incident Commander System specific glossary/acronyms, resource typing, the Incident Action Plan process, and meetings. The IMH can be located on the USCG's Homeport Website.

3.2 QUALIFIED INDIVIDUAL

It is the responsibility of the Qualified Individual (QI) or his/her designee to coordinate with the Federal On-Scene Coordinator (FOSC) and State On-Scene Coordinator (SOSC) throughout the response, if applicable.

Vital duties of the Qualified Individual (QI) include:

- Notify all response personnel, as needed.
- Identify the character, exact source, amount, and extent of the release, as well as the other items needed for notification.
- Assess the interaction of the spilled substance with water and/or other substances stored at the Facility and notify response personnel at the scene of that assessment.

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- Assess the possible hazards to human health and the environment due to the release. This assessment must consider both the direct and indirect effects of the release (i.e., the effects of any toxic, irritating, or asphyxiating gases that may be generated or the effects of any hazardous surface water runoffs from water or chemical agents used to control fire and heat-induced explosion).
- Assess and implement prompt removal actions to contain and remove the substance released.
- Coordinate rescue and response actions as previously arranged with all response personnel.
- Activate and engage in contracting with oil spill removal organizations.
- Use authority to immediately access Company funding to initiate cleanup activities.
- Direct cleanup activities until properly relieved of this responsibility.
- Arrangements will be made to ensure that the Qualified Individual (QI) or the Alternate Qualified Individual (AQI) is available on a 24-hour basis and is able to arrive at the Facility in a reasonable time.
- The AQI shall replace the QI in the event of his/her absence and have the same responsibilities and authority.

3.3 INITIAL RESPONSE TEAM (IRT)

The first Company person on scene will function as the Incident Commander and person-in-charge until relieved by an authorized supervisor who will then assume the position of Incident Commander (IC). Transfer of command will take place as more senior management contract support respond to the incident. For response operations within the control of the Initial Response Team, the role of IC will typically be assumed and retained by the Qualified Individual.

The number of positions/personnel required to staff the Initial Response Team will depend on the size and complexity of the incident. The duties of each position may be performed by the IC directly or delegated as the situation demands. The IC is always responsible for directing the response activities and will assume the duties of all the primary positions until the duties can be delegated to other qualified personnel.

A complete functional ICS organization is shown in Figure 3.1. The Initial Response Team should try to fill the necessary positions and request additional support from the Crisis Response Team to fill/back up all the positions as the incident may dictate. Detailed job descriptions of the primary response team positions are provided in Section 3.7.

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3.4 REGIONAL EMERGENCY PREPAREDNESS TEAM (EPT)

The Emergency Preparedness Team (EPT) supports the Initial Response Team. The number of positions/personnel required to staff the EPT will depend on the size and complexity of the incident.

The Regional Emergency Preparedness Team is staffed by personnel from various Regional locations. The EPT provides necessary information to the appropriate Federal, State/Province, and Local authorities with designated response roles, including the National Response Center (NRC), the Canadian National Energy Board (NEB), if necessary, State Emergency Response Commission (SERC) Provincial Ministry, and local response agencies.

3.5 INCIDENT COMMAND SYSTEM (ICS)

The Incident Command System is intended to be used as an emergency management tool to aid in mitigating all types of emergency incidents. This system is readily adaptable to very small emergency incidents as well as more significant or complex emergencies. The Incident Command System utilizes the following criteria as key operational factors:

- Assigns overall authority to one individual
- Provides structured authority, roles and responsibilities during emergencies
- The system is simple and familiar, and is used routinely at a variety of incidents
- Communications are structured
- There is a structured system for response and assignment of resources
- The system provides for expansion, escalation, and transfer/transition of roles and responsibilities
- The system allows for "Unified Command" where agency involvement at the command level is required

Effective establishment and utilization of the Incident Command System during response to all types of emergencies can:

- Provide for increased safety
- Shorten emergency mitigation time by providing more effective and organized mitigation
- Cause increased confidence and support from local, State, Federal, and public sector emergency response personnel
- Provide a solid cornerstone for emergency planning efforts

Section 3.7 provides a comprehensive list of every response team member's duty assignment.

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3.6 UNIFIED COMMAND

As a component of an Incident Commander System, the Unified Command (UC) is a structure that brings together the Incident Commanders of all major organizations involved in the incident to coordinate an effective response while still meeting their own responsibilities. The Unified Command links the organizations responding to the incident and provides a forum for the Responsible Party and responding agencies to make consensus decisions. Under the Unified Command, the various jurisdictions and/or agencies and responders may blend together throughout the organization to create an integrated response team. The Incident Commander System process requires the Unified Command to set clear objectives to guide the on-scene response resources.

Multiple jurisdictions may be involved in a response effort utilizing Unified Command. These jurisdictions could be represented by any combination of:

- Geographic boundaries
- Government levels
- Functional responsibilities
- Statutory responsibilities

The participants of Unified Command for a specific incident will be determined taking into account the specifics of the incident and existing response plans and/or decisions reached during the initial meeting of the Unified Command. The Unified Command may change as an incident progresses, in order to account for changes in the situation.

The Unified Command is responsible for overall management of an incident. The Unified Command directs incident activities and approves and releases resources. The Unified Command structure is a vehicle for coordination, cooperation and communication which is essential to an effective response.

Unified Command representatives must be able to:

- Agree on common incident objectives and priorities
- Have the capability to sustain a 24-hour-7-day-per-week commitment to the incident
- Have the authority to commit agency or Company resources to the incident
- Have the authority to spend agency or Company funds
- Agree on an incident response organization
- Agree on the appropriate Command and General Staff assignments
- Commit to speak with "one voice" through the Public Information Officer or Joint Information Center
- Agree on logistical support procedures
- Agree on cost-sharing procedures

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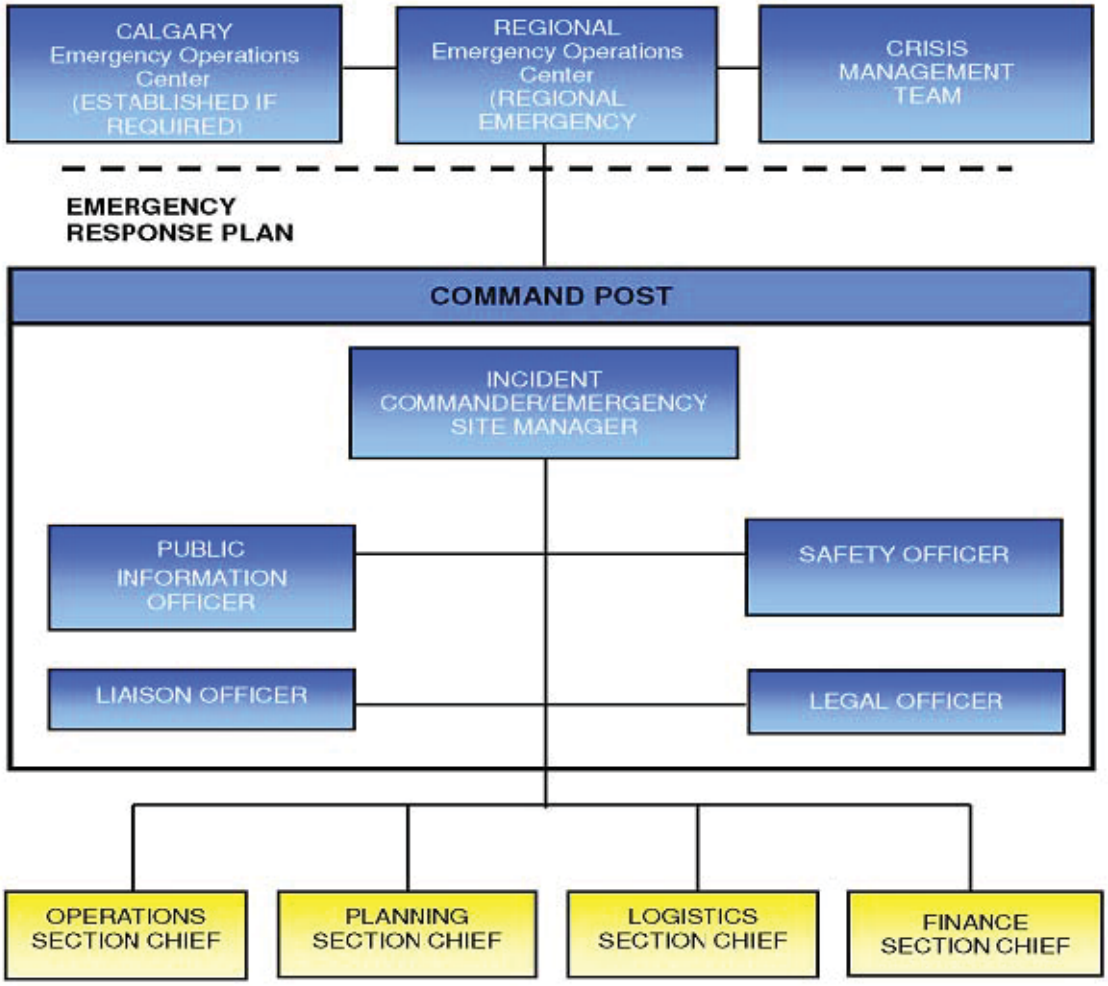
FIGURE 3.1
INCIDENT COMMAND SYSTEM

INCIDENT MANAGEMENT SYSTEM



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3.7 ICS ROLES AND RESPONSIBILITIES

COMMON RESPONSIBILITIES

The following is a checklist applicable to all personnel in an Incident Commander System organization:

- Receive assignment, including:
  - Job assignment
  - Resource order number and request number
  - Reporting location
  - Reporting time
  - Travel instructions
  - Special communications instructions

- Upon arrival, check-in at designated check-in location.
- Receive briefing from immediate supervisor.
- Acquire work materials.
- Supervisors maintain accountability for assigned personnel.
- Organize and brief subordinates.
- Know your assigned radio frequency(s) and ensure communications equipment is operating properly.
- Use clear text and Incident Commander System terminology (no codes) in all communications.
  Complete forms and reports required of the assigned position and send to Documentation Unit.
- Maintain unit records, including Unit Log (ICS Form 214).
- Respond to demobilization orders and brief subordinates regarding demobilization.

UNIT LEADER RESPONSIBILITIES

In Incident Commander System, a Unit Leader's responsibilities are common to all units in all parts of the organization. Common responsibilities of Unit Leaders are listed below.

- Review common responsibilities.
- Receive briefing from Incident Commander, Section Chief or Branch Director, as appropriate.
- Participate in incident planning meetings, as required.
- Determine current status of unit activities.
- Order additional unit staff, as appropriate.
- Determine resource needs.
- Confirm dispatch and estimated time of arrival of staff and supplies.
- Assign specific duties to staff; supervise staff.
- Develop and implement accountability, safety and security measures for personnel and resources.
  Supervise demobilization of unit, including storage of supplies.
- Provide Supply Unit Leader with a list of supplies to be replenished.
- Maintain unit records, including Unit Log (ICS Form 214).

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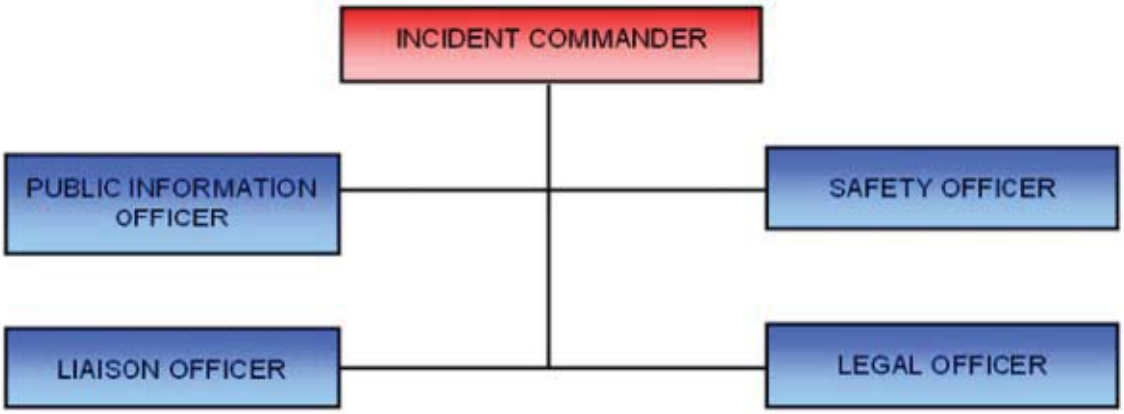
COMMAND



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INCIDENT COMMANDER

- Assess the situation and/or obtain a briefing from the prior Incident Commander.
- Determine Incident Objectives and strategy.
- Establish the immediate priorities.
- Establish an Incident Command Post.
- Brief Command Staff and Section Chiefs.
- Review meetings and briefings.
- Establish an appropriate organization.
- Ensure planning meetings are scheduled as required. (Refer to Figure 3.2, The Operational Planning "P" for assistance).
- Approve and authorize the implementation of an Incident Action Plan.
- Ensure that adequate safety measures are in place.
- Coordinate activity for all Command and General Staff.
- Coordinate with key people and officials.
- Approve requests for additional resources or for the release of resources.
- Keep agency administrator informed of incident status.
- Approve the use of trainees, volunteers, and auxiliary personnel.
- Authorize release of information to the news media.
- Ensure incident Status Summary (ICS Form 209-CG) is completed and forwarded to appropriate higher authority.
- Order the demobilization of the incident when appropriate.
- Assign any of the Incident Commander roles and responsibilities to a Deputy Incident Commander as needed.

PUBLIC INFORMATION OFFICER

- Determine from the Incident Commander if there are any limits on information release.
- Develop material for use in media briefings.
- Obtain Incident Commander approval of media releases.
- Inform media and conduct media briefings.
- Arrange for tours and other interviews or briefings that may be required.
- Obtain media information that may be useful to incident planning.
- Maintain current information summaries and/or displays on the incident and provide information on the status of the incident to assigned personnel.

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LIAISON OFFICER

- Be a contact point for Agency Representatives.
- Maintain a list of assisting and cooperating agencies and Agency Representatives. Monitor check-in sheets daily to ensure that all Agency Representatives are identified.
- Assist in establishing and coordinating interagency contacts.
- Keep agencies supporting the incident aware of incident status.
- Monitor incident operations to identify current or potential inter-organizational problems.
- Participate in planning meetings, providing current resource status, including limitations and capability of assisting agency resources.
- Coordinate response resource needs for Natural Resource Damage Assessment and Restoration (NRDAR) activities with the Operations during oil and HAZMAT responses.
- Coordinate response resource needs for incident investigation activities with the Operations.
- Ensure that all required agency forms, reports and documents are completed prior to demobilization.
- Coordinate activities of visiting dignitaries.

SAFETY OFFICER

- Participate in planning meetings.
- Identify hazardous situations associated with the incident.
- Review the Incident Action Plan for safety implications.
- Exercise emergency authority to stop and prevent unsafe acts.
- Investigate accidents that have occurred within the incident area.
- Review and approve the medical plan.
- Develop the Site Safety Plan and publish Site Safety Plan summary (ICS Form 208) as required.

LEGAL OFFICER

- Participate in planning meetings, if requested.
- Advise on legal issues relating to in-situ burning, use of dispersants, and other alternative response technologies.
- Advise on legal issues relating to differences between Natural Resource Damage Assessment Restoration (NRDAR) and response activities.
- Advise on legal issues relating to investigations.
- Advise on legal issues relating to finance and claims.
- Advise on legal issues relating to response.

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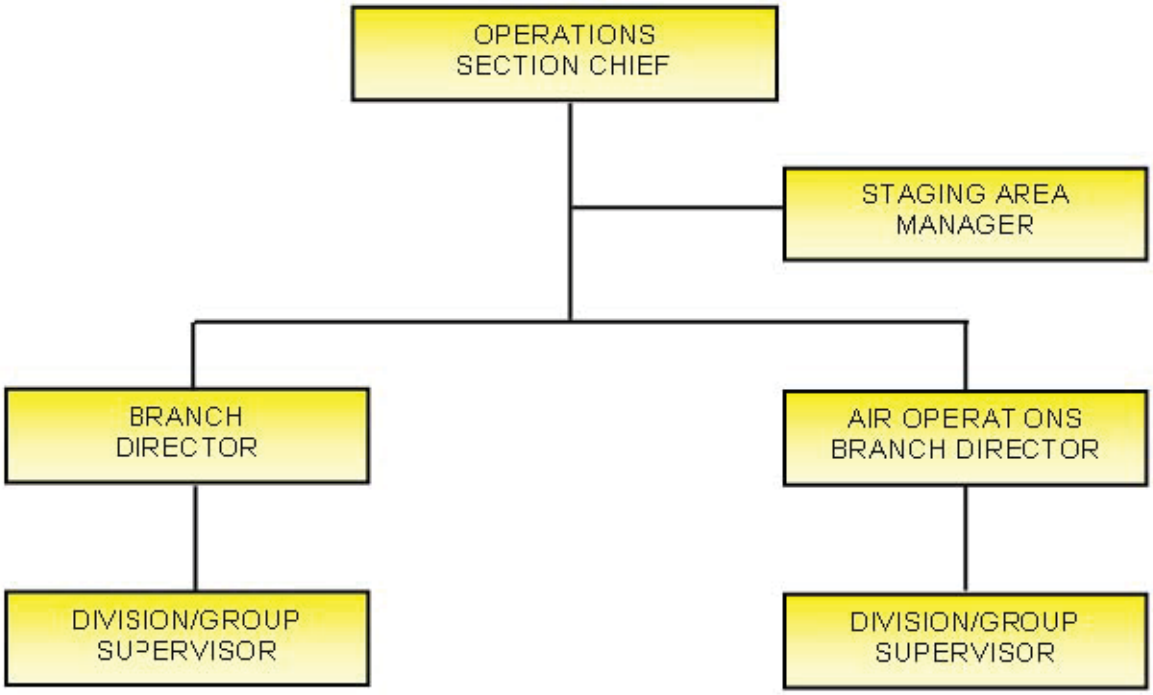
OPERATIONS



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OPERATIONS SECTION GENERAL FUNCTIONS

- Responsible for managing tactical operations at the incident site directed toward reducing the immediate hazard, saving lives and property, establishing situational control, and restoring normal operations.
- Directs and coordinates all incident tactical operations.
- Executes the Incident Action Plan.

OPERATIONS SECTION CHIEF

- Develop operations portion of Incident Action Plan.
- Brief and assign Operations Section personnel in accordance with the Incident Action Plan.
- Supervise Operations Section.
- Determine need and request additional resources.
- Review suggested list of resources to be released and initiate recommendation for release of resources.
- Assemble and disassemble strike teams assigned to the Operations Section.
- Report information about special activities, events, and occurrences to the Incident Commander.
- Respond to resource requests in support of National Resource Damage Assessment and Restoration activities.

BRANCH DIRECTOR

- Develop with subordinates alternatives for Branch control operations.
- Attend planning meetings at the request of the Operations.
- Review Assignment List (ICS Form 204-CG) for Divisions/Groups within the Branch. Modify lists based on effectiveness of current operations.
- Assign specific work tasks to Division/Group Supervisors.
- Supervise Branch operations.
- Resolve logistic problems reported by subordinates.
- Report to Operations when: the Incident Action Plan is to be modified; additional resources are needed; surplus resources are available; or hazardous situations or significant events occur.
- Approve accident and medical reports originating within the Branch.

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DIVISION/GROUP SUPERVISOR

- Implement Incident Action Plan for Division/Group.
- Provide the Incident Action Plan to Strike Team Leaders, when available.
- Identify increments assigned to the Division/Group.
- Review Division/Group assignments and incident activities with subordinates and assign tasks.
- Ensure that the Incident Commander and/or Resources Unit is advised of all changes in the status of resources assigned to the Division/Group.
- Coordinate activities with adjacent Division/Group.
- Determine need for assistance on assigned tasks.
- Submit situation and resources status information to the Branch Director or the Operations.
- Report hazardous situations, special occurrences, or significant events (e.g., accidents, sickness, discovery of unanticipated sensitive resources) to the immediate supervisor.
- Ensure that assigned personnel and equipment get to and from assignments in a timely and orderly manner.
- Resolve logistics problems within the Division/Group.
- Participate in the development of Branch plans for the next operational period.

STAGING AREA MANAGER

- Establish Staging Area layout.
- Determine any support needs for equipment, feeding, sanitation and security.
- Establish check-in function as appropriate.
- Post areas for identification and traffic control.
- Request maintenance service for equipment at Staging Area as appropriate.
- Respond to request for resource assignments.
- Obtain and issue receipts for radio equipment and other supplies distributed and received at Staging Area.
- Determine required resource levels from the Operations.
- Advise the Operations when reserve levels reach minimums.
- Maintain and provide status to Resource Unit of all resources in Staging Area.
- Demobilize Staging Area in accordance with the Incident Demobilization Plan.

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AIR OPERATIONS BRANCH DIRECTOR

- Organize preliminary air operations.
- Request declaration (or cancellation) of restricted air space
- Participate in preparation of the Incident Action Plan through the Operations. Insure that the air operations portion of the Incident Action Plan takes into consideration the Air Traffic Control requirements of assigned aircraft.
- Perform operational planning for air operations.
- Prepare and provide Air Operations Summary (ICS Form 220) to the Air Support Group and Fixed-Wing Bases.
- Determine coordination procedures for use by air organization with ground Branches, Divisions, or Groups.
- Coordinate with appropriate Operations Section personnel.
- Supervise all air operations activities associated with the incident.
- Evaluate helibase locations.
- Establish procedures for emergency reassignment of aircraft.
- Schedule approved flights of non-incident aircraft in the restricted air space area.
- Coordinate with the Operations Coordination Center (OCC) through normal channels on incident air operations activities.
- Inform the Air Tactical Group Supervisor of the air traffic situation external to the incident.
- Consider requests for non-tactical use of incident aircraft.
- Resolve conflicts concerning non-incident aircraft.
- Coordinate with Federal Aviation Administration.
- Update air operations plans.
- Report to the Operations on air operations activities.
- Report special incidents/accidents.
- Arrange for an accident investigation team when warranted.

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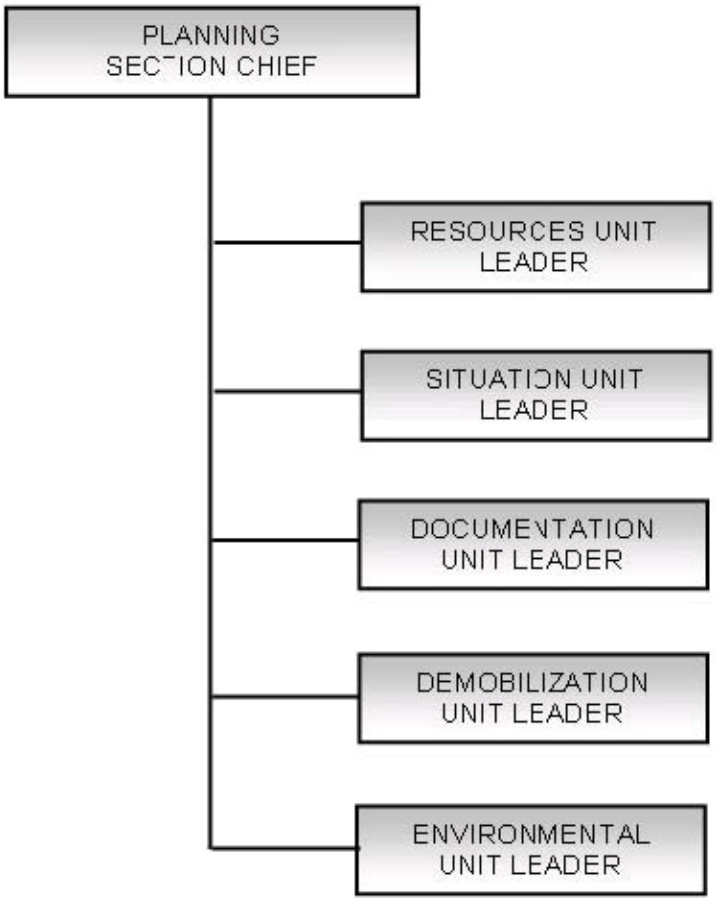
PLANNING



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PLANNING SECTION GENERAL FUNCTIONS

- Responsible for gathering, evaluating, and disseminating tactical information and intelligence critical to the incident.
- Maintaining incident documentation and providing documentation services.
- Preparing and documenting Incident Action Plans.
- Conducting long-range and/or contingency planning.
- Developing alternative strategies.
- Tracking resources assigned to the incident.
- Developing plans for waste disposal.
- Developing plans for demobilization.

PLANNING SECTION CHIEF

- Collect and process situation information about the incident.
- Supervise preparation of the Incident Action Plan.
- Provide input to the Incident Commander and the Operations in preparing the Incident Action Plan.
- Chair planning meetings and participate in other meetings as required. (Refer to Figure 3.2, The Operational Planning “P” for assistance).
- Reassign out-of-service personnel already on-site to Incident Commander System organizational positions as appropriate.
- Establish information requirements and reporting schedules for Planning Section Units (e.g., Resources, Situation Units).
- Determine the need for any specialized resources in support of the incident.
- If requested, assemble and disassemble Strike Teams and Task Forces not assigned to Operations.
- Establish special information collection activities as necessary (e.g., weather, environmental, toxics, etc.).
- Assemble information on alternative strategies.
- Provide periodic predictions on incident potential.
- Report any significant changes in incident status.
- Compile and display incident status information.
- Oversee preparation and implementation of the Incident Demobilization Plan.
- Incorporate plans (e.g., Traffic, Medical, Communications, Site Safety) into the Incident Action Plan.

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RESOURCES UNIT LEADER

- Establish the check-in function at incident locations.
- Prepare Organization Assignment List (ICS Form 203-CG) and Incident Organization (ICS Form 207-CG).
- Prepare appropriate parts of Assignment List (ICS Form 204).
- Prepare and maintain the Incident Command Post display (to include organization chart and resource allocation and deployment).
- Maintain and post the current status and location of all resources.
- Maintain master roster of all resources checked in at the incident.

SITUATION UNIT LEADER

- Begin collection and analysis of incident data as soon as possible.
- Prepare, post, or disseminate resource and situation status information as required, including special requests.
- Prepare periodic predictions or as requested by the Planning Section Chief.
- Prepare the Incident Status Summary (ICS Form 209-CG).
- Provide photographic services and maps if required.

DOCUMENTATION UNIT LEADER

- Set up work area; begin organization of incident files.
- Establish duplication service; respond to requests.
- File all official forms and reports.
- Review records for accuracy and completeness; inform appropriate units of errors or omissions.
- Provide incident documentation as requested.
- Store files for post-incident use.

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DEMOBILIZATION UNIT LEADER

- Participate in planning meetings as required.
- Review incident resource records to determine the likely size and extent of demobilization effort.
- Based on the above analysis, add additional personnel, workspace, and supplies as needed.
- Coordinate demobilization with Agency Representatives.
- Monitor the on-going Operations Section resource needs.
- Identify surplus resources and probable release time.
- Develop incident check-out function for all units.
- Evaluate logistics and transportation capabilities to support demobilization.
- Establish communications with off-incident facilities, as necessary.
- Develop an Incident Demobilization Plan detailing specific responsibilities and release priorities and procedures.
- Prepare appropriate directories (e.g., maps, instructions, etc.) for inclusion in the demobilization plan.
- Distribute demobilization plan (on and off-site).
- Provide status reports to appropriate requestors.
- Ensure that all Sections/Units understand their specific demobilization responsibilities.
- Supervise execution of the Incident Demobilization Plan.
- Brief the Planning Section Chief on demobilization progress.

ENVIRONMENTAL UNIT LEADER

- Participate in Planning Section meetings.
- Identify sensitive areas and recommend response priorities.
- Following consultation with natural resource trustees, provide input on wildlife protection strategies (e.g., removing oiled carcasses, pre-emptive capture, hazing, and/or capture and treatment).
- Determine the extent, fate and effects of contamination.
- Acquire, distribute and provide analysis of weather forecasts.
- Monitor the environmental consequences of cleanup actions.
- Develop shoreline cleanup and assessment plans. Identify the need for, and prepare any special advisories or orders.
- Identify the need for, and obtain, permits, consultations, and other authorizations including Endangered Species Act (ESA) provisions.
- Following consultation with the Federal On-Scene Commander's Historical/Cultural Resources Technical Specialist identify and develop plans for protection of affected historical/cultural resources.
- Evaluate the opportunities to use various response technologies.
- Develop disposal plans.
- Develop a plan for collecting, transporting, and analyzing samples.

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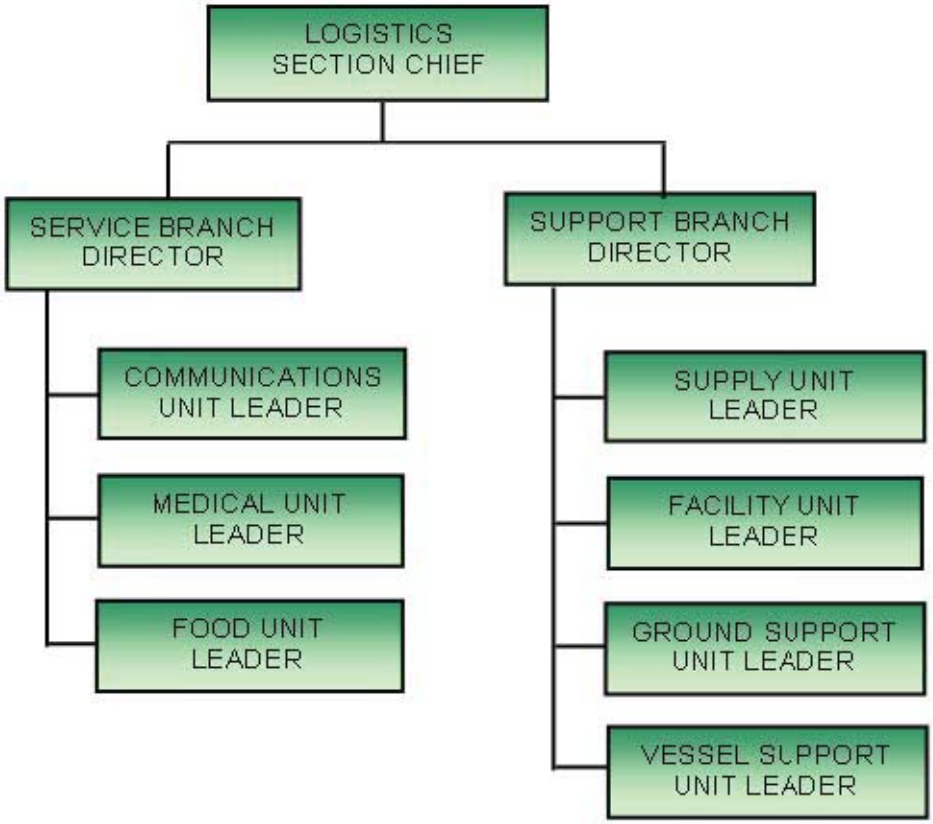
LOGISTICS



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LOGISTICS SECTION GENERAL FUNCTIONS

- Responsible for all support requirements needed to facilitate effective and efficient incident management, including ordering resources from off-incident locations.
- Ordering, obtaining, maintaining, and accounting for essential personnel, equipment, and supplies.
- Providing communication planning and resources.
- Setting up food services.
- Setting up and maintaining incident facilities.
- Providing support transportation.
- Providing medical services to incident personnel.

LOGISTICS SECTION CHIEF

- Plan the organization of the Logistics Section.
- Assign work locations and preliminary work tasks to Section personnel.
- Notify the Resources Unit of the Logistics Section units activated including names and locations of assigned personnel.
- Assemble and brief Branch Directors and Unit Leaders.
- Participate in preparation of the Incident Action Plan.
- Identify service and support requirements for planned and expected operations.
- Provide input to and review the Communications Plan, Medical Plan and Traffic Plan.
- Coordinate and process requests for additional resources.
- Review the Incident Action Plan and estimate Section needs for the next operational period.
- Advise on current service and support capabilities.
- Prepare service and support elements of the Incident Action Plan.
- Estimate future service and support requirements.
- Receive Incident Demobilization Plan from Planning Section.
- Recommend release of Unit resources in conformity with Incident Demobilization Plan.
- Ensure the general welfare and safety of Logistics Section personnel.

SERVICE BRANCH DIRECTOR

- Determine the level of service required to support operations.
- Confirm dispatch of Branch personnel.
- Participate in planning meetings of Logistics Section personnel.
- Review the Incident Action Plan.
- Organize and prepare assignments for Service Branch personnel.
- Coordinate activities of Branch Units.
- Inform the Logistic Section Chief of Branch activities.
- Resolve Service Branch problems.

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COMMUNICATIONS UNIT LEADER

- Prepare and implement the Incident Radio Communications Plan (ICS Form 205-CG).
- Ensure the Incident Communications Center and the Message Center is established.
- Establish appropriate communications distribution/maintenance locations within the Base/Camp(s).
- Ensure communications systems are installed and tested.
- Ensure an equipment accountability system is established.
- Ensure personal portable radio equipment from cache is distributed per Incident Radio Communications Plan.
- Provide technical information as required on:

    - Adequacy of communications systems currently in operation.
    - Geographic limitation on communications systems.
    - Equipment capabilities/limitations.
    - Amount and types of equipment available.
    - Anticipated problems in the use of communications equipment.

- Supervise Communications Unit activities.
- Maintain records on all communications equipment as appropriate.
- Ensure equipment is tested and repaired.
- Recover equipment from Units being demobilized.

MEDICAL UNIT LEADER

- Participate in Logistics Section/Service Branch planning activities.
- Prepare the Medical Plan (ICS Form 206-CG).
- Prepare procedures for major medical emergency.
- Declare major emergency as appropriate.
- Respond to requests for medical aid, medical transportation, and medical supplies.
- Prepare and submit necessary documentation.

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FOOD UNIT LEADER

- Determine food and water requirements.
- Determine the method of feeding to best fit each facility or situation.
- Obtain necessary equipment and supplies and establish cooking facilities.
- Ensure that well-balanced menus are provided.
- Order sufficient food and potable water from the Supply Unit.
- Maintain an inventory of food and water.
- Maintain food service areas, ensuring that all appropriate health and safety measures are being followed.
- Supervise caterers, cooks, and other Food Unit personnel as appropriate.

SUPPORT BRANCH DIRECTOR

- Determine initial support operations in coordination with the Logistic Section Chief and Service Branch Director.
- Prepare initial organization and assignments for support operations.
- Assemble and brief Support Branch personnel.
- Determine if assigned Branch resources are sufficient.
- Maintain surveillance of assigned units work progress and inform the Logistic Section Chief of their activities.
- Resolve problems associated with requests from the Operations Section.

SUPPLY UNIT LEADER

- Participate in Logistics Section/Support Branch planning activities.
- Determine the type and amount of supplies en route.
- Review the Incident Action Plan for information on operations of the Supply Unit.
- Develop and implement safety and security requirements.
- Order, receive, distribute, and store supplies and equipment.
- Receive and respond to requests for personnel, supplies, and equipment.
- Maintain an inventory of supplies and equipment.
- Service reusable equipment.
- Submit reports to the Support Branch Director.

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FACILITY UNIT LEADER

- Review the Incident Action Plan.
- Participate in Logistics Section/Support Branch planning activities.
- Determine requirements for each facility, including the Incident Command Post.
- Prepare layouts of incident facilities.
- Notify Unit Leaders of facility layout.
- Activate incident facilities.
- Provide Base and Camp Managers and personnel to operate facilities.
- Provide sleeping facilities.
- Provide security services.
- Provide facility maintenance services (e.g., sanitation, lighting, clean up).
- Demobilize Base and Camp facilities.
- Maintain facility records.

GROUND SUPPORT UNIT LEADER

- Participate in Support Branch/Logistics Section planning activities.
- Develop and implement the Traffic Plan.
- Support out-of-service resources.
- Notify the Resources Unit of all status changes on support and transportation vehicles.
- Arrange for and activate fueling, maintenance, and repair of ground resources.
- Maintain Support Vehicle Inventory and transportation vehicles (ICS Form 218).
- Provide transportation services, In accordance with requests from the Logistic Section Chief or Support Branch Director.
- Collect information on rented equipment.
- Requisition maintenance and repair supplies (e.g., fuel, spare parts).
- Maintain incident roads.
- Submit reports to Support Branch Director as directed.

VESSEL SUPPORT UNIT LEADER

- Participate in Support Branch/Logistics Section planning activities.
- Coordinate development of the Vessel Routing Plan.
- Coordinate vessel transportation assignments with the Protection and Recovery Branch or other sources of vessel transportation.
- Coordinate water-to-land transportation with the Ground Support Unit, as necessary.
- Maintain a prioritized list of transportation requirements that need to be scheduled with the transportation source.
- Support out-of-service vessel resources, as requested.
- Arrange for fueling, dockage, maintenance and repair of vessel resources, as requested.
- Maintain inventory of support and transportation vessels.

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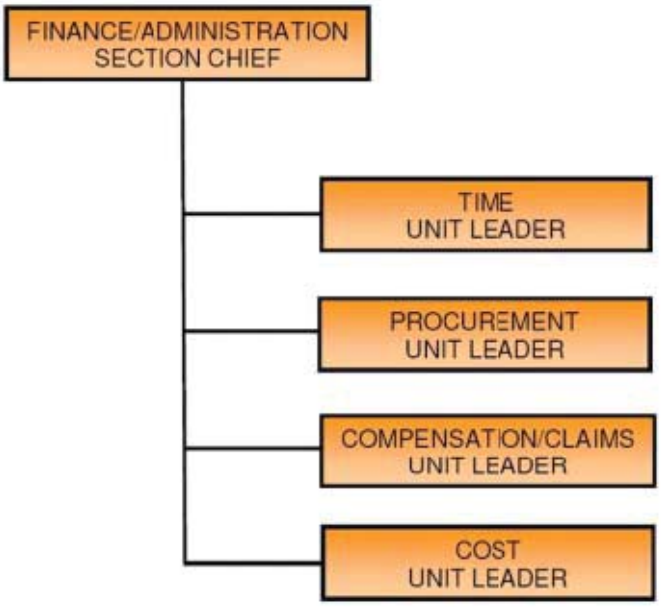
FINANCE/ADMINISTRATION



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FINANCE/ADMINISTRATION SECTION GENERAL FUNCTIONS

- Responsible for all financial and cost analysis aspects of an incident. (Note: Not all incidents will require a separate Finance/Administration Section. In cases that require only one specific function (e.g., cost analysis), this service may be provided by a member of the Planning Section.)
- Administering any contract negotiation.
- Providing cost analysis as it pertains to the Incident Action Plan.
- Maintaining cost associated with the incident.
- Tracking personnel and equipment time.
- Addressing compensation for injury or damage to property issues.

FINANCE/ADMINISTRATION SECTION CHIEF

- Attend planning meetings as required.
- Manage all financial aspects of an incident.
- Provide financial and cost analysis information as requested.
- Gather pertinent information from briefings with responsible agencies.
- Develop an operating plan for the Finance/Administration Section; fill supply and support needs.
- Determine the need to set up and operate an incident commissary.
- Meet with assisting and cooperating agency representatives, as needed.
- Maintain daily contact with agency(s) administrative headquarters on Finance/ Administration matters.
- Ensure that all personnel time records are accurately completed and transmitted, according to policy.
- Provide financial input to demobilization planning.
- Ensure that all obligation documents initiated at the incident are properly prepared and completed.
- Brief administrative personnel on all incident-related financial issues needing attention or follow-up prior to leaving incident.

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TIME UNIT LEADER

- Determine incident requirements for time recording function.
- Determine resource needs.
- Contact appropriate agency personnel/representatives.
- Ensure that daily personnel time recording documents are prepared and in compliance with policy.
- Establish time unit objectives.
- Maintain separate logs for overtime hours.
- Establish commissary operation on larger or long-term incidents as needed.
- Submit cost estimate data forms to the Cost Unit, as required.
- Maintain records security.
- Ensure that all records are current and complete prior to demobilization.
- Release time reports from assisting agency personnel to the respective Agency Representatives prior to demobilization.
- Brief the Finance/Administration Section Chief on current problems and recommendations, outstanding issues, and follow-up requirements.

PROCUREMENT UNIT LEADER

- Review incident needs and any special procedures with Unit Leaders, as needed.
- Coordinate with local jurisdiction on plans and supply sources.
- Obtain the Incident Procurement Plan.
- Prepare and authorize contracts and land-use agreements.
- Draft memoranda of understanding as necessary.
- Establish contracts and agreements with supply vendors.
- Provide for coordination between the Ordering Manager, agency dispatch, and all other procurement organizations supporting the incident.
- Ensure that a system is in place that meets agency property management requirements. Ensure proper accounting for all new property.
- Interpret contracts and agreements; resolve disputes within delegated authority.
- Coordinate with the Compensation/Claims Unit for processing claims.
- Coordinate use of impress funds, as required.
- Complete final processing of contracts and send documents for payment.
- Coordinate cost data in contracts with the Cost Unit Leader.
- Brief the Finance/Administration Section Chief on current problems and recommendations, outstanding issues, and follow-up requirements.

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COMPENSATION/CLAIMS UNIT LEADER

- Establish contact with the incident Security Officer and Liaison Officer (or Agency Representatives if no Liaison Officer is assigned).
- Determine the need for Compensation for Injury and Claims Specialists and order personnel as needed.
- Establish a Compensation for Injury work area within or as close as possible to the Medical Unit.
- Review Medical Plan (ICS Form 206-CG).
- Ensure that Compensation/Claims Specialists have adequate workspace and supplies.
- Review and coordinate procedures for handling claims with the Procurement Unit.
- Brief the Compensation/Claims Specialists on incident activity.
- Periodically review logs and forms produced by the Compensation/Claims Specialists to ensure that they are complete, entries are timely and accurate and that they are in compliance with agency requirements and policies.
- Ensure that all Compensation for Injury and Claims logs and forms are complete and routed appropriately for post-incident processing prior to demobilization.
- Keep the Finance/Administration Section Chief briefed on Unit status and activity.
- Demobilize unit in accordance with the Incident Demobilization Plan.

COST UNIT LEADER

- Coordinate cost reporting procedures.
- Collect and record all cost data.
- Develop incident cost summaries.
- Prepare resources-use cost estimates for the Planning Section.
- Make cost-saving recommendations to the Finance/Administration Section Chief.
- Ensure all cost documents are accurately prepared.
- Maintain cumulative incident cost records.
- Complete all records prior to demobilization.
- Provide reports to the Finance/Administration Section Chief.

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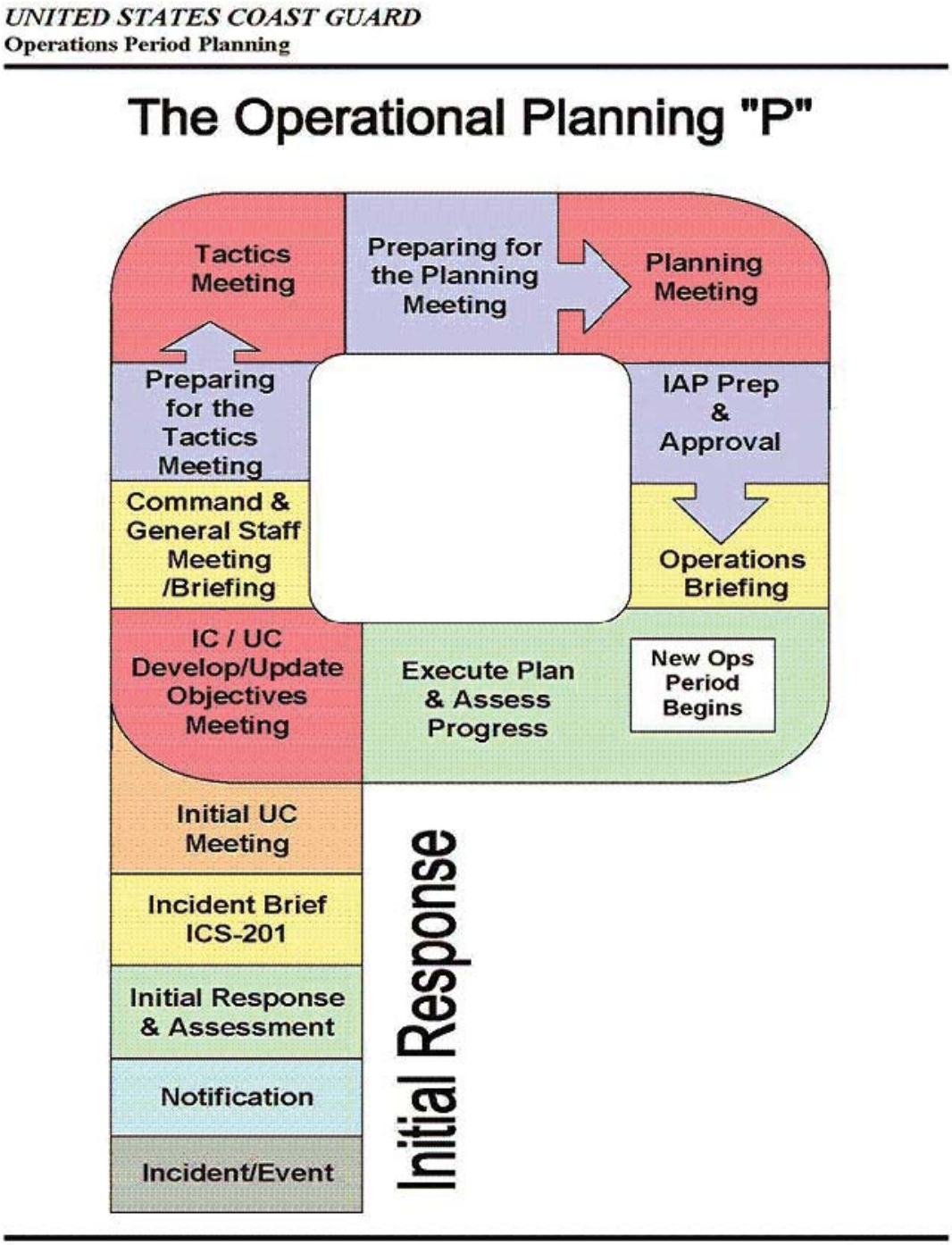
FIGURE 3.2



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SECTION 4

SPILL IMPACT CONSIDERATIONS

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4.1 CRITICAL AREAS TO PROTECT

The critical areas to protect are classified as high, moderate, and low sensitivity to oil for non-coastal/inland environments. The Federal, Province/State, and Local authorities will further clarify these categories at the time of the response. The categories are defined as follows:

HIGH SENSITIVITY
• Areas which are high in productivity, abundant in many species, extremely sensitive, difficult to rehabilitate, or inhabited by threatened/endangered species. • Areas which consist of forested areas, brush/grassy areas, wooded lake areas, freshwater marshes, wildlife sanctuaries/refuges, and vegetated river/stream banks.
MODERATE SENSITIVITY
• Areas of moderate productivity, somewhat resistant to the effects of oiling. • Areas which consist of degraded marsh habitat, clay/silt banks with vegetated margins, and gravel/cobble beaches.
LOW SENSITIVITY
• Areas of low productivity, man-made structures, and/or high energy. • Areas which consist of gravel, sand, or clay material, barren/rocky riverbanks and lake edges, man-made structures, and concrete/compacted earthen drainage ditches.

4.2 ENVIRONMENTAL/SOCIO-ECONOMIC SENSITIVITIES

Environmental/Socio-economic sensitivities are of extreme importance when planning a response effort. The health and safety of the public and the environment, as well as the protection of the various socio-economic sensitivities, must be promptly addressed in order to mitigate the extent of damage and minimize the cost of the clean-up effort.

It is important to protect archeological sites and heritage resources (e.g. National Parks, National Marine Conservation Areas, and National Historic Sites). Impacted archeological sites or heritage resources of an area need to be identified and the likely impacts that result from the activities should be addressed. Specific consideration should be given to access to, and general use and disturbance of areas. The assessment should consider both direct and indirect impacts, cultural protocols and strategies for minimizing impacts. Consultation with local indigenous communities should occur as part of the planning process.

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The Company will explore, where appropriate, equivalent environmental protection systems, methods, devices, or technologies that maintain or may be less damaging to the character of heritage resources or archeological sites. If a release from the pipeline impacts a heritage resource, the Company will respond as outlined in Section 3.0, report to the appropriate authority prescribed by law, cleanup and restore the area as required by regulation, and conduct such sampling, analyses, or associated monitoring during and after restoration.

All environmental/socio-economic sensitivities are worthy of protection, but must be prioritized during a response effort. When making decisions on which areas to designate as collection areas and which to protect, the following sources may be consulted:

- Canadian Wildlife Services, U.S. Fish and Wildlife Service and related province/ state agencies
- Applicable Area Contingency Plans
- Other industry and private experts

The environmental and socio-economic sensitivities in the vicinity of the Pipeline have been broken down into specific categories and identified in this Section. To further clarify the location of the sensitive areas of concern, references to published Area Contingency Plans and Environmental Sensitivity Maps are also provided in this section.

4.3 FISHERIES AND WILDLIFE PROTECTION

The Company will work with Federal, Province/State, and local agency personnel to provide labor and transportation to retrieve, clean, and rehabilitate birds and wildlife affected by an oil spill, as necessary. Oversight of the Company's wildlife preservation activities and coordination with Federal, Province/State, and Local agencies during an oil spill is the responsibility of the Incident Commander.

Protecting fish habitat (e.g. spawning and rearing grounds) is important to both consumers and commercial fisheries. Beyond typical response strategies, other options could include moving floating facilities, temporarily sinking facilities using cages designed for this purpose, temporary suspension of water intakes, or closing sluice gates to isolate the facilities from contamination.

Special consideration should be given to the protection and rehabilitation of endangered species and other wildlife and their habitat in the event of an oil spill and subsequent response. Jurisdictional authorities should be notified and worked with closely on all response/clean-up actions related to wildlife protection and rehabilitation. Laws with significant penalties are in place to ensure appropriate protection of these species.

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Wildlife Rescue

The Company will work with Federal, Province/State, and Local agency personnel to provide labor and transportation to retrieve, clean, and rehabilitate wildlife affected by an oil spill, as the situation demands.

The following are items which should be considered for wildlife rescue and rehabilitation during a spill response:

Bird relocation can be accomplished using a variety of deterrents, encouraging birds to avoid areas of spilled oil. Bird relocation can be accomplished by utilizing deterrent methods including:

- Use of visual stimuli, such as inflatable bodies, owls, stationary figures, or helium balloons, etc.
- Use of auditory stimuli, such as propane cannons, recorded sounds, or shell crackers.
- Use of herding with aircraft, boats, vehicles, or people (as appropriate).Use of capture and relocation.

Search and Rescue -Points to consider

- **The Company's involvement should be limited to offering assistance as needed or requested by the agencies.**
- Prior to initiating any organized search and rescue plan, authorization must be obtained from the appropriate Federal/State agency.
- Initial search and rescue efforts, if needed, should be left up to the appropriate agencies.
- They have the personnel, equipment, and training to immediately begin capturing contaminated wildlife.
- With or without authorization, it must be anticipated that volunteer citizens will aid distressed/contaminated wildlife on their own. It is important to communicate that it may be illegal to handle wildlife without express authority from appropriate agencies. Provisions should be made to support an appropriate rehabilitator; however, **no support should be given to any unauthorized volunteer rescue efforts.**
- The regulatory agencies and response personnel should be provided the name and location of a qualified rehabilitator in the event contaminated wildlife is captured.

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4.4 STAGING AREAS

When establishing personnel and equipment staging areas for a response to a Pipeline discharge, the following criteria should be evaluated:

- Access to waterborne equipment launching facilities and/or land equipment.
- Access to open space for staging/deployment of heavy equipment and personnel.
- Access to public services utilities (electricity, potable water, public phone, restroom and washroom facilities, etc.).
- Access to the environmental and socio-economically sensitive areas which are projected for impact.

4.5 CONTAINMENT AND RECOVERY OF SPILLED PRODUCT

General descriptions of various specific response techniques that may be applied during a response effort are discussed below. Company responders are free to use all or any combination of these methods as incident conditions require, provided they meet the appropriate safety standards and other requirements relative to the situation encountered. Data was obtained from reports, manuals and pamphlets prepared by the American Petroleum Institute, Environmental Protection Agency, and the United States Coast Guard. The most effective cleanup of a product spill will result from an integrated combination of clean-up methods. Each operation should complement and assist related operations and not merely transfer spillage problems to areas where they could be more difficult to handle.

The spill should be assessed as soon as possible to determine the source, extent and location of travel. Terrain and other physical conditions downgradient of the spill site will determine the methods of control at a point in advance of the moving product. Often, the bulk of a spill can be contained at a single location or a few key locations in the immediate vicinity of the source point. When possible, the execution of this type of initial containment strategy helps confine a spill to a relatively limited area.

Spill on Land (Soil Surfaces)

Containment Methods

Product can be trapped in ditches and gullies by earth dams. Where excavating machinery is available, dams can be bulldozed to contain lakes of product. Dams, small and large, should be effectively employed to protect priority areas such as inlets to drains, sewers, ducts and watercourses. These can be constructed of earth, sandbags, absorbents, planks or any other effective method. If time does not permit a large dam, many small ones can be made, each one holding a portion of the spill as it advances. The terrain will dictate the placement of the dams. If the spill is minor, natural dams or earth absorption will usually stop the product before it advances a significant distance. Cleanup is the main concern in such situations.

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In situations where vapors from a spill present a clear and present danger to property or life (possible ignition because of passing automobiles, nearby houses, or work vehicles approaching the area), spraying the surface of the spill with dispersant will greatly reduce the release of additional vapors from the product. This method is especially adapted to gasoline spills on soil surfaces.

Removal Methods

The recovery and removal of free product from soil surfaces is a difficult job. The best approaches at present seem to be:

- Removal with suction equipment to tank truck if concentrated in volumes large enough to be picked up. Channels can be formed to drain pools of product into storage pits. The suction equipment can then be used.

- Small pockets may have to be dipped up by hand.

- If practicable after removal of the bulk of the spill, controlled burning presents the possibility of a fast, simple, and inexpensive method of destruction of the remainder of the product. If all other options have been executed and the site is still unsafe for further activity because explosive vapors persist, the vapors may need to be intentionally ignited to prevent an accumulation sufficient to become an explosive mixture, provided the other requirements of these guidelines for controlled burning are met.

Intentional ignition to remove released product should be utilized only if all of the following conditions are met:

- Other steps and procedures have been executed and a determination has been made that this is the safest remaining method of control.

- Intentional burning will not unduly damage pipelines, adjacent property, or the environment.

- Controlled burning is permitted by government authorities. Local government authorities to be contacted may include city council, county board of commissioners, city or county fire chiefs, the county forestry commission or fire tower, and the local environmental protection agency. In seeking permission from these authorities, be prepared to convince them that adequate safety precautions have been and will be taken during the operation.

- Controlled burning is conducted with the consent of local land owners.

- Safety must always be a prime consideration when considering controlled burning of product. Sparks and heat radiation from large fires can start secondary fires and strong winds make fire control difficult. There must be no danger of the fire spreading beyond control limits. All persons must be at a safe distance from the edge of the inflammable area. Remember that all burning must be controlled burning.

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Spill on Lake or Pond (Calm or Slow-Moving Water)

Containment Methods

A lake or pond offers the best conditions for removal of product from water. Although the removal is no easy task, the lake or pond presents the favorable conditions of low or no current and low or no waves.

The movement of product on a lake or pond is influenced mainly by wind. The product will tend to concentrate on one shore, bank or inlet. Booms should be set up immediately to hold the product in the confined area in the event of a change in wind direction.

If the spill does not concentrate itself on or near a shore (no wind effect), then a sweeping action using boats and floating booms will be necessary.

The essential requirement for this operation is that it be done very slowly. The booms should be moved at not more than 40 feet per minute. Once the slick is moved to a more convenient location (near shore), the normal operations of removal should begin.

If the slick is small and thin (rainbow effect) and not near the shoreline, an absorbent boom instead of a regular boom should be used to sweep the area very slowly and absorb the slick. The product may not have to be moved to the shoreline. See Figure 4.1 for on-water recovery decision tree.

Removal Methods

If the Containment slick is thick enough, regular suction equipment may be used first; however, in most instances, a floating skimmer should be used.

If the floating skimmer starts picking up excess water (slick becomes thin), drawing the boom closer to the bank as product is removed will also keep film of product thicker.

However, when the slick becomes too thin, the skimmer should be stopped and an absorbent applied (with a boat if necessary) to remove the final amounts. The floating skimmer (if speed is a must) or hand skimmers (if water is shallow enough) or both can be used to pick up the product-soaked absorbent. Before pumping the product-soaked absorbent with a floating skimmer, ensure that the absorbent in question can be pumped and will not harm the pump. Several types are nonabrasive to pump internals. If the floating skimmer is used first, the product-soaked absorbent/water mixture should be pumped into a tank truck.

A better method of retrieving the product-soaked absorbent is to draw it in as close to the shore as possible with the booms used to confine the product initially. The absorbent can then be hand skimmed from the water surface and placed in drums, on plastic sheets or in lined roll-off boxes. It should then be disposed of by acceptable means.

The final rainbow on the surface can be removed with additions of more absorbent.

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Spill on Small to Medium Size Streams (Fast-Flowing Creeks)

Containment Methods

The techniques used for product containment on fast-flowing shallow streams are quite different from the ones used on lakes, ponds, or other still bodies of water. The containment and removal processes require a calm stretch of water to allow the product to separate onto the surface of the water. If a calm stretch of water does not exist naturally, a deep slow-moving area should be created by damming. The dam can be constructed by using sandbags, planks or earth. If a dam is required, it should be situated at an accessible point where the stream has high enough banks. The dam should be constructed soundly and reinforced to support the product and water pressure.

- Underflow dam -The underflow dam is one method that can be used, especially on small creeks. The water is released at the bottom, of the dam using a pipe or pipes which are laid during construction of the dam. The flow rate through the pipe must be sufficient to keep the dam from overflowing. One method is to lay the pipe at an angle through the dam (while dam is being constructed) so that the height of the downstream end of the pipe will determine the height the water will rise behind the dam.

- Overflow dam -Another method of containment is the overflow type dam. The dam is constructed so that water flows over the dam, but a deep pool is created which slows the surface velocity of the water. Therefore, the condition of a calm stretch of water is met. The overflow dam may be used where larger flow rates (medium size creeks) of water are involved

  With this type dam, a separate barrier (floating or stationary boom) must be placed across the pool created by the dam. The separate barrier arrests the surface layer of product. At the same time, the water is flowing under the barrier and over the top of the dam. The barrier should be placed at an angle of 45 % across the pool to decrease the effective water velocity beneath it. Also, it helps to concentrate the product at the bank and not all along the barrier. A second barrier should be placed approximately 10 to 15 feet downstream of the first one as a secondary back-up.

  The stationary boom type barrier should be made of wood planks or other suitable material. The stationary boom should be soundly constructed and sealed against the bank. The ends of the planks can be buried in the banks of the stream and timber stakes driven into the stream bed for support as needed. The necessary length of the boom will be approximately 1-1/2 times the width of the waterway.

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The plank boom should extend six to eight inches deep into the water and about two inches or higher above the water level. If the increase in velocity under the stationary boom is causing release of trapped product, it should be moved upward slightly. At no time should barrier be immersed more than 20% of the depth of the pool at the barrier location; that is, if the pool created by damming is three feet deep, do not exceed an immersion depth of seven inches with the barrier at the position the barrier is installed.

Another method used with the underflow dam is having the pipe or pipes sized to carry only a portion of the flow needed. The pipe would be placed at the bottom of the dam and level with the creek bed. The remaining flow of the creek could be siphoned or preferably pumped around the dam from a point away from the dam and from the deepest portion of the pool. The pumping or siphoning can be controlled to maintain the desired water level at the dam. The key is the removal of water through or around the dam at the lowest point in the basin. This prevents the oil from escaping with the released water.

A floating boom can be used in place of the stationary type if the created pool's size (bank to bank) and depth will permit. Since changing the depth and/or length of a standard floating boom in a small stream is difficult, the use of the separation of product and water. The advantages of using a floating boom are the speed of deployment and the fact that there is no need for additional support as with the stationary boom.

- Multiple Impoundments -Since emergency built dams (either underflow or overflow) are seldom perfect, a series of dams is usually required. The first one or two will trap the bulk and the ones that are downstream will trap the last traces of product. Precautions should be taken to ensure that the foundations of emergency dams are not washed away by the released water. If earth is used to construct an overflow dam, a layer of earth-filled bags should be placed on top of the dam so erosion will not take place. See Figure 4.1 for on-water recovery decision tree.

Removal Methods

Once the containment dams are constructed, the problem or removal of the product from the water surface should be the prime consideration. The removal must be continuous or else build-up of product behind the dams or booms might lead to product escaping the traps.

The type of removal procedures used depends largely on the amount of product being trapped in a given span of time, if the amount of product moving down the stream is of sufficient quantity, the first dam or fixed boom would quite possibly trap enough for the floating skimmer to work efficiently. The skimmer will pump the product and possibly some water to a tank truck or other holding tank. Separated water may be released from the bottom of the tank truck if it becomes necessary. The absorbents could then be used at downstream dams or booms. It is inadvisable to place an absorbent in the stream prior to or at the first dam in anticipation of the arriving product. Let the product accumulate at the first dam and use the floating skimmer to recover the product.

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Disposal of gross amount of product-soaked absorbent would not then be a problem. Follow directions on use of each absorbent. Some are designed to be placed on water before product arrives; others are intended only to be placed on the product after it accumulates on the water. Plastic sheets should be used to place the product-soaked absorbent on as it is hand skimmed from the water. Alternatively, the material may be placed in drums or lined roll-off boxes.

The containment and removal of spilled product on small to medium fast-flowing streams might require a combination of underflow or overflow dams, fixed booms, skimmers, and absorbents, to ensure a complete cleanup.

Spill on Large Streams and Rivers

Containment Methods

The containment techniques differ considerably on large streams and rivers versus small streams. First, the smooth calm area of water necessary for product-water separation must be found along the stream or river rather than making one as with small streams. Floating booms (rather than fixed booms or dams) must be used to trap the surfaced product.

Local conditions of current and wind must be considered when selecting the site for the boom. A point with a low water velocity near the bank, sufficient depth to operate the product removal equipment, and good access are required. The fact that wind may tend to concentrate the product against one bank must be considered. A smooth, undisturbed area of water is required immediately upstream of the boom to ensure that the product has opportunity to separate out onto the surface. The boom should be positioned where the current is at a minimum. It is more effective to boom at a wide, slow position than on a narrow, fast stretch of water.

If the boom are positioned straight across a river or stream, at right angles to the flow, surface water tends to dive beneath the barrier (boom) when current velocities exceed about ½ knot (0.8 ft./sec.). However, if the current of the entire river is ½ knot or less, then a boom can be positioned straight across the river or large stream, but angled slightly in relation of the banks. By placing the boom at an angle to the banks, product on the surface is diverted along the boom to the side of the river.

The current velocity is usually much slower near the river bank than in the center and the product will move along the boom toward the bank for removal. A water-tight seal between the bank and the boom is essential. A secondary boom should be set up immediately downstream of the first one to capture the amounts that escape the upstream boom. A boom can be employed parallel to the river flow at the bank to form the seal with the booms used to trap the product.

Where the current velocity of the chosen site exceeds ½ knot, the boom should be positioned in two smooth curves from a point of maximum velocity (usually the center of the river) to both banks. However, this double-boom required product to be removed from both sides of the river. To determine the appropriate angle of boom placement and support (mooring) needed to hold the booms in position, the current velocity should be measured by timing a floating object which is 80% submerged over a distance of 100 feet. A time of 60 seconds over this distance indicates a water current of approximately 1 knot.

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For currents from 1 to 2.5 knots (1.7 to 4.2 ft./sec.), the more the boom will have to be angled acute to the bank. The length of the boom will have to be such to reach the center of the river. For currents between ½ and 1 knot (0.8 and 1.7 ft./sec.), the angle of employment can be enlarged.

The major load on the boom is taken by the terminal moorings, particularly the one in the center of the river. However, intermediate moorings are also required both to maintain the smooth curve of the boom to prevent breaking of the boom and to assist with preventing skirt deflection. The intermediate moorings are preferably positioned every 25 feet and must be adjusted to avoid the formation of indentations in the boom profile. These trap product in pockets, prevent its deflection to the bank, and also encourage diving currents. The mooring ropes should be five times the water depth.

In certain situations, it might be advantageous to position booms to deflect the approaching spilled product to a slower moving area. Naturally, additional booms would have to be positioned around this slower moving area prior to deflecting the product to the area. This approach has been used along river which has lagoons, etc., with a very low current action. The recovery would take place in the lagoons and not along the river bank. See Figure 4.1 for on-water recovery decision tree.

Removal Methods

The product collected upstream of the floating booms in a large stream or river should be removed from the water surface as it accumulates. Regular suction equipment, a floating skimmer, and/or absorbents (including absorbent booms) should be used to remove the product as appropriate to the quantity being trapped in a given span of time. If the amount moving down the stream is of sufficient quantity, the primary floating boom would possibly trap enough for the floating skimmer to work efficiently. The skimmer will pump the product and some water to a tank truck or other holding tank.

The absorbents would then be used upstream of the secondary boom to absorb the underflow from the primary boom. An absorbent boom can also be placed between the primary and secondary booms to help the other absorbents control the underflow from the primary boom.

It is best to hand skim the saturated absorbents and place on plastic sheets. However, if the absorbent used can be pumped after product absorption and speed of removal is a necessity, the floating skimmer can be used to remove the product-soaked absorbent.

The disadvantage of pumping the product-soaked absorbent to a truck is the volume that will accumulate (skimmer will pump excess water) and the disposal problems associated with the large water/product-soaked absorbent mixture.

Spill on Stream which Flows into Lake or Pond

In certain locations where streams (small and large ones) flow into lakes or ponds at relatively short distances, it is conceivable that a spill could reach the lake before containment and recovery operations are set up. If time permits for containment operations to be set up on the stream in question, it then would be handled as described above depending upon the stream size involved.

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However, if product in the stream is near the lake site or if product is flowing into the lake with a significant amount yet to arrive, a different containment should be employed.

Containment Methods

Product on a stream flowing into a lake should be boomed as close to the entrance as possible. The boom should be positioned on the lake at an angle to the residential stream current so as to direct the surface water to a slower moving area. The area where the product is being deflected should be enclosed by booms to contain it. An additional boom for sweeping the product to the bank will be required. This area of containment should not have a current velocity of more than 1/2 knot (0.8 ft./sec.), preferably less. See Figure 4.1 for on-water recovery decision tree.

Removal Methods

The removal of product from the lake or pond's surface would be handled as described earlier.

For sizable releases, collected product will usually be pumped into tank trucks and transported to a storage facility. Tank trucks are available at several locations throughout.

Spill in Urban Areas

Oil spills in urban areas can greatly impact recreational use, human health, wildlife habitat(s), and potential beach or park closures. Manmade structures along waterways require unique protection strategies. Manmade structures could include vertical shore protection structures such as seawalls, piers, and bulkheads, as well as riprap revetments and groins, breakwaters, and jetties. Vertical structures can be constructed of concrete, wood, and corrugated metal. They usually extend below the water surface, although seawalls can have beaches or riprap in front of them. These structures are very common along developed shores, particularly in harbors, marinas, and residential areas. The range in degree of exposure to waves and currents varies widely, from very low in dead-end canals, to very high on offshore breakwaters. Boat wakes can generate wave energy in otherwise sheltered areas. Maintaining shipping or other kinds of vessel traffic through navigation channels or waterways during a spill response is a difficult consideration because there is usually economic and political pressure to re-establish normal operations as soon as possible. This consideration extends to vehicular traffic through urban areas. Deploying booms and skimmers or constructing recovery sites can conflict with such traffic for several days. Also, passage of deep-draft vessels through the waterway can suddenly change water level and flow or create wakes, causing booms to fail. For these reasons, recovery efforts must be coordinated through the Unified Command to ensure the cooperation of all parties involved.

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Containment Methods

Containment techniques in an urban area depend greatly on the ability to deploy equipment due to obstacles presented by the urban area. Most booming and containment techniques will work with slight modifications such as direct anchoring instead of the use of booming buoys. Often, debris and other obstacles cause gaps in containment or clog up the flow of oil in diversion booming. Vessel traffic can also cause containment to fail, due to splash over from vessel wakes.

Removal Methods

Normal recovery techniques work when recovering oil in an urban area. However, recovery can be hampered by several situations. Floating debris clogging skimming equipment is the main cause for low recovery rates. Another problem for recovery in an urban area is lack of storage space. Often traffic problems or lack of access prevent storage equipment such as frac tanks and vacuum trucks from approaching the recovery zone.

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Spill Under Ice

Containment Methods

The traditional strategy for dealing with oil under the ice in a river or lake is to cut a slot to aid in recovery. Ice slots can be cut using chain saws, handsaws, ice augers or some form of trencher. Another effective variation of this technique is the diversionary plywood barrier method which is also discussed below. See Figure 4.1 for on-water decision tree.

Removal Methods

Ice slotting is a very basic technique used to gain access to oil trapped beneath the ice. In ice slotting, a J shaped outline is sketched into the ice at a 30 degree angle to the current. The slight J hook or curve is necessary at the upstream side to provide flow towards the recovery area. In general, the slot width should be 1.5 times the thickness of the ice. Remember, a block of ice is heavy and the width of the slot must be taken into consideration so it can be safely removed or pushed under if the water beneath the ice is sufficiently deep. The length of the slot will be determined by the width of the river and strategy.

This technique is a successful strategy to implement. However, there are a few pit falls to be aware off. First, responders will fatigue rapidly if required to cut the slot or slots by hand using a chain saw or hand held saw. This can present a problem if there are not a sufficient number of Hazmat technicians available. Secondly, when cutting with chain saws, large volumes of water are kicked up by the moving chain onto the responder. This is a safety problem when the responders get wet in extreme cold weather conditions. Wearing rain gear however can reduce this problem.

A second technique is to slot the ice and use plywood to help divert oil beneath the ice to a recovery area. This technique is called the diversionary plywood barrier method. In this technique, a narrow slot is made through the ice and 4' x 8' sheets of plywood or equivalent are dropped into the slot to create a barrier and force the oil to follow along it to the collection area. This is the same principal employed when using floating boom.

The slot can be cut or drilled depending on the equipment available at the time of the response. If drilling is required, a gas powered ice auger can be used. In this scenario a series of 8" or 10" holes are drilled next to each other in the J pattern.

A chain saw can be used to connect the holes if an ice bridge exists between two auger holes. After the ice auguring is complete, plywood can be dropped into the augured slot.

Again, river ice is dirty and chipper blades on the augers may only last long enough to complete a single auger hole. This technique requires a large inventory of chipper blades. Extra auger flights can be used, which reduces down time to change blades. A real plus to slotting the ice with an ice auger is the limited exposure of responders to water. The water is generally restricted to the area around the responder's feet.

If an ice auger is not available, a chain saw can be used to cut a narrow slot. After the slot has been cut and ice removed, plywood can be inserted. When using a chainsaw that makes a 3/8" cut, a 1/8"-1/4" plywood or outdoor siding can be inserted into the slot and effectively be used to create the barrier. Again, the down side when using a large chain saws is fatigue and splash from water being kicked up by the chain. However, this problem is not as bad as cutting large slots as described above. Since only a single slot is made, the number of responders can be reduced and extra personal protective equipment in the form of rain gear can be used to minimize the water splash.

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Spill on Ice

When managing an oil spill on ice special consideration must be given to several safety factors. Thickness of the ice and general accessibility of equipment must be considered when planning for on-ice recovery. Ice that is too thin to safely traverse or broken ice may prevent active recovery.

Containment Methods

For ice-covered on-land or on-water spills, snow or earthen berms may be constructed to contain oil around the leak, if terrain permits. Dikes filled with sorbent materials may be used on spills in smaller streams to create a manmade dam to prevent the further migration of the oil.

Oil may become encapsulated due to melting and refreezing of the ice. Oil may then be more difficult to access and remove. See Figure 4.1 for on-water recovery decision tree.

Removal Methods

Generally, on-ice recovery consists of the manual removal of the product from the spill site. If conditions permit, vacuum trucks or suction pumps may be used to remove pools of oil that may have collected. Often, product removal will be done by hand using brooms, shovels and rakes. Manually moving the oil/snow mixture into piles for collection where it is either vacuum or manually collected into storage containers.

Spill in Wetland Areas

Wetlands, which include upland and inland marshes, swamps and bogs, are highly sensitive to spills because they collect run-off from surrounding environments, and because they are home to many commercially and ecologically important species. Wetlands are very susceptible to damage and are a high priority to protect. Precautions should be taken so that the recovery effort does not cause more damage than that cause by the release.

Containment Methods

Containment booms can be strategically deployed to contain or divert the product into recovery areas where skimmers and vacuums can be used to remove the product. Berms can also be built to contain or divert the product. Consideration must be given to the damage that can be caused by holding the product in the wetland areas. Often, allowing the product to flow to natural collection areas and possibly assisting the flow by the use of high volume low pressure water pumps may be the best course of action.

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Removal Methods

Skimmers and vacuums can be deployed to recover contained oil. Other acceptable response techniques might include bioremediation, sorbents and in-situ burning. The use of heavy equipment is often not practical because of the damage it can cause to plant and animal life. During recovery, specially designed flat bottom shallow draft vessels and the use of plywood or boards may be used to reduce the damage caused by recovery personnel. If the water table is high and the oil will not permeate the soil, shallow trenches may be dug to collect oil for removal.

The Unified Command must balance the need to remove the product with the damage caused by active removal. Considerations for long term passive recovery should be considered.

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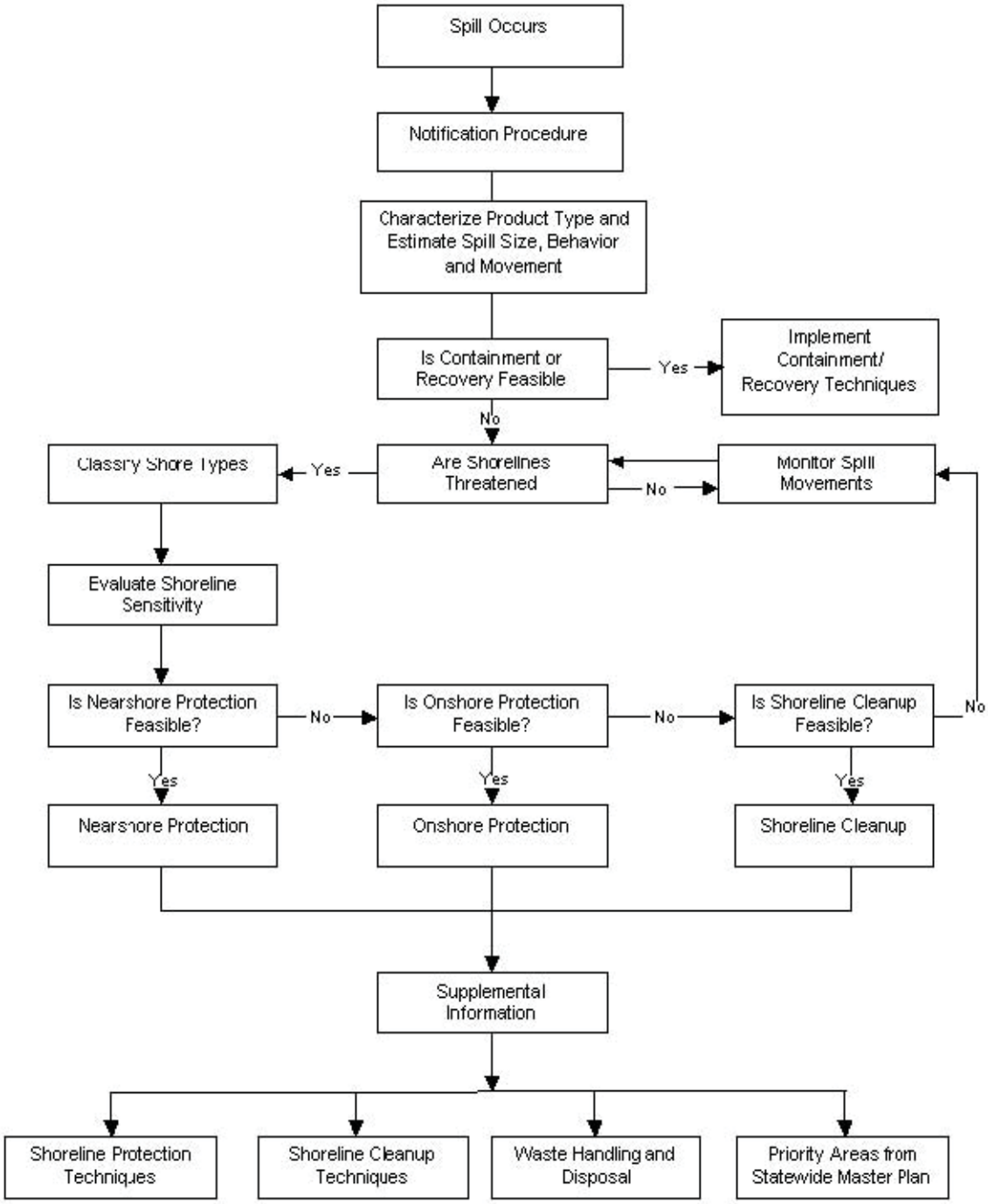
FIGURE 4.1
ON WATER RESPONSE FLOWCHART



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4.6 VULNERABILITY ANALYSIS

A thorough examination of published Area Contingency Plans (ACPs) was conducted to identify sensitive areas in all the response zones.

The Environmental Sensitivity Maps will be created using this data.

4.7 ALTERNATIVE RESPONSE STRATEGIES

There are no pre-approved response options for inland spills within the United States. Any plans to use dispersants or in situ burn by the Company will be submitted to the Federal On-Scene Coordinator for Regional Response Team approval prior to such action being taken.

IN SITU BURNING

When considering the use of in situ burning the following considerations should be evaluated. In most cases, an agency application with further considerations will need to be completed before burning will be approved by the agency.

Size, Nature, and Product Spilled

- Flammability of the product. (Will the product burn?)
- Location of spill. (Distance and direction to nearest human use areas.)
- Volume of product released.
- Estimate of the surface area covered by the spill.
- How long has oil been exposed?
- Will burning cause more hazardous by-products?

Weather and Forecast

- Current weather conditions. (Rain / Heat)
- Wind speed and direction.
- 24 hour forecast.
- 48 hour forecast.

Evaluate the Response Operations

- Is there time enough to conduct burning?
- Is safety equipment available?
- Is adequate personnel available for monitoring / emergency response?
- Is mechanical recovery more intrusive than burning?

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Habitats Impacted and Resources at Risk

- Have local agency / Officials been contacted.
  - Public Health
  - Land Owner / Manager
  - Local Fire Management (Fire Marshall)
  - Historic Property Specialist
  - Province / State Resource Agency
  - Aboriginal / Native American interests

- What is / will be the impact to surface water intakes and wells.
- Are endangered habitats / endangered species present?
- Is area used by Migratory Animals?
- What wildlife is present?

Burn Plan

- How much of the oil is expected to burn?
- How long will it be expected to burn?
- How will burn be ignited?
- How will burn be extinguished?
- How will burned oil residue be collected?
- What are the monitoring protocols?

DISPERSANT USE

Dispersants are not commonly used on inland spills. Working closely with Federal, Province / State and local agencies will be necessary for gaining approval to use dispersants. Since dispersants do not eliminate the oil, only break up and spread the oil throughout the water column, it is important to look at the total effect the oil will have on the environment while considering the use of dispersants.

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APPENDIX A

RESPONSE EQUIPMENT/RESOURCES

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A.1 COMPANY OWNED RESPONSE EQUIPMENT

The Company owns and operates oil spill response equipment contained within response trailers staged throughout the pipeline system. This equipment is maintained according to manufacturer's recommendations by Company and/or contracted personnel. An equipment summary detailing locations, type and amount stored in the response trailers is listed in Figure A.1. The Company also has contracts in place with Oil Spill Removal Organizations and other clean-up contractors that are capable of responding to all discharges along the Pipeline. Figure A.2 lists the contracted Oil Spill Removal Organizations.

20' boom trailers are located at the Hardisty Pump Station (Alberta), Regina Pump Station (Saskatchewan), in Valley City (North Dakota) at an external contractor site, and in Brookings (South Dakota) at a TransCanada office location.

The Qualified Individual has the authority to activate other private contractors, experts, and consultants as the situation demands.

All Pipeline personnel who might be involved in an oil spill have been informed that detergents or other surfactants are prohibited from being used on an oil spill in the water and that dispersants can only be used with the approval of the Canadian Regional Environmental Emergency Team (REET) or US Regional Response Team, the interagency group composed of Federal and State agency representatives that coordinates oil spill response.

A.2 OTHER COMPANY RESOURCES

Additional Company spill response equipment and manpower resources are not available to supplement the response operation; however, third party contractors will be activated on an as needed basis.

A.3 CONTRACT RESOURCES

The resources will be secured from a Company approved contractor. Management will typically handle notification/implementation of these resources. Figure A.2 provides a quick reference to the Oil Spill Removal Organizations and details their response capability and estimated response times. Telephone reference is provided in Figure 1.5. (Note: The *Company will ensure that each OSRO has a comprehensive maintenance program and applicable training / drills programs in place at contract renewal.)*

A.4 COOPERATIVE/MUTUAL AID RESOURCES

The Company is a member of the following Oil Spill Cooperatives or mutual aid groups:

- Western Canadian Spill Services Ltd.
- Alberta -Area U and S Oil Spill Cooperatives
- Saskatchewan -Area 3, 6, and 4 & 5 Oil Spill Cooperatives

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A.5 VOLUNTEERS

Volunteers will not be utilized by the Company for the response operations. In the U.S., all volunteers will be referred to the Federal Regional Response Team.

A.6 COMMUNICATIONS

Effective and efficient communications systems are essential for emergency response at every level. The communications system will be utilized to gather information and current status reports as well as to provide coordination and direction to widely separated work groups involved in search, containment/diversion, repair, traffic control, public control or evacuation, and restoration.

The Company's overall Emergency Notification Chart (Figure 1.2) indicates individuals within the Company and governmental agencies (Figure 1.5) who must be contacted in the event of an emergency.

Notification information for the Qualified Individuals, Alternate Qualified Individuals, emergency response contractors, and governmental agencies is located in Section 1.0 and the Response Zone Annexes.

Lines of communication between the Incident Commander, local personnel, and contractors are demonstrated in the organization charts provided in Figures 3.1 and 3.2. Communication of the overall spill response operation between the Company and the responsible government agencies will occur between the Incident Commander and the Federal On-Scene Coordinator.

Central Communications System

Prearranged communication channels are of the utmost importance in dealing with Company emergencies. The notification procedures and telephone contacts documented in Section 1.0 will be reviewed in accordance with the earlier documented updating procedures. The predetermined communications channels include the following:

- A list of emergency telephone numbers for internal management and emergency response personnel (Figures 1.2 and 1.5).
- A list of emergency telephone numbers for various external resources such as the Fire Departments, Public Officials and local agencies is provided in the Annexes.
- A list of emergency telephone numbers for contract response resources (Figure 1.5).

Communications Equipment

Field communications during a spill response will be handled via radios, telephones, cellular phones, fax machines, and computers and will be maintained by Company personnel. In the event of a Worst Case Discharge, field communications will be enhanced with contract resources as the situation demands.

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Communications Type

Voice communications may be conducted over the public telephone system or Company provided two-way radio equipment.

Radios - Hand-held and vehicle-mounted radio sets are the most effective means of communication for the field response operation. The units are battery operated, multi-channeled, and have a typical range that will cover the area of the response operation. Additional radio sets and battery packs/charges will be necessary in the event of a prolonged response operation.

Telephone (Conventional) - Conventional land line telephones are the most effective means of communication for regulatory and advisory notifications during a spill response operation. Additional telephone lines can be installed in the event of a prolonged response operation. All major facilities have access to standard telephone service.

Cellular - Cellular telephones are useful during spill events giving the user the ability to travel while using the communication system.

FAX Machines - FAX machines allow for a rapid transfer of information/documentation such as status reports/updates, written notifications, and purchase orders. All administrative offices have facsimile machines.

Computers - Computers are commonly used in networks which allow access to various other locations and company personnel. Computers also speed the consolidation of information and preparation of a written report.

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FIGURE A.1
COMPANY OWNED SPILL RESPONSE EQUIPMENT

COMPANY OWNED RESPONSE EQUIPMENT	
5 SPILL RESPONSE TRAILERS (ONE PER RESPONSE ZONE)	
Description	**Quantity**
Response boat 18.5 foot work boat with a 60 HP outboard	1
Jon boat 14 foot Safety boat with a 9.9 hp	1
34 ft Equipment trailer with 6 ft office includes equipment shelving, heat lights, power awning, rear ramp door and 1 side door. Roof rack for storage of the 14' boat and 500ft boom.	1
River Boom 6" x 6'	500 ft
Portable dam 50 ft	1
Diesel /hydraulic Skimming System with diesel power transfer pump and hoses	1
Sorbent pads	5 bales
Sorbent boom	5 bales
500 gallon portable tank	1
2,000 gallon portable tank	1
10,000 gallon portable bladder	1
Winter equipment(e.g. Chain saws, chains, pry bars, ropes, ice, augers)	varies
Bird Hazing Kit	1
20' boom Trailer	1

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FIGURE A.2
RESPONSE RESOURCES
Zone : Not determined

Area : Not determined						
OSRO Name	Contract Number	Environment Type	Facility Classification Level			
			MM	W1	W2	W3
National Response Corporation	TBD	River/Canal	X	X	X	X
		Inland	X	X	X	X
		Open Ocean	X	X	X	X
		OffShore	X	X	X	X
		Near Shore	X	X	X	X
		Great Lakes				

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FIGURE A.3
USCG OSRO CLASSIFICATIONS

The USCG has classified OSROs according to their response capabilities, within each Captain of the Port (COTP) zone, for vessels and for facilities in four types of environments. Response capabilities are rated MM, W1, W2, or W3 as described below:

MINIMUM EQUIPMENT REQUIREMENTS FOR OSRO CLASSIFICATION			
Classification	**Resource Quantity Guidelines**	**Maximum Facility Response Times**	**Maximum Vessel Response Times**
Rivers/Canals			
MM	Protective Boom: 4,000*ft EDRC:; 1,200 bbls TSC: 2,400 bbls	High Volume Ports: 6 hours Other Ports: 12 hours	High Volume Ports:12 hours Other Ports: 24 hours
W1	Protective Boom: 25,000*ft EDRC:; 1,875 bbls TSC: 3,750 bbls	High Volume Ports: 12 hours Other Ports: 24 hours	High Volume Ports:12 hours Other Ports: 24 hours
W2	Protective Boom: 25,000*ft EDRC:; 3,750 bbls TSC: 7,500 bbls	High Volume Ports: 30 hours Other Ports: 36 hours	High Volume Ports:36 hours Other Ports: 48 hours
W3	Protective Boom:25,000*ft EDRC:; 7,500 bbls TSC: 15,000 bbls	High Volume Ports: 54 hours Other Ports: 60 hours	High Volume Ports:60 hours Other Ports: 72 hours
Great Lakes			
MM	Protective Boom: 6,000*ft EDRC:; 1,250 bbls TSC: 2,500 bbls	All Ports: 6 hours	All Ports: 12 hours
W1	Protective Boom:30,000*ft EDRC:; 6,250 bbls TSC: 12,500 bbls	High Volume Ports: 12 hours Other Ports: 24 hours	High Volume Ports:12 hours Other Ports: 24 hours
W2	Protective Boom:30,000*ft EDRC:; 12,500 bbls TSC: 25,000 bbls	All Ports: 36 hours	All Ports: 42 hours
W3	Protective Boom:30,000*ft EDRC:; 25,000 bbls TSC: 50,000 bbls	All Ports: 60 hours	All Ports: 66 hours

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MINIMUM EQUIPMENT REQUIREMENTS FOR OSRO CLASSIFICATION			
Classification	**Resource Quantity Guidelines**	**Maximum Facility Response Times**	**Maximum Vessel Response Times**
Inland			
MM	Protective Boom:6,000*ft EDRC:; 1,200 bbls TSC: 2,400 bbls	High Volume Ports: 6 hours Other Ports: 12 hours	High Volume Ports: 12 hours Other Ports: 24 hours
W1	Protective Boom: 30,000*ft EDRC:; 12,500 bbls TSC: 25,500 bbls	High Volume Ports: 12 hours Other Ports: 24 hours	High Volume Ports: 12 hours Other Ports: 24 hours
W2	Protective Boom: 25,000*ft EDRC:; 12,500 bbls TSC: 25,500 bbls	High Volume Ports: 30 hours Other Ports: 36 hours	High Volume Ports: 36 hours Other Ports: 48 hours
W3	Protective Boom: 25,000*ft EDRC:; 50,500 bbls TSC: 100,500 bbls	High Volume Ports: 54 hours Other Ports: 60 hours	High Volume Ports: 60 hours Other Ports: 72 hours
Great Lakes			
MM	Protective Boom: 8,000*ft EDRC:; 1,200 bbls TSC: 2,400 bbls	High Volume Ports: 6 hours Other Location: 24 hours	High Volume Ports: 12 hours Other Ports: 24 hours
W1	Protective Boom: 30,000*ft EDRC:; 12,500 bbls TSC: 25,500 bbls	High Volume Ports: 12 hours Other Ports: 24 hours	High Volume Ports: 12 hours Other Ports: 24 hours
W2	Protective Boom: 30,000*ft EDRC:; 25,500 bbls TSC: 50,500 bbls	High Volume Ports: 30 hours Other Ports: 36 hours	High Volume Ports: 36 hours Other Ports: 48 hours
W3	Protective Boom: 30,000*ft EDRC:; 50,000 bbls TSC: 100,000 bbls	(for open ocean, plus travel time from shore) High Volume Ports: 54 hours Other Location: 60 hours	(for open ocean, plus travel time from shore) High Volume Ports: 60 hours Other Location: 72 hours

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MINIMUM EQUIPMENT REQUIREMENTS FOR OSRO CLASSIFICATION			
Classification	**Resource Quantity Guidelines**	**Maximum Facility Response Times**	**Maximum Vessel Response Times**
Offshore			
MM	Protective Boom:6,000*ft EDRC:; 1,200 bbls TSC: 2,400 bbls	High Volume Ports:6 hours Other Ports: 12 hours	High Volume Ports: 12 hours Other Ports: 24 hours
W1	Protective Boom: 15,000*ft EDRC: 12,500 bbls TSC: 25,500 bbls	High Volume Ports:24hours Other Ports: 48hours	High Volume Ports: 24 hours Other Ports: 48 hours
W2	Protective Boom: 15,000*ft EDRC: 25,000 bbls TSC: 50,000 bbls	High Volume Ports:30hours Other Ports: 36hours	High Volume Ports: 36hours Other Ports: 48hours
W3	Protective Boom: 15,000*ft EDRC: 50,000 bbls TSC: 100,000 bbls	High Volume Ports:54hours Other Ports: 60hours	High Volume Ports: 60hours Other Ports: 72hours
Open Ocean			
MM	Protective Boom: 0*ft EDRC: 1,200 bbls TSC: 2,400 bbls	High Volume Ports:6hours Other Ports: 12hours	High Volume Ports: 12hours Other Ports: 24hours
W1	Protective Boom: 0*ft EDRC: 12,500 bbls TSC: 25,000 bbls	High Volume Ports:6hours Other Ports: 12hours	High Volume Ports: 12hours Other Ports: 24hours
W2	Protective Boom: 0*ft EDRC: 25,000 bbls TSC: 50,000 bbls	High Volume Ports:30hours Other Ports: 36hours	High Volume Ports: 36hours Other Ports: 48hours
W3	Protective Boom: 0*ft EDRC: 50,000 bbls TSC: 100,000 bbls	High Volume Ports:54hours Other Ports: 60hours	High Volume Ports: 60hours Other Ports: 72hours

1. Rivers/canals include bodies of water, including the Intracoastal Waterway and other bodies artificially created for navigation, confined within an inland area and having a project depth of 12 feet (3.66 meters).
2. EDRC stands for "effective daily recovery capacity," or the calculated recovery capacity of oil recovery devices determined by using a formula that takes into account limiting factors such as daylight, weather, sea state, and emulsified oil in the recovered material.
3. TSC stands for "temporary storage capacity," meaning sufficient storage capacity equal to twice the EDRC of an OSRO. Temporary storage may include inflatable bladders, rubber barges, certified barge capacity, or other temporary storage that can be utilized on scene at a spill response and which is designed and intended for the storage of flammable or combustible liquids. It does not include vessels or barges of opportunity for which no pre-arrangements have been made. Fixed shore-based storage capacity, ensured available by contract or other means, will be acceptable.

* In addition, 1,000 feet of containment boom plus 300 feet per skimming system.

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FIGURE A.4
AGREEMENTS/CONTRACTS

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NRC Packet

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Decision Summary (DS-244)

TransCanada
In business to deliver

To:	Richard Prior	**Date:**	October 14, 2008
From:	John Hayes	**Location:**	Calgary, Alberta
Subject:	NRC OSRO Resource Retainer		

Decision Proposed ($125,000 per Annum(U.S. Currency) for 3 years)

Your approval is requested for funds related to emergency response planning and preparedness. As a matter of risk mitigation and regulatory compliance, it is proposed to enter into a contractual retainer to address a number of emergency response functions during operations. This amount falls within the existing capital expenditures for emergency response for 2009.

Background

National Response Corporation (NRC) will provide Keystone with Oil Spill Response Organization (OSRO) resources. Specifically, NRC will be the overall coordinating company that has the ability to safely respond to spill related incidents along the pipeline. NRC ensures spill readiness which included supplier subcontracts, training, workshops and overall spill site coordination. NRC has the proven ability to handle spills of all sizes and is approved by the United States Coastguard.

NRC has its own equipment, spill managers and a network of related industries to ensure Keystone is prepared to respond efficiently and effectively. The retention of a contractor is mandatory for Keystone to meet regulatory requirements. Having a retainer guarantees Keystone the resources when most needed.

The contract should start on January 1, 2009 and will form part of the existing Emergency Response Plan for 2009. This type of contract was not contemplated in the original Emergency Response budget of 3MM, but is part of the overall plan. The first year will be absorbed by the existing budget and for future years, these costs should be part of a field operations budget.

Requested by:

John Hayes – Operations Manager Keystone Pipeline	14 October 2008 Date

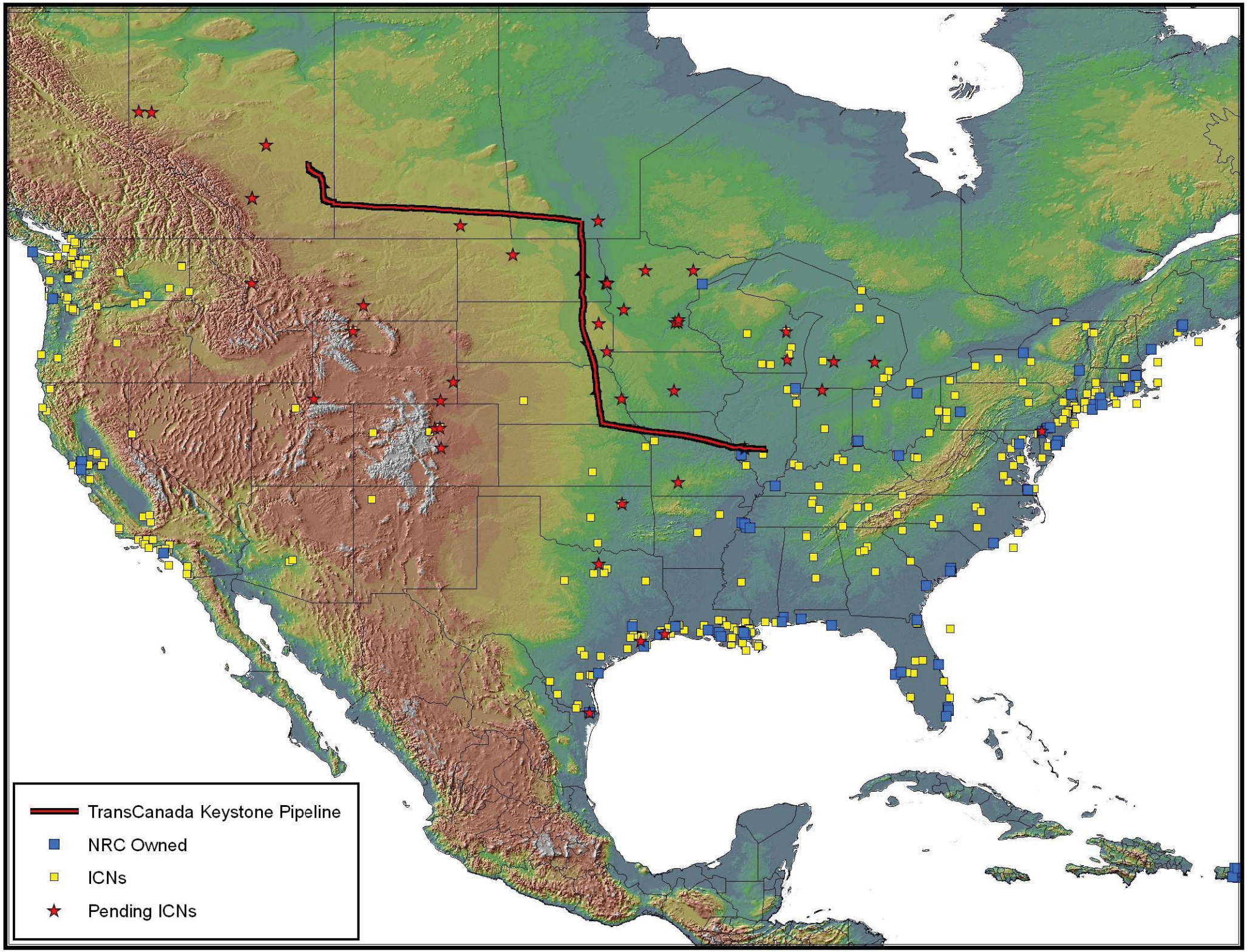
Approved by:

Rob Sillner Integration Manager, Keystone Pipeline	14 October 2008 Date

National Response Corporation, Inc.

National Response Corporation, Inc. is an Oil Spill Response Organization contracted to conduct oil recovery for TransCanada Keystone Limited Partnership and TC Oil Pipeline Operations, Inc. National Response Corporation uses a network of associated cleanup contractors throughout North America and the world. National Response Corporation has been certified by the United States Coast Guard, as described in the Emergency Response Manual, to respond to releases along the length of the Pipeline.

For further information about National Response Corporation and a list of response equipment you can visit their website at http://www.nrcc.com.


TransCanada Keystone Pipeline
NRC Owned
ICNs
Pending ICNs

APPENDIX B

DISPOSAL PLAN

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B.1 OVERVIEW

A major oil spill response would generate significant quantities of waste materials ranging from oily debris and sorbent materials to sanitation water and used batteries. All these wastes need to be classified and segregated (i.e., oily, liquid, etc.), transported from the site, and treated and/or disposed at approved disposal sites. Each of these activities demands that certain health and safety precautions be taken, which are strictly controlled by Federal and State Laws and Regulations. This Section provides an overview of the applicable State Regulations governing waste disposal, and a discussion of various waste classification, handling, transfer, storage, and disposal techniques. It is the responsibility of the Environmental Unit to manage waste disposal needs during an oil spill cleanup.

B.2 WASTE CLASSIFICATION

Oily-Liquid Wastes

Oily liquid wastes (i.e., oily water and emulsions) that would be handled, stored, and disposed during response operations are very similar to those handled during routine storage and transfer operations. The largest volume of oily liquid wastes would be produced by recovery operations (e.g., through the use of vacuum devices or skimmers). In addition, oily water and emulsions would be generated by vehicle operations (e.g., spent motor oils, lubricants, etc.), and equipment cleaning operations.

Non-Oily -Liquid Wastes

Response operations would also produce considerable quantities of non-oily liquid wastes. Water and other non-oily liquid wastes would be generated by the storage area and stormwater collection systems, equipment cleaning (i.e., water contaminated with cleaning agents), and office and field operations (i.e., sewage, construction activities).

Solid Wastes

A solid waste is defined as any discarded material provided that it is not specifically excluded under the regulations. These exclusions cover materials such as domestic sewage and mixtures of sewage discharged through a sewer system or industrial wastewater point source discharges.

A discarded material is any material which is abandoned (disposed, burned or incinerated) or accumulated, stored or treated prior to being abandoned. A discarded material is also any material recycled or any material considered inherently wastelike. Recycled material is considered solid waste when used in a manner constituting disposal, placed on land or burned for energy recovery.

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A solid waste may be considered a hazardous waste. A solid waste, as defined above, may be a hazardous waste if it is not excluded from regulation and is either a listed hazardous waste or exhibits the characteristics of a hazardous waste. A solid waste exhibits the characteristics of a hazardous waste if it exceeds the thresholds established in determining the following:

1. Ignitability
2. Corrosivity
3. Reactivity
4. Toxicity

A solid waste may also become a hazardous waste if it is mixed with a listed hazardous waste or, in the case of any other waste (including mixtures), when the waste exhibits any of the characteristics identified above.

Oily -Solid / Semi-Solid Wastes

Oily solid/semi-solid wastes that would be generated by containment and recovery operations include damaged or worn-out booms, disposable/soiled equipment, used sorbent materials, saturated soils, contaminated beach sediments, driftwood, and other debris.

Non-Oily -Solid / Semi-Solid Wastes

Non-oily solid/semi-solid wastes would be generated by emergency construction operations (e.g., scrap, wood, pipe, and wiring) and office and field operations (i.e., refuse). Vessel, vehicle, and aircraft operations also produce solid wastes.

B.3 WASTE HANDLING

A primary concern in the handling of recovered oil and oily debris is contaminating unaffected areas or recontaminating already cleaned areas. Oily wastes generated during the response operations would need to be separated by type and transferred to temporary storage areas and/or transported to incineration or disposal sites. Proper handling of oil and oily wastes is imperative to ensure personnel health and safety.

Safety Considerations

Care shall be taken to avoid or minimize direct contact with oily wastes. All personnel handling or coming into contact with oily wastes shall wear protective clothing. A barrier cream can be applied prior to putting on gloves to further reduce the possibility of oily waste absorption. Safety goggles shall be worn by personnel involved in waste handling activities where splashing might occur. Any portion of the skin exposed to oily waste should be washed with soap and water as soon as possible. Decontamination zones should be set up during response operations to ensure personnel are treated for oil exposure.

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Wastes Transfer

During response operations, it may be necessary to transfer recovered oil and oily debris from one point to another several times before the oil and oily debris are ultimately recycled, incinerated or disposed at an appropriate disposal site. Depending on the location of response operations, any or all of the following transfer operations may occur:

- From portable or vessel-mounted skimmers into flexible bladder tanks, storage tanks of the skimming vessel itself, or a barge.
- Directly into the storage tank of a vacuum device.
- From a skimming vessel or flexible bladder to a barge.
- From a vacuum device storage tank to a barge.
- From a barge to a tank truck.
- From a tank truck to a processing system (e.g., oil/water separator).
- From a processing system to a recovery system and/or incinerator.
- Directly into impermeable bags that, in turn, are placed in impermeable containers.
- From containers to trucks.

There are four general classes of transfer systems that may be employed to affect oily waste transfer operations:

- **Pumps:** Rotary pumps, such as centrifugal pumps, may be used when transferring large volumes of oil, but they may not be appropriate for pumping mixtures of oil and water. The extreme shearing action of centrifugal pumps tends to emulsify oil and water, thereby increasing the viscosity of the mixture and causing low, inefficient transfer rates. The resultant emulsion would also be more difficult to separate into oil and water fractions. Lobe or "positive displacement" pumps work well on heavy, viscous oils, and do not emulsify the oil/water mixture. Double-acting piston and double acting diaphragm pumps are reciprocating pumps that may also be used to pump oily wastes.
- **Vacuum Systems:** A vacuum truck may be used to transfer viscous oils but they usually pick up a very high water/oil ratio.
- **Belt/Screw Conveyors:** Conveyors may be used to transfer oily wastes containing a large amount of debris. These systems can transfer weathered debris laden oil either horizontally or vertically for short distances (i.e., 10 feet) but are bulky and difficult to set up and operate.
- **Wheeled Vehicles:** Wheeled vehicles may be used to transfer liquid wastes or oily debris to storage or disposal sites. These vehicles have a limited transfer volume (i.e., 100 barrels) and require good site access.

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B.4 WASTE STORAGE

Interim storage of recovered oil, oily and non-oily waste would be considered to be an available means of holding the wastes until a final management method is selected. In addition, the segregation of wastes according to type would facilitate the appropriate method of disposal. The storage method used would depend upon:

- The type and volume of material to be stored.
- The duration of storage.
- Access.

During an oil spill incident, the volume of oil that can be recovered and dealt with effectively depends upon the available storage capacity. Typical short-term storage options are summarized in Figure B.1. The majority of these options can be used either onshore or offshore.

If storage containers such as bags or drums are used, the container must be clearly marked with the proper Canadian Transport Dangerous Goods/United States Department of Transportation marking to indicate the type of material/waste contained and/or the ultimate disposal option.

Fuel barges may be the best option for temporary storage of oil recovered in open waters and frac tanks for inland spills. Depending on size, these vessels may be able to hold up to 6,000 barrels of oil and water and frac tanks may hold up to 500-550 barrels. The barge deck can be used as a platform for operating oil spill clean-up equipment and storing containment boom.

Steel or rubber tanks can be used to store oil recovered near the shoreline. To facilitate offloading, demulsifiers may be used to break emulsions prior to placing the recovered substance into the barges or storage tanks.

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Use of any site for storage is dependent on the approval of the local authorities. The following elements affect the choice of a potential storage site:

- Geology
- Ground water
- Soil
- Flooding
- Surface water
- Slope
- Covered material
- Capacity
- Climatic factors
- Land use
- Toxic air emissions
- Security
- Access
- Public contact

B.5 WASTE DISPOSAL

Techniques for Disposal of Recovered Oil

Recovery, reuse, and recycling are the best choices for remediation of a spill, thereby reducing the amount of oily debris to be bermed onsite or disposed of at a solid waste landfill. Treatment is the next best alternative, but incineration and burning for energy recovery have more options within the state. There are some limitations and considerations in incinerating for disposal. Environmental quality of incineration varies with the type and age of the facility. Therefore, when incineration becomes an option during an event, local air quality authorities would be contacted for advice about efficiency and emissions of facilities within their authority. Approval of the local air authorities is a requirement for any incineration option. Landfilling is the last option. Final disposal at a solid or dangerous waste landfill is the least environmentally sound method of dealing with a waste problem such as oily debris.

Note: Prior to the disposal of ANY waste products, the Incident Commander or his designee must contact the Keystone / TransCanada Community, Safety and Environmental Department to receive direction and guidance on the proper disposal methods and procedures.

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During an oil spill incident, the Company would consult with the proper regulating agency to identify the acceptable disposal methods and sites appropriately authorized to receive such wastes. The Company maintains a list of approved disposal sites that satisfy local, Province/State, and Federal

Regulations and Company requirements: This identification of suitable waste treatment and disposal sites would be prepared by the Environmental Unit in the form of an Incident Disposal Plan which must be authorized by the U.S. Coast Guard and/or the Environmental Protection Agency or National Energy Board.

An Incident Disposal Plan would include predesignated interim storage sites, segregation strategies, methods of treatment and disposal for various types of debris, and the locations/contacts of all treatment and disposal site selections. Onsite treatment/disposal is preferred.

In order to obtain the best overall Incident Disposal Plan, a combination of methods should be used. There is no template or combination of methods that can be used in every spill situation. Each incident should be reviewed carefully to ensure that an appropriate combination of disposal methods is employed.

The different types of wastes generated during response operations would require different disposal methods. To facilitate the disposal of wastes, they should be separated by type for temporary storage, transport and disposal. Figure B.2 lists some of the options that would be available to segregate oily wastes. The figure also depicts methods that may be employed to separate free and/or emulsified water from the oily liquid waste.

The following is a brief discussion of some disposal techniques available for recovered oil and oily debris.

Recycling

This technique entails removing water from the oil and blending the oil with uncontaminated oil. Recovered oil can be shipped to refineries provided that it is exempt from hazardous waste regulations. There it can be treated to remove water and debris, and then blended and sold as a commercial product.

The Company's designated Disposal Specialist is responsible for ensuring that all waste materials be disposed at an internally approved disposal site.

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Incineration

This technique entails the complete destruction of the recovered oil by high temperature thermal oxidation reactions. There are licensed incineration facilities as well as portable incinerators that may be brought to a spill site. Incineration may require the approval of the local Air Pollution Control Authority. Factors to consider when selecting an appropriate site for onsite incineration would include:

- Proximity to recovery locations.
- Access to recovery locations.
- Adequate fire control.
- Approval of the local air pollution control authorities.

In Situ Burning / Open Burning

Burning techniques entail igniting oil or oiled debris and allowing it to burn under ambient conditions. These disposal techniques are subject to restrictions and permit requirements established by federal, province/state and local laws. They would not be used to burn Polychlorinated biphenyls, waste oil containing more than 1,000 parts per million of halogenated solvents, or other substances regulated by the Environmental Protection Agency or Environment Canada. Permission for in situ burning may be difficult to obtain when the burn takes place near populated areas.

As a general rule, in situ burning would be appropriate only when atmospheric conditions will allow the smoke to rise several hundred feet and rapidly dissipate. Smoke from burning oil will normally rise until its temperature drops to equal the ambient temperature. Afterwards, it will travel in a horizontal direction under the influence of prevailing winds.

Landfill Disposal

This technique entails burying the recovered oil in an approved landfill in accordance with regulatory procedures. Landfill disposal of free liquids is prohibited by Federal Law in the United States.

With local health department approval, non-burnable debris which consists of oiled plastics, gravel and oiled seaweed, kelp, and other organic material may be transported to a licensed, lined, approved municipal or private landfill and disposed of in accordance with the landfill guidelines and regulations. Landfill designation would be planned only for those wastes that have been found to be unacceptable by each of the other disposal options (e.g., waste reduction, recycling, energy recovery). Wastes would be disposed only at Company-approved disposal facilities. The Disposal Specialist is responsible for ensuring that all waste materials are disposed at a Company internally approved disposal site. Disposal at a non-approved facility would require approval by the Disposal Specialist prior to sending any waste to such a facility.

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FIGURE B.1
TEMPORARY STORAGE METHODS

CONTAINER	ONSHORE	OFFSHORE	SOLIDS	LIQUIDS	NOTES
Barrels	x	x	x	x	May require handling devices. Covered and clearly marked.
Tank Trucks	x	x		x	Consider road access. Barge-mounted offshore.
Dump/Flat Bed Trucks-Roll-offs	x		x		May require impermeable liner and cover. Consider flammability of vapors at mufflers.
Barges		x	x	x	Liquids only in tanks. Consider venting of tanks.
Oil Storage Tanks	x	x		x	Consider problems of large volumes of water in oil.
Bladders	x	x		x	May require special hoses or pumps for oil transfer.
Frac Tanks	x			x	Consider road access.

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FIGURE B.2
OILY WASTE SEPARATION AND DISPOSAL METHODS

TYPE OF MATERIAL	SEPARATION METHODS	DISPOSAL METHODS
LIQUIDS		
Non-emulsified oils	Gravity separation of free water	Incineration Use of recovered oil as refinery/production facility feedstock
Emulsified oils	Emulsion broken to release water by: • heat treatment • emulsion breaking chemicals • mixing with sand • centrifuge • filter/belt press	Use of recovered oil as refinery/production facility feedstock
SOLIDS		
Oil mixed with sand and soil	Collection of liquid oil leaching from sand during temporary storage Extraction of oil from sand by washing with water or solvent Removal of solid oils by sieving	Incineration Use of recovered oil as refinery/production facility feedstock Direct disposal Stabilization with inorganic material Degradation through land farming or composting
Oil mixed with cobbles or pebbles	Screening Collection of liquid oil leaching from materials during temporary storage Extraction of oil from materials by washing with water or solvent	Incineration Direct Disposal Use of recovered oil as refinery/production facility feedstock
Oil mixed with wood and sorbents	Screening Collection of liquid oil leaching from debris during temporary storage Flushing of oil from debris with water	Incineration Direct disposal Degradation through land farming or composting for oil mixed with seaweed or natural sorbents

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APPENDIX C

BASICS OF OIL SPILL RESPONSE

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C.1 DIKES, BERMS AND DAMS

Dikes, berms, and dams are land-based tactics, with the objective of containing spilled oil and limiting spreading of oil slicks, thus minimizing impacts to the environment. Dikes, berms and dams are embankment structures built-up from the existing terrain, placed to contain and accumulate oil for recovery. These barriers can serve to:

- Contain and stabilize a contaminated area.
- Contain or divert oil on water or oil that has potential to migrate.
- Create cells for recovery.
- Use natural depressions to act as containment areas for recovery.

The tactic may be deployed in association with a recovery tactic, such as Shoreline Recovery or On-land Recovery. Dikes, berms, and dams are most effective when placed before oil arrives. Dikes, berms, and dams can also be used to exclude oil from a sensitive area, which is covered in the Beach Berms and Exclusion Dams tactic. The tactic can also be used in conjunction with an excavation tactic to enhance containment volumes (see Pits, Trenches, and Slots). The general strategy is to:

1. Identify the location and trajectory of the spill or potential spill.
2. Plan a deployment configuration that best supports the operating environment and available resources.
3. Mobilize to the location and deploy response resources.
4. Construct the containment structure and ensure it does not leak.
5. Consider the need to remove any water-bottom that may collect beneath the oil inside the structure.
6. Monitor the containment structure on an appropriate basis.
7. If oil collects in the structure, utilize an appropriate recovery system for removal.

Tactic Description

This tactic involves building an embankment perpendicular to the flow of the oil slick or around a contaminated area. Dike, berm, and dam structures can be constructed with a wide variety of materials including: soil, gravel, snow, sand bags, oil boom, timbers and logs. Selection of the construction material depends on the operating environment, location, available materials, and whether the structure is to be temporary or permanent. The containment area should be lined with an impermeable membrane, such as plastic sheeting, to keep oil and oily water from leaking or migrating into the soil. The structure may include a method to regulate flow, such as a weir or spill way. Dikes, berms, and dams can be built by manual labor or with earth-moving equipment depending on the location and available resources.

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Deployment Configurations

BERMS

A containment berm can be constructed of available materials such as earth, gravel, or snow. Use earth-moving equipment or manual labor to construct the berm. Form the materials into a horseshoe shape ahead of the flow of oil. Use plastic sheeting to line the walls of a soil berm to prevent oil penetration. Sandbags filled with sand or other heavy material also make excellent containment barriers.

DAMS

An underflow dam can be used when there is too much water flow to allow for a complete blockage of a drainage channel. The dam is built of earth, gravel, or other barriers such as sandbags or plywood sheets. Wherever possible, line the upstream side of the dam with plastic sheeting to prevent erosion and penetration of oil into the dam material. Underflow dams use inclined culverts or pipes to move water downstream while leaving the spill contained behind the dam. The capacity of the pipe(s) should exceed the stream flow rate. It may be necessary to use pumps to remove water behind a dike. Valves or culvert plugs can also be used to control flow rate. Pipes must be placed on the upstream side of the dam, with the elevated end on the downstream side. Make sure that the upstream end of the pipe is submerged and below the oil/water interface. The height of the elevated downstream end of the pipe will determine the water level behind the dam.

EXISTING ROADS

Roadways that are built up above the terrain can be used as dikes. However, road construction usually allows for natural drainage through culverts or bridges. These drainage structures must be controlled to turn the road into a barrier.

CULVERT BLOCKING

A culvert can be blocked using sheet metal, plywood barriers, or inflatable culvert plugs. Use a full block only when the culvert will be blocked for the entire cleanup operation, if the oil floating on the water will not contaminate additional soil or tundra, and if blocking the water flow will not threaten the road. Otherwise, an adjustable weir or culvert plug should be used. Plywood and/or sandbags can also be used as culvert blocks, but are more labor-intensive and pose a higher potential for injury. A wood block may require a headwall with kickers oriented to support the boards or plywood. Place the blocking materials over the upstream end of the culvert. Plastic sheeting over the outside of the block will prevent oil penetration.

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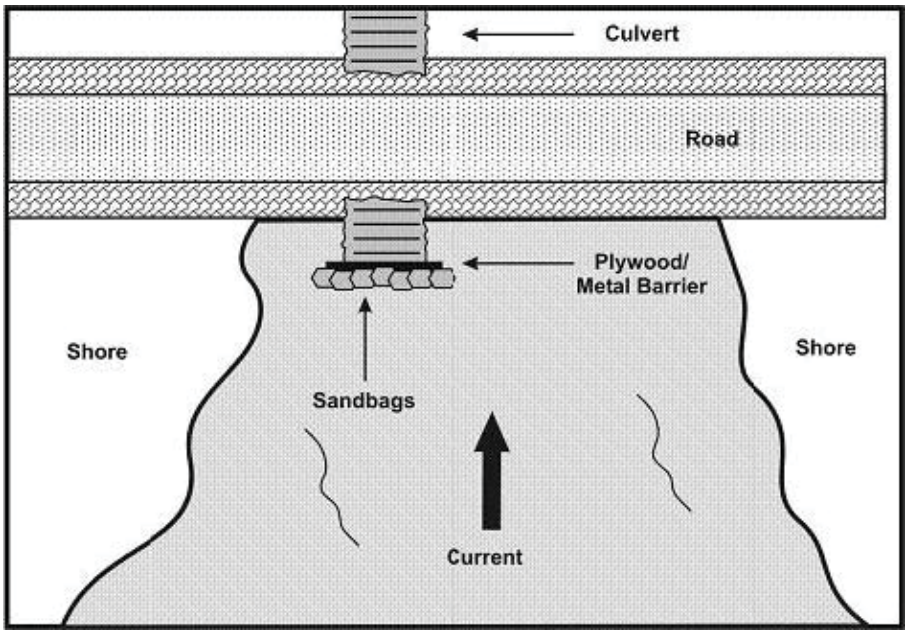
FIGURE C.1
Culvert Blocking



EARTH MOVING EQUIPMENT

A bulldozer, road grader, or front-end loader drives around the spill with its blade angled towards the spill, pushing earth or snow into a berm. Once the perimeter has been covered with an initial berm, shore-up areas as necessary.

SNOW

Because of the absorbent quality of snow, it makes an excellent berm for both containment and recovery. A snow berm can be strengthened by spraying it with a fine water mist that forms an ice layer on top of the snow. A snow berm is built around the areas of heaviest oiling to contain oil or diesel spilled to tundra and/or ice in winter.

MESH FENCE

Plastic mesh fencing may be used to quickly construct an underflow dam system. The mesh fencing is placed across the drainage and held in place with stakes. Absorbent boom, oil boom, plywood, or even dry dead grass can be placed on the upstream side of the fencing. Running water will find its way under the barrier fence, but oil floating on top of the water will be trapped. The advantages of this system are that it is lightweight and mobile.

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C.2 DEFLECTION BOOM

Objective & Strategy

The objective is to direct spilled oil away from a location to be protected or simply to change the course of the slick. “Deflection” is used to describe the tactic where oil is redirected away from an area but not recovered.

Tactic Description

The boom is placed at an optimum angle to the oil trajectory, using the movement of the current to carry oil along the boom and then releasing it into the current again with a new trajectory. The angle is chosen to prevent oil from entraining beneath the boom skirt. Boom may be held in place by anchors, vessels, or a boom control device.

Deflection Boom may be used to temporarily avoid impacts to a sensitive area, but there is no recovery associated with the tactic, thus no oil is removed from the environment.

The general strategy is to:

1. Identify the location and trajectory of the spill or potential spill.
2. Identify, prioritize, and select sensitive areas to be protected from impact.
3. Select a deployment configuration that best supports the operating environment and available resources.
4. Mobilize to the location and deploy the tactic.
5. Place boom using secured anchor systems, mooring points, vessels, boom control devices, etc.
6. Monitor and adjust the boom on an appropriate basis.

BOOM ANGLE

Select the appropriate boom angle to keep oil from entraining under the boom. Where currents exceed 3 knots the boom must be almost parallel to the current to prevent entrainment. In currents exceeding 3 knots, a cascade of boom arrays may be used; the first boom array will slow the velocity of the slick allowing subsequent arrays to deflect the oil.

ANCHOR SYSTEMS

Boom is secured in place using standard anchoring systems. Anchor sizes vary depending on the boom type and the operating equipment.

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DEPLOYMENT CONFIGURATIONS

Single Boom

Boom is deployed from a site at an optimum angle to the current and anchored to deflect the oil away from a location. Figures C.2 and C.3 illustrate two single boom deflection techniques.

FIGURE C.2
Deflective Booming Technique (Single Boom Method)

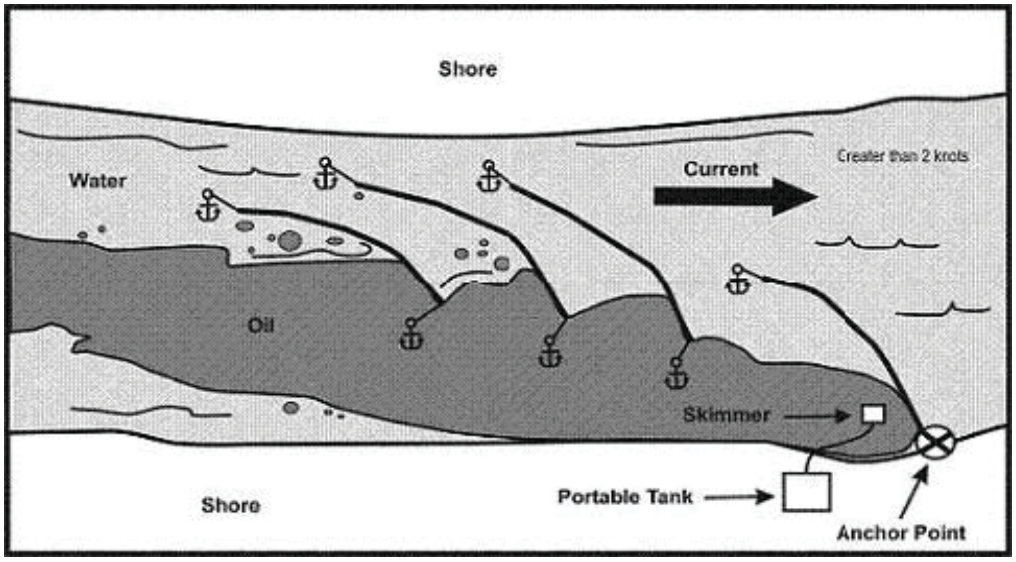

FIGURE C.3
Deflective Booming Technique (Single Boom Method)

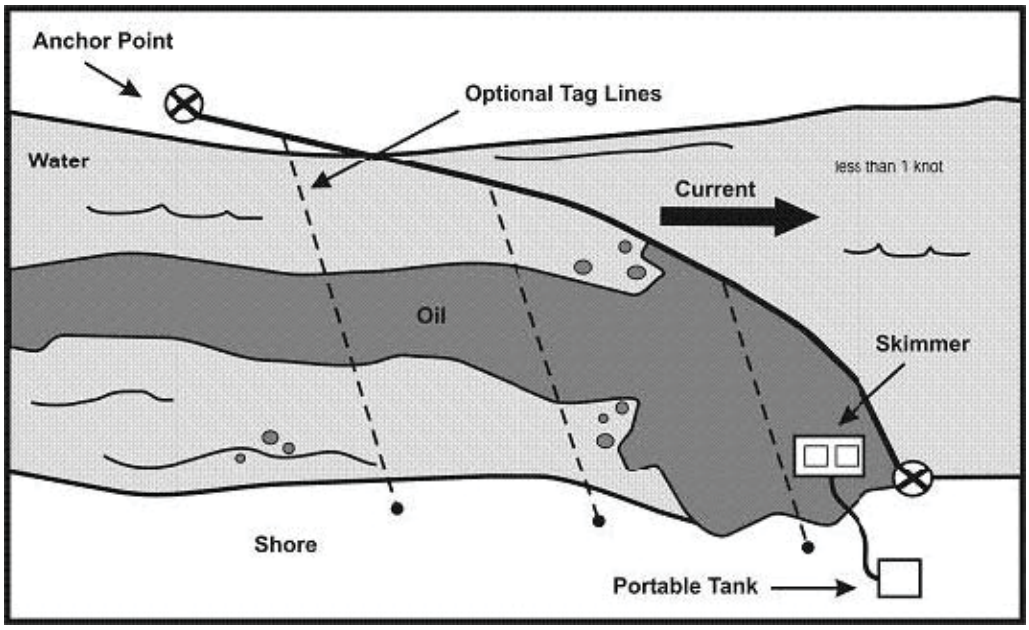

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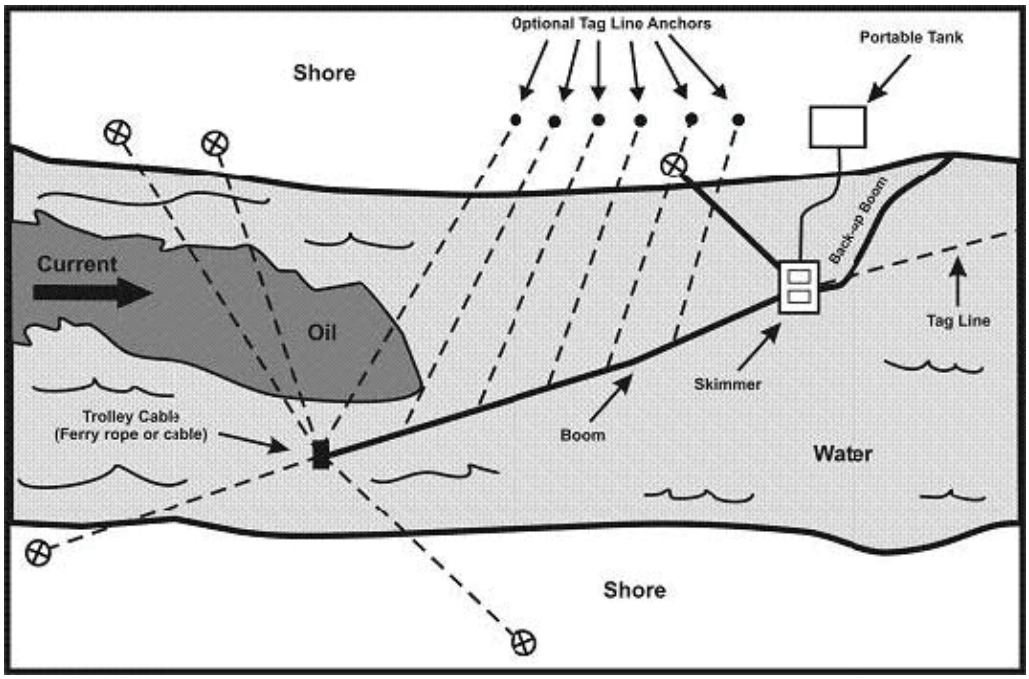
FIGURE C.4
Deflective Booming Technique (Cascade Method)



Cascade

Several booms are deployed in a cascade configuration when a single boom cannot be used because of fast current or because it is necessary to leave openings in the boom for vessel traffic, etc. This configuration can be used in strong currents where it may be impossible to effectively deploy one continuous section of boom. Shorter sections of boom used in a cascade deployment are easier to handle in faster water, thereby increasing efficiency. Additional equipment may be required to set and maintain this system as compared to the single boom configuration.

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C.3 CONTAINMENT BOOM

Objective & Strategy

Containment booming is a fixed-boom tactic. The objective is to corral spilled oil on the water, usually near the source, thus minimizing spreading and impacts to the environment. It is usually deployed with Shoreline Recovery.

This tactic can be deployed for oil spill migrating downstream or downhill to water or through water.

The general strategy is to:

1. Identify the location and trajectory of the spill or potential spill.
2. Select a deployment configuration that best supports the operating environment and available resources.
3. Mobilize to the location and deploy the tactic.
4. Place boom, using secure anchor system or mooring points.
5. Monitor the boom on an appropriate basis.
6. If oil collects in the boom, utilize an appropriate recovery tactic to remove it.

Tactic Description

Containment boom systems are comprised of the appropriate oil boom for containment and concentration, and anchoring systems to hold the boom in place.

Containment boom systems are not recommended for the fast water environment because of the high probability of fixed-boom failure and the difficulty of anchoring in this environment.

Containment boom systems are not recommended for the broken ice environment, because of the high probability of fixed-boom failure and loss due to ice encounters.

Anchoring systems are often deployed first and then the boom is set from one anchor to the adjacent anchor. Boom can be placed from shoreline to shoreline.

A second layer of containment boom, outside the primary boom, has two advantages:

1. It breaks the sea chop and reduces its impact on the primary boom,
2. It may capture oil that has escaped if the primary boom fails.

Figure C.5 illustrates a simple containment booming technique.

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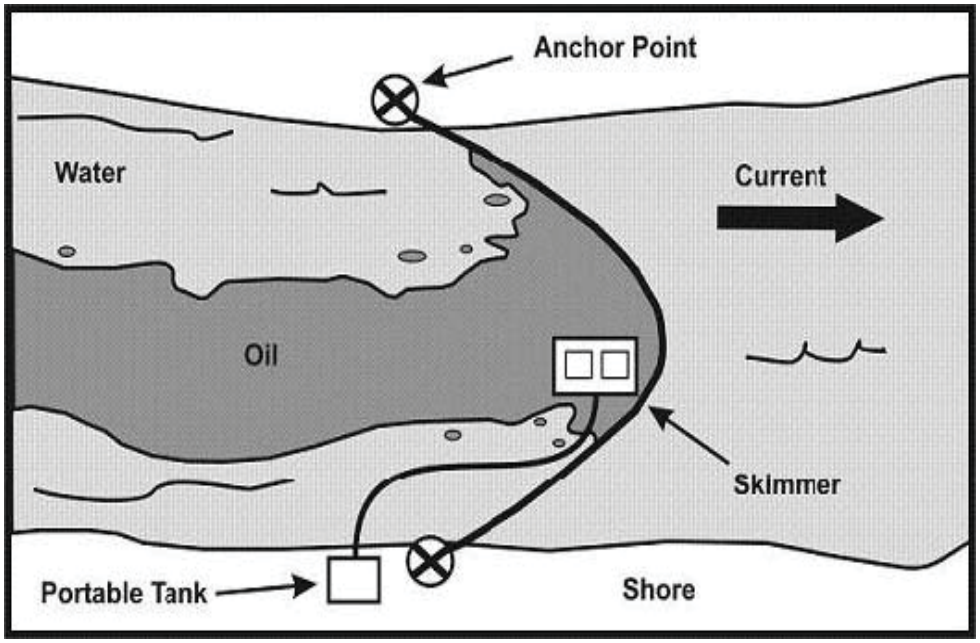
Deployment Considerations

- It is often advisable to "line" the containment boom with sorbent materials (passive recovery) to recover the sheen and reduce decontamination costs.
- If the oil slick is moving, due to wind or current, consider containment at the source and ahead of the leading edge.
- If spill is moving in excess of 1 knot consider the Diversion Boom Tactic.
- Anchor systems must be selected based on the maximum stress that might be expected to occur on the boom array, considering stronger currents and winds than when the anchor is set.
- Site conditions will influence deployment configuration options.
- Combinations of Containment Boom and Diversion Boom tactics are often used together to optimize success.

FIGURE C.5
Containment Booming Technique (Catenary Method)



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C.4 DIVERSION BOOM

Objective & Strategy

The objective is to redirect the spilled oil from one location or direction of travel to a specific site for recovery. For the purposes of maintaining consistent and clear terms, diversion is always associated with oil recovery, in contrast with the term deflection, which is used to describe the tactic where oil is redirected away from an area but not recovered.

Tactic Description

The Diversion Boom tactic is for water-born spills where there is some current, usually from 0.5 to 3.0 knots. The boom is placed at an optimum angle to the oil trajectory, using the movement of the current to carry oil along the boom to a recovery location. The angle is chosen to prevent oil from entraining beneath the boom skirt. Oil can be diverted to a shoreline or away from a shoreline or shoal waters. This tactic is always associated with a Shoreline Recovery. Figures C.6 and C.7 illustrate two diversionary booming techniques. These techniques are the Open Chevron and the Closed Chevron technique respectively.

FIGURE C.6
Open Chevron Booming Technique

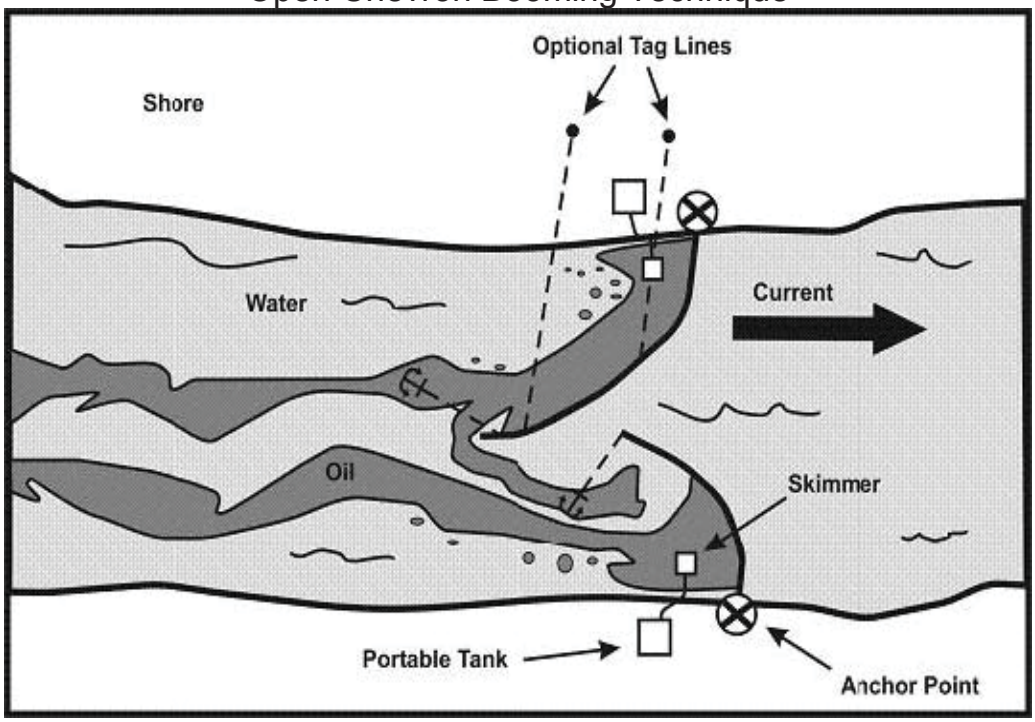

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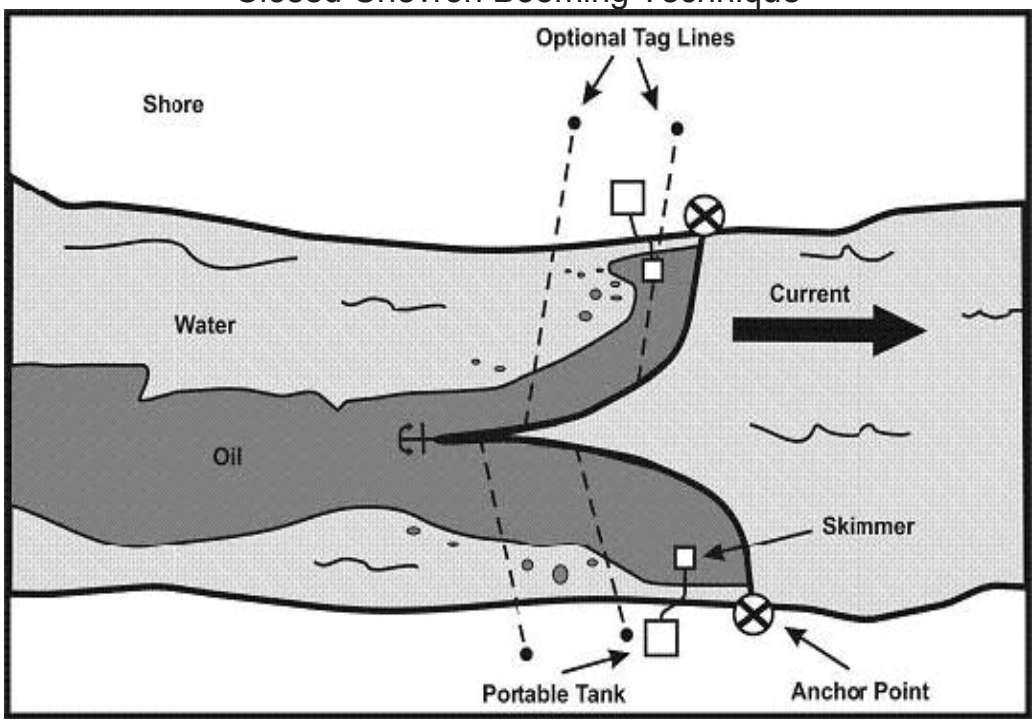
FIGURE C.7
Closed Chevron Booming Technique



ANCHOR SYSTEMS

Boom is secured in place using standard anchoring systems. Anchor sizes vary depending on the boom type and the operating environment.

Boom Angle

Select the appropriate boom angle to keep oil from entraining under the boom. Note that the angle relative to the current decreases rapidly as the current increases. Where currents exceed 3 knots the boom must be almost parallel to the current to prevent entrainment. In currents exceeding 3 knots, a cascade of boom arrays may be used; the first boom array will slow the velocity of the slick allowing subsequent arrays to deflect the oil.

Single Boom

A basic diversion technique is to divert oil from a current to a recovery site along a shoreline. The recovery site is chosen where there is minimal current and a suitable recovery system can be deployed. The boom is then anchored at the site and deployed at an optimum angle to the current and secured/anchored to divert the oil to the shoreline for recovery.

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C.5 SHORELINE RECOVERY

Objective & Strategy

The objective is to remove spilled oil that has been diverted to a designated recovery site accessible from the shore.

Shoreline Recovery is usually deployed as part of another tactic, such as Diversion Boom strategy. When deployed in conjunction with another tactic, fewer personnel may be required.

The general strategy is to:

1. Identify the primary recovery site.
2. Assess site conditions and access routes.
3. Determine the appropriate recovery and storage systems based on oil type, access, and deployment restrictions.
4. Mobilize and deploy equipment to recover and temporarily store the oil from the recovery site.
5. Take precautions to minimize contamination of the shoreline at the collection site.
6. Man and monitor the system as appropriate.
7. Store and transfer recovered oil and oily water according to an approved waste management plan.

Tactic Description

Shoreline recovery systems can be deployed from land access routes (beaches, all-terrain vehicles), or water access. Access to the recovery site and the oil type will influence/dictate the options of equipment to be used.

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SKIMMING SYSTEMS

Shoreline recovery requires at least one portable skimming system to remove spilled oil. The typical portable skimming system includes:

- Skimmer with pump and power pack
- Hose (suction and discharge with fittings)
- Oil transfer and decanting pump(s)
- Repair kit (tools and extra parts)

There are many models of skimmers to choose from, but they all fall into three types:

- **Weir skimmers** draw liquid from the surface by creating a sump in the water into which oil and water pour. The captured liquid is pumped from the sump to storage. Weir skimmers can recover oil at high rates, but they can also recover more water than oil, especially when the oil is in thin layers on the surface of the water. This creates the need to separate the water from the oil and decant it back into the environment. Otherwise, the recovered water takes available storage volume. Weir skimmers are best employed where oil has been concentrated into thick pools or where there are very large volumes of oil and recovered liquid storage capacity.

- **Oleophilic skimmers** pick up oil that adheres to a collection surface, leaving most of the water behind. The oil is then scraped from the collection surface and pumped to a storage device. Oleophilic skimmers do not recover oil as fast as weir skimmers, but they have the advantage of recovering very little water. Oleophilic skimmers may be used where oil is very thin on the surface. Oleophilic skimmers are a good choice where liquid storage capacity is limited.

- **Suction skimmers** use a vacuum to lift oil from the surface of the water. These skimmers require a vacuum pump or air conveyor system. Like weir skimmers, suction skimmers may also collect large amounts of water if not properly operated. Most suction skimmers are truck mounted and work best at sites with road access.

Primary Oil Storage Devices

Primary oil storage devices for shoreline recovery can be portable tanks, bladders, or truck-mounted tanks on the shoreline. If access is not restricted, larger systems can be used and deployed by heavy lifting equipment. If the site is accessible by road, vacuum trucks may be used for oil recovery, storage, and transport.

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Recovery Location

Selection of a shoreline recovery location is critical to the success of this tactic. A recovery site should be in calm water with minimal currents. The site must have enough level ground to set up and operate a power pack and portable tanks. Sites with road access are preferred, but if not available, the site must have some other suitable access. Shelter, food and water for the response crew must also be considered in selecting a site.

C.6 ICE OPERATIONS

Objective & Strategy

Much like that of diversion booming, the objective is to redirect the spilled oil from one location or direction of travel to a specific site for recovery. With a layer of ice preventing the use of booming equipment, other response strategies must be employed.

Tactic Description

ICE SLOTTING

Ice slotting (Figure C.8) may be used in cases where the ice is thick enough to support the response equipment and personnel. Consideration for the weakening and cracking of the ice must be taken when conducting ice slotting operations. Slotting Angle The slot should be angled at approximately 30 degrees to the river's edge. The slotting needs to be wide enough to place a skimming system into the water to recover the oil. The lead end of the slot should have a slight curve which parallels the river current to allow the current to push the oil towards the recovery area.

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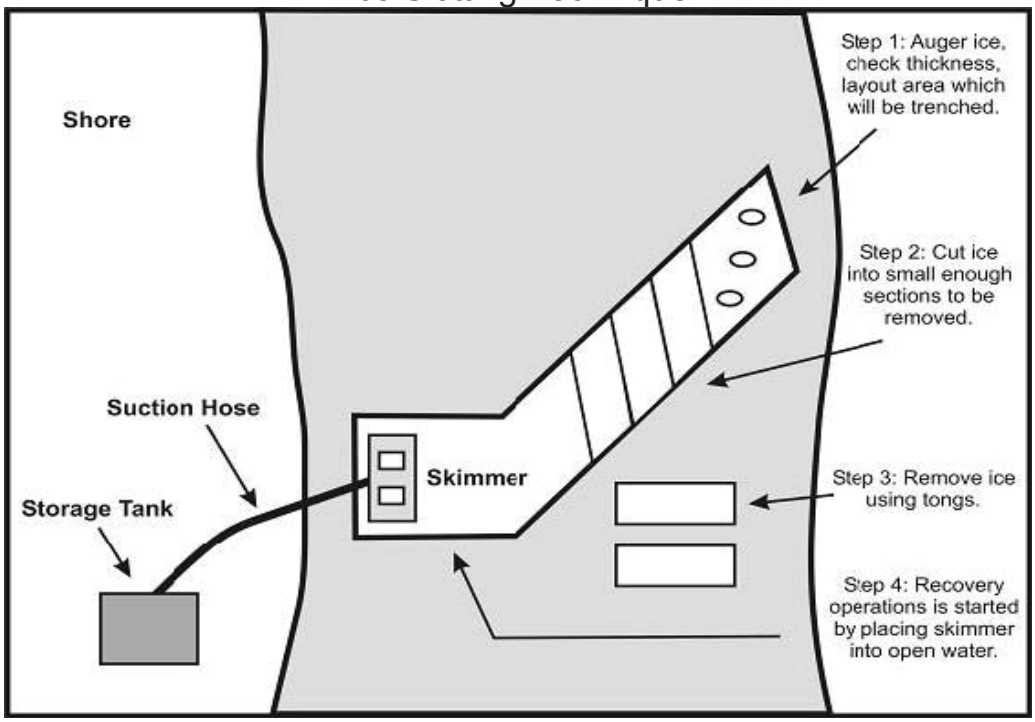
FIGURE C.8
Ice Slotting Technique



DEFLECTION BOARDS

In place of using booming equipment it may be possible to use flat boards, such as plywood, to divert the oil under the ice into a recovery area, which has been cut out. To use this form of diversion, the depth of the water under the ice and the speed of the current ice must be considered. The angle in which the boards are placed is derived much like that of deflection booming. In any current above 3 knots, a series of cascading boards should be considered. Also, the depth of the water must be considered. The stronger the current the deeper the boards must be placed to prevent entrainment. If the water is not deep enough to place the boards to prevent entrainment, ice slotting methods may be required. Figure C.9 illustrates the overall method of using deflective boards. Figure C.10 illustrates a close up of the deflective board response method.

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FIGURE C.9
Deflective Boards Recovery Strategy

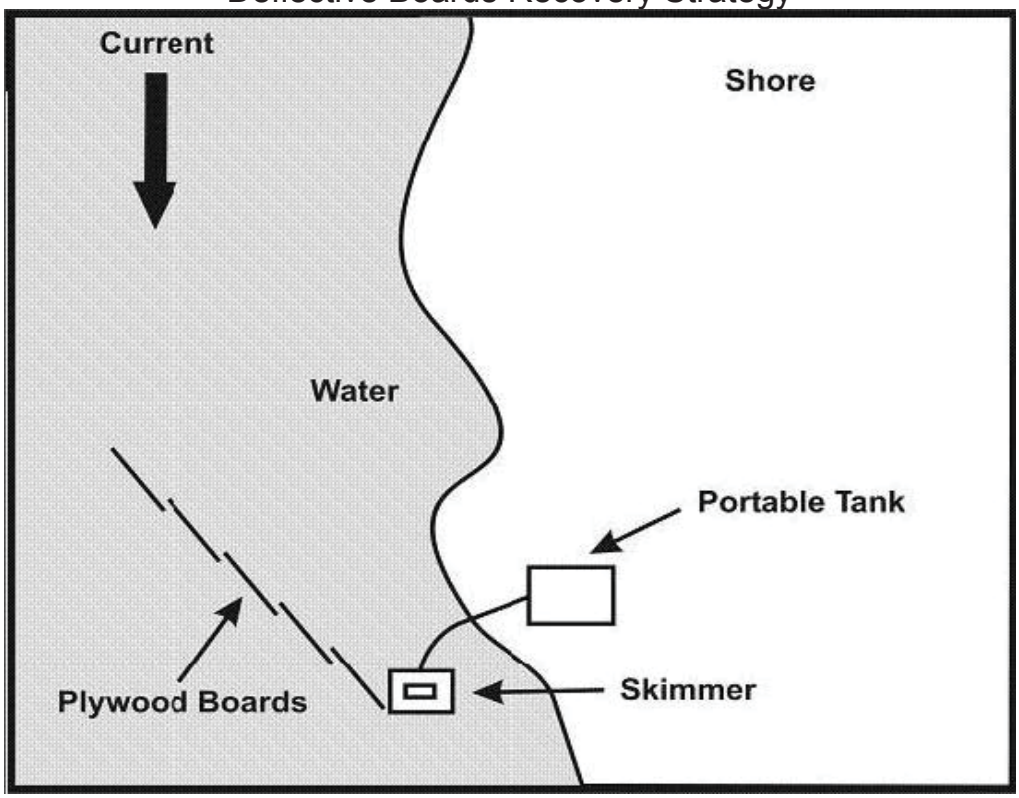
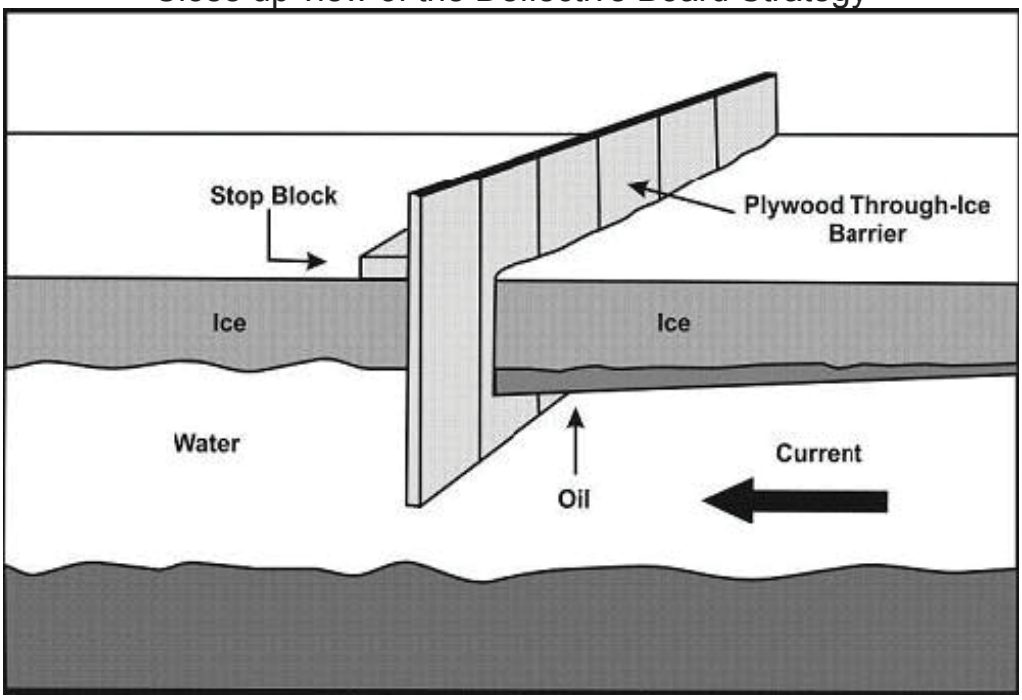


FIGURE C.10
Close up view of the Deflective Board Strategy



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Appendix F.4

Fate and Transport Technical Memorandum

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APPENDIX F.4

FATE AND TRANSPORT TECHNICAL MEMORANDUM

F.4.1 INTRODUCTION

F.4.1.1 Purpose of Report

The purpose of this technical report is to describe the physical, chemical, and biological factors that affect the fate and transport of crude oil if released to the ground or subsurface. Special consideration is given to groundwater and environmental conditions similar to those found along the proposed Keystone XL Pipeline route through Nebraska.

The report presents information on the properties of the crude oil that would be carried by the pipeline. The technical report describes, in the context of a pipeline release, the properties of geology and groundwater and the complex interrelationship between crude oil constituents and the porous geologic media they could move through. Lastly, the report presents a quantitative discussion of dissolved benzene movement in groundwater. This technical report is not intended to evaluate other potentially adversely affected media or receptors. The Final Evaluation Report does provide qualitative information on the impact of a potential release to air, land, and surface water.

F.4.1.2 Project Understanding

TransCanada Keystone Pipeline, LP (Keystone), proposes to construct, operate, and maintain a crude oil pipeline and ancillary facilities from Hardisty, Alberta, Canada, to Steele City, Nebraska, referred to as the Keystone XL Pipeline project. The Nebraska Legislature directed the Nebraska Department of Environmental Quality (NDEQ) to evaluate the portion of the Keystone XL Pipeline project that has been rerouted to avoid the Sand Hills in Nebraska.

NDEQ has requested that HDR Engineering, Inc. (HDR), assist it in conducting an environmental evaluation of Keystone's proposed Nebraska Reroute and ultimately in producing an Evaluation Report. As part of this environmental evaluation, NDEQ asked HDR to research the likely contents of the pipeline and evaluate the fate and transport of these materials if they were to be released to the ground or subsurface—particularly, with respect to impacts on Nebraska water resources.

F.4.2 METHODOLOGY

F.4.2.1 Spill Scenario and Model Selection

Commenters expressed concern about potential oil spills from the pipeline and potential contamination of the Ogallala Aquifer. This report was developed to describe how crude oil constituents change over time and move in the subsurface during a leak and the resultant impact on groundwater.

There are a number of analytical and numerical models that could be used to predict the movement of petroleum hydrocarbons in the subsurface, prior to contact with groundwater or after groundwater has been contacted. Because the specific geology and hydrogeology of a potential release site are unknown, a one-dimensional analytical spreadsheet model was used. The focus of this paper is to document the results of modeling the fate and transport of chemicals of concern from a pipeline spill that had contacted groundwater, thus addressing the concern of comments from the public information meetings. A receptor was assumed to be downgradient of the contaminant source, and the model inputs were selected to provide a conservative output. The selected model is being used by the State of California to identify constituent movement downgradient from a continuous source release. This model was selected because it met the model selection criteria and has been widely used and reviewed. The model effort assumed crude oil constituents (specifically benzene) had been continuously released to groundwater for several years, enough time to create a maximum plume condition.

F.4.3 HYDROCARBON FATE AND TRANSPORT

F.4.3.1 Crude Oil Composition

Keystone has identified five categories of crude oil that would be transported through the pipeline:

- Dilbit, produced from the Alberta oil sands in Canada
- Synthetic crude oil, produced from the Alberta oil sands
- Synbit, produced from the Alberta oil sands
- Dilsynbit, produced from the Alberta oil sands
- Conventional light crude oil, produced from the Bakken Formation in Montana and North Dakota

The precise composition of crude oils, including dilbit and synthetic crude oil, varies considerably and is determined by the producers or shippers who consider this proprietary information. However, the tariff for Keystone's proposed pipeline, which would require approval by the U.S. Department of Energy's Federal Energy Regulatory Commission (FERC), would provide shippers with a set of technical specifications regarding vapor pressure, sediment and water content, temperature, density, viscosity, and other chemical characteristics that may not be exceeded (DOS, 2011). Keystone would not blend materials and would not add any products to the crude oils transported by the pipeline. It would be the responsibility of each shipper to ensure that each batch of crude oil would meet Keystone's specifications.

Keystone has indicated the primary crude oil source for the Keystone XL Pipeline would originate from the Alberta Oil Sands and is referred to as bitumen. The additive used to dilute the bitumen is known as a diluent. One of the products that could be used as a diluent is natural gas condensate, the liquids that condense from natural gas when it is processed. The dilbit is formed by blending the bitumen with the diluents and is typically blended using 70 to 75 percent bitumen and 25 to 30 percent diluent.

Table F.4-1 on the following page presents publicly available information on oil sands-derived crude oils and conventional crude from the Bakken formation. The specific crude oils presented in the table were selected to represent typical products that could be transported by the pipeline.

Table F.4-1. Selected Chemical Properties of Various Crude Oils

Crude Source	Name	Benzene (% by weight)	BTEX (% by weight)	Light Hydrocarbons (% by volume)
Western Canada (Dilbit)	Western Canadian Select[a]	0.16	0.80	10.1
Western Canada (Dilbit)	Cold Lake Dilbit Blend[a]	0.23	1.0	12.6
Western Canada (Dilbit)	Seal Heavy[a]	0.2	1.2	10.4
Western Canada (Dilsynbit)	Albian Heavy[a]	0.14	1.1	10.7
Western Canada (Heavy Crude)	Western Canadian Blend[a]	0.1	0.59	7.42
Western Canada (Heavy Crude)	Lloyd Blend[a]	0.2	0.92	10.5
North Dakota (Light Crude)	Bakken Crude[b,c,]	NA	NA	16.3

Notes:
BTEX: Benzene, toluene, ethyl benzene, xylene
Light Hydrocarbons: Crude oils from different sources contain different proportions of light hydrocarbons. The table presents the sum of the butanes, pentanes, and hexanes (as a percentage) as an indicator of each oil's relative lightness or heaviness.
NA = Not available or not analyzed.

[a] *Five-year average in <crudemonitor.ca> for Canadian oils.*
[b] *Capline. 2012. Capline Crude Oil Quality. Shell Pipeline Company, LP, Houston, TX, <http://www.caplinepipeline.com/Reports2.aspx>, retrieved on November 7, 2012.*
[c] *Keystone response to NDEQ data request, September 10, 2012, revised Table 3.11-1 from* Supplemental Environmental Report for the Nebraska Reroute *(Keystone, 2012) (light hydrocarbons).*

F.4.3.2 Constituent Phases

Once a petroleum product is released to the environment, its chemistry begins to be altered by constituent fate and transport processes such as leaching, volatilization, and biodegradation (Air Force Center for Environmental Excellence, 2005).

The petroleum hydrocarbon constituents of a released free product may partition into four phases in the subsurface:

- residual (adsorbed onto soil particles including organic matter)
- vapor (in soil gas)
- free or separate (liquid hydrocarbons)
- aqueous (dissolved in water)

The two significant factors that affect constituent fate and transport are constituent characteristics and site characteristics. How the chemical and physical properties of the crude oil constituents affect their fate and transport in the subsurface is described in Section F.4.3.3. Geologic and subsurface properties that affect fate and transport and are likely to be encountered along the Nebraska Reroute portion of the Keystone XL Pipeline are presented in Section F.4.3.4.

F.4.3.3 Constituent Properties

The chemical and physical properties of petroleum hydrocarbon compounds that affect fate and transport include density, viscosity, solubility, interfacial tension, vapor pressure, volatility, soil water sorption coefficient, organic carbon partition coefficient, and biodegradation.

Density

Density, which refers to the mass per unit volume of a substance, is often presented as specific gravity (the ratio of a substance's density to that of water) (EPA, 1996). The density of water is about 1.0 g/mL at normal groundwater temperatures. The density of the crude oil in the Keystone XL Pipeline would be less than 1.0 and may range from around 0.85 g/mL to as high as 0.93 g/mL. Because the crude oil would have a specific gravity less than water, it would tend to float on water.

Density varies as a function of several parameters, most notably temperature; however, in most subsurface environments the temperature (and hence the density) remains relatively constant. The density of most fluids generally decreases as temperature increases. Fluid temperatures inside the pipeline will be greater than ambient soil temperatures. Keystone has stated that increased oil temperatures are the result of heat generated by the friction from oil moving through the pipeline. According to the Final EIS (Appendix L, Figure 1), wintertime temperatures of the product would range from about 90 degrees Fahrenheit (°F) at the South Dakota-Nebraska border to about 95°F at the Nebraska-Kansas border. Summertime temperatures would range between 120°F and 130°F in Nebraska (DOS, 2011a). This estimate is based on a flow of 900,000 barrels per day. At Keystone's estimated maximum flow of 830,000 barrels per day, the temperature would be expected to be less than this value.

The increase in temperature will have the effect of reducing the density or making the product more buoyant. Density not only affects the buoyancy of a liquid but also the subsurface mobility. The hydraulic conductivity of a porous medium is a function of the density and viscosity of the liquid. As the density increases, the hydraulic conductivity with respect to the liquid may also increase (EPA, 1995). See Section F.4.3.4 for additional discussion on hydraulic conductivity.

Once the soil temperature reaches a steady state, the soil adjacent to the pipeline could be as much as 40°F warmer than the ambient surrounding soil temperatures. The projected soil temperature gradient is anticipated to be confined to an 8-foot-wide strip centered on the pipeline. Additional information is provided in the Final Evaluation Report. Under the scenario of a small undetected leak, the fluid within the Keystone XL Pipeline would migrate toward the cooler ambient temperature. Two physical processes would have an impact on the density. Initially the higher temperature would cause the volatile fraction of the crude oil to vaporize. The loss of the lighter fractions would result in a higher density, additionally, because as the temperature would decrease the density would increase.

Viscosity

Viscosity is a fluid's resistance to flow and is caused by the internal friction developed between molecules within the fluid. Viscosity can be considered to be a qualitative description in that the higher a fluid's viscosity, the more resistive it is to flow. Fluids with lower viscosity move more rapidly through the subsurface than fluids with higher viscosity. This means that a less viscous petroleum product is generally more easily recovered from the subsurface and leaves a lower residual saturation than a more viscous petroleum product (see Section F.4.3.5 for additional discussion). Viscosity is temperature-dependent. The viscosity of most fluids will decrease as the temperature increases. The lower the viscosity, the less energy and time needed for a fluid to flow in a porous medium. The viscosity of a free product in the subsurface environment typically changes over time, becoming more viscous as more volatile components evaporate and dissolve from the liquid hydrocarbon mass, and, as is the case with the Keystone XL Pipeline, more viscous as the temperature decreases.

Solubility

Crude oil is a blend of many different chemical compounds, each with its own properties. Each chemical has different solubility properties. Solubility provides an important indication of a compound's ability to migrate in the environment; highly soluble compounds will tend to move with groundwater, while insoluble compounds will not. Water solubility refers to the maximum concentration of a chemical that dissolves in a given amount of pure water. Environmental conditions, such as temperature and pH, can influence a chemical's solubility, which, in turn, also affects a constituent's volatilization from water. The tendency for a compound to be transported by groundwater is directly related to its solubility and inversely related to both its tendencies to adsorb to soil and to volatilize from water. Compounds with high water solubilities tend to desorb from soils and sediments, are less likely to volatilize from water, and are susceptible to biodegradation. More information on solubility and the dissolution of constituents is in Section F.4.3.3.

Interfacial Tension

The surface of any liquid behaves as if it is covered by a thin stretched membrane. This phenomenon is known as surface tension and depends on the nature of the liquid, the surrounding environment, and the temperature. When this effect occurs between two liquid phases, it is referred to as interfacial tension. The characteristics of free hydrocarbon movement are largely determined by tension that exists at the interface between immiscible fluids. Immiscible fluids, such as oil and water, are two liquids that are incapable of being combined to form a homogeneous mixture. Interfacial tension causes a liquid to rise in a capillary tube (or in a porous medium such as soil) and form a meniscus. The height of the capillary rise is inversely proportional to the radius of the tube (or the pore spaces in soil), which explains why the capillary rise is greater in fine-grained porous media than in coarse-grained material. In general, higher surface tensions result in higher capillary pressure, which may produce higher residual saturation (Cohen et al., 1993). The interfacial tension between a liquid and its own vapor is called surface tension. The greater the interfacial tension, the greater the stability of the interface between the two fluids.

Interfacial tension is the primary factor controlling wettability, which is further discussed in Section F.4.3.3.

Vapor Pressure

Vapor pressure is a measure of the pressure at which a compound and its vapor are in equilibrium. Thus, vapor pressure largely determines how quickly constituents will evaporate from surface soils or water bodies into the air (Dragun, 1988).

Volatility

The Henry's Law Constant value (H) for a compound is the ratio of the compound's vapor pressure to its aqueous solubility and is normally expressed in units of atm-m^3/mol.

Where: atm = atmosphere
m^3 = cubic meter
mol = mole fraction of compound

The H value can be used to make general predictions about the compound's tendency to volatilize from water. Substances with H less than 10^{-7} atm-m^3/mol will generally volatilize slowly, while compounds with H greater than 10^{-3} atm-m^3/mol will volatilize rapidly (Cohen et al., 1993). The Henry's law relationship is valid only for dilute solutions where water concentrations are much less than the compound's water solubility. When petroleum concentrations in soils and soil water approach residual saturation, the relationship may not be valid.

Soil-water Sorption Coefficient

The soil-water sorption coefficient (K_d) is the tendency of a compound to be adsorbed onto soil or sediment particles. K_d is measured as the ratio of the amount of the chemical sorbed per unit weight of soil or sediment to the concentration of the chemical in solution. The magnitude of the sorption for most soil/water systems is a function of the resistance of the chemical to dissolve in water as measured by the water solubility and the organic carbon content of the soil. Compounds that are less soluble in water tend to adsorb more strongly onto soil particles. Because most petroleum constituents are nonionic (the electrons of the chemical are shared rather than being bound together by the attraction between oppositely charged ions), they adsorb more readily to organic carbon rather than mineral particles in soil (Dragun, 1988). Therefore, adsorption is a more important process in aquifers with high organic carbon content. In addition, adsorption reactions between petroleum constituents and organic particles are usually chemical in nature, and, therefore, are reversible equilibrium reactions. Thus they will also desorb from these particles as well. In general, adsorption retards the movement of constituents in aquifers.

Organic Carbon Partition Coefficient

The organic carbon partition coefficient (K_{oc}) describes the sorption affinity a chemical has for organic carbon and consequently the tendency for compounds to be adsorbed to soil and sediment (based on the organic carbon content of the soil or sediment). This coefficient is often referred to as the adsorption coefficient. A high K_{oc} indicates that organic chemicals bond tightly to organic matter in the soil, so less of the chemical is available to move into groundwater or surface water. Fraction of organic carbon, F_{oc}, is a function of soil type and depth. Generally, soil organic carbon is about 60 percent of the total soil organic matter content. Typical values of

soil organic matter for sandy-loam soils range from approximately 1 to 4 percent. Sands and clay soils have less organic carbon (<1 percent) and loams have up to 10 percent. Peat soils could have up to 50 percent organic matter. Organic matter content typically decreases with depth (Cohen et al., 1993). K_{oc} can be calculated by dividing the soil-water sorption coefficient (K_d) by the organic carbon (F_{oc}).

Biodegradation

Biodegradation is a natural process by which hydrocarbons are consumed by microorganisms through a series of enzyme-catalyzed oxidative-reduction reactions. When oxygen is the electron acceptor, aerobic bacteria convert hydrocarbon constituents to degradation byproducts and eventually to carbon dioxide and water by transferring electrons from the hydrocarbon to oxygen, thus reducing it to water. Under anaerobic conditions, alternative electron acceptors are used by the microorganisms. Alternative electron acceptors, in order of preference, include nitrate, manganese, ferric iron, sulfate, and carbon dioxide (American Society for Testing and Materials [ASTM], 1998).

The capability of petroleum hydrocarbons to biodegrade depends on composition and chemical structure. Lighter, more soluble hydrocarbons are typically more biodegradable than heavier, less soluble hydrocarbons. Hydrocarbons with simple chemical structures are more biodegradable than complex hydrocarbons. For example, straight-chain hydrocarbons degrade faster than branched structures and monoaromatic compounds (those compounds that contain a single benzene ring) such as benzene and toluene are more easily degraded then polycyclic aromatic compounds such as naphthalene (ASTM, 1998).

F.4.3.4 Geologic Properties

From a geologic perspective, the extent and rate of petroleum hydrocarbon migration depends in part on the properties of the subsurface medium in which it is released. In the context of fluid flow in the subsurface, geologic media can be classified on the basis of the dominant characteristics of pore space, fractures, or channels through which fluids move. In porous media, fluids move through the interconnected voids between solid grains of soil. Fractured media are those in which fluids migrate readily through fractures rather than the adjacent soil or rock matrix. Fracturing is usually associated with consolidated materials, but it can also occur in unconsolidated clays because of desiccation (EPA, 1996).

Porosity and permeability are the two most important media-specific properties of a natural geologic material. Porosity characterizes the ability of media to store fluids, and permeability characterizes the ability of the media to transport fluids.

Porosity and Effective Porosity

Porosity is the amount of void space in a consolidated or unconsolidated material and defines the storage capacity of a subsurface medium. Two types of porosity are referred to in the literature: total and effective. Total porosity is based on the volume of all voids (primary and secondary), whether or not the pores are connected. Effective ("drainable") porosity is a function of the connected pore spaces in the medium and is always less than the total porosity. Effective porosity is the term that characterizes the ratio of the volume of interconnected pores to the total volume of unconsolidated materials or rock. Calculation of the amount of free and immobile product in the subsurface requires a value or estimate of effective porosity.

The porosity is greatest when grains are nearly equal in size (referred to as well-graded or sorted) and nonspherical in shape. Unconsolidated sediments that contain a wide range of grain sizes (referred to as poorly graded or sorted) tend to have a lower porosity because smaller grains fill the pore spaces between the larger grains. When pores are not connected and dead-end pores exist, groundwater cannot move through this part of the rock or sediment.

There is no direct correlation between effective and total porosity. Effective porosity is approximated by drainable porosity and can be significantly less than total porosity. In general, the smaller the grains in the soil, the smaller the effective porosity (and the greater the retention capacity or residual saturation). For example, clays and limestones can have an upper range of total porosity that is in excess of 55 percent, but a lower range of drainable porosity of 1 percent or less (EPA, 1996).

Permeability and Hydraulic Conductivity

Permeability of a geologic material is a measure of its ability to transmit fluid. The rates of groundwater flow and hydrocarbon product migration are related directly to permeability. The intrinsic permeability of a geologic medium is independent of the nature of the fluid flowing through the medium. Intrinsic permeability is related to hydraulic conductivity, which is a measure of the ability of the geologic medium to transmit water, but hydraulic conductivity is a function of properties of both the medium and the fluid.

The hydraulic conductivity of fluids more viscous than water, such as those in the Keystone XL Pipeline, will be less than water. Geologic media with high hydraulic conductivities are highly permeable and can easily transmit nonviscous fluids, especially water and many types of petroleum products. The rate of hydrocarbon product migration also depends on other parameters, but intrinsic permeability exhibits the greatest impact.

The nature of geologic processes results in the nonuniform deposition and formation of rocks and sediments. Geologic media often are characterized by the degree of uniformity in grain size and properties such as permeability. Geologic media with uniform properties over a large area are referred to as being homogeneous. By contrast, geologic media that vary in grain size from place to place are called heterogeneous. In nature, heterogeneity is much more common than homogeneity. Soil properties (such as permeability, texture, composition) can be dramatically different over short distances. These changes strongly influence the direction and rate of the flow of groundwater, hydrocarbons, and vapor through the subsurface.

F.4.3.5 Properties Influenced by Hydrocarbons and Geology

The movement of hydrocarbons in the subsurface also depends on several factors that are functions of properties of both the fluid and the geologic media, capillary pressure, relative permeability, wettability, saturation, and residual saturation. Although all of these factors are interrelated, the most important are capillary pressure and relative permeability.

Capillary Pressure

Capillary pressure is the difference in pressure observed between two phases (such as hydrocarbon liquid and water) that occupy the same pore space. Capillary pressure causes porous media to draw in water and repel hydrocarbons. This is the result of interfacial tension at the boundary between two immiscible phases. In the vadose zone, where water saturation is

absent, zone capillary pressure is negative (or less than atmospheric) and is referred to as suction or tension. Capillary pressures are larger in fine-grained media (such as silt or clay) than in coarse-grained media (such as gravel). The capillary fringe above the water table is a familiar consequence of capillary pressure. Because capillary pressure resistance is inversely proportional to pore size, the height of the capillary fringe is greater in finer-grained media and lower in larger-porous media.

The distribution and accumulation of hydrocarbon product in the subsurface is influenced by capillary pressure. Soil water content and the size and orientation of pore spaces affect the penetration of hydrocarbon product in the vadose zone. Penetration of free product into the subsurface is enhanced by dry soil conditions and facilitated by inclined, relatively permeable pathways. Upon reaching the capillary fringe, resistance to downward movement will be increased and hydrocarbons will spread laterally and accumulate above the saturated media. This accumulation is sometimes referred to as a "lens" or "pancake." As long as there is a sufficient supply of hydrocarbons from above, the lens thickness and downward pressure will continue to increase. Before the petroleum product (the nonwetting fluid) will begin to displace water (the wetting fluid) and enter the largest pores, the hydrocarbon pressure head must exceed the resistance of the capillary forces. The pressure required for this to occur is referred to as the "threshold entry pressure" (Cohen et al., 1993).

Similarly, in the saturated zone, hydrocarbons will tend to spread laterally over fine-grained capillary barriers and move through fractures and coarser media wherever possible. The thickness or height of a hydrocarbon column needed to develop sufficient hydrocarbon pressure to exceed capillary force resistance is known as the critical hydrocarbon thickness (or height). Because capillary forces can restrict the migration of hydrocarbon product into water-saturated media, fine-grained layers can act as capillary barriers; therefore, hydrocarbon product tends to move through pathways where capillary effects are weak, such as lenses of sand and gravel.

Relative Permeability

When more than one immiscible fluid exists in a porous medium, the fluids compete for pore space. The result is that the mobility is diminished for each fluid. The relative permeability of the petroleum hydrocarbons and water depends on saturation of each fluid in the porous medium. The relative permeability of a particular geologic medium that is completely saturated with a particular fluid is equal to the intrinsic permeability. The reduction in permeability of the multiphase flow system can be quantified by multiplying the intrinsic permeability of the geologic media by a dimensionless ratio known as the relative permeability. As with saturation, the relative permeability of each fluid phase present varies from zero (0 percent saturation) to one (100 percent saturation) (Cohen et al., 1993).

Three different types of flow regimes can exist at a location where a subsurface discharge has occurred. The first flow regime exists where petroleum hydrocarbons occur as a potentially mobile, continuous phase and saturation is high. Water is restricted to small pores. The relative permeability of water is low. Such conditions may be observed within large mobile product accumulations. The second flow regime exists where both petroleum hydrocarbons and water occur as continuous phases, but generally do not share the same pore spaces. However, the relative permeability of each fluid is greatly reduced by the saturation of the other fluid. Such conditions may be representative of zones of smaller mobile product accumulations at the water table. The final flow regime is where petroleum hydrocarbons are discontinuous and trapped as

residual in isolated pores. Flow is almost exclusively the movement of water, not as petroleum hydrocarbons. Examples of such conditions may be found within zones of residual petroleum hydrocarbons retained below the water table (EPA, 1995).

Wettability

Wettability refers to the preferential spreading of one fluid over solid surfaces in a two-fluid system where the two are immiscible (EPA, 1996). Wettability is primarily driven by the interfacial tension between the fluids. Because of the dependence on interfacial tension, the size of the pore spaces in a geologic medium strongly influences which fluid is the wetting fluid and which fluid is the nonwetting fluid. The dominant adhesive force between the wetting fluid and media solid surfaces causes porous media to draw in the wetting fluid (typically water) and repel the nonwetting fluid (typically hydrocarbon or air) (Cohen et al., 1993). Liquids (hydrocarbon or water), rather than air, preferentially wet solid surfaces in the vadose zone. In the saturated zone, water will generally be the wetting fluid and displace hydrocarbons (EPA, 1995). Whereas the wetting fluid (usually water in a hydrocarbon-water system) tends to coat solid surfaces and occupy smaller openings in porous media, the nonwetting fluid tends to be constricted to the largest openings (such as relatively large pore spaces). When a formerly saturated porous medium drains, a thin film of adsorbed wetting fluid will always remain on the solid.

The factors affecting wettability relations in immiscible fluid systems include mineralogy of the geologic media, the chemistry of the groundwater and the petroleum hydrocarbon, the presence of organic matter or surfactants, and the saturation history of the media.

Saturation and Residual Saturation

Saturation of a porous medium may be defined as the relative fraction of total pore space containing a particular fluid in a representative volume of a porous medium (EPA, 1995). The saturation level for each of the fluids ranges between 0 (the fluid is not present in the pore space and saturation is 0 percent) and 1 (the fluid completely occupies the pore space and saturation is 100 percent). Of course, a given pore space can be filled to a maximum of only 100 percent, and the proportions of each phase saturation must sum to 1 (or 100 percent saturation). The mobility of a liquid through a porous medium is a function of the saturation of the porous medium with respect to that liquid. For it to flow through a porous medium, a liquid must be continuous through the area where flow occurs. As liquid drains from the medium, the liquid phase becomes discontinuous. The point at which the saturation level for a continuous liquid phase other than water (specifically petroleum hydrocarbon) becomes discontinuous (and hence immobile) is known as the residual saturation (EPA, 1995). The corresponding saturation level for water is called the irreducible water saturation. At these low saturations, capillary pressures are very high.

During drainage, the larger pores drain the wetting fluid (water) quickly while the smaller pores drain slowly, if at all. During wetting, the smaller pores fill first, and the larger pores fill last. The consequence of this phenomenon is that the vadose zone will retain less residual petroleum hydrocarbon than the saturated zone (EPA, 1995).

As stated previously, residual saturation refers to the saturation level at which a continuous mass of petroleum hydrocarbons becomes discontinuous and immobilized by capillary forces (EPA, 1995). Residual saturation is important because it represents the amount of petroleum that cannot be recovered by pumping or gravity drainage. Following a release of petroleum

hydrocarbons into the subsurface, the hydrocarbon mass seeps downward in the unsaturated zone. If the volume of the release is enough to sufficiently saturate the soil, the leading edge of the hydrocarbon mass continues to move deeper into the subsurface. Behind and above the leading edge, a significant portion of the hydrocarbon mass is retained in pore spaces by capillary forces.

Generally, the finer-grained the soil, the higher the residual saturation. Residual saturation for the wetting fluid is conceptually different from that for the nonwetting fluid. When the wetting fluid (water) drains from a porous medium, even at the level of the irreducible water saturation, there is a thin, continuous layer of water occupying the smallest pores and coating the grains of the medium. As the nonwetting fluid (petroleum hydrocarbon) drains from a porous medium, the pores drain incompletely because of the residual water that remains in the smallest pores. The result is that discontinuous blobs of immobile petroleum hydrocarbon remain in the soil at the level of the residual saturation. More viscous fluids tend to have higher residual saturations than less viscous fluids. Fluids that are more dense for a given viscosity drain to a greater degree under the influence of gravity than do less dense fluids. Fluids that have high interfacial tension also tend to exhibit higher capillary pressure, which may result in higher residual saturation. Although field-scale values for residual saturation are difficult to either measure or accurately estimate, in general, residual saturation levels tend to be much higher in the saturated zone (0.15 to 0.50) than in the unsaturated zone (0.10 to 0.20) (EPA, 1995). The residual phase often represents a potential long-term source for continued groundwater contamination.

F.4.3.6 Fate of Hydrocarbons in the Subsurface

Volatilization

The volatility of a compound is a measure of the transfer of the compound from the aqueous phase to the gaseous phase. The factors that control volatilization are the solubility, molecular weight, vapor pressure, and the nature of the air-water interface through which it must pass. Henry's Law Constant is a valuable parameter that can be used to help evaluate the propensity of an organic compound to volatilize from the water. Henry's Law Constant is defined as the vapor pressure divided by the aqueous solubility. Therefore, the greater the Henry's Law Constant, the greater the tendency to volatilize from the aqueous phase. For more concentrated solutions or pure-phase compounds, volatilization is best described by Raoult's Law, which states that the vapor pressure over a solution is equal to the mole fraction (or the amount of a constituent divided by the total amount of all constituents in a mixture) of the solute (a substance dissolved in another substance times the vapor pressure of the pure-phase (single component) liquid. Again, this is a measure of the escaping tendency of molecules from the pure hydrocarbon product to the gaseous phase.

Dissolution

Many petroleum hydrocarbons are relatively insoluble in groundwater, with primarily the more volatile chemicals (BTEX) and some short-chain aliphatic hydrocarbons (compounds that do not contain benzene rings) showing any appreciable potential for going into solution with groundwater. The solubility of an organic compound is the equilibrium concentration of the compound in water at a specified temperature and pressure. For all practical purposes, the solubility represents the maximum concentration of that compound in water. For petroleum

hydrocarbons in contact with water, the equilibrium dissolved-phase concentrations may be conservatively estimated using the solubility of the pure liquid in water and its mole fraction in the hydrocarbon mixture (EPA, 1995). The maximum concentration that can be achieved in this scenario is referred to as the effective solubility, as indicated in the following equation.

$$S^e_i = X_i S_i$$

Where:

S^e_i = effective aqueous solubility of compound i in a nonaqueous phase liquid (NAPL) mixture
X_i = mole fraction of compound i in NAPL mixture
S_i = aqueous solubility of the pure-phase compound

The effective solubility represents the concentration that may occur at equilibrium under ideal conditions. However, the degree to which these compounds partition to the water phase is a function of many variables, including temperature, pH, cosolvents, dissolved organic matter, and dissolved inorganic compounds (salinity) (EPA, 1995). In general, higher dissolution rates may be associated with higher groundwater velocities, higher hydrocarbon saturation in the subsurface, increased contact area between hydrocarbons and water, and hydrocarbons with a high fraction of soluble components (EPA, 1995). The effective solubility of benzene in groundwater will vary with the type of petroleum, for example, gasoline, diesel, fuel oil, or crude oil. In these examples, the total amount of benzene in the petroleum varies from approximately 1 percent in gasoline (or 10,000 mg/L) to 0.1 to 0.3 percent for crude oil (1,000 to 3,000 mg/L). In the literature, effective solubilities of benzene in groundwater typically vary between approximately 17 mg/L (gasoline) and 2 mg/L (crude oil).

Sorption

Sorption is defined as the interaction of a constituent with a solid (EPA, 1995). In soil or aquifer material adversely affected by petroleum hydrocarbon, constituents in the petroleum hydrocarbon will partition onto solid phase material. The primary pathway in which this process occurs is through the water phase. For example, when petroleum hydrocarbons are released into the subsurface and reach groundwater, some components will dissolve into the aqueous phase, then partition onto aquifer material.

In general, solid-phase (adsorbed) constituents may represent a small fraction of the total constituent mass in soil and aquifer material where continuous phase or residual petroleum hydrocarbons exist. The majority of the constituent mass in these systems is typically present in the nonaqueous phase liquid. Desorption of the constituent (that is, mass transfer of constituent from the solid phase to the water phase) is often a rate-limited step and is partially responsible for the tailing effect commonly observed in groundwater pump-and-treat systems.

Biodegradation

Microbes found under many subsurface conditions are capable of degrading petroleum hydrocarbons. Biodegradation occurs as microbes use organic compounds as a source of energy. Biodegradation eliminates petroleum hydrocarbons by converting them to carbon dioxide and

water while increasing microbial biomass. The rate that hydrocarbons degrade depends on a number of site-specific factors such as oxygen content, pH, moisture content, temperature, nutrient concentrations, and the type of microbes. Biological transformations are affected by temperature. As the temperature increases, biological activity generally tends to increase. Biodegradation is affected by the volume of product released. Free product and a saturated condition inhibit microbial activity.

Transport of Hydrocarbons in the Subsurface

Petroleum hydrocarbon materials are relatively insoluble in groundwater, with primarily the more volatile chemicals (BTEX) and some short-chain aliphatic hydrocarbons showing any appreciable potential for water solubility. These volatile compounds are also of greatest concern from a human health perspective with the ability to adversely affect groundwater, surface water, drinking water wells, irrigation wells, and other potential receptors.

In general, constituents in groundwater will move primarily in a horizontal direction that is determined by the hydraulic gradient. The hydraulic gradient is the groundwater elevation difference between two points x distance apart (unitless) or the slope of the water table in the direction of groundwater flow. In some instances, hydraulic gradients can change intensity or even direction based on local groundwater influences. Groundwater can also move in a vertical direction as a result of natural or induced conditions. Vertical gradients are typically experienced where there are confining geological units. Drinking water or irrigation wells also contribute to vertical gradients in an aquifer. Normally, horizontal gradients are greater than vertical gradients within the aquifer but the reverse is true in close proximity to a pumping well. As the constituents migrate downgradient, they will decrease in concentration because of such processes as dispersion (molecular and hydrodynamic), filtration, sorption, various chemical processes, and microbial degradation.

Processes such as hydrodynamic dispersion affect all constituents equally, while sorption, chemical processes, and degradation may affect various constituents at different rates. The complex factors that control the movement of constituents in groundwater and the resulting behavior of constituent plumes are commonly difficult to assess because of the interaction of the many factors that affect the extent and rate of constituent movement. Predictions of movement and behavior can be used only as estimates, and modeling is often a useful tool to integrate the various factors (EPA, 1989).

The two dominant transport mechanisms for constituents in groundwater systems are advection and dispersion. Advection describes constituent mass transport due simply to the bulk flow of water in which the constituent is dissolved or to movement of contamination as a consequence of groundwater flow. Advection is the transport of a constituent at an average groundwater velocity (EPA, 1989). Advective flow velocities are based on the average (bulk) properties of the aquifer materials and the average hydraulic gradient causing flow. Darcy's Law is the basis for quantifying the rate of fluid flow through saturated subsurface materials. The average linear velocity depends on 1) the hydraulic conductivity of the subsurface geologic formation in the direction of groundwater flow, 2) the porosity of the formation, and 3) the hydraulic gradient in the direction of groundwater flow. For constituents that react through precipitation/dissolution, adsorption, and/or partitioning reactions within the subsurface formation, the constituent velocity can vary significantly from the average groundwater velocity.

Constituents like other dissolved solutes in groundwater also move on a smaller scale than calculated using Darcy's law and bulk values of aquifer properties such as porosity and hydraulic conductivity. Constituent movement is also controlled by the process of mechanical dispersion. Dispersive mixing causes some constituent molecules to move ahead of the average advective velocity along the hydraulic gradient and some molecules to move laterally (transverse) to the hydraulic gradient. Dispersion is caused by 1) molecular diffusion (important at only very low velocities) and 2) hydrodynamic mixing (occurring at higher velocities in laminar flow through porous media). Constituents traveling through porous media have different velocities and flow paths with different lengths. Constituents moving along a shorter flow path or at a higher velocity, therefore, arrive at a specific point sooner than constituents following a longer path or traveling at a lower velocity, resulting in hydrodynamic dispersion (EPA, 1989). The net effect is to spread (disperse) the constituent plume about the advective front. The amount of spreading is related to the dispersivity of the sediment, the advective velocity of groundwater flow, and the molecular diffusion of the constituent in the water in the pore space. The amount of diffusion is a function of the concentration gradient and the porosity of the materials.

F.4.4 RELEASE SCENARIO AND MODELING RESULTS

F.4.4.1 Release Scenario

The impact of a release of crude oil on the Ogallala Aquifer was a major concern of Nebraska residents. This section will review a spill scenario and the potential impact of that spill on groundwater. The modeling effort assumed crude oil constituents (specifically benzene) had been continuously released for several years where the pipeline is either submerged or near groundwater; therefore, there is enough time to create a maximum plume impact.

The petroleum hydrocarbons to be transported in the Keystone XL Pipeline are complex mixtures. Some of the compounds within the complex mixture of crude oils have been identified as either known or probable carcinogens (Neff, 1994). These compounds are the most volatile, soluble, and mobile fractions within the petroleum mixture. As discussed previously, solubility refers to the maximum concentration of a chemical that dissolves in a given amount of pure water. However, the individual components never reach the concentrations predicted from their solubility constants as individual chemicals. Chemicals like benzene or toluene, which may constitute a small percentage within an initial bulk petroleum product, have a much greater tendency to stay in the hydrocarbon mixture than dissolve into the water-based system beyond the hydrocarbon product boundary. Therefore, the effective solubility of these chemicals as part of a complex mixture is less than it would be in a release of the pure chemical. Modeling of the fate and transport of any evaluated compound will incorporate the conservative assumption that solubility of the released compound will equal its maximum effective solubility in the petroleum mixture within the pipeline. Benzene was selected as a surrogate compound to model in this release scenario. Benzene is a known carcinogen and is one of the most volatile, soluble and mobile compounds in the petroleum hydrocarbon fluid. Using Raoult's Law and the petroleum constituent percentages proposed for the Keystone XL Pipeline, it was possible to calculate the maximum effective solubility of benzene. For modeling, the initial concentrations selected were 10 mg/L and 15 mg/L. These values provide a conservative estimate for maximum benzene concentrations as a result of a release from the Keystone XL Pipeline. These concentrations are consistent with those cited in literature (EPA, 1995; Alaska Department of Environmental Conservation, 2011).

Calculations were developed to estimate the time of travel of a dissolved phase groundwater constituent to a downgradient receptor using an analytical spreadsheet model. The spreadsheet model used is a program available through the California Environmental Protection Agency website, <http://www.waterboards.ca.gov/rwqcb4/water_issues/programs /ust/model_non_steady.shtml>.

The model solution simulates the primary methods of fate and transport of dissolved-phase constituents in groundwater: advection and dispersion. The continuous release model includes a first-order degradation rate constant to simulate degradation of dissolved constituents in the subsurface; decreases in chemical concentration are typically caused by biodegradation, adsorption, volatilization, and chemical decay. The analytical model provides a conservative estimate of groundwater constituent travel times and its use is appropriate given the "screening tool" nature of this evaluation. Details regarding the model solution are provided below.

The model assumes a vertical plane source of constant concentration. The width and depth of the vertical plane have been assumed using release volume of 10,000 barrels and a porosity of 0.3 (effective porosity of 0.15).

F.4.4.2 Continuous Source Release Model Description

A spreadsheet application of the Domenico transient analytical solution (1987) to the advection-dispersion partial-differential equation was used to evaluate transport of dissolved-phase organic constituents in groundwater, assuming a continuous release source. This model includes a first-order degradation rate constant to incorporate a natural degradation factor for the organic constituent. The model includes input values for groundwater velocity; longitudinal, transverse, and vertical dispersion; the first-order degradation rate constant (this term approximates a variety of physical, chemical, and biological attenuation processes into a single parameter); and the dimensions of the source area. Because plume concentration is a function of travel time in the model, the analytical model can be applied to estimate the plume travel time and maximum constituent concentration at a specific receptor location. The equation that solves the Domenico transient analytical solution (1987) is:

$$C(x,0,0,t)=\frac{C_0}{2}\exp\left\{\frac{x}{2\alpha_x}\left[1-\left(1+\frac{4\lambda\alpha_x}{v}\right)^{\frac{1}{2}}\right]\right\}\times\left\{erfc\left[\frac{x-vt\left(1+\frac{4\lambda\alpha_x}{v}\right)^{\frac{1}{2}}}{2(\alpha_x vt)^{\frac{1}{2}}}\right]\right\}$$

$$\times erf\left[\frac{Y}{4(\alpha_y x)^{\frac{1}{2}}}\right]\times erf\left[\frac{Z}{4(\alpha_z x)^{\frac{1}{2}}}\right]$$

Where:

$C(x,0,0,t)$ – constituent concentration in a downgradient well along the plume centerline at time t and at a distance *x* (mg/L)

C_0 – constituent concentration in the source well (mg/L)

x – centerline distance between the downgradient well and source well (feet)

α_x, α_y, and α_z – longitudinal, transverse, and vertical dispersivity (feet), respectively

λ – degradation rate constant (1/day)

ν – groundwater velocity (feet/day)

Y – source width (feet)

Z – source depth (feet)

erf – error function

erfc – complementary error function

exp – exponential function

t – time

The assumptions used for the Domenico nonsteady state analytical equation are presented below. While these assumptions simplify many hydrogeologic and contaminant fate conditions that may be experienced along the proposed Nebraska Reroute, together they provide a conservative result that might actually occur in groundwater in Nebraska. Certainly, most aquifers are not homogeneous and changes in groundwater flow direction (horizontally, vertically) and velocity occur. However, these assumptions provide a reasonable approach that likely overstates potential benzene concentrations in groundwater downgradient of a potential long term leak.

- Transient or nonsteady state (concentration is a function of time)
- A continuous release source
- Homogeneous aquifer properties
- One-dimensional groundwater flow
- No change in groundwater flow direction and velocity
- First-order degradation rate
- Constituent concentration estimated at the centerline of the plume
- Molecular diffusion based on concentration gradient is neglected
- Adsorption in transport process is neglected

F.4.4.3 Calculation Summary

Using the California Environmental Protection Agency spreadsheet model, estimates of the impact of a release to groundwater were developed using the hydrogeologic conditions found in sandy areas where the Ogallala Group is present.

Two scenarios were developed to approximate different groundwater velocities in the model. The hydrogeologic parameters used for this groundwater region as model inputs are:

- Hydraulic conductivity (K) = 40 feet/day and 120 feet/day
- Hydraulic gradient (dh/dl) = 0.0017
- Effective porosity = 0.15 and 0.2

The input parameters used to develop these estimates are:

- A release volume of 10,000 barrels
- Source area – 1 foot deep and 200 feet wide
- A continuous constituent source
- Initial release concentration of 10 mg/L and 15 mg/L
- First order attenuation rate of 0.001 (per day) for benzene
- Variable longitudinal dispersivity, simulated as of 0.1 times distance to receptor (feet)
- Transverse dispersivity of 0.33 times the longitudinal dispersivity
- Vertical dispersivity of 0.056 times the longitudinal dispersivity
- Downgradient receptor location of 500, 750, and 1,000 feet

Regional aquifer data were obtained from the USGS Elkhorn Loup groundwater flow model (USGS, 2010) and the Groundwater Atlas of Nebraska (University of Nebraska–Lincoln [UNL], 1998). Travel time and maximum concentration estimates were developed based on the assumptions listed above and the regional hydrogeologic information obtained from the Elkhorn Loup model and the Groundwater Atlas of Nebraska. These estimates are summarized in Table F.4-2 and Table F.4-3, below. Dispersivity values were selected from the California Environmental Protection Agency User Manual.

A concentration of 5 µg/L was selected for evaluating the distance downgradient from a potential release where a receptor would be adversely affected. This value is the Safe Drinking Water Act Maximum Contaminant Level and is also the groundwater protection standard in Nebraska Title 118 Groundwater Quality Standards and Use Classification.

F.4.4.4 Model Results

Two modeling scenarios were performed. The first scenario utilized a groundwater velocity of approximately 0.5 foot/day. The second scenario utilized a groundwater velocity of approximately 1.0 foot/day. The first set of results is presented in Table F.4-2 and Table F.4-3. The first scenario estimated the concentration of benzene could reach 5 µg/L at a well 500 feet downgradient in approximately 2 years and at a well 750 feet downgradient in 4 years. The results indicate the plume would likely stabilize and not reach an estimated benzene concentration of 5 µg/L at a well 1,000 feet downgradient. The leading edge of the plume would have concentrations of benzene below 5 µg/L and would be expected to arrive more quickly at the receptor wells and extend farther from the source, possibly exceeding 1,000 feet in length.

In the second scenario, as might be expected with higher groundwater velocities, the contaminant plume would arrive sooner at the downgradient wells. The model estimated that the concentration of benzene could reach 5 µg/L at a well 500 feet downgradient in approximately 280 days. The plume of benzene could reach the Maximum Contaminant Level of 5 µg/L in a well that is 750 feet downgradient in approximately one and half years. It would take slightly under 3 years for the plume to reach an estimated benzene concentration of 5 µg/L at a well 1,000 feet downgradient. In this second scenario, the plume would extend further than in the first scenario.

A summary of the results of the model runs is presented in the tables below. Detailed model results are presented as Attachment B. The results of the NDEQ evaluation provide a rough

estimate of how a plume of dissolved-phase contaminants might behave under certain conditions in Nebraska.

Table F.4-2. Summary of Model Output, Benzene Concentration at Initial Release: 10 mg/L (10,000 µg/L), Approx Lower Groundwater Velocity

Description of Model Output	Distance to Receptor (feet)		
	500	750	1,000
Time when plume first reaches 5 µg/L at the receptor	760 days	NA	NA
Time when plume reaches its peak concentration at the receptor	2,280 days	3,100 days	3,900 days
Maximum concentration at the receptor	16 µg/L	4.7 µg/L	1.8 µg/L

Note: NA – Not applicable, meaning plume concentration of 5 µg/L not attained.

Table F.4-3. Summary of Model Output, Benzene Concentration at Initial Release: 15 mg/L (15,000 µg/L), Lower Groundwater Velocity

Description of Model Output	Distance to Receptor (feet)		
	500	750	1,000
Time when plume first reaches 5 µg/L at the receptor	680 days	1,560 days	NA
Time when plume reaches its peak concentration at the receptor	2,280 days	3,100 days	3,700 days
Maximum concentration at the receptor	23 µg/L	7.1 µg/L	2.7 µg/L

Note: NA – Not applicable, meaning plume concentration of 5 µg/L not attained.

The results of is the second scenario are presented in Table F.4-4 and Table F.4-5.

Table F.4-4. Summary of Model Output, Benzene Concentration at Initial Release: 10 mg/L (10,000 µg/L), Higher Groundwater Velocity

Description of Model Output	Distance to Receptor (feet)		
	500	750	1,000
Time when plume first reaches 5 µg/L at the receptor	320 days	640 days	NA
Time when plume reaches its peak concentration at the receptor	1160 days	1660 days	2120 days
Maximum concentration at the receptor	27 µg/L	9.9 µg/L	4.7 µg/L

Note: NA – Not applicable, meaning plume concentration of 5 µg/L not attained.

Table F.4-5. Summary of Model Output, Benzene Concentration at Initial Release: 15 mg/L (15,000 µg/L), Higher Groundwater Velocity

Description of Model Output	Distance to Receptor (feet)		
	500	750	1,000
Time when plume first reaches 5 µg/L at the receptor	280 days	540 days	1040 days
Time when plume reaches its peak concentration at the receptor	1140 days	1660 days	2120 days
Maximum concentration at the receptor	40 µg/L	15 µg/L	6.9 µg/L

The results of the evaluation are consistent with published literature on dissolved-phase hydrocarbon plumes. In a review of 604 petroleum release sites (API, 1998), the lengths of combined plumes of BTEX were evaluated. The majority of plume lengths were less than 200 feet in length. In general, the plume delineation concentration in the study varied from 1 µg/L to 10 µg/L. Less than 2 percent of all BTEX plumes reviewed were greater than 900 feet long. The results of the NDEQ evaluation appear to be reasonable when compared with the API study.

Conclusion

The NDEQ evaluation and published literature suggest that dissolved contaminants moving in groundwater have limits to the extent they migrate. Groundwater underlies most of the state of Nebraska. Formations within the High Plains Aquifer could be hydraulically interconnected and this interconnection supports a continuous water table throughout most of the region. There are a number of local or site specific factors that would determine the impact to groundwater due to a crude oil spill. Among the primary factors are the amount and type of petroleum that reaches groundwater, the groundwater velocity and the degradation rate of the constituents.

However, the evaluation concludes that a crude oil spill that comes in contact with groundwater would have consequences on a local, rather than a regional level.

F.4.5 REFERENCES

Air Force Center for Environmental Excellence. 2005. "Petroleum Fuels: Basic Composition and Properties." PROACT Fact Sheet. Revised August. <http://www.afcee.af.mil/shared/media/document/AFD=070924-150.pdf>.

Alaska Department of Environmental Conservation. 2011. *Hydrocarbon Risk Calculator User Manual*. Lawrence Acomb, Geosphere, Inc., CH2MHILL.

American Petroleum Institute (API). 1998. *Characteristics of Dissolved Petroleum Hydrocarbon Plumes*. Version 1.1. Prepared by Groundwater Service, Inc., for API Soil and Groundwater Technical Task Force. December 1998.

American Society for Testing and Materials (ASTM). 1998. "Standard Guide for Remediation of Ground Water by Natural Attenuation at Petroleum Release Sites." In *Annual Book of ASTM* Standards. Historical Standard: ASTM E1943-98. West Conshohocken, Pennsylvania: ASTM International. doi: 10.1520/E1943-98.

Capline. 2012. Capline Crude Oil Quality. Shell Pipeline Company, LP, Houston, Texas. Retrieved November 7, 2012. <http://www.caplinepipeline.com/Reports2.aspx>.

Cohen, Robert M., James W. Mercer, and John Matthews. 1993. *DNAPL Site Evaluation*. Boca Raton, Florida: C.K. Smoley.

Domenico, P. A. 1987. "An analytical model for multidimensional transport of decaying contaminant species". *Journal of Hydrology* 91**:** 49-58.

Dragun, J. 1988. *The Soil Chemistry of Hazardous Materials*. Silver Springs, Maryland: Hazardous Material Control Research Institute..

Neff, Jerry M. 1994. *Transport and Fate of Non-BTEX Petroleum Chemicals in Soil and Groundwater*. Washington, D.C.: American Petroleum Institute.

TransCanada Keystone Pipeline, LP (Keystone). 2012. *Supplemental Environmental Report for the Nebraska Reroute*. Document Number KXL-TAL-1005-002. Prepared by exp Energy Services Inc., Tallahassee, Florida, for TransCanada Keystone Pipeline LP, Houston, Texas. September 5.

University of Nebraska-Lincoln (UNL). 1998. Conservation and Survey Division. "Nebraska Groundwater Atlas".

U.S. Department of the Interior, U.S. Geological Survey (USGS). 2010. Simulation of Groundwater Flow and Effects of Groundwater Irrigation on Stream Base Flow in the Elkhorn and Loup River Basins, Nebraska, 1895–2055—Phase Two.

U.S. Department of State (DOS), Bureau of Oceans and International Environmental and Scientific Affairs. 2011. *Final Environmental Impact Statement: Keystone XL Pipeline Project*. Washington, D.C. August 26.

U.S. Environmental Protection Agency (EPA). 1989. "Transport and Fate of Contaminants in the Subsurface." Document Number EPA 625-4-89-019. September.

———. 1995. "Light Nonaqueous Phase Liquids." Ground Water Issue. Document Number EPA 540-S-95-500. July. <http://www.epa.gov/tio/tsp/download/lnapl.pdf>.

———. 1996. "How to Effectively Recover Free Product at Leaking Underground Storage Tank Sites: A Guide for State Regulators." Document Number EPA 510-R-96-001. September. Retrieved August 19, 2012. <http://www.epa.gov/swerust1/pubs/fprg.htm>.

Attachment A

Abbreviations and Acronyms

Abbreviation, Acronym, or Short Form	Definition
µg/L	micrograms per liter
ASTM	American Society for Testing and Materials
atm	atmosphere
BTEX	benzene, toluene, ethyl benzene, xylene
dh/dl	Hydraulic gradient
DOS	U.S. Department of State
EPA	U.S. Environmental Protection Agency
F	Fahrenheit
g/mL	grams per milliliter
H	Henry's Law Constant
HDR	HDR Engineering, Inc.
K_d	soil-water sorption coefficient
K_{oc}	organic carbon partition coefficient
K	Hydraulic conductivity
Keystone	TransCanada Keystone Pipeline, LP
FERC	Federal Energy Regulatory Commission
F_{oc}	fraction of organic carbon
m^3	cubic meter
mg/L	milligrams per liter
Mol	mole fraction of compound
NAPL	nonaqueous phase liquid
NDEQ	Nebraska Department of Environmental Quality
pH	concentration of hydrogen ion in a solution
USGS	U.S. Department of the Interior, U.S. Geological Survey

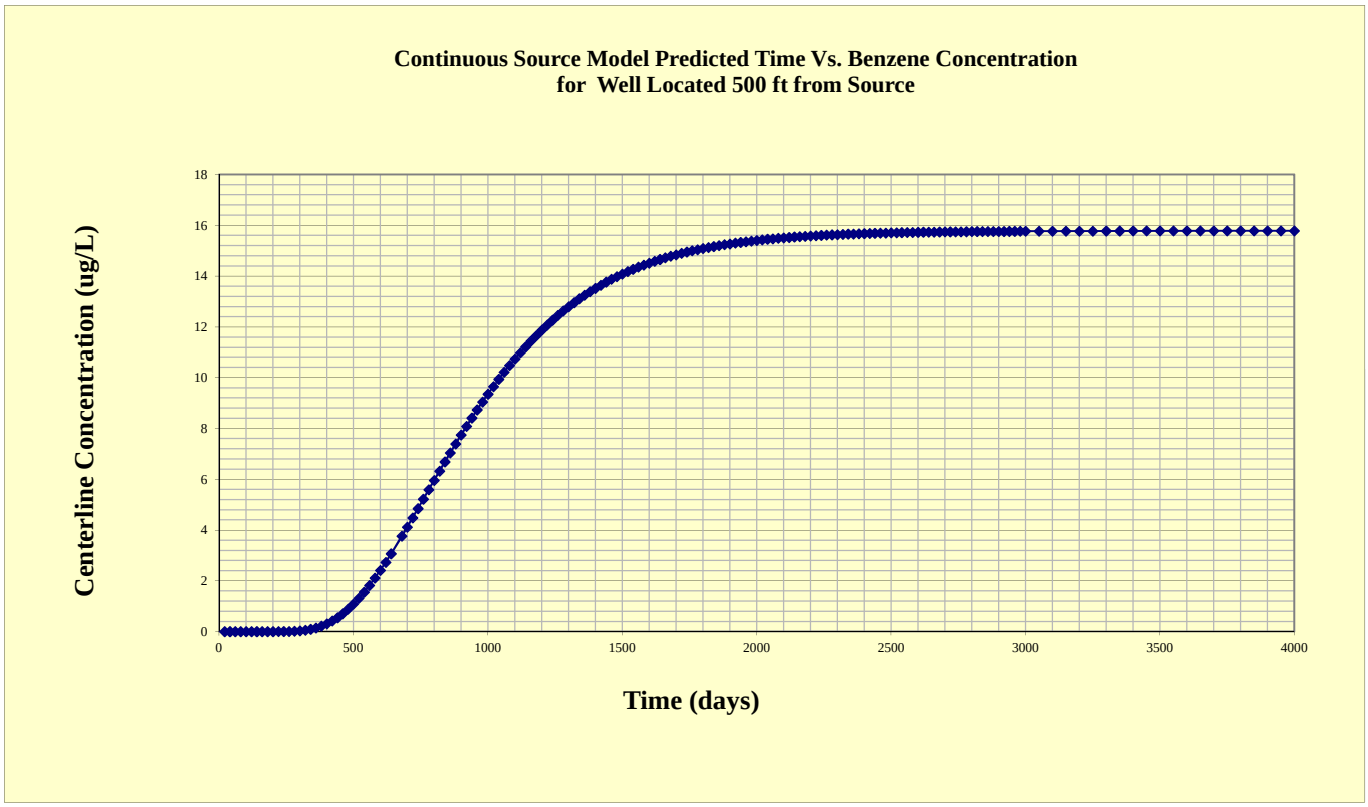
Attachment B

Modeling Runs

Dommencio Non-Steady State
Spreadsheet Analytical Model

Scenario 1: 10 mg/L, Well Distance 500 feet			
Source concentration	C_0	10000	ug/L
X axis dispersivity	α_x	50	ft
Y axis dispersivity	α_y	16.5	ft
Z axis dispersivity	α_z	2.8	ft
Groundwater velocity	u	0.46	ft/day
Source dimension Y	Y	200	ft
Source dimension Z	Z	1	ft
First order attenuation rate	λ	0.001	1/day
Distance from source to Well 1	X_1		ft
Distance from source to Well 2	X_2		ft
Distance to downgradient well	X_3	500	ft
SUMMARY SOLUTIONS & STATISTICS	days	years	
Time when plume first reached 0.1 ug/L in well	**360**	**1.0**	
Time when plume first reached 1 ug/L in well	**500**	**1.4**	
Time when plume first reached 5 ug/L in well	**760**	**2.1**	
Time when plume reached its peak in well	**2280**	**6.2**	
Time remaining for plume to reach 5 ug/L in well	**760**	**2.1**	
Maximum concentration in well	**15.62**	ug/L	
			C
			10000

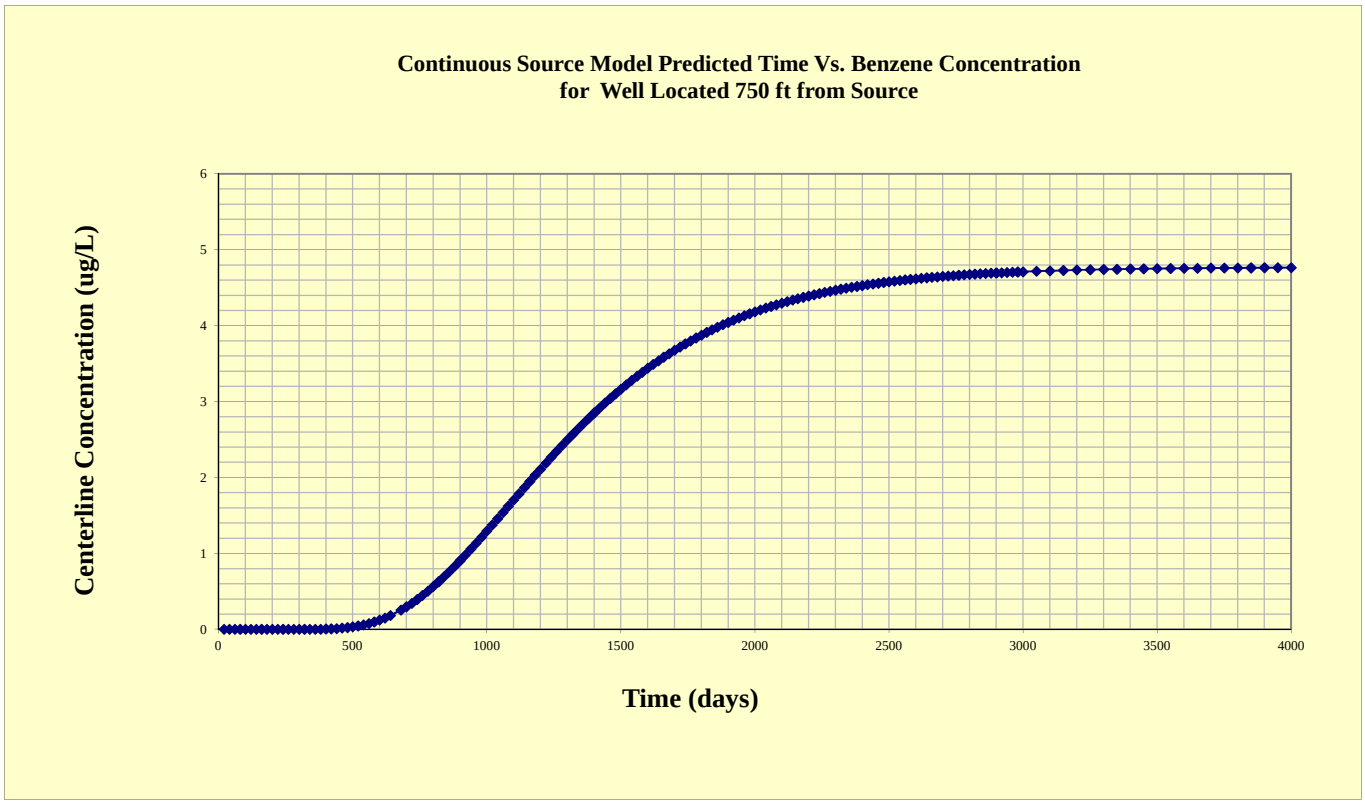
Input parameters for gw velocity
K (ft/day)
40
dh/dl
0.001721763
effective porosity
0.15
C mg/L
10



Dommencio Non-Steady State
Spreadsheet Analytical Model

Scenario 1: 10 mg/L Well distance 750 feet			
Source concentration	C_0	10000	ug/L
X axis dispersivity	α_x	75	ft
Y axis dispersivity	α_y	24.75	ft
Z axis dispersivity	α_z	4.2	ft
Groundwater velocity	u	0.46	ft/day
Source dimension Y	Y	200	ft
Source dimension Z	Z	1	ft
First order attenuation rate	λ	0.001	1/day
Distance from source to Well 1	X_1		ft
Distance from source to Well 2	X_2		ft
Distance to well	X_3	750	ft
SUMMARY SOLUTIONS & STATISTICS	days	years	
Time when plume first reached 0.1 ug/L in well	**600**	**1.6**	
Time when plume first reached 1 ug/L in well	**940**	**2.6**	
Time when plume first reached 5 ug/L in well	**0**	**0.0**	
Time when plume reached its peak in well	**3100**	**8.5**	
Time remaining for plume to reach 5 ug/L in well	**0**	**0.0**	
Maximum concentration in well	**4.72**	ug/L	
			C
			10000

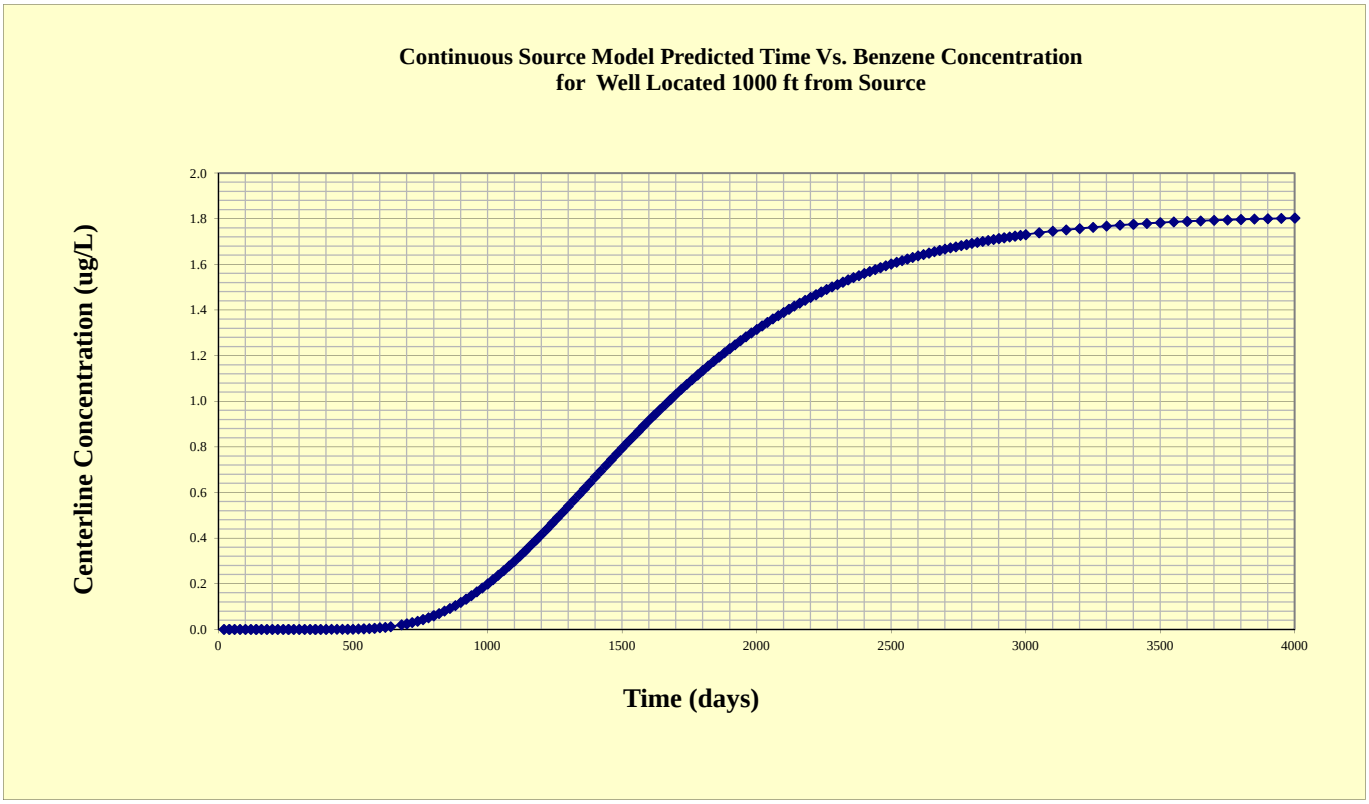
Input parameters for gw velocity
K (ft/day)
40
dh/dl
0.001721763
effective porosity
0.15
C mg/L
10



Dommencio Non-Steady State
Spreadsheet Analytical Model

Scenario 1: 10mg/L, Well Distance 1000 feet			
Source concentration	C_0	10000	ug/L
X axis dispersivity	α_x	100	ft
Y axis dispersivity	α_y	33	ft
Z axis dispersivity	α_z	5.6	ft
Groundwater velocity	u	0.46	ft/day
Source dimension Y	Y	200	ft
Source dimension Z	Z	1	ft
First order attenuation rate	λ	0.001	1/day
Distance from source to Well 1	X_1		ft
Distance from source to Well 2	X_2		ft
Distance to well	X_3	1000	ft
SUMMARY SOLUTIONS & STATISTICS	days	years	
Time when plume first reached 0.1 ug/L in well	**880**	**2.4**	
Time when plume first reached 1 ug/L in well	**1680**	**4.6**	
Time when plume first reached 5 ug/L in well	**0**	**0.0**	
Time when plume reached its peak in well	**3900**	**10.7**	
Time remaining for plume to reach 5 ug/L in well	**0**	**0.0**	
Maximum concentration in well	**1.80**	ug/L	
			C
			10000

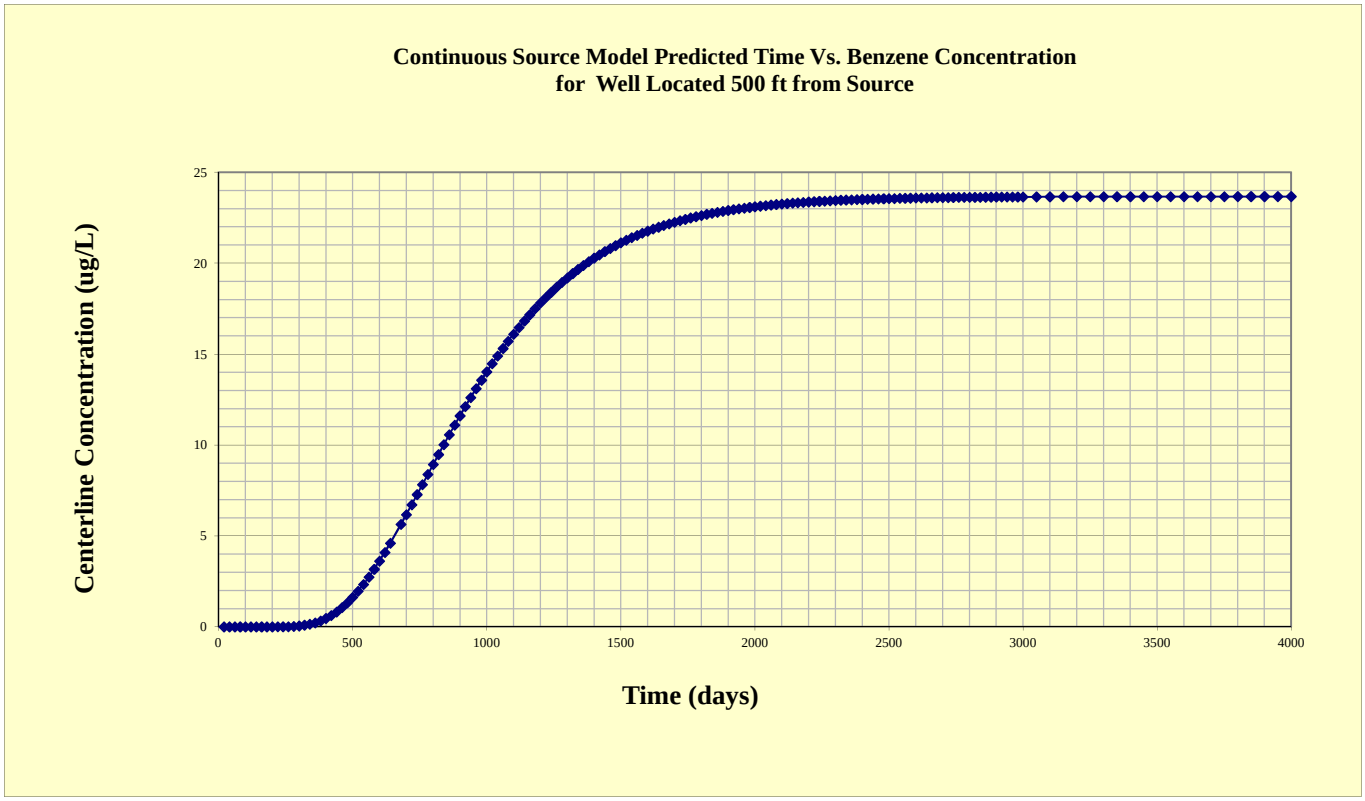
Input parameters for gw velocity
K (ft/day)
40
dh/dl
0.001721763
effective porosity
0.15
C mg/L
10



Dommencio Non-Steady State
Spreadsheet Analytical Model

Scenario 1: 15mg/L, Well Distance 500 feet			
Source concentration	C_0	15000	ug/L
X axis dispersivity	α_x	50	ft
Y axis dispersivity	α_y	16.5	ft
Z axis dispersivity	α_z	2.8	ft
Groundwater velocity	u	0.46	ft/day
Source dimension Y	Y	200	ft
Source dimension Z	Z	1	ft
First order attenuation rate	λ	0.001	1/day
Distance from source to Well 1	X_1		ft
Distance from source to Well 2	X_2		ft
Distance to well	X_3	500	ft
SUMMARY SOLUTIONS & STATISTICS	days	years	
Time when plume first reached 0.1 ug/L in well	**340**	**0.9**	
Time when plume first reached 1 ug/L in well	**460**	**1.3**	
Time when plume first reached 5 ug/L in well	**680**	**1.9**	
Time when plume reached its peak in well	**2280**	**6.2**	
Time remaining for plume to reach 5 ug/L in well	**680**	**1.9**	
Maximum concentration in well	**23.43**	ug/L	
			C
			15000

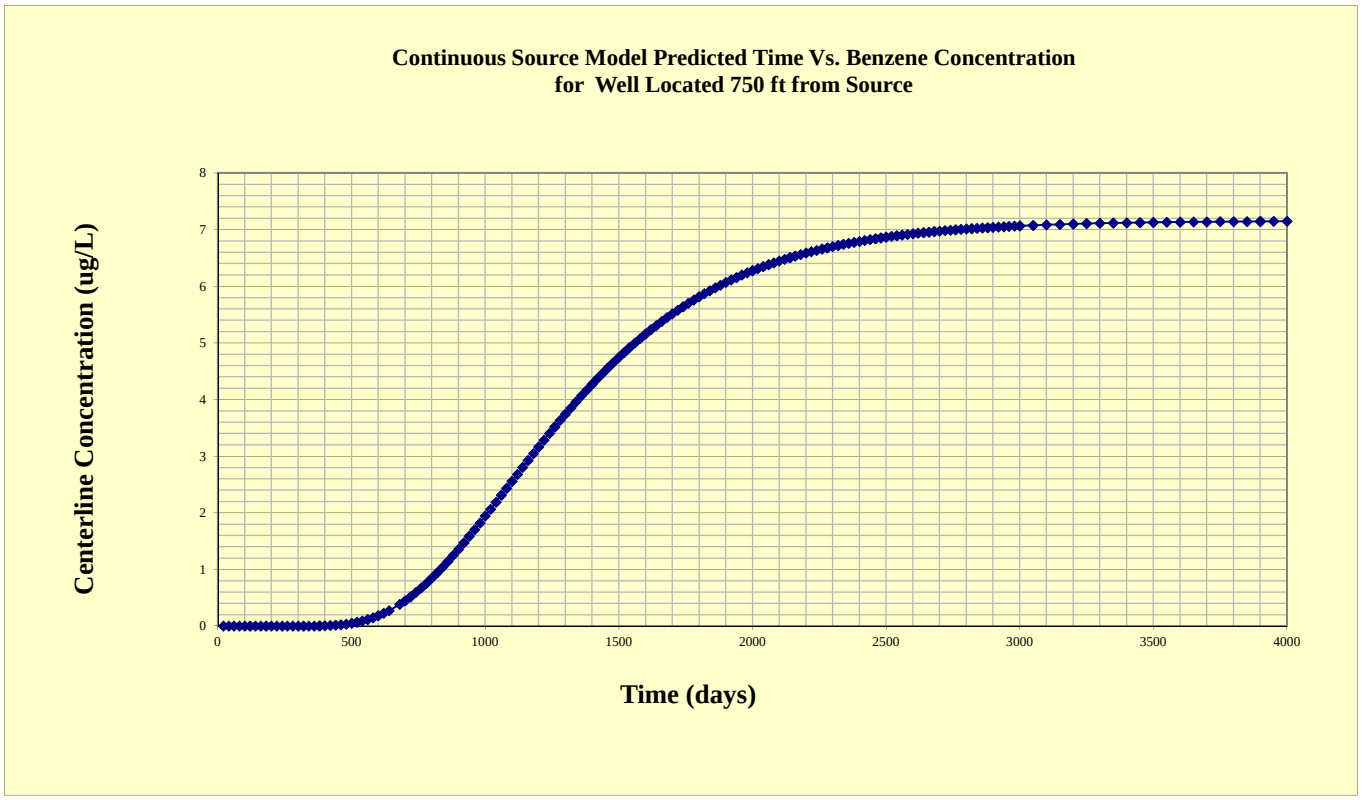
Input parameters for gw velocity
K (ft/day)
40
dh/dl
0.001721763
effective porosity
0.15
C mg/L
15



Dommencio Non-Steady State
Spreadsheet Analytical Model

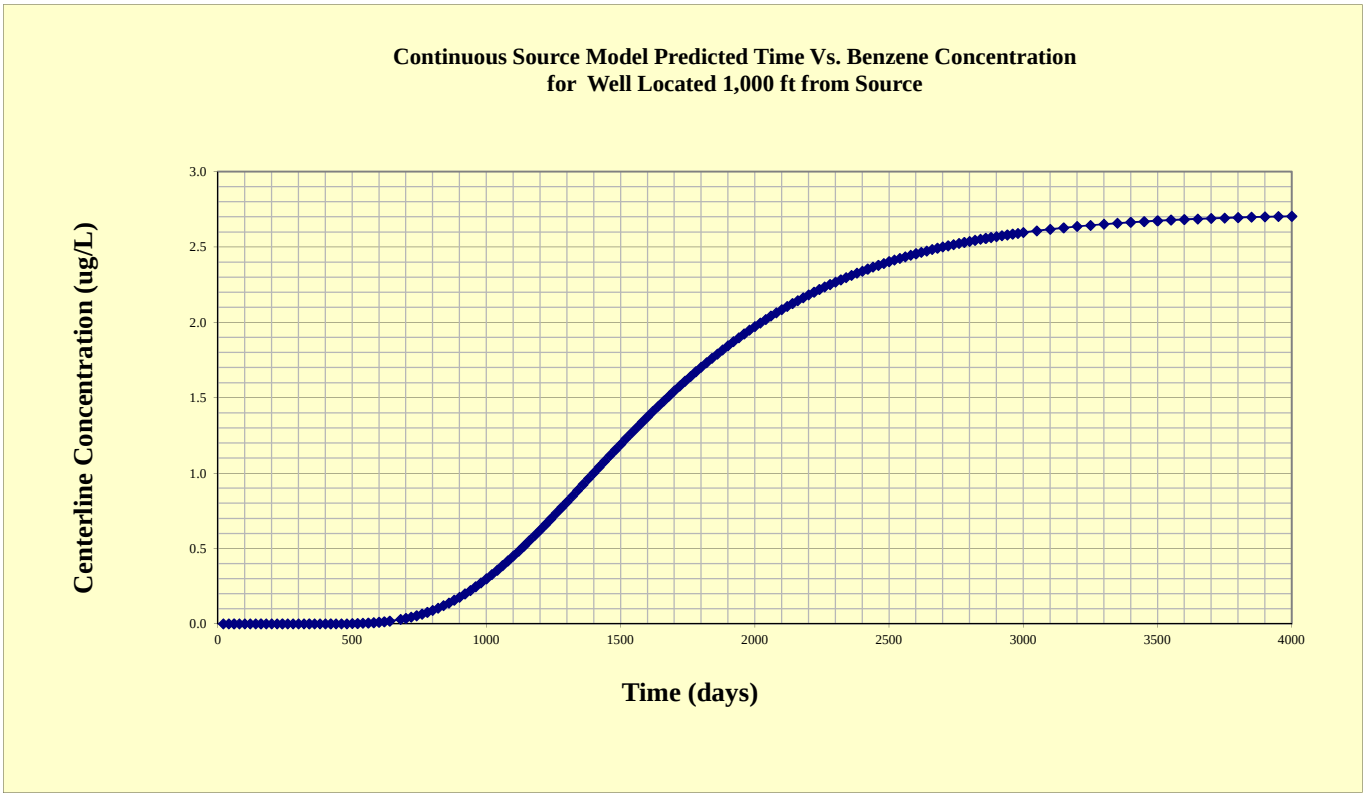
Scenario 1: 15 mg/L, Well Distance 750 feet			
Source concentration	C_0	15000	ug/L
X axis dispersivity	α_x	75	ft
Y axis dispersivity	α_y	24.75	ft
Z axis dispersivity	α_z	4.2	ft
Groundwater velocity	u	0.46	ft/day
Source dimension Y	Y	200	ft
Source dimension Z	Z	1	ft
First order attenuation rate	λ	0.001	1/day
Distance from source to Well 1	X_1		ft
Distance from source to Well 2	X_2		ft
Distance to well	X_3	750	ft
SUMMARY SOLUTIONS & STATISTICS	days	years	
Time when plume first reached 0.1 ug/L in well	560	1.5	
Time when plume first reached 1 ug/L in well	840	2.3	
Time when plume first reached 5 ug/L in well	1560	4.3	
Time when plume reached its peak in well	3100	8.5	
Time remaining for plume to reach 5 ug/L in well	1560	4.3	
Maximum concentration in well	7.08	ug/L	
			C
			15000

Input parameters for gw velocity
K (ft/day)
40
dh/dl
0.001721763
effective porosity
0.15
C mg/L
15



Scenario 1: 15 mg/L, Well distance 1,000 feet			
Source concentration	C_0	15000	ug/L
X axis dispersivity	α_x	100	ft
Y axis dispersivity	α_y	33	ft
Z axis dispersivity	α_z	5.6	ft
Groundwater velocity	u	0.46	ft/day
Source dimension Y	Y	200	ft
Source dimension Z	Z	1	ft
First order attenuation rate	λ	0.001	1/day
Distance from source to Well 1	X_1		ft
Distance from source to Well 2	X_2		ft
Distance to well	X_3	1000	ft
SUMMARY SOLUTIONS & STATISTICS	days	years	
Time when plume first reached 0.1 ug/L in well	**820**	**2.2**	
Time when plume first reached 1 ug/L in well	**1400**	**3.8**	
Time when plume first reached 5 ug/L in well	**0**	**0.0**	
Time when plume reached its peak in well	**3700**	**10.1**	
Time remaining for plume to reach 5 ug/L in well	**0**	**0.0**	
Maximum concentration in well	**2.69**	ug/L	
			C
			15000

Input parameters for gw velocity
K (ft/day)
40
dh/dl
0.001721763
effective porosity
0.15
C mg/L
15

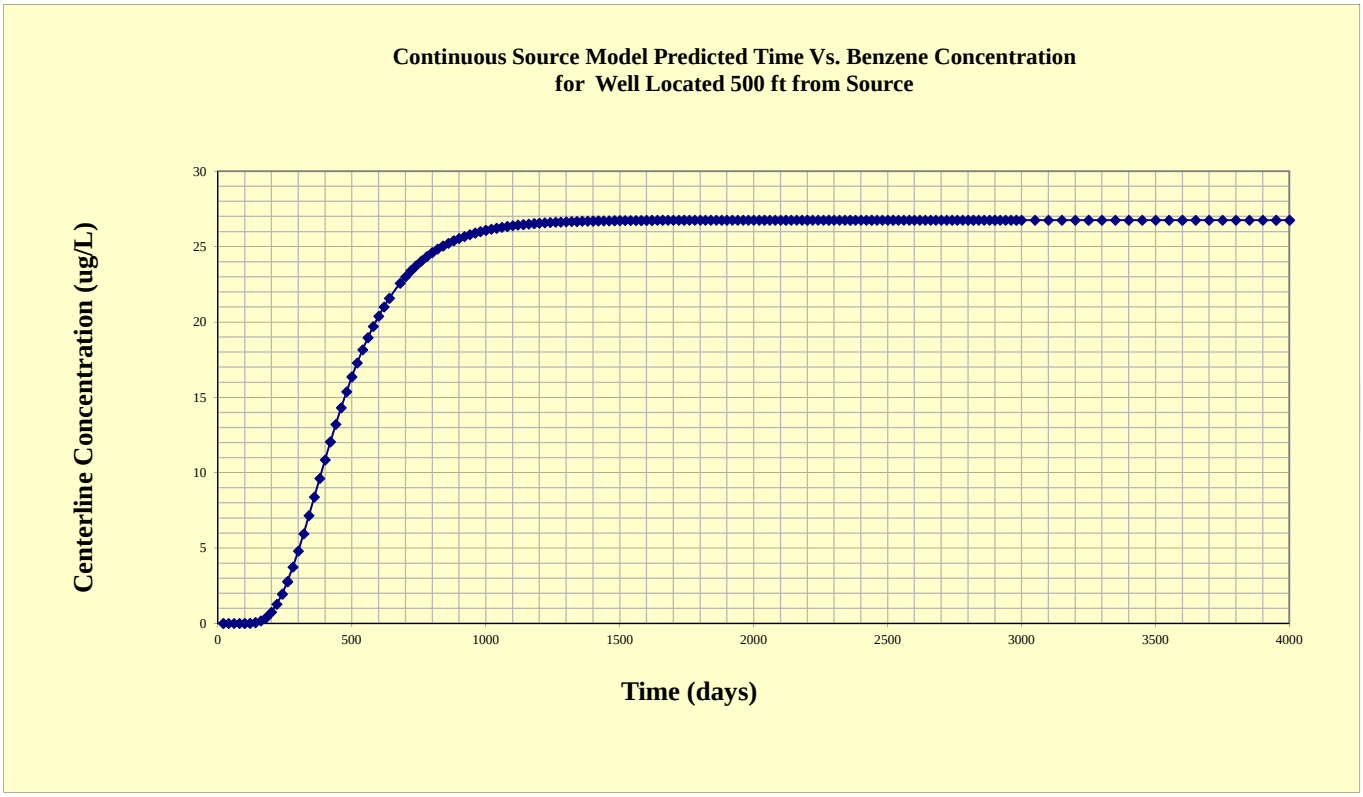


Domenico Non-Steady State
Spreadsheet Analytical Model

Scenario 2: 10 mg/L, Well Distance 500 feet			
Source concentration	C_0	10000	ug/L
X axis dispersivity	α_x	50	ft
Y axis dispersivity	α_y	16.5	ft
Z axis dispersivity	α_z	2.8	ft
Groundwater velocity	u	1.03	ft/day
Source dimension Y	Y	200	ft
Source dimension Z	Z	1	ft
First order attenuation rate	λ	0.001	1/day
Distance from source to Well 1	X_1		ft
Distance from source to Well 2	X_2		ft
Distance to well	X_3	500	ft
SUMMARY SOLUTIONS & STATISTICS	days	years	
Time when plume first reached 0.1 ug/L in well	**160**	**0.4**	
Time when plume first reached 1 ug/L in well	**220**	**0.6**	
Time when plume first reached 5 ug/L in well	**320**	**0.9**	
Time when plume reached its peak in well	**1160**	**3.2**	
Time remaining for plume to reach 5 ug/L in well	**320**	**0.9**	
Maximum concentration in well	**26.49**	ug/L	
			C
			10000

Input Parameters for gw velocity

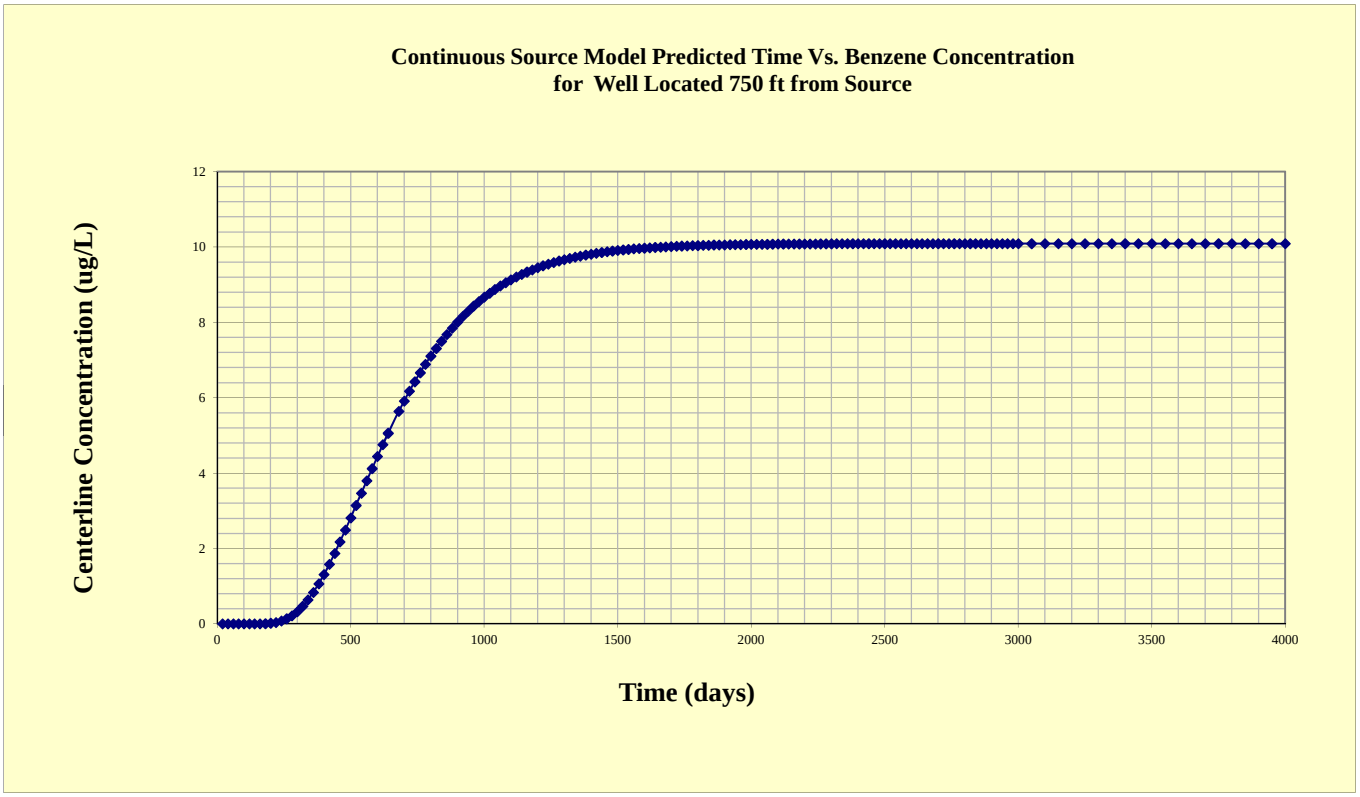
K (ft/day)
120
dh/dl
0.001721763
effective porosity
0.2
C mg/L
10



Domenico Non-Steady State
Spreadsheet Analytical Model

Scenario 2: 10 mg/L, Well Distance 750 feet			
Source concentration	C_0	10000	ug/L
X axis dispersivity	α_x	75	ft
Y axis dispersivity	α_y	24.75	ft
Z axis dispersivity	α_z	4.2	ft
Groundwater velocity	u	1.03	ft/day
Source dimension Y	Y	200	ft
Source dimension Z	Z	1	ft
First order attenuation rate	λ	0.001	1/day
Distance from source to Well 1	X_1		ft
Distance from source to Well 2	X_2		ft
Distance to well	X_3	750	ft
SUMMARY SOLUTIONS & STATISTICS	days	years	
Time when plume first reached 0.1 ug/L in well	**260**	**0.7**	
Time when plume first reached 1 ug/L in well	**380**	**1.0**	
Time when plume first reached 5 ug/L in well	**640**	**1.8**	
Time when plume reached its peak in well	**1660**	**4.5**	
Time remaining for plume to reach 5 ug/L in well	**640**	**1.8**	
Maximum concentration in well	**9.99**	ug/L	
			C
			10000

Input Parameters for gw velocity
K (ft/day)
120
dh/dl
0.001721763
effective porosity
0.2
C mg/L
10

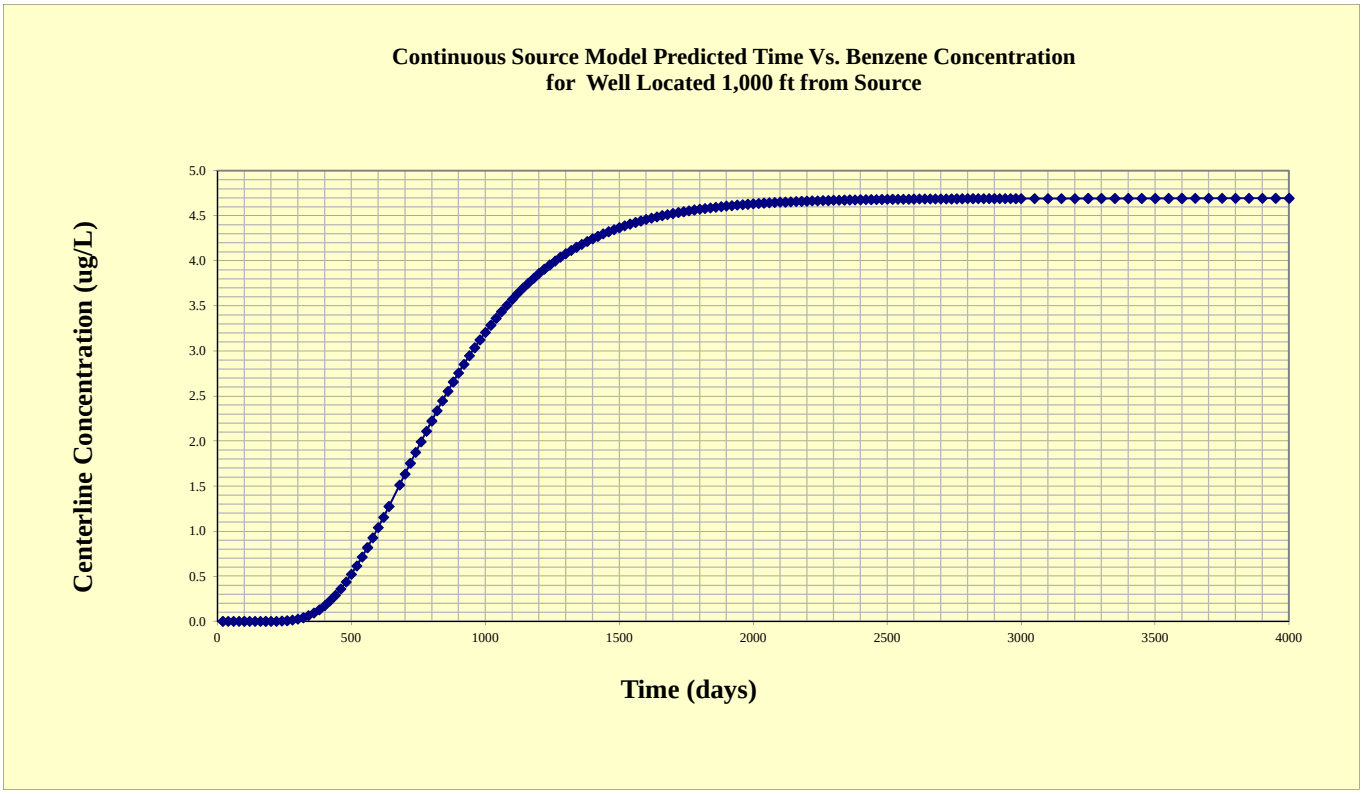


Domenico Non-Steady State
Spreadsheet Analytical Model

Scenario 2: 10 mg/L, Well Distance 1,000 Feet			
Source concentration	C_0	10000	ug/L
X axis dispersivity	α_x	100	ft
Y axis dispersivity	α_y	33	ft
Z axis dispersivity	α_z	5.6	ft
Groundwater velocity	u	1.03	ft/day
Source dimension Y	Y	200	ft
Source dimension Z	Z	1	ft
First order attenuation rate	λ	0.001	1/day
Distance from source to Well 1	X_1		ft
Distance from source to Well 2	X_2		ft
Distance to well	X_3	1000	ft
SUMMARY SOLUTIONS & STATISTICS	days	years	
Time when plume first reached 0.1 ug/L in well	**380**	**1.0**	
Time when plume first reached 1 ug/L in well	**600**	**1.6**	
Time when plume first reached 5 ug/L in well	**0**	**0.0**	
Time when plume reached its peak in well	**2120**	**5.8**	
Time remaining for plume to reach 5 ug/L in well	**0**	**0.0**	
Maximum concentration in well	**4.65**	ug/L	
			C
			10000

Input Parameters for gw velocity

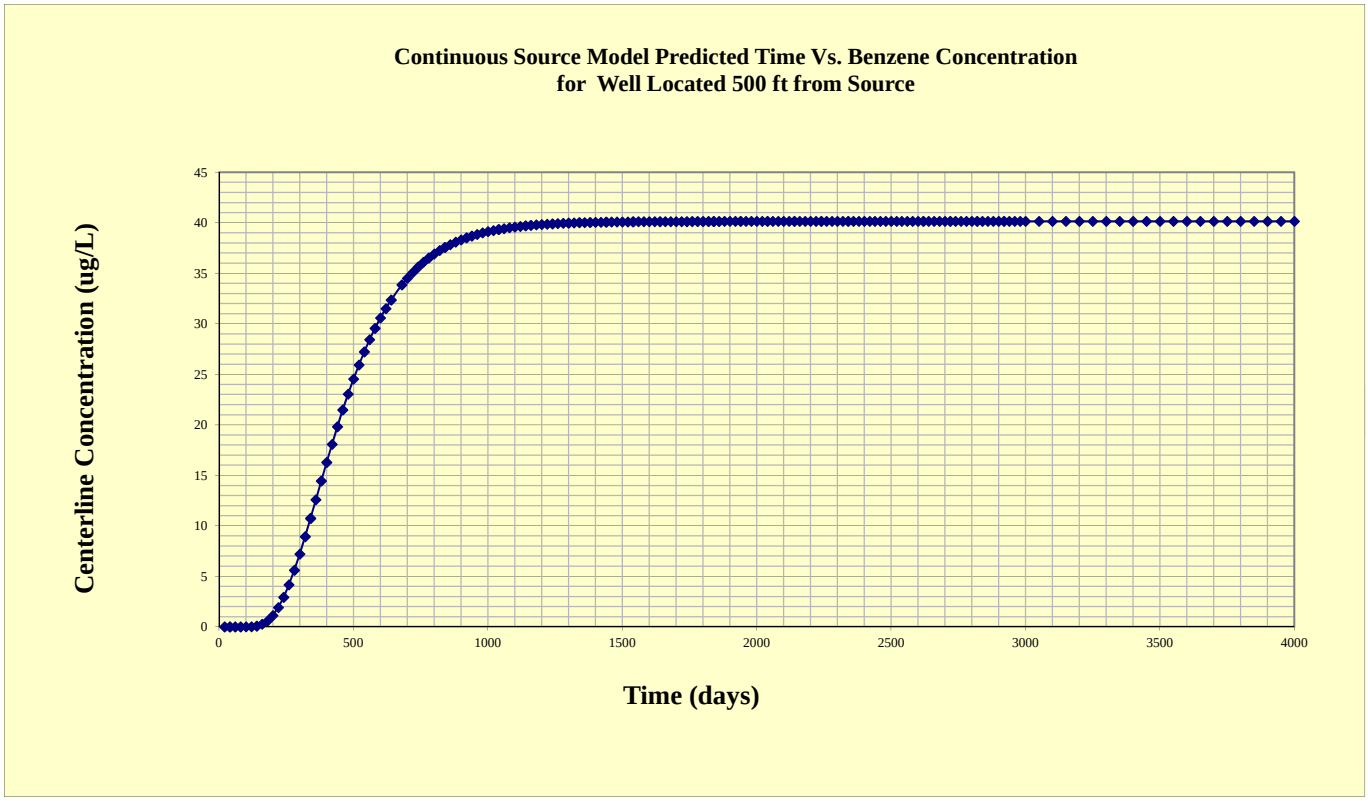
K (ft/day)
120
dh/dl
0.001721763
effective porosity
0.2
C mg/L
10



Domenico Non-Steady State
Spreadsheet Analytical Model

Scenario 2: 15 mg/L, Distance to well 500 feet			
Source concentration	C_0	15000	ug/L
X axis dispersivity	α_x	50	ft
Y axis dispersivity	α_y	16.5	ft
Z axis dispersivity	α_z	2.8	ft
Groundwater velocity	u	1.03	ft/day
Source dimension Y	Y	200	ft
Source dimension Z	Z	1	ft
First order attenuation rate	λ	0.001	1/day
Distance from source to Well 1	X_1		ft
Distance from source to Well 2	X_2		ft
Distance to well	X_3	500	ft
SUMMARY SOLUTIONS & STATISTICS	days	years	
Time when plume first reached 0.1 ug/L in well	**160**	**0.4**	
Time when plume first reached 1 ug/L in well	**200**	**0.5**	
Time when plume first reached 5 ug/L in well	**280**	**0.8**	
Time when plume reached its peak in well	**1160**	**3.2**	
Time remaining for plume to reach 5 ug/L in well	**280**	**0.8**	
Maximum concentration in well	**39.74**	ug/L	
			C
			15000

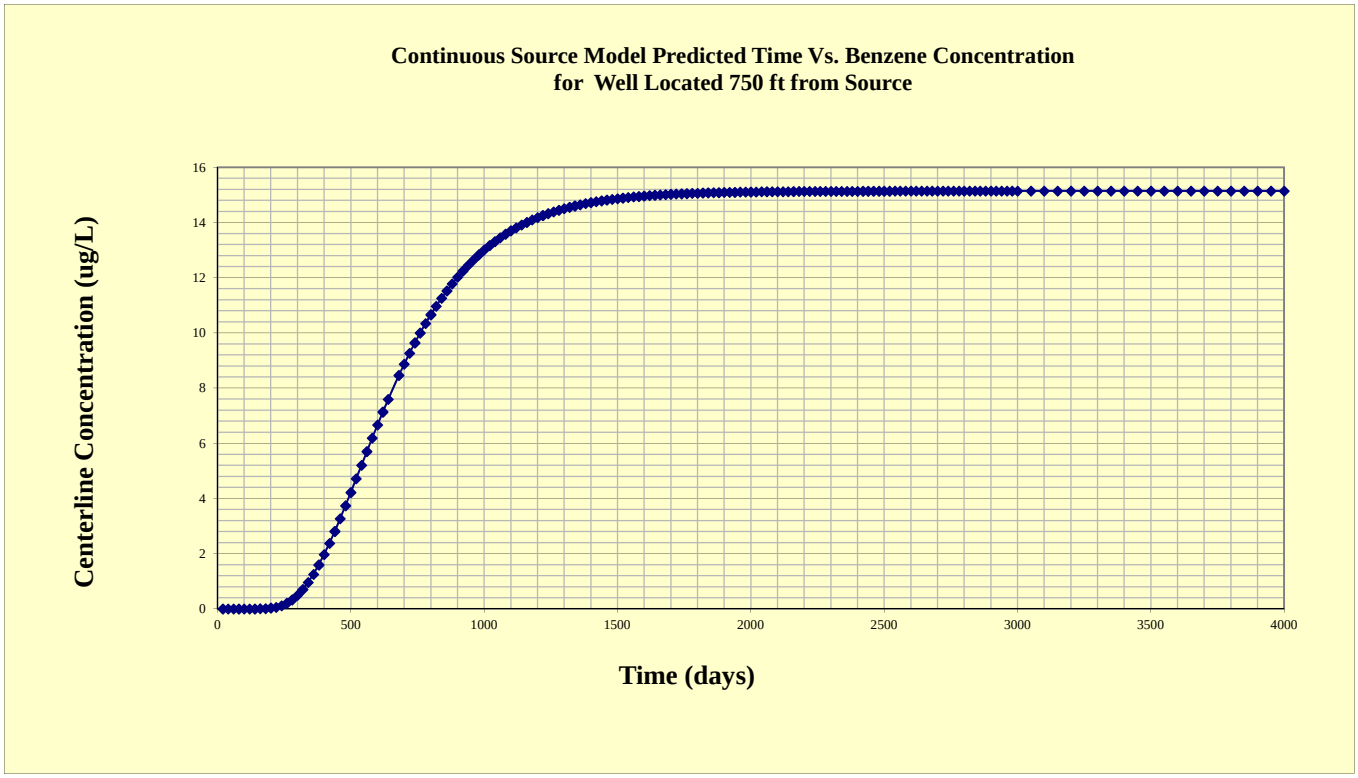
Input Parameters for gw velocity
K (ft/day)
120
dh/dl
0.001721763
effective porosity
0.2
C mg/L
15



Domenico Non-Steady State
Spreadsheet Analytical Model

Scenario 2: 15 mg/L, Distance to well 750 feet			
Source concentration	C_0	15000	ug/L
X axis dispersivity	α_x	75	ft
Y axis dispersivity	α_y	24.75	ft
Z axis dispersivity	α_z	4.2	ft
Groundwater velocity	u	1.03	ft/day
Source dimension Y	Y	200	ft
Source dimension Z	Z	1	ft
First order attenuation rate	λ	0.001	1/day
Distance from source to Well 1	X_1		ft
Distance from source to Well 2	X_2		ft
Distance to well	X_3	750	ft
SUMMARY SOLUTIONS & STATISTICS	days	years	
Time when plume first reached 0.1 ug/L in well	**240**	**0.7**	
Time when plume first reached 1 ug/L in well	**360**	**1.0**	
Time when plume first reached 5 ug/L in well	**540**	**1.5**	
Time when plume reached its peak in well	**1660**	**4.5**	
Time remaining for plume to reach 5 ug/L in well	**540**	**1.5**	
Maximum concentration in well	**14.99**	ug/L	
			C
			15000

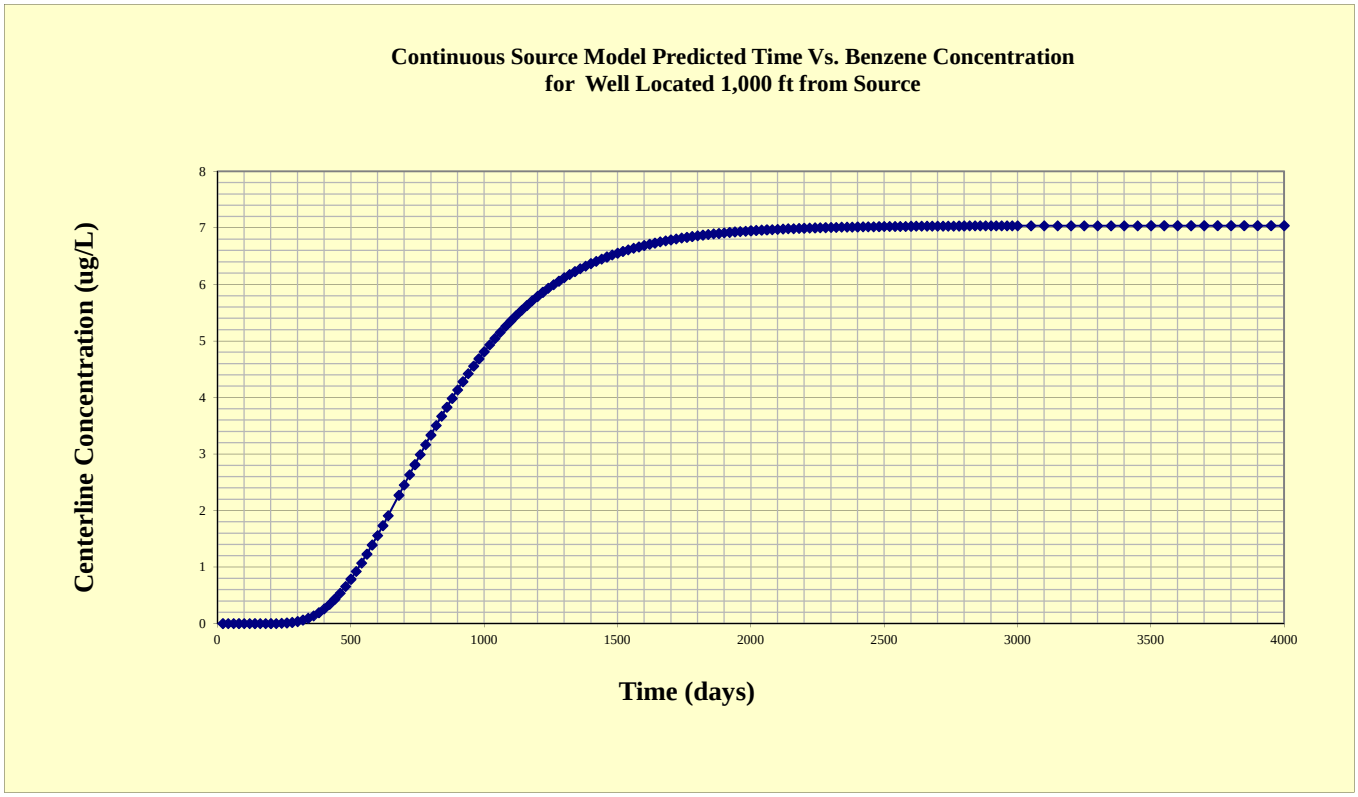
Input Parameters for gw velocity
K (ft/day)
120
dh/dl
0.001721763
effective porosity
0.2
C mg/L
15



Domenico Non-Steady State
Spreadsheet Analytical Model

Scenario 2: 15mg/L, Well Distance 1,000 feet			
Source concentration	C_0	15000	ug/L
X axis dispersivity	α_x	100	ft
Y axis dispersivity	α_y	33	ft
Z axis dispersivity	α_z	5.6	ft
Groundwater velocity	u	1.03	ft/day
Source dimension Y	Y	200	ft
Source dimension Z	Z	1	ft
First order attenuation rate	λ	0.001	1/day
Distance from source to Well 1	X_1		ft
Distance from source to Well 2	X_2		ft
Distance well	X_3	1000	ft
SUMMARY SOLUTIONS & STATISTICS	days	years	
Time when plume first reached 0.1 ug/L in well	**360**	**1.0**	
Time when plume first reached 1 ug/L in well	**540**	**1.5**	
Time when plume first reached 5 ug/L in well	**1040**	**2.8**	
Time when plume reached its peak in well	**2120**	**5.8**	
Time remaining for plume to reach 5 ug/L in well	**1040**	**2.8**	
Maximum concentration in well	**6.97**	ug/L	
			C
			15000

Input Parameters for gw velocity
K (ft/day)
120
dh/dl
0.001721763
effective porosity
0.2
C mg/L
15



Appendix F.5

Material Safety Data Sheets (MSDS)

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Appendix F.5 – Material Safety Data Sheets (MSDS)

F.5.1 – Dilbit

F.5.2 – Typical Heavy Oil

F.5.3 – Typical Light Oil

F.5.4 – Heavy Crude Oil/Diluent Mix (Christina Lake/Foster Creek)

F.5.5 –Western Canadian Select (WCS)

Appendix F.5.1
MSDS for Dilbit

Received from Keystone in Response to NDEQ Data Request

Section 1: PRODUCT AND COMPANY IDENTIFICATION

Product Name: Dilbit

Synonyms: Diluted Bitumen; AWB – Access Western Blend; Pipeline Sales Oil.

Product Use: Base product for Petroleum Refining.

Manufacturer/Supplier: MEG Energy Corp.
Christina Lake Regional Project
P.O Box 21008
Fort McMurray, AB
T9H 5B2

Phone Number: 403-770-5596

Emergency Phone: MEG Emergency Number: 1-800-575-1400

FOR EMERGENCIES INVOLVING DANGEROUS GOODS Call CANUTEC's 24-hr Number: 613-996-6666

Date of Preparation: August 31, 2011

Section 2: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
DANGER
HARMFUL OR FATAL IF SWALLOWED. CAN ENTER LUNGS AND CAUSE DAMAGE. CANCER HAZARD – CAN CAUSE CANCER. IRRITATING TO EYES AND SKIN.

Colour: Light to dark brown.
Physical State: Liquid.
Odour: Hydrocarbon.

WHMIS	Personal Protection Equipment	TDG (Ground)

Potential Health Effects: See Section 11 for more information.

Likely Routes of Exposure: Eye contact. Skin contact. Inhalation. Ingestion. Skin absorption.

Eye: Irritating to eyes. Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision. Hydrogen sulphide may cause eye irritation at 1-20 ppm and acute conjunctivitis at higher concentrations. Above 50 ppm H2S, eye irritation may include symptoms of redness, severe swelling, tearing, sensitivity to light and the appearance of 'Halos' around lights.

Skin: Irritating to skin. Signs/symptoms may include localized redness, swelling, and itching.

Ingestion: Harmful or fatal: may cause lung damage if swallowed. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. May cause gastrointestinal irritation. Signs/symptoms may include abdominal pain, stomach upset, nausea, vomiting and diarrhea.

Inhalation: May cause respiratory tract irritation. Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain. May cause headache, dizziness, confusion, loss of appetite and loss of consciousness. Inhalation of Toluene may result in peculiar skin sensations (e. g. pins and needles) or numbness. Hydrogen sulphide

may cause symptoms such as digestive upset and loss of appetite, loss of sense of smell and pulmonary edema. At 500-1000 ppm Hydrogen sulphide may cause respiratory paralysis, collapse and death without rescue.

Chronic Effects: See Section 11 for more information.

Medical Conditions Aggravated By Exposure: Not available.

Target Organs: Skin. Eyes. Gastrointestinal tract. Respiratory system. Lungs. Blood. Cardiovascular system. Bone marrow. Liver. Reproductive system. Nervous system.

Potential Environmental Effects: See Section 12 for more information.

This material is considered hazardous by the OSHA Hazard Communication Standard, (29 CFR 1910.1200).

Section 3: COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS No.	Wt. %
Petroleum	8002-05-9	60 - 100
Hexane	110-54-3	5 - 10
Benzene	71-43-2	1 - 5
Toluene	108-88-3	1 - 5
Xylenes	1330-20-7	0.5 - 1.5
Benzene, ethyl-	100-41-4	0.1 - 1
Hydrogen sulfide (H2S)	7783-06-4	< 0.1

Section 4: FIRST AID MEASURES

Eye Contact: Flush eyes with plenty of water for at least 15 minutes. If signs/symptoms persist, get medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. If signs/symptoms develop, get medical attention.

Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Inhalation: Remove person to fresh air. If breathing has stopped apply artificial respiration. If signs/symptoms develop, get medical attention.

General Advice: In case of accident or if you feel unwell, seek medical advice immediately (show the label or MSDS where possible).

Note to Physicians: Symptoms may not appear immediately. For inhalation of Hydrogen Sulphide, consider oxygen.

Section 5: FIRE FIGHTING MEASURES

Flammability: Flammable liquid by WHMIS criteria. Flammable liquid by OSHA criteria. Released vapours may form flammable/explosive mixtures. Vapours may travel considerable distances to ignition sources and cause a flash fire. Cool containing vessels with water jet in order to prevent pressure build-up, auto-ignition or explosion.

Means of Extinction
Suitable Extinguishing Media: Dry chemical, foam, water fog, carbon dioxide.

Unsuitable Extinguishing Media: Do not use water except as a fog.

Products of Combustion: Oxides of carbon. Oxides of sulphur. Aldehydes.

Protection of Firefighters: Keep upwind of fire. Wear full fire fighting turn-out gear (full Bunker gear) and respiratory protection (SCBA). Hydrogen sulphide is heavier than air and may collect in low lying areas and confined spaces.

Explosion Data
Sensitivity to Mechanical Impact: This material is not sensitive to mechanical impact.
Sensitivity to Static Discharge: This material is sensitive to static discharge at temperatures above the flash point.

Section 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions: Evacuate all unnecessary personnel. Stay upwind. Eliminate all ignition sources. Use personal protection recommended in Section 8. Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Don full-face, positive pressure, self-contained breathing apparatus.

Environmental Precautions: Keep out of drains, sewers, ditches, and waterways.

Methods for Containment: Stop leak if without risk. Contain spill and absorb with inert absorbent. Large pools may be covered with foam to prevent vapour evolution. Do not flush to sewer or allow to enter waterways.

Methods for Clean-Up: Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material. Large spills should be removed with explosion proof vacuum equipment.

Other Information: Dispose of in accordance with all federal, provincial and local regulations. Comply with federal, provincial, and local requirements for spill and/or release notification.

Section 7: HANDLING AND STORAGE

Handling:
Do not swallow. Do not get in eyes, or on skin. All equipment used when handling the product must be grounded. Handle and open container with care. When using do not eat or drink. Wash hands before eating, drinking, or smoking. Harmful concentrations of hydrogen sulfide (H_2S) gas can accumulate in excavations and low-lying areas as well as the vapour space of storage and bulk transport compartments. See Section 8 for information on Personal Protective Equipment.

Storage:
Store in cool, dry, well-ventilated area away from incompatible materials, heat, and sources of ignition. All storage containers and pumping equipment should be grounded. Keep out of the reach of children. Head spaces in storage containers may contain toxic hydrogen sulphide gas. Structural materials and lighting and ventilation systems should be corrosion resistant.

Section 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines
Component

Petroleum
(8002-05-9) **ACGIH:** Exposure by all routes should be carefully controlled to levels as low as possible (2009); For Mineral oil, excluding metal working fluids; Poorly and mildly refined
(8002-05-9) **OSHA:** 500 ppm (TWA), 2000 mg/m³ (TWA); 400 ppm (TWA) [Vacated]

Hexane
(110-54-3) **ACGIH:** 50 ppm (TWA); Skin, BEI (1996)
(110-54-3) **OSHA:** 500 ppm (TWA), 1800 mg/m³ (TWA); Skin. 50 ppm (TWA) [Vacated]

Benzene
(71-43-2) **ACGIH:** 0.5 ppm (TWA); 2.5 ppm (STEL); Skin; A1; BEI (1996)
(71-43-2) **OSHA:** 1 ppm (TWA); 5 ppm (STEL);

Toluene
(108-88-3) **ACGIH:** 20 ppm (TWA); A4; BEI (2006)
(108-88-3) **OSHA:** 200 ppm (TWA); 300 ppm (C); 500 ppm (Peak) (Maximum duration: 10 minutes.) 100 ppm (TWA); 150 ppm (STEL) [Vacated]

Xylenes
(1330-20-7) **ACGIH:** 100 ppm (TWA); 150 ppm (STEL); A4; BEI (1992)
(1330-20-7) **OSHA:** 100 ppm (TWA), 435 mg/m³ (TWA); 150 ppm (STEL) [Vacated]

Benzene, ethyl-
(100-41-4) **ACGIH:** 20 ppm (TWA); A3; BEI (2010)
(100-41-4) **OSHA:** 100 ppm (TWA), 435 mg/m³ (TWA); 125 ppm (STEL) [Vacated]

Hydrogen sulfide (H2S)
(7783-06-4) **ACGIH:** 1 ppm (TWA); 5 ppm (STEL); (2009)
(7783-06-4) **OSHA:** 20 ppm (C); 50 ppm (Peak) (Maximum duration: 10 mins. once only if no other meas. exp. occurs.) 10 ppm (TWA); 15 ppm (STEL) [Vacated]

PEL: Permissible Exposure Limit
TLV: Threshold Limit Value
TWA: Time-Weighted Average
STEL: Short-Term Exposure Limit
C: Ceiling

Engineering Controls: Use ventilation adequate to keep exposures (airborne levels of dust, fume, vapour, gas, etc.) below recommended exposure limits. Use explosion-proof ventilation equipment.

Personal Protective Equipment

Eye/Face Protection: Wear safety glasses. Ensure that eyewash stations are close to the workstation location.

Hand Protection:	Wear impervious gloves. Consult manufacturer specifications for further information.
Skin and Body Protection:	Wear suitable protective clothing. Flame resistant clothing such as Nomex ® is recommended in areas where material is stored or handled.
Respiratory Protection:	If engineering controls and ventilation are not sufficient to control exposure to below the allowable limits then an appropriate NIOSH/MSHA approved air-purifying respirator or self-contained breathing apparatus (SCBA) should be used. Supplied air breathing apparatus must be used when oxygen concentrations are low or if airborne concentrations exceed the limits of the air-purifying respirators.
General Hygiene Considerations:	Handle according to established industrial hygiene and safety practices.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Viscous liquid.
Colour:	Light to dark brown.
Odour:	Hydrocarbon.
Odour Threshold:	0.00047 ppm, (H_2S)
Physical State:	Liquid.
pH:	Not available.
Viscosity:	60.7 cSt @ 40 °C
Melting Point:	Not available.
Boiling Point:	34.9 °C to 720 °C
Flash Point:	Not available.
Evaporation Rate:	Not available.
Lower Flammability Limit:	Not available.
Upper Flammability Limit:	Not available.
Vapor Pressure:	Not available.
Vapor Density:	> 1 (Air = 1)
Specific Gravity:	0.9178 (Water = 1) @ 15 °C
Density:	917.0 kg/m³ @ 15 °C
Solubility in Water:	Insoluble.
Coefficient of Water/Oil Distribution:	Not measurable. Product is more soluble in oil.
Auto-ignition Temperature:	Not available.
Percent Volatile, wt. %:	Non-volatile.
VOC content, wt. %:	Not available.

Section 10: STABILITY AND REACTIVITY

Stability: Stable under normal storage conditions.

Conditions of Reactivity: Contact with incompatible materials. Sources of ignition. Exposure to heat.

Incompatible Materials: Strong oxidizers.

Hazardous Decomposition Products: Not available.

Possibility of Hazardous Reactions: None known.

Section 11: TOXICOLOGICAL INFORMATION

EFFECTS OF ACUTE EXPOSURE

Component Toxicity

Component	CAS No.	LD_{50} oral	LD_{50} dermal	LC_{50}
Petroleum	8002-05-9	4300 mg/kg, (rat)	Not available.	Not available.
Hexane	110-54-3	25000 mg/kg, (rat)	Not available.	48000 ppm, (rat), 4H
Benzene	71-43-2	930 mg/kg, (rat)	>9400 µl/kg, (rabbit)	10000 ppm, (rat), 7H
Toluene	108-88-3	600 mg/kg, (rat)	14.1 mL/kg, (rabbit)	49000 mg/m³, 4H, (rat)
Xylenes	1330-20-7	>1700 mg/kg, (rat)	4300 mg/kg, (rabbit)	5000 ppm, (rat), 4H
Benzene, ethyl-	100-41-4	3500 mg/kg, (rat)	17800 µl/kg, (rabbit)	Not available.
Hydrogen sulfide (H2S)	7783-06-4	Not available.	Not available.	444 ppm, (rat),

Eye: Irritating to eyes. Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision. Hydrogen sulphide may cause eye irritation at 1-20 ppm and acute conjunctivitis at higher concentrations. Above 50 ppm H2S, eye irritation may include symptoms of redness, severe swelling, tearing, sensitivity to light and the appearance of 'Halos' around lights.

Skin: Irritating to skin. Signs/symptoms may include localized redness, swelling, and itching.

Ingestion: Harmful or fatal: may cause lung damage if swallowed. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. May cause gastrointestinal irritation. Signs/symptoms may include abdominal pain, stomach upset, nausea, vomiting and diarrhea.

Inhalation: May cause respiratory tract irritation. Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain. May cause headache, dizziness, confusion, loss of appetite and loss of consciousness. Inhalation of Toluene may result in peculiar skin sensations (e. g. pins and needles) or numbness. Hydrogen sulphide may cause symptoms such as digestive upset and loss of appetite, loss of sense of smell and pulmonary edema. At 500-1000 ppm Hydrogen sulphide may cause respiratory paralysis, collapse and death without rescue.

Skin Sensitization: Not hazardous by OSHA/WHMIS criteria.

Respiratory Sensitization: Not hazardous by OSHA/WHMIS criteria.

EFFECTS OF CHRONIC EXPOSURE

Target Organs: Skin. Eyes. Gastrointestinal tract. Respiratory system. Lungs. Blood. Cardiovascular system. Bone marrow. Liver. Kidneys. Reproductive system. Nervous system.

Chronic Effects: Hazardous by OSHA/WHMIS criteria. May cause chronic effects. Prolonged or repeated contact may dry skin and cause irritation. Repeated dermal application of crude oils in rats produced systemic toxicity in blood, liver, thymus and bone marrow. Chronic inhalation of n-Hexane may cause peripheral nerve disorders and central nervous system effects. Long term inhalation of Benzene, Toluene or Xylene vapours can result in bone marrow abnormalities with damage to blood forming tissues and may cause anemia and other blood cell abnormalities. Immunodepressive effects have also been reported. Repeated exposure of the eyes to high concentrations of Xylenes vapour may cause reversible eye damage. Hydrogen sulphide may reduce lung function; cause neurological effects such as headaches, nausea, depression and personality changes; eye and mucous membrane irritation: damage to cardiovascular system.

Carcinogenicity: Hazardous by OSHA/WHMIS criteria. May cause cancer. Lifetime skin painting studies in animals with whole crude oils and crude oil fractions have produced tumours in animals following prolonged and repeated skin contact. Chronic exposure to benzene has been associated with an increased incidence of leukemia and multiple myeloma (tumour composed of cells of the type normally found in the bone marrow).

Component Carcinogenicity

Component	ACGIH	IARC	NTP	OSHA	Prop 65
Petroleum	A2	Group 3	Not listed.	Not listed.	Not listed.
Hexane	Not listed.	Not listed.	Not listed.	Not listed.	Not listed.
Benzene	A1	Group 1	List 1	OSHA Carcinogen	Listed.
Toluene	A4	Group 3	Not listed.	Not listed.	Not listed.
Xylenes	A4	Group 3	Not listed.	Not listed.	Not listed.
Benzene, ethyl-	A3	Group 2B	Not listed.	OSHA Carcinogen	Listed.
Hydrogen sulfide (H2S)	Not listed.	Not listed.	Not listed.	Not listed.	Not listed.

Mutagenicity: Hazardous by OSHA/WHMIS criteria. May cause heritable genetic damage.

Reproductive Effects: Possible risk of impaired fertility. Studies exist which report a link to crude oil and reproductive effects including menstrual disorders.

Developmental Effects

Teratogenicity: Not hazardous by OSHA/WHMIS criteria.

Embryotoxicity: Hazardous by OSHA/WHMIS criteria. Possible risk of harm to the unborn child. Repeated dermal application of crude oils to pregnant rats produced maternal toxicity and fetal developmental toxicity and fetal tumours. Benzene and Xylene have caused adverse fetal effects in laboratory animals. Exposure to Toluene may affect the developing fetus.

Toxicologically Synergistic Materials: Not available.

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity: 21 and 41 mg/l, 96 hr., Rainbow trout;
2.7 and 4.1 mg/l, 96 hr., Mysid;
122 and 528 ml/kg, 96 hr., Algae.

Persistence / Degradability: Not available.

Bioaccumulation / Accumulation: Not available.

Mobility in Environment: Not available.

Section 13: DISPOSAL CONSIDERATIONS

Disposal Instructions: Disposal should be in accordance with applicable regional, national and local laws and regulations. Local regulations may be more stringent than regional or national requirements.

Section 14: TRANSPORTATION INFORMATION

CFR

Proper Shipping Name: PETROLEUM CRUDE OIL, 3, UN 1267, I

Class: 3

UN Number: 1267

Packing Group: I

Label Code:

TDG

Proper Shipping Name: PETROLEUM CRUDE OIL, 3, UN 1267, I

Class: 3

UN Number: 1267

Packing Group: I

Label Code:

Section 15: REGULATORY INFORMATION

Chemical Inventories

US (TSCA)
The components of this product are in compliance with the chemical notification requirements of TSCA.

Canada (DSL)
The components of this product are in compliance with the chemical notification requirements of the NSN Regulations under CEPA, 1999.

Federal Regulations

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

WHMIS Classification:
Class B2 - Flammable Liquids.
Class D2A - Carcinogenicity.
Class D2A - Embryotoxicity.
Class D2A - Mutagenicity.
Class D2A - Chronic toxic effects.
Class D2B - Skin irritant.
Class D2B - Eye irritant.

Hazard Symbols:

United States
This MSDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SARA Title III

Component	Section 302 (EHS) TPQ (lbs.)	Section 304 EHS RQ (lbs.)	CERCLA RQ (lbs.)	Section 313	RCRA CODE	CAA 112(r) TQ (lbs.)
Petroleum	Not listed.	Not listed.	Not listed.	Not listed.	Not listed.	Not listed.
Hexane	Not listed.	Not listed.	5000	313 & X	Not listed.	Not listed.
Benzene	Not listed.	Not listed.	10	313	U019	Not listed.
Toluene	Not listed.	Not listed.	1000	313	U220	Not listed.
Xylenes	Not listed.	Not listed.	100	313	U239	Not listed.
Benzene, ethyl-	Not listed.	Not listed.	1000	313	Not listed.	Not listed.
Hydrogen sulfide (H2S)	500	100	100	313s	U135	10000

State Regulations
Massachusetts
US Massachusetts Commonwealth's Right-to-Know Law (Appendix A to 105 Code of Massachusetts Regulations Section 670.000)

Component	CAS No.	RTK List
Petroleum	8002-05-9	Listed.
Hexane	110-54-3	Listed.
Benzene	71-43-2	E
Toluene	108-88-3	Listed.
Xylenes	1330-20-7	Listed.
Benzene, ethyl-	100-41-4	Listed.
Hydrogen sulfide (H2S)	7783-06-4	E

Note: E = Extraordinarily Hazardous Substance

New Jersey
US New Jersey Worker and Community Right-to-Know Act (New Jersey Statute Annotated Section 34:5A-5)

Component	CAS No.	RTK List
Petroleum	8002-05-9	SHHS
Hexane	110-54-3	SHHS
Benzene	71-43-2	SHHS
Toluene	108-88-3	SHHS
Xylenes	1330-20-7	SHHS
Benzene, ethyl-	100-41-4	SHHS
Hydrogen sulfide (H2S)	7783-06-4	SHHS

Note: SHHS = Special Health Hazard Substance

Pennsylvania
US Pennsylvania Worker and Community Right-to-Know Law (34 Pa. Code Chap. 301-323)

Component	CAS No.	RTK List
Petroleum	8002-05-9	Listed.
Hexane	110-54-3	Listed.
Benzene	71-43-2	ES
Toluene	108-88-3	E
Xylenes	1330-20-7	E
Benzene, ethyl-	100-41-4	E
Hydrogen sulfide (H2S)	7783-06-4	E

Note: E = Environmental Hazard; S = Special Hazardous Substance

California
California Prop 65: WARNING: This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

Component	Type of Toxicity
Benzene	developmental, male & cancer
Toluene	developmental & female
Benzene, ethyl-	cancer
Polycyclic Aromatic Hydrocarbons	cancer
Nickel	cancer

Section 16: OTHER INFORMATION

Disclaimer:
The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. It is the user's responsibility to satisfy oneself as to the suitability and completeness of this information for his own particular use.

Expiry Date: August 30, 2014

Version: 1.0

MSDS Prepared by: **Deerfoot Consulting Inc.**

Phone: (403) 720-3700

Appendix F.5.2
MSDS for Typical Heavy Oil

Received from Keystone in Response to NDEQ Data Request

TransCanada Keystone Pipeline LP

Heavy Oil MSDS

TransCanada
In business to deliver

1. Product and Company Identification

Product Name: Typical Heavy Oil

Synonyms: Not Available

Intended Use: Chemical feedstock

Chemical Family: Blend of Heavy Petroleum Crude, Medium Crude and Synthetic Crude

Supplier: TransCanada Keystone Pipeline LP
450 – First Street S.W.,
P.O. Box 1000, Station M Calgary, Alberta, CANADA, T2P 4K6

Emergency Phone: **1-800-982-7222 (24 Hour)**

2. Composition/Information on Ingredients

Hazardous Ingredients:

Name	CAS#	TWA (ppm)	TWA (Mg/M³)	Exposure Limits STEL (ppm)	STEL (Mg/M³)	CEIL (ppm)	CEIL (Mg/M³)	% by Weight
Crude Oil (Hydrocarbon C5 and C6 Rich)	8002-05-09	100	n/av	n/av	n/av	n/av	n/av	100
Hydrogen Sulfide	7783-06-04	10	14	15	21	20	28	<0.5
Benzene	71-43-2		3.2		16			0.05-1.0
Toluene	108-88-3	50	188					1-5
Xylene	1330-20-7							0.1-1.5

Toxicity values of the hazardous ingredients

Crude oil (Hydrocarbons C5 and C6 Rich) LD50:4,300 mg/Kg (Rat). LC50: Not available.

Hydrogen Sulphide (H_2S) LC50 Inhalation Mouse = 673 ppm 1 hour. LC50 Inhalation Rat = 444 ppm for 4 hours

Benzene. LD50 Oral rat = 930-5600 mg/Kg. LC50 Inhalation rat = 13,700 ppm for 4 hrs.

Xylene. LD50 Oral rat = 4300 mg/Kg. LC50 Inhalation rat = 6700 ppm for 4 hrs. LD50 Dermal rabbit >2000 mg/Kg.

Toluene. LD50 Oral rat = 5000 mg/Kg. LC50 Inhalation rat = 8000 ppm for n4 hrs. LD50 Dermal rabbit = 14000 mg/Kg.

3. First Aid Measures

Eye: Flush eyes for at least 15 minutes with clean water. Patch lightly, allowing drainage. Seek medical attention.

Skin: Remove contaminated clothing. Wash skin thoroughly with soap and water. Seek medical attention ifirritation develops.

Inhalation (Breathing): Protect rescuer. Move exposed person to fresh air. If breathing has stopped apply artificial respiration. Seek medical attention.

Ingestion (Swallowing): If swallowed, do not induce vomiting or give liquids. Seek immediate medical attention.

4. Protective Clothing

Respiratory: Respiratory protection may be required in poorly ventilated areas. Properly fitted air purifying masks equipped with organic vapour filters will provide protection at low concentrations. Air supplied respirators or positive pressure self contained breathing apparatus is required when atmospheric concentrations of hydrocarbon vapours are likely to exceed 10X the occupational exposure limit or when high concentrations of H2S may be present.

Skin: Impervious gloves and clothing should be worn as appropriate to protect against skin contact. Neoprene or nitrile material is suggested.

Eye: Non-vented chemical goggles to prevent eye irritation from the solvent vapours.

Other: As required by the situation according to your companies policies and procedures. Contact your supervisor for direction.

5. Physical Data

Appearance:	Black Brown
Physical State:	Liquid
Odour:	Petroleum Odor
Vapor Pressure (mm Hg):	155 - 520
Vapor Density:	2.5 - 5.0
Boiling Point/Range:	10°C - 1000°C
Freezing/Melting Point:	Not Available
Solubility in Water:	Not Available
Specific Gravity:	0.92-0.94 (Water =1)
Percent Volatile:	100 vol.%
pH (1% soln/water)	Not Applicable
Odor Threshold	0.13 ppm H2S
Freezing Point	Not Available
Molecular Weight	Not Applicable
Melting Point	Not available
Density (kg/m^3)	920-940
Evaporation Rate (nButAc=1):	Not Available

6. Stability and Reactivity

Stability: This product is stable

Hazardous Decomposition Products: Carbon monoxide, carbon dioxide and irritant fumes and gases including sulphur oxides, nitrogen oxides and aldehydes.

Hazardous Polymerization: Will not occur

Materials to Avoid (Incompatible Materials): Strong acids, strong oxidizers, chlorine.

7. Toxicological Information

Routes of entry: Ingestion, inhalation, eye contact, skin contact.

TLV: TLV-TWA 100 PPM (525 mg/m3) for stoddard solvent from ACGIH.
Hydrogen Sulfide:
TWA: 10ppm, 14 mg/m3 ACGIH
STEL: 2.5 ppm STEL ACGIH
CEILING: 20 ppm, 28 mg/m3 Alberta OEL
Consult local authorities for acceptable exposure limits. Consult local authorities for acceptable exposure limits.
Benzene. TWA: (1ppm 3.2 mg/m3) STEL: 5.0 ppm (16 mg/m)^3) from Alberta OEL's SKIN
ACGIH (TLV) (United States) TWA 0.5 ppm. STEL 2.5 ppm (SKIN)

Toxicity to animals: Hydrocarbons C5 and C6 Rich
LD50: Not available
LC50: Not available
Hydrogen Sulphide (H2S)
LC50 Inhalation Mouse = 673 ppm 1 hour
LC50 Inhalation RAT = 444ppm for 4 hours
Remark: No additional remark

Chronic effects: This product may contain benzene. Benzene has been classified by the international agency for research on cancer as a group 1 product indicating sufficient evidence of carcinogenicity. Studies exist which report a link to crude oil and reproductive effects including fetal tumors and menstrual disorders. This product contains small quantities of xylene. High exposure to xylene has fetotoxic effects in animal studies. This product contains small quantities of polycylic aromatic hydrocarbons. Prolonged contact with these compounds has been associated with the induction of skin and lung tumours.
Remark: No additional remark

Acute effects: Sensitizing Capability: No effects known. Irritancy: Skin, eye and upper respiratory tract irritant.

Ingestion: Pulmonary aspiration hazard if swallowed and vomiting occurs.

Skin: Prolonged skin contact can cause defatting of the skin resulting in dry cracked skin and dermatitis.

Eyes: Eye contact with product or product vapours may result in eye irritation.

Inhalation: May cause headache, dizziness, loss of appetite and loss of consciousness. Product vapours are irritating to the respiratory tract.
Remark: This product contains small quantities of hydrogen sulphide (H2S) gas which may collect in confined spaces. Acute effects vary with concentration of H2S released from mild eye, nose and throat irritation at approximately 100 ppm to sudden unconsciousness or death at 500 ppm.

Synergistic: Not available

8. Fire and Explosion

Auto-ignition temperature: Not available

Flash points: CLOSED CUP: -40°C (-40°F)

Flammable Limits: Not available

Extinguishing Media: Use DRY chemicals, CO_2, or foam to extinguish fire. Water may not be an effective medium to extinguish fire. Cool contained vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special fire fighting procedures: Use supplied air or self contained breathing apparatus (SCBA) for large fires or for fires in enclosed areas.

Flammability: Highly flammable liquid. Released vapours may form flammable/explosive mixtures at or above the flash point. Vapours may travel considerable distances to ignition sources and cause a flash fire. All storage containers and pumping equipment must be grounded.

Risks of explosion: This material is sensitive to static discharge. This product is not sensitive to mechanical impact.

9. Preventative Measures

Waste Disposal: Dispose of in accordance with all federal, provincial and local regulations.

Storage: Keep away from all ignition sources. Maintain temperature below the flash point. Head spaces in storage containers may contain hydrocarbon vapours and toxic hydrogen sulphide gas.

Ventilation: Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Spill and Leak: Evacuate unecessary personnel. Eliminate all ignition sources. Be alert to the potential for the presence of hydrogen sulphide gas and don appropriate protective equipment. Stop leak if safe to do so. Contain spill and absorb with inert absorbent. Large spills should be removed with explosion proof vacuum equipment. Large pools may be covered with foam to prevent vapour evolution. Comply with federal, provincial, and local requirements for spill notification.

10. Classification/Regulatory Information

TDG road/rail: TDG CLASS 3: Flammable liquid with a flash point less than or equal to 60.5°C (140.9°F). Closed cup tes method.

PIN: 1267 - PETROLEUM CRUDE OIL

WHMIS: WHMIS CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
WHMIS CLASS D-2A: Material causing other toxic effects (VERY TOXIC).
WHMIS CLASS D-2B: Material causing other toxic effects (TOXIC).

Other: This product is on the Domestic Substances List (DSL). TSCA (Toxic Substance Control Act): This product is listed on the TSCA Inventory.

Refer to federal, state, and local legislation for further requirements.

Appendix F.5.3
MSDS for Typical Light Oil

Received from Keystone in Response to NDEQ Data Request

TransCanada Keystone Pipeline LP

Light Oil MSDS

TransCanada
In business to deliver

1. Product and Company Identification

Product Name: Typical Light Oil

Synonyms: Not Available

Intended Use: Chemical feedstock

Chemical Family: Blend of Medium Crude and Synthetic Crude

Supplier: TransCanada Keystone Pipeline LP
450 – First Street S.W.,
P.O. Box 1000, Station M Calgary, Alberta, CANADA, T2P 4K6

Emergency Phone: **1-800-982-7222 (24 Hour)**

2. Composition/Information on Ingredients

Hazardous Ingredients:

Name	CAS#	TWA (ppm)	TWA (Mg/M³)	Exposure Limits STEL (ppm)	STEL (Mg/M³)	CEIL (ppm)	CEIL (Mg/M³)	% by Weight
Crude Oil (Hydrocarbon C5 and C6 Rich)	8002-05-09	100	n/av	n/av	n/av	n/av	n/av	100
Hydrogen Sulfide	7783-06-04	10	14	15	21	20	28	<0.5
Benzene	71-43-2		3.2		16			0.1-1.0
Toluene	108-88-3	50	188					1-5
Xylene	1330-20-7							0.1-1.5

Toxicity values of the hazardous ingredients

Crude oil (Hydrocarbons C5 and C6 Rich) LD50:4,300 mg/Kg (Rat). LC50: Not available.

Hydrogen Sulphide (H_2S) LC50 Inhalation Mouse = 673 ppm 1 hour. LC50 Inhalation Rat = 444 ppm for 4 hours

Benzene. LD50 Oral rat = 930-5600 mg/Kg. LC50 Inhalation rat = 13,700 ppm for 4 hrs.

Xylene. LD50 Oral rat = 4300 mg/Kg. LC50 Inhalation rat = 6700 ppm for 4 hrs. LD50 Dermal rabbit >2000 mg/Kg.

Toluene. LD50 Oral rat = 5000 mg/Kg. LC50 Inhalation rat = 8000 ppm for n4 hrs. LD50 Dermal rabbit = 14000 mg/Kg.

3. First Aid Measures

Eye: Flush eyes for at least 15 minutes with clean water. Patch lightly, allowing drainage. Seek medical attention.

Skin: Remove contaminated clothing. Wash skin thoroughly with soap and water. Seek medical attention ifirritation develops.

Inhalation (Breathing): Protect rescuer. Move exposed person to fresh air. If breathing has stopped apply artificial respiration. Seek medical attention.

Ingestion (Swallowing): If swallowed, do not induce vomiting or give liquids. Seek immediate medical attention.

4. Protective Clothing

Respiratory: Respiratory protection may be required in poorly ventilated areas. Properly fitted air purifying masks equipped with organic vapour filters will provide protection at low concentrations. Air supplied respirators or positive pressure self contained breathing apparatus is required when atmospheric concentrations of hydrocarbon vapours are likely to exceed 10X the occupational exposure limit or when high concentrations of H2S may be present.

Skin: Impervious gloves and clothing should be worn as appropriate to protect against skin contact. Neoprene or nitrile material is suggested.

Eye: Non-vented chemical goggles to prevent eye irritation from the solvent vapours.

Other: As required by the situation according to your companies policies and procedures. Contact your supervisor for direction.

5. Physical Data

Appearance:	Amber to Black
Physical State:	Liquid
Odour:	Petroleum Odor
Vapor Pressure (mm Hg):	155 - 620
Vapor Density:	>1
Boiling Point/Range:	-90°C - 1100°C
Freezing/Melting Point:	Not Available
Solubility in Water:	Not Available
Specific Gravity:	0.82-0.90 (Water =1)
Percent Volatile:	100 vol.%
pH (1% soln/water)	Not Applicable
Odor Threshold	0.13 ppm H2S
Freezing Point	Not Available
Molecular Weight	Not Applicable
Melting Point	Not available
Density (kg/m^3)	820-900
Evaporation Rate (nButAc=1):	Not Available

6. Stability and Reactivity

Stability: This product is stable

Hazardous Decomposition Products: Carbon monoxide, carbon dioxide and irritant fumes and gases including sulphur oxides, nitrogen oxides and aldehydes.

Hazardous Polymerization: Will not occur

Materials to Avoid (Incompatible Materials): Strong acids, strong oxidizers, chlorine.

7. Toxicological Information

Routes of entry: Ingestion, inhalation, eye contact, skin contact.

TLV: TLV-TWA 100 PPM (525 mg/m3) for stoddard solvent from ACGIH.
Hydrogen Sulfide:
TWA: 10ppm, 14 mg/m3 ACGIH
STEL: 2.5 ppm STEL ACGIH
CEILING: 20 ppm, 28 mg/m3 Alberta OEL
Consult local authorities for acceptable exposure limits. Consult local authorities for acceptable exposure limits.
Benzene. TWA: (1ppm 3.2 mg/m3) STEL: 5.0 ppm (16 mg/m)^3) from Alberta OEL's SKIN
ACGIH (TLV) (United States) TWA 0.5 ppm. STEL 2.5 ppm (SKIN)

Toxicity to animals: Hydrocarbons C5 and C6 Rich
LD50: Not available
LC50: Not available
Hydrogen Sulphide (H2S)
LC50 Inhalation Mouse = 673 ppm 1 hour
LC50 Inhalation RAT = 444ppm for 4 hours
Remark: No additional remark

Chronic effects: This product may contain benzene. Benzene has been classified by the international agency for research on cancer as a group 1 product indicating sufficient evidence of carcinogenicity. Studies exist which report a link to crude oil and reproductive effects including fetal tumors and menstrual disorders. This product contains small quantities of xylene. High exposure to xylene has fetotoxic effects in animal studies. This product contains small quantities of polycylic aromatic hydrocarbons. Prolonged contact with these compounds has been associated with the induction of skin and lung tumours.
Remark: No additional remark

Acute effects: Sensitizing Capability: No effects known. Irritancy: Skin, eye and upper respiratory tract irritant.

Ingestion: Pulmonary aspiration hazard if swallowed and vomiting occurs.

Skin: Prolonged skin contact can cause defatting of the skin resulting in dry cracked skin and dermatitis.

Eyes: Eye contact with product or product vapours may result in eye irritation.

Inhalation: May cause headache, dizziness, loss of appetite and loss of consciousness. Product vapours are irritating to the respiratory tract.
Remark: This product contains small quantities of hydrogen sulphide (H2S) gas which may collect in confined spaces. Acute effects vary with concentration of H2S released from mild eye, nose and throat irritation at approximately 100 ppm to sudden unconsciousness or death at 500 ppm.

Synergistic: Not available

8. Fire and Explosion

Auto-ignition temperature: Not available

Flash points: CLOSED CUP: -40°C (-40°F)

Flammable Limits: Not available

Extinguishing Media: Use DRY chemicals, CO_2, or foam to extinguish fire. Water may not be an effective medium to extinguish fire. Cool contained vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special fire fighting procedures: Use supplied air or self contained breathing apparatus (SCBA) for large fires or for fires in enclosed areas.

Flammability: Highly flammable liquid. Released vapours may form flammable/explosive mixtures at or above the flash point. Vapours may travel considerable distances to ignition sources and cause a flash fire. All storage containers and pumping equipment must be grounded.

Risks of explosion: This material is sensitive to static discharge. This product is not sensitive to mechanical impact.

9. Preventative Measures

Waste Disposal: Dispose of in accordance with all federal, provincial and local regulations.

Storage: Keep away from all ignition sources. Maintain temperature below the flash point. Head spaces in storage containers may contain hydrocarbon vapours and toxic hydrogen sulphide gas.

Ventilation: Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Spill and Leak: Evacuate unecessary personnel. Eliminate all ignition sources. Be alert to the potential for the presence of hydrogen sulphide gas and don appropriate protective equipment. Stop leak if safe to do so. Contain spill and absorb with inert absorbent. Large spills should be removed with explosion proof vacuum equipment. Large pools may be covered with foam to prevent vapour evolution. Comply with federal, provincial, and local requirements for spill notification.

10. Classification/Regulatory Information

TDG road/rail: TDG CLASS 3: Flammable liquid with a flash point less than or equal to 60.5°C (140.9°F). Closed cup tes method.

PIN: 1267 - PETROLEUM CRUDE OIL

WHMIS: WHMIS CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
WHMIS CLASS D-2A: Material causing other toxic effects (VERY TOXIC).
WHMIS CLASS D-2B: Material causing other toxic effects (TOXIC).

Other: This product is on the Domestic Substances List (DSL). TSCA (Toxic Substance Control Act): This product is listed on the TSCA Inventory.

Refer to federal, state, and local legislation for further requirements.

Appendix F.5.4

MSDS for Heavy Crude Oil/Diluent Mix (Christina Lake/Foster Creek)

Reprinted from Appendix V of DOS Final EIS (August 2011)

SECTION 1 – MATERIAL IDENTIFICATION AND USE

Material Name: HEAVY CRUDE OIL/DILUENT MIX (CHRISTINA LAKE/FOSTER CREEK)
Use: Process stream, fuels and lubricants production
WHMIS Classification: Class B, Div. 2, Class D, Div. 2, Sub-Div. A and B
NFPA: Fire: 2 **Reactivity**: 0 **Health**: 3
TDG: **UN:** 1267 **Class:** 3
Packing Group: I (boiling point less than 35 deg. C)
II (boiling point 35 deg. C or above, and flash point less than 23 deg. C)
Manufacturer/Supplier: ENCANA CORPORATION
#1800, 855 - 2nd Street S.W., P.O. BOX 2850,
CALGARY, ALBERTA, T2P 2S5
Emergency Telephone: 403-645-3333
Chemical Family: Crude oil/condensate mix

SECTION 2 – HAZARDOUS INGREDIENTS OF MATERIAL

Hazardous Ingredients	Approximate Concentrations (%)	C.A.S. Nos.	LD50/LC50 Specify Species & Route	Exposure Limits
Crude oil	50 - 70	8002-05-9	LD50,rat, skin,>2 g/kg	5 mg/m3 (OEL,TLV)
Hydrocarbon Diluent	30 - 50	N.Av.	N.Av.	900 mg/m3 (OEL)*
Benzene	0.05 - 0.1	71-43-2	LD50,rat,oral,930 mg/kg LC50,rat,4 hr,13200 ppm	1 ppm (OEL), 0.5 ppm (TLV)
Hydrogen Sulphide	<20 ppm	7783-06-04	LC50, rat, 4 hrs, 444 ppm	10 ppm (OEL,TLV)

OEL = 8 hr. Alberta Occupational Exposure Limit; TLV = Threshold Limit Value (8 hrs) *OEL for gasoline

SECTION 3 – PHYSICAL DATA FOR MATERIAL

Physical State: Liquid
Specific Gravity: 0.92 – 0.94
Vapour Density (air=1): 2.5 -5.0
Percent Volatiles, by volume: 20 - 30 (estimated)
pH: N.Av.
Vapour Pressure (mmHg): approx. 300 @ 20C
Odour Threshold (ppm): N.Av.
Evaporation Rate: N.Av.
Boiling Pt. (deg.C): initial B.Pt. variable (16 – 30C)
Freezing Pt. (deg.C): <0
Coefficient of Water/Oil Distribution: <0.1
Odour & Appearance: Brown/black liquid, hydrocarbon odour
(N.Av. = not available N.App. = not applicable)

SECTION 4 – FIRE AND EXPLOSION

Flammability: Yes **Conditions**: Material will ignite at normal temperatures.
Means of Extinction: Foam, CO2, dry chemical. Explosive accumulations can build up in areas of poor ventilation.
Special Procedures: Use water spray to cool fire-exposed containers, and to disperse vapors if spill has not ignited. Cut off fuel and allow flame to burn out.
Flash Point (deg.C) & Method: <-35 (PMCC)
Upper Explosive Limit (% by vol.): 8 (estimated) **Sensitivity to Impact**: No
Lower Explosive Limit (% by vol.): 0.8 (estimated) **Sensitivity to Static Discharge**: Yes, at elevated temperatures
Auto-Ignition Temp. (deg.C): 250 (estimated) **TDG Flammability Classification**: N.App.
Hazardous Combustion Products: Carbon monoxide, carbon dioxide, sulphur oxides

SECTION 5 – REACTIVITY DATA

Chemical Stability: Stable **Conditions**: Heat
Incompatibility: Yes **Substances**: Oxidizing agents (e.g. chlorine)
Reactivity: Yes **Conditions**: Heat, strong sunlight
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide, sulphur oxides

SECTION 6 – TOXICOLOGICAL PROPERTIES OF PRODUCT

Routes of Entry:
Skin Absorption : Yes **Skin Contact**: Yes **Eye Contact**: Yes
Inhalation: **Acute**: Yes **Chronic**: Yes **Ingestion**: Yes
Effects of Acute Exposure: Vapour may cause irritation of eyes, nose and throat, dizziness and drowsiness. Contact with skin may cause irritation and possibly dermatitis. Contact of liquid with eyes may cause severe irritation/burns.
Effects of Chronic Exposure: Due to presence of benzene, long term exposure may increase the risk of anaemia and leukemia. Repeated skin contact may increase the risk of skin cancer.
Sensitization to Product: No.
Exposure Limits of Product: 1 ppm (Alberta 8 hr OEL for benzene)
Irritancy: Yes
Synergistic Materials: None reported
Carcinogenicity: Yes **Reproductive Effects**: Possibly **Teratogenicity**: Possibly **Mutagenicity**: Possibly

SECTION 7 – PREVENTIVE MEASURES

Personal Protective Equipment: Use positive pressure self-contained breathing apparatus, supplied air breathing apparatus or cartridge air purifying respirator approved for organic vapours where concentrations may exceed exposure limits (note: cartridge respirator not suitable for oxygen deficiency or IDLH situations).
Gloves: Viton (nitrile adequate for short exposure to liquid)
Eye: Chemical splash goggles. **Footwear**: As per safety policy **Clothing**: As per fire protection policy
Engineering Controls: Use only in well ventilated areas. Mechanical ventilation required in confined areas. Equipment must be explosion proof.
Leaks & Spills: Stop leak if safe to do so. Use personal protective equipment. Use water spray to cool containers. Remove all ignition sources. Provide explosion-proof clearing ventilation, if possible. Prevent from entering confined spaces. Dyke and pump into containers for recycling or disposal. Notify appropriate regulatory authorities.
Waste Disposal: Contact appropriate regulatory authorities for disposal requirements.
Handling Procedures & Equipment: Avoid contact with liquid. Avoid inhalation. Bond and ground all transfers. Avoid sparking conditions.
Storage Requirements: Store in a cool, dry, well ventilated area away from heat, strong sunlight, and ignition sources.
Special Shipping Provisions: N.App.

SECTION 8 – FIRST AID MEASURES

Skin: Flush skin with water, removing contaminated clothing. Get medical attention if irritation persists or large area of contact. Decontaminate clothing before re-use.

Eye: Immediately flush with large amounts of luke warm water for 15 minutes, lifting upper and lower lids at intervals. Seek medical attention if irritation persists.

Inhalation: Ensure own safety. Remove victim to fresh air. Give oxygen, artificial respiration, or CPR if needed. Seek medical attention immediately.

Ingestion: Give 2-3 glasses of milk or water to drink. DO NOT INDUCE VOMITING. Keep warm and at rest. Get immediate medical attention.

SECTION 9 – PREPARATION DATE OF MSDS

Prepared By: EnCana Environment, Health and Safety (EHS)
Phone Number: (403) 645-2000 Preparation Date: August 19, 2009 Expiry Date: August 19, 2012

Appendix F.5.5
MSDS for Western Canadian Select (WCS)

Reprinted from Appendix V of DOS Final EIS (August 2011)

Husky Energy

Material Safety Data Sheet

WHMIS	Personal Protection	TDG Road/Rail

Section I. Product Identification and Uses

Common/Trade name	**Western Canadian Select (WCS)**		
Synonyms	Not available.	**CAS #**	8002-05-09
Chemical family	Blend of Heavy Petroleum Crude, Medium Sweet Crude and Synthetic Crude.	**DSL**	On the DSL list.
Supplier	Husky Oil Operations Limited PO Box 6525 Station 'D' Calgary, Alberta T2P 3G7 403-298-6111	**Manufacturer**	Husky Oil Operations Limited PO Box 6525 Station 'D' Calgary, Alberta T2P 3G7 403-298-6111
Material uses	Chemical feedstock		

Section 2. First Aid Measures

Eye contact	Flush eyes for at least 15 minutes with clean water. Patch lightly, allowing drainage. Seek medical attention.
Skin contact	Remove contaminated clothing. Wash skin thoroughly with soap and water. Seek medical attention if irritation develops.
Inhalation	Protect rescuer. Move exposed person to fresh air. If breathing has stopped apply artificial respiration. Seek medical attention.
Ingestion	If swallowed, do not induce vomiting or give liquids. Seek immediate medical attention.

Section 3. Hazardous Ingredients

		Exposure Limits						
Name	**CAS #**	**TWA (ppm)**	**TWA (Mg/M3)**	**STEL (ppm)**	**STEL (Mg/M3)**	**CEIL (ppm)**	**CEIL (Mg/M3)**	**% by Weight**
Crude Oil (Hydrocarbons C5 and C6 Rich)	8002-05-09	100	n/av	n/av	n/av	n/av	n/av	100
Hydrogen Sulphide	7783-06-4	10	14	15	21	n/av	n/av	<0.5
Benzene	71-43-2	0.5	n/av	2.5	n/av			0.1-1
Toluene	108-88-3	20	n/av					1-5
Xylene	1330-20-7	100	n/av	150	n/av			1-30

Toxicity values of the hazardous ingredients	Crude oil (Hydrocarbons C5 and C6 Rich) LD50:4,300 mg/Kg (Rat). LC50: Not available. **Hydrogen Sulphide (H2S) LC50 Inhalation Mouse = 673 ppm 1 hour. LC50 Inhalation Rat = 444 ppm for 4 hours** **Benzene. LD50 Oral rat= 930-5600 mg/Kg. LC50 Inhalation rat = 13,700 ppm for 4 hrs.** **Xylene. LD50 Oral rat= 4300 mg/Kg. LC50 Inhalation rat= 6700 ppm for 4 hrs. LD50 Dermal rabbit >2000 mg/Kg.** **Toluene. LD50 Oral rat= 5000 mg/Kg. LC50 Inhalation rat= 8000 ppm for n4 hrs. LD50 Dermal rabbit= 14000 mg/Kg.**

Continued on Next Page

Section 4. Physical Data

Physical state and appearance	Liquid. Black/Brown.
Odor	Petroleum Odour
pH (1% soln/water)	Not applicable.
Odor threshold	O.13 ppm H2S
Evaporation rate	Not available.
Freezing point	Not available.
Boiling point	10°C - 1000°C
Specific gravity	0.92 -0.94 (Water = 1)
Volatility	100 (%vol)
Vapor density	Not available.
Vapor pressure	Not available.
Water/oil dist. coeff.	Not available.
Solubility	Not available.
Molecular Weight	Not applicable.
Melting Point	Not available.
Density	Not available.

Section 5. Fire and Explosion Data

Auto-ignition temperature	Not available.
Flash points	CLOSED CUP: -40°C (-40°F)
Flammable limits	Not available.
Extinguishing Media	Use DRY chemicals, CO2, or foam to extinguish fire. Water may not be an effective medium to extinguish fire. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.
Special fire fighting procedures	Use supplied air or self contained breathing apparatus (SCBA) for large fires or for fires in enclosed areas.
Flammability	Highly flammable liquid. Released vapours may form flammable/explosive mixtures at or above the flash point. Vapours may travel considerable distances to ignition sources and cause a flash fire. All storage containers and pumping equipment must be grounded.
	Remark No additional remark.
Risks of explosion	This material is sensitive to static discharge. This product is not sensitive to mechanical impact.
	Remark No additional remark.

Section 6. Reactivity Data

Stability	The product is stable.
Hazardous decomp. products	Carbon monoxide, carbon dioxide and irritant fumes and gases including sulphur oxides, nitrogen oxides and aldehydes.
Reactivity	Incompatible material: Strong acids, strong oxidizers, chlorine. Hazardous polymerization: Will not occur.
	Remark No additional remark.

Continued on Next Page

Section 7. Toxicological Properties

Routes of entry	Ingestion. Inhalation. Eye contact. Skin contact.
TLV	TLV-TWA 100 PPM (525 mg/m3) for stoddard solvent from ACGIH. Hydrogen Sulfide: TWA: 10 ppm, STEL: 15 ppm, from ACGIH Benzene TWA:0.5 ppm, STEL: 2.5 ppm, from ACGIH, SKIN Toluene TWA: 20 ppm, from ACGIH Consult local authorities for acceptable exposure limits.
Toxicity to animals	**Hydrocarbons C5 and C6 Rich** LD50: Not available. LC50: Not available. **Hydrogen Sulphide (H2S)** **LC50 Inhalation Mouse = 673 ppm 1 hour** **LC50 Inhalation Rat = 444 ppm for 4 hours**
	Remark No additional remark.
Chronic effects	This product may contain benzene. Benzene has been classified by the international agency for research on cancer as a group 1 product indicating sufficent evidence of carcinogenicity. Studies exist which report a link to crude oil and reproductive effects including fetal tumors and menstrual disorders. This product contains small quantities of xylene. High exposure to xylene has produced fetotoxic effects in animal studies. This product contains small quantities of polycylic aromatic hydrocarbons. Prolonged contact with these compound has been associated with the induction of skin and lung tumours. This product may contain toluene which is known to cause visual impairment, narcosis, anxiety, muscle fatigue, insomnia, dermatitis, parathesis, liver and kidney damage and to affect reproduction.
	Remark No additional remark.
Acute effects	Sensitizing Capabiltiy: No effects known. Irritancy: Skin, eye and upper respiratory tract irritant.
Ingestion	Pulmonary aspiration hazard if swallowed and vomitting occurs.
Skin	Prolonged skin contact can cause defatting of the skin resulting in dry cracked skin and dermatitis.
Eyes	Eye contact with product or product vapours may result in eye irritation.
Inhalation	May cause headache, dizziness, loss of appetite and loss of consiousness. Product vapours are irritating to the respiratory tract.
	Remark This product contains small quantities of hydrogen sulphide (H2S) gas which may collect in confined spaces. Acute effects vary with concentration of H2S released from mild eye, nose and throat irritation at approximately 100 ppm to sudden unconsciousness or death at 500 ppm.
Synergistic materials	Not available.

Section 8. Preventive Measures

Waste disposal	Dispose of in accordance with all federal, provincial and local regulations.
Storage	Keep away from all ignition sources. Maintain temperature below the flash point. Head spaces in storage containers may contain hydrocarbon vapours and toxic hydrogen sulphide gas.
Ventilation	Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.
Spill and leak	Evacuate unecessary personnel. Eliminate all ignition sources. Be alert to the potential for the presence of hydrogen sulphide gas and don appropriate protective equipment. Stop leak if safe to do so. Contain spill and absorb with inert absorbent. Large spills should be removed with explosion proof vacuum equipment. Large pools may be covered with foam to prevent vapour evolution. Comply with federal, provincial, and local requirements for spill notification.

Continued on Next Page

Section 9. Classification/Regulatory Information

TDG road / rail

TDG CLASS 3: Flammable liquid with a flash point less than or equal to 60.5 C (140.9 F). Closed cup test method.

PIN: 1267 - PETROLEUM CRUDE OIL

Remark
No additional remark.

WHMIS

WHMIS CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
WHMIS CLASS D-2A: Material causing other toxic effects (VERY TOXIC).
WHMIS CLASS D-2B: Material causing other toxic effects (TOXIC).

Remark
No additional remark.

Other

This product is on the Domestic Substances List (DSL). TSCA (Toxic Substance Control Act): This product is listed on the TSCA Inventory.
Refer to federal, provincial, and local legislation for further requirements.

Section 10. Protective Clothing

Eye

Non-vented chemical goggles to prevent eye irritation from the solvent vapours.

Skin

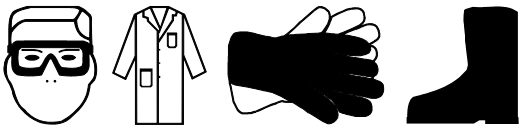
Impervious gloves and clothing should be worn as appropriate to protect against skin contact. Neoprene or nitrile material is suggested.

Respiratory

Respiratory protection may be required in poorly ventilated areas. Properly fitted air purifying masks equipped with organic vapour filters will provide protection at low concentrations. Air supplied respirators or positive pressure self contained breathing apparatus is required when atmospheric concentrations of hydrocarbon vapours are likely to exceed 10X the occupational exposure limit or when high concentrations of H2S may be present.

Other

As required by the situation according to your companies policies and procedures. Contact your supervisor for direction.



Section 11. Preparation Information

References

-Provisional Domestic Substances List, Canadian Ennvironmental Protection Act, Volume 1-Registry Number Index, April 1990; Environment Canada. -SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. CCOHS (Chem advi)
CCOHS(Cheminfo) Doccumentation of the Threshold Limit Values and Biological Exposure Indices (ACGIH)
Pocket Guide to Chemical Hazards (NIOSH)
Transportation of Dangerous Goods Shedule II List II

MSDS Status

Acronyms: TLV = Threshold Limit Value N/AP = Not applicable N/AV = Not Available COC = Cleveland Open Cup PMCC = Pensky Martens Closed Cup

Validated by Husky Corporate Hygiene on 3/19/2009.	**Verified by Husky Corporate Hygiene.**
Supersedes: 11/28/2005	**Printed 3/9/2009.**

Continued on Next Page

Emergency Phone # 403-262-2111

While the company believes the data set forth herein are accurate as of the date hereof, the company makes no warranty with respect thereto and expressly disclaims all liability for reliance thereon. Such data are offered solely for your consideration, investigation and verification.

Appendix G

Public Outreach and Coordination Materials

Appendix G.1

Notification Materials

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Press Release 4/26/2012

Press Release 6/1/2012

Press Release 7/16/2012

Press Release 9/5/2012

Distribution Letters 7/2012 and 9/2012

PRESS RELEASE

from the Nebraska Department of Environmental Quality

For more information, contact
Brian McManus (402) 471-4223, or
Jim Bunstock (402) 471-4243

For Immediate Release
April 19, 2012

NDEQ Receives Pipeline Route Corridor Report from TransCanada

The Nebraska Department of Environmental Quality announced that TransCanada has submitted a report to the agency that assesses alternative routing corridors for the Nebraska Keystone XL pipeline. NDEQ has posted this information on their web site, along with a summary of next steps in the review process, and related information. The web site also provides the public the ability to submit comments and view documents related to this state review.

NDEQ Director Mike Linder said that the state review process can now occur, following the passage of LB1161, which became effective on April 18, 2012. This legislation provides NDEQ the authority to review major oil pipeline projects proposed in the state which will be included in a federal agency environmental review. One major component of the review will be public access to information.

"Public participation will be important throughout this review, and NDEQ will make every effort to provide information and invite comment throughout the process," Linder said. "There will be a number of ways to review and comment through live meetings, internet comments or through the mail."

Next steps in the process

Linder said that the agency will soon announce times and dates of a series of public information meetings, which will be held in the proposed route area. NDEQ will provide the public with information on the review process, and the public will be able to examine the proposed route corridor information submitted by TransCanada.

After these information sessions are completed, NDEQ will provide initial feedback to TransCanada. TransCanada would then finalize the route that it wants to have evaluated by the state, and will conduct more in-depth and on-the-ground definition of the proposed route. NDEQ and its contractor, HDR Engineering, will then evaluate the route through a review process that would satisfy National Environmental Policy Act (NEPA) requirements. The draft report that is developed by NDEQ will be posted on the agency web site for public review.

After the draft report is made public, NDEQ will announce a public hearing date. Following the public hearing and review of public comments, NDEQ will develop a final evaluation report, which will be presented to the Governor. This information will also be posted on NDEQ's web site. The Governor will decide whether he approves the route reviewed in the state's final report, and transmit this decision to any federal agencies involved in the approval of the pipeline.

The report and related information is now on-line at https://ecmp.nebraska.gov/deq-seis/ The report contains several maps describing alternatives evaluated by TransCanada, with the preferred route identified on a map on page 31.

At that location, the public can also submit comments to NDEQ, review documents related to the project, and view other background materials. There is also a link to this information on the main page of NDEQ's web site, http://deq.ne.gov/.

PRESS RELEASE

from the Nebraska Department of Environmental Quality

For more information, contact
Brian McManus (402) 471-4223, or
Jim Bunstock (402) 471-4243

For Immediate Release
April 26, 2012

Four NDEQ Pipeline Information Sessions to be Held in May

Locations include: O'Neill, Neligh, Albion and Central City

The Nebraska Department of Environmental Quality will conduct a series of information sessions in May, to discuss with the public the proposed Keystone XL pipeline route corridor information that has been submitted by TransCanada. The four meetings will be located along the proposed corridor area.

"These meetings will be one opportunity for the agency to meet with interested persons and discuss where we are at in the pipeline review process," said NDEQ Director Mike Linder. "We will have detailed maps available, so that people can get a clearer idea of where the corridor is proposed, and we will have staff on hand to discuss the next steps in the process, and how comments can be submitted."

Dates and locations are:

O'Neill - May 9, 4-7 p.m. at the O'Neill Community Center, 501 S. 4th St.
Neligh – May 10, 4-7 p.m. at the Neligh-Oakdale High School Gym, 600 J St.
Albion – May 16, 4-7 p.m. at the Boone County Fairgrounds, 11th and Fairview Ave.
Central City – May 17, 4-7 p.m. at the Central City Community Room, 1515 17th St.

The information sessions will be an opportunity to meet and talk with those involved in the review, in an "open house" format with tables and posters around the room. Topics will include NDEQ's role in the review process, a large area featuring detailed map enlargements, an overview of the next steps in the review process, and an area to submit comments to be considered by the agency. NDEQ has also invited TransCanada to attend the information sessions, to respond to questions that are beyond the scope of the state's review.

"NDEQ and our contractor, HDR Engineering, will continue to review this initial proposal, and following the meetings, we will have discussions with TransCanada about our initial reactions to their route corridor report," Linder said. "TransCanada is then expected to submit a more refined route plan for the state's evaluation."

Linder said that during this review, NDEQ will develop a draft evaluation report which will be made available to the public. Several months from now when the draft evaluation report is completed, the agency will announce a public hearing on Nebraska's review. Public comments are invited now through the conclusion of the public hearing, and those comments will be considered as the state develops a final report to submit to the Governor.

To find out more about the process, review documents or submit comments, go to NDEQ's new web site that focuses on the pipeline review at: https://ecmp.nebraska.gov/deq-seis/ A link to this area can also be found on NDEQ's main web site, at www.deq.ne.gov

PRESS RELEASE

from the Nebraska Department of Environmental Quality

For more information, contact
Brian McManus (402) 471-4223, or
Jim Bunstock (402) 471-4243

For Immediate Release
June 1, 2012

Pipeline Corridor Map Books Located at Six Libraries; Detailed Information Now Featured in "Online Meeting"

Map books are now available in six libraries to provide the public with an additional method to view detailed information regarding the proposed route corridor in Nebraska that TransCanada has submitted for the Keystone XL pipeline. The map books are located in the public libraries in the towns of Springview, O'Neill, Neligh, Albion, Fullerton and Central City.

In addition, NDEQ has developed an "Online Meeting" that presents a web site version of the information that was discussed at four public information meetings in May.

Online Meeting

The Online Meeting includes an explanation of Nebraska's role and the evaluation process, a route corridor overview that includes detailed map enlargements, Sand Hills information, and public review options. To view this information, go to NDEQ's pipeline project web site at https://ecmp.nebraska.gov/deq-seis/, and select **Online Public Information Meeting**.

Map Books

The map books that have been distributed to local libraries provide an overview key map that divides the proposed re-routed portion into 59 segments. This is followed by 59 individual map enlargements that provide a close-up view of each segment of the proposed corridor. Nebraska Department of Environmental Quality Director Mike Linder said that the agency decided to provide these maps locally in libraries near the proposed corridor after discussing issues with the public at information meetings in May. Map enlargements are also located at the project web site listed above.

"Some nearby residents expressed concern that some people may have limited internet access, but still want to get a closer look at what is being proposed," Linder said. "We agreed that providing hard copy map enlargements to the local libraries would be a useful way to provide the public access to this information."

NDEQ continues to accept public comment. Comments that are received prior to June 15 will be considered and incorporated into initial feedback that NDEQ intends to provide to TransCanada in late June. However, comments will continue to be accepted after that date, and will be considered as the agency develops a draft evaluation report. Several months from now, when the draft evaluation report is completed, the agency will announce a public hearing on Nebraska's review. Public comments are invited now through the conclusion of the public hearing, and those comments will be considered as the state develops a final report to submit to the Governor.

To find out more about the process, review documents or submit comments, go to NDEQ's new web site that focuses on the pipeline review at: https://ecmp.nebraska.gov/deq-seis/ A link to this area can also be found on NDEQ's main web site, at www.deq.ne.gov

PRESS RELEASE

from the Nebraska Department of Environmental Quality

For more information, contact
Brian McManus (402) 471-4223, or
Jim Bunstock (402) 471-4243

For Immediate Release
July 16, 2012

NDEQ Provides Initial Feedback Report to TransCanada

The Nebraska Department of Environmental Quality (NDEQ) has provided an initial feedback report to TransCanada regarding the state's evaluation of the rerouted portion of the proposed Keystone XL Pipeline project.

This is a preliminary step in the communication process in the ongoing project review, explained Pat Rice, NDEQ Pipeline Project Manager. The purpose of the report is to provide TransCanada with initial feedback based on public comments the agency has received, and to provide some observations from the agency. TransCanada is expected to consider the information from NDEQ's initial feedback report as it develops a more defined route.

To view a copy of the initial feedback report, click on this link. Or, go to NDEQ's new web site that focuses on the pipeline review at: https://ecmp.nebraska.gov/deq-seis/ Select Public Documents in the left panel; then select Document Type – Report, then click on Submit. A link to this pipeline project page can also be found on NDEQ's main web site, at www.deq.ne.gov.

PRESS RELEASE

from the Nebraska Department of Environmental Quality

For more information, contact
Brian McManus (402) 471-4223, or
Jim Bunstock (402) 471-4243

For Immediate Release
September 5, 2012

NDEQ Receives Environmental Report from TransCanada

The Nebraska Department of Environmental Quality announced today that TransCanada has submitted a Supplemental Environmental Report to the agency that provides detailed route information for the Keystone XL pipeline through Nebraska. TransCanada had submitted a preliminary report to the state in April, 2012, and NDEQ had responded in July with an initial feedback report.

The Supplemental Environmental Report submitted today by TransCanada will be the basis for the state's Evaluation Report. It is expected that a draft of the state's report will be completed and made public in the fall of 2012. At that time, DEQ will announce a public hearing. Public comments continue to be accepted, and will be considered as the agency develops this evaluation report. After comments from the comment period and hearing are considered, the report will be finalized and submitted to Governor Dave Heineman. The final Evaluation Report could be submitted to the Governor by the end of this year. The Governor will have 30 days to indicate his approval or disapproval of the submitted reports.

"This is an important step in the process, and NDEQ and our contractor will conduct a thorough review of TransCanada's environmental report," said NDEQ Director Mike Linder. "An initial scan of the report indicates that it responds to some of the comments raised by the NDEQ and the public, but a full evaluation will now begin."

NDEQ is making TransCanada's environmental report available on its web site for public review and comment. In addition to TransCanada's Environmental Report, detailed maps of the route will also be posted on the site soon. To view the report, select the link at NDEQ's main page at http://deq.ne.gov/, or you can go directly to NDEQ's Pipeline Project page at https://ecmp.nebraska.gov/deq-seis. The web site also provides the public the ability to submit comments and view other documents related to this state review.

Dave Heineman
Governor

STATE OF NEBRASKA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Michael J. Linder
Director
Suite 400, The Atrium
1200 'N' Street
P.O. Box 98922
Lincoln, Nebraska 68509-8922
Phone (402) 471-2186
FAX (402) 471-2909
website: www.deq.state.ne.us

July 16, 2012

Re: Nebraska Department of Environmental Quality's
Keystone XL Pipeline Evaluation Feedback Report

Dear Librarian:

The Nebraska Department of Environmental Quality is providing copies of the report, "Nebraska's Keystone XL Pipeline Evaluation Feedback Report to TransCanada," to six libraries along the proposed corridor. Attached is your library's copy of the Feedback Report. This Feedback Report should serve as a supplemental public resource to the Proposed Corridor Map books, which NDEQ had provided to the six libraries on May 29, 2012.

The Keystone XL Pipeline Project is a proposed approximate 854-mile, 36-inch diameter pipeline to transport crude oil from Hardesty, Alberta, Canada to Steele City, Nebraska. The Nebraska Legislature directed NDEQ to evaluate the portion of the Keystone XL Pipeline project that has been rerouted to avoid the Sand Hills in the State of Nebraska. NDEQ held public information meetings along the proposed corridor in May and received feedback from the public. Then, NDEQ compiled the comments to identify the issues important to Nebraskans. Those issues are presented in this Feedback Report.

This report also:

- provides background information on the Pipeline project;
- describes the actions taken by NDEQ to gather input from the public;
- identifies key issues that NDEQ will analyze when developing the state's Evaluation Report;
- provides NDEQ comments regarding Keystone's proposed corridor and Reroute Report;
- lists the additional information that NDEQ will request from Keystone to complete its analyses;
- describes the activities NDEQ will undertake to complete the evaluation following Keystone's submittal of site-specific environmental data obtained in field surveys during May through August 2012.

This Feedback Report is being provided to six public libraries along the proposed corridor (Albion, Fullerton, Central City, Springview, O'Neill, and Neligh.) Hard copies of the report are also available at NDEQ's Lincoln offices. An electronic copy of the report can be found at NDEQ's Project Website https://ecmp.nebraska.gov/deq-seis/. Copies are also being distributed to interested agencies, elected officials, and federally-recognized tribes.

The NDEQ appreciates the efforts of all interested parties who have participated in this evaluation process to date. Please place this Report with the map book previously provided to your library.

Sincerely,

Brian McManus, NDEQ Public Information Officer

An Equal Opportunity/Affirmative Action Employer
Printed with soy ink on recycled paper

Dave Heineman
Governor

STATE OF NEBRASKA

DEPARTMENT OF ENVIRONMENTAL QUALITY
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P.O. Box 98922
Lincoln, Nebraska 68509-8922
Phone (402) 471-2186
FAX (402) 471-2909
website: www.deq.state.ne.us

July 16, 2012

Re: Nebraska Department of Environmental Quality's
Keystone XL Pipeline Evaluation Feedback Report

Dear Agency representative:

The Nebraska Department of Environmental Quality is providing you a copy of the report "Nebraska's Keystone XL Pipeline Evaluation Feedback Report to TransCanada." Additionally, an electronic copy of the Feedback Report can be found at the project website (https://ecmp.nebraska.gov/deq-seis/).

The Keystone XL Pipeline Project is a proposed approximate 854-mile, 36-inch diameter pipeline to transport crude oil from Hardesty, Alberta, Canada to Steele City, Nebraska. From that point, the project would connect with the existing Keystone pipeline – Cushing Extension. The Nebraska Legislature directed NDEQ to evaluate the portion of the Keystone XL Pipeline project that has been rerouted to avoid the Sand Hills in the State of Nebraska. NDEQ held public information meetings along the proposed corridor in May and received feedback from the public. Then, NDEQ compiled the comments to identify the issues important to Nebraskans. Those issues are presented in this Feedback Report.

This report also:

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- lists the additional information that NDEQ will request from Keystone to complete its analyses;
- describes the activities NDEQ will undertake to complete the evaluation following Keystone's submittal of site-specific environmental data obtained in field surveys during May through August 2012.

The Feedback Report has been made available to the public at the Project Website https://ecmp.nebraska.gov/deq-seis/, and hard copies of the Feedback Report may be found in six public libraries along the proposed corridor (Albion, Fullerton, Central City, Springview, O'Neill, and Neligh) and at the NDEQ's office in Lincoln. Copies are also being distributed to interested agencies, elected officials, and federally-recognized tribes.

The NDEQ appreciates the efforts of all interested parties who have participated in this evaluation process to date. We look forward to receiving your comments.

Sincerely,

Brian McManus, NDEQ Public Information Officer

An Equal Opportunity/Affirmative Action Employer
Printed with soy ink on recycled paper

Dave Heineman
Governor

STATE OF NEBRASKA

DEPARTMENT OF ENVIRONMENTAL QUALITY
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Lincoln, Nebraska 68509-8922
Phone (402) 471-2186
FAX (402) 471-2909
website: www.deq.state.ne.us

September 24, 2012

Re: Nebraska Department of Environmental Quality's Keystone XL Pipeline Evaluation, Pipeline Route Resource Maps for Public Review

Dear Librarian:

The Nebraska Department of Environmental Quality is providing you with a Pipeline Route Resource Map for public review. The attached map book is being provided to allow the public to review Keystone's revised preferred route. Your library is among ten libraries, located near the pipeline route, that are receiving the resource maps. This map book serves as the most current version of maps and any other versions may be archived at your discretion.

The Keystone XL Pipeline Project is a proposed approximate 854-mile, 36-inch diameter pipeline to transport crude oil from Hardesty, Alberta, Canada to Steele City, Nebraska. The Nebraska Legislature directed NDEQ to evaluate the portion of the Keystone XL Pipeline project that has been rerouted to avoid the Sand Hills in the State of Nebraska.

The NDEQ appreciates the efforts of all interested parties who have participated in this evaluation process to date. The map book, as well as other project reference materials, can also be found online on the NDEQ's project website at https://ecmp.nebraska.gov/deq-seis/. If you have any questions, please contact me at brian.mcmanus@nebraska.gov or (402) 471-4223.

Sincerely,

Brian C. McManus

Brian McManus, NDEQ Public Information Officer

An Equal Opportunity/Affirmative Action Employer
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Appendix G.2

Meeting Materials

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Request Card

Meeting Boards 5/2012

Meeting Handout 5/2012

Meeting Comment Form

Online Comment Form

Online Meeting

Other Exhibit Boards

Pipeline Map Request Card

Name: _____

Address: _____

_____

_____

Phone #: _____

Map #, Township- Section- Range: _____

_____

Place
Stamp
Here

Nebraska Pipeline Review Project
PO Box 98922
Lincoln, NE 68509-8922

Welcome!

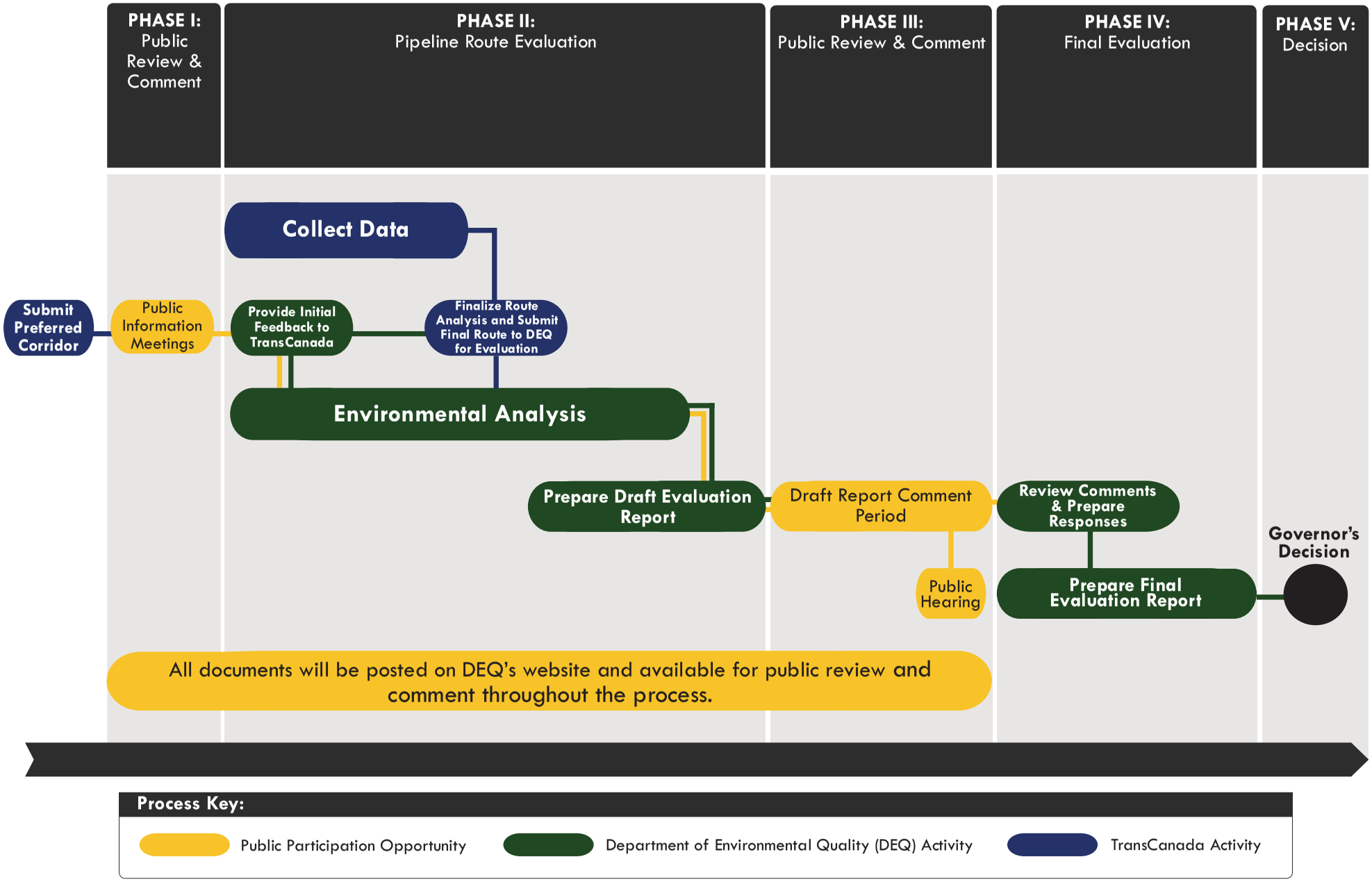
The purpose of this meeting is to provide the public with an opportunity to:

- Understand Nebraska Department of Environmental Quality's (NDEQ) evaluation process and its next steps
- Review detailed maps of TransCanada's proposed reroute of the Keystone XL Pipeline in Nebraska
- Provide NDEQ with comments on:
  - Environmental impacts
  - Economic impacts
  - Social impacts
  - Other impacts to Nebraska

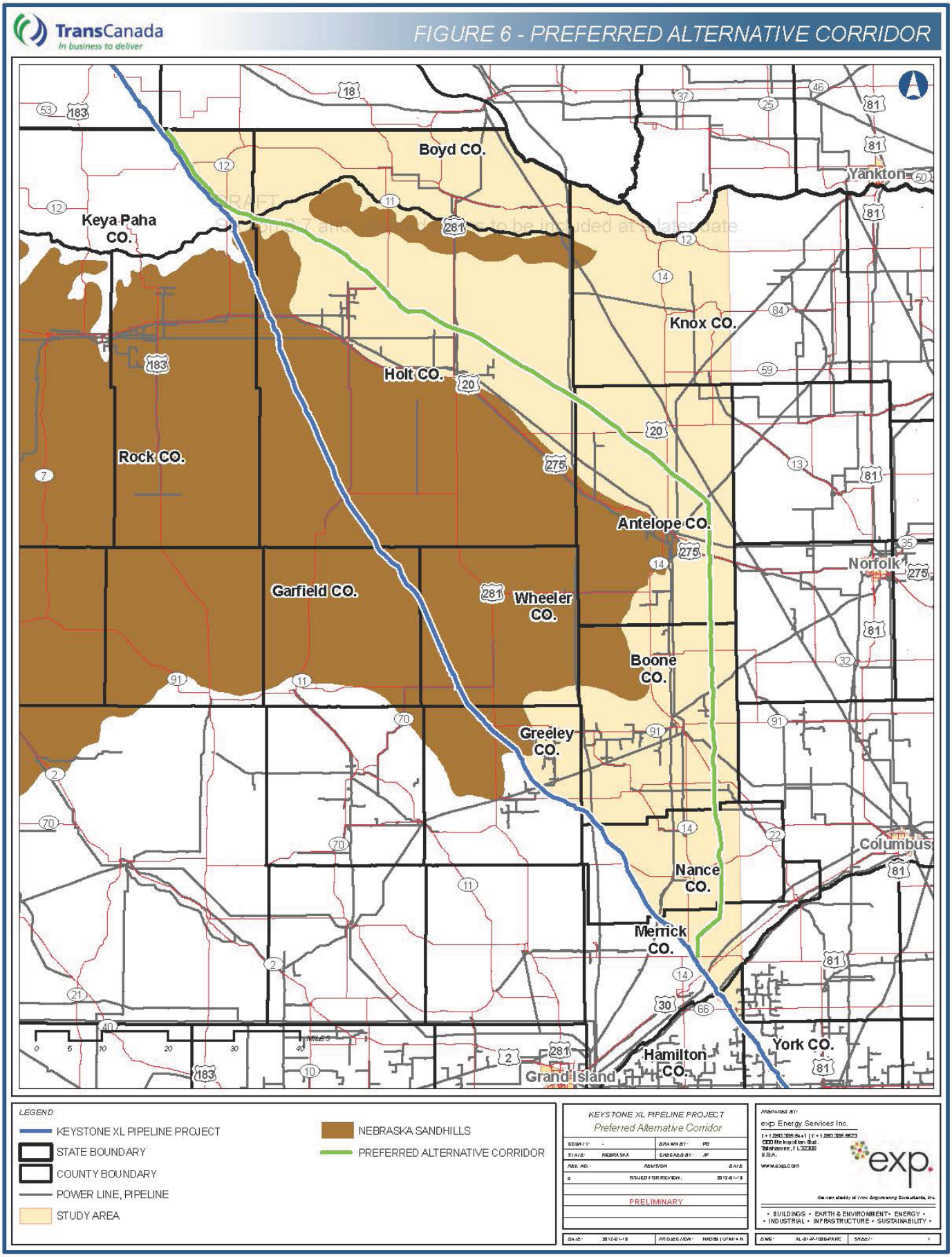
The Purpose of Nebraska's Evaluation

- Evaluate environmental, economic, social and other impacts in Nebraska
- Provide opportunity for public review and comment
- Provide an effective and timely evaluation of the route through Nebraska
- Collaborate with the U.S. State Department as necessary

Nebraska's Evaluation Process

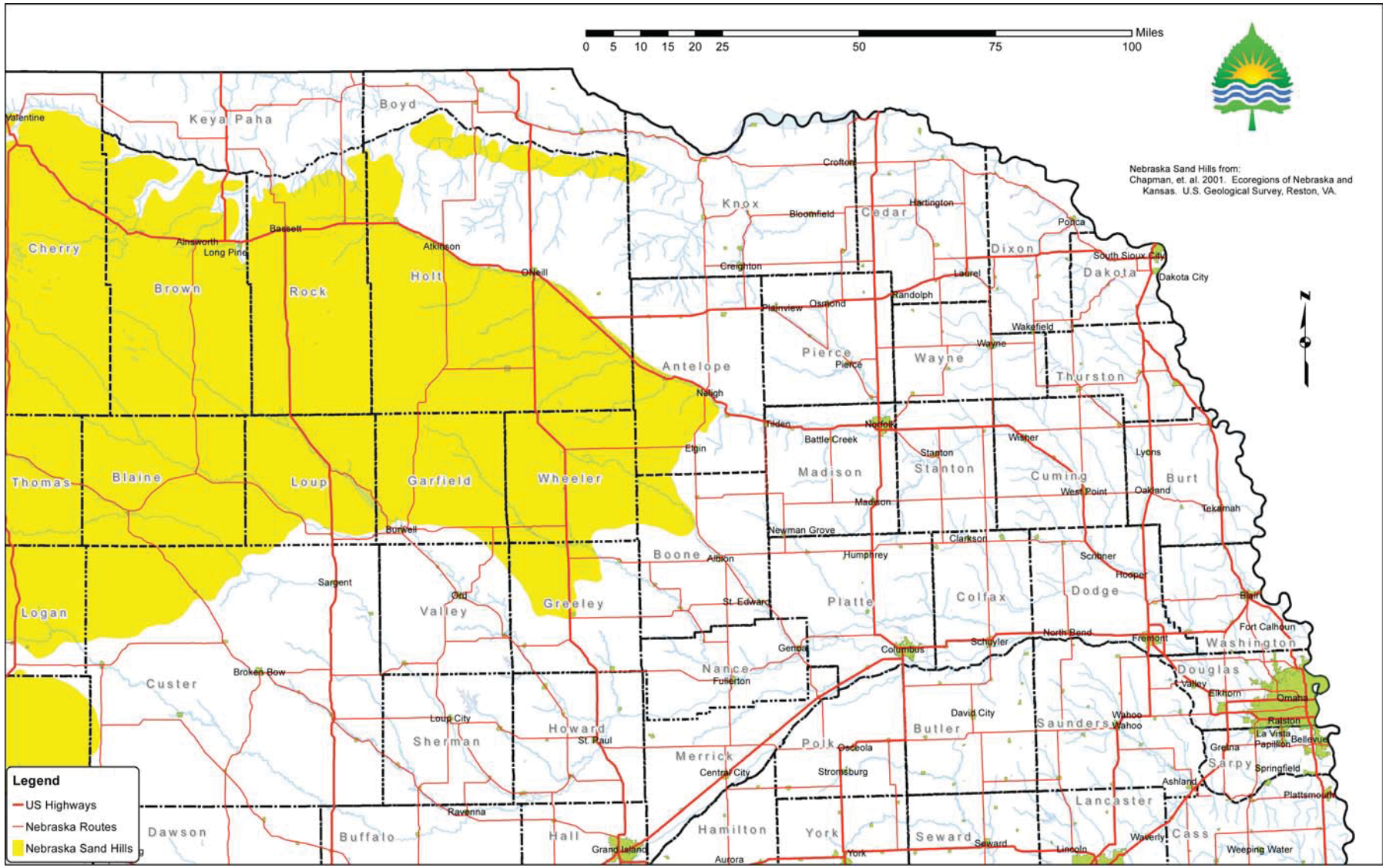


TransCanada's Preferred Alternative Corridor



Source: TransCanada Keystone Pipeline Project - Initial Report Identifying Alternative and Preferred Corridors for Nebraska Reroute, dated April 18, 2012

The Sand Hills



The Sand Hills Definition

Available geospatial datasets depicting landform, soils, topography, geology, and water resources in Nebraska were examined to determine the extent of the Nebraska Sand Hills. Printed resources from UNL Conservation and Survey Division were consulted as well as the USDA Natural Resources Conservation Service's Soil Survey.

Sources examined include:

- National Hydrography Dataset
- Topographic Regions of Nebraska
- Nebraska Soil Associations
- Bedrock Geology of Nebraska
- Groundwater Regions (of Nebraska)
- Depth to Water (in Nebraska)
- 2005 Land Use Mapping
- Major Aquifers of the U.S.
- Static Water Levels of Finished Wells
- Level III and Level IV Ecoregions

We decided on EPA's Level III Ecoregions as best describing the expanse of the Sand Hills because it integrated geology, topography, vegetation, climate, soils, land use, wildlife, and hydrology. Development of these boundaries was a multi-year collaborative process involving the following agencies:

Public Review & Comment

Public review and comment is welcome at any time during this evaluation.

Comments may be made in any of the following ways:

- Visit the NDEQ project website:
  https://ecmp.nebraska.gov/deq-seis
- Mail a letter to:
  Nebraska Pipeline Review Project
  P.O. Box 98922
  Lincoln, NE 68509-8922
- Call the Comment Line: 800-295-8912
- Email the project: NDEQ.SEISpubliccomment@Nebraska.gov
- Submit a comment at a public information meeting

Comments submitted to Nebraska DEQ will be posted to the Project Website.

Nebraska's Keystone XL Pipeline Evaluation

Public Information Meeting

The purpose of this meeting is to provide the public an opportunity to:

- Understand Nebraska Department of Environmental Quality's (NDEQ) evaluation process and its next steps
- Review detailed maps of TransCanada's Proposed reroute of the Keystone XL Pipeline in Nebraska
- Provide NDEQ with comments on:
  - Environmental impacts
  - Economic impacts
  - Social impacts
  - Other impacts to Nebraska

Nebraska's Evaluation Process:

The purpose of Nebraska's evaluation is to:

- Evaluate environmental, economic, social and other impacts
- Provide opportunity for public review and comment
- Provide an effective and timely evaluation of the route through Nebraska
- Collaborate with the U.S. State Department as necessary

The State of Nebraska is responsible for protecting its natural resources, agricultural resources, aesthetics, economy, and communities through reasonable regulation for the common good and welfare. As such, the state is responsible for ensuring that an oil pipeline proposed to be located within, through, or across Nebraska is in compliance with all state laws, rules, and regulations relating to water, air, and wildlife under the Constitution of Nebraska and state law.

-Legislative Bill 4

After these information sessions are completed, NDEQ will provide initial feedback to TransCanada, based on an initial technical review and public input. TransCanada will then finalize the route that it wishes to have evaluated by the state, and will conduct more in-depth and on-the-ground definition of the proposed route. NDEQ will then evaluate the route through a review process that would consider the environmental, economic, social, and other impacts of the proposed pipeline. The draft evaluation report that is developed by NDEQ will be posted on the agency website and made available for public review and comment.

After the draft evaluation report is made public, NDEQ will announce the public hearing date. Following the public hearing and review of public comments, NDEQ will develop a final evaluation report, which will be presented to the Governor; this information will also be posted on NDEQ's website. The Governor will decide whether he approves the route evaluated in the state's final report.

Public Review and Comment

In addition to providing comments during the two specific rounds of public reviews and meetings, NDEQ also welcomes public review and comment at any time during this evaluation. All comments will be posted to NDEQ's website.

Comments may be made in any of the following ways:

- Visit the NDEQ project website: https://ecmp.nebraska.gov/deq-seis
- Mail a letter to:
  Nebraska Pipeline Review Project
  P.O. Box 98922
  Lincoln, NE 68509-8922
- Call the Comment Line: 800-295-8912
- Email the project at NDEQ.SEISpubliccomment@nebraska.gov
- Submit a comment at a public information meeting

Keystone XL Pipeline Project Overview

The Keystone XL Pipeline Project is a proposed approximate 854-mile, 36-inch diameter pipeline to transport crude oil from Hardisty, Alberta, Canada to Steele City, Nebraska. From that point, the project would connect with the existing Keystone pipeline - Cushing Extension. At the terminus of the Cushing Extension, the oil would be delivered into a new 36-inch pipeline to be constructed as the Keystone Pipeline Gulf Coast Project for transportation to refinery markets in the Gulf Coast area of the United States. The Project would have an initial nominal throughput capacity of 700,000 barrels per day (bpd) and can be expanded to an ultimate nominal capacity of 830,000 bpd through the installation of additional pumping capacity.

TransCanada's Preferred Corridor

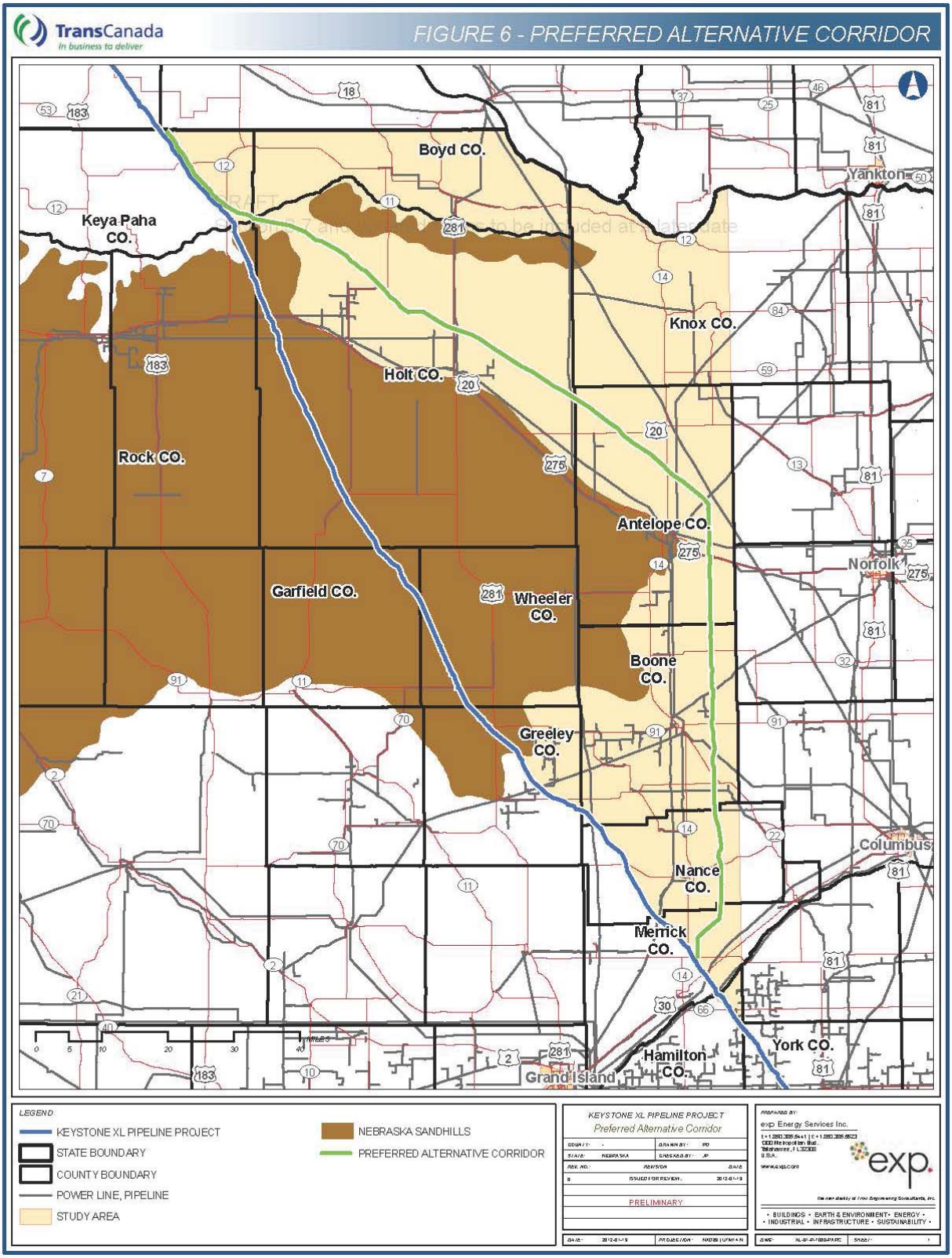
On April 18, 2012, TransCanada submitted to Nebraska a routing alternatives analysis through the northern portion of Nebraska that identified a preferred corridor which is intended to avoid the Sand Hills region. A copy of this corridor is provided on the map on the next page. The route information submitted by TransCanada will be evaluated by the NDEQ as directed by Nebraska Legislative Bill 4 as modified by Nebraska Legislative Bill 1161, which became effective on April 18, 2012.

Abridged Table 4 - Summary of Preferred Corridor

Source: TransCanada Keystone XL Pipeline Project - Initial Report Identifying Alternative and Preferred Corridors for Nebraska Reroute, dated April 18, 2012

Parameter/Constraint	
Length	173.53 mi.
Width of Study Corridor	2,000 ft.
Pipeline Diameter	36 in.
Listed Species Habitat (miles crossed)	
American Burying Beetle (ABB)	90.75 mi.
Interior Least Tern	20.47 mi.
Northern redbelly dace	19.57 mi.
Piping plover	20.47 mi.
River otter	11.61 mi.
Small white lady's slipper	46.73 mi.
Western prairie fringed orchid	89.72 mi.
Whooping crane	172.53 mi.
Public Lands – State (miles crossed)	1.39 mi.
High Consequence Areas (miles crossed)	
Ecologically unusually sensitive areas (USA)	1.76 mi.
High Consequence Areas	
Wild and Scenic rivers (number crossed)[3]	1
Depth to Groundwater (miles crossed)[1]	
5 to 10 feet	10.48 mi.
10 to 15 feet	12.38 mi.
15 to 20 feet	12.03 mi.
More than 20 feet	137.64 mi.
Waterbody Crossings (number)	
Perennial	29
Intermittent	65
Road/railroad/pipeline/power line crossings (number)	204
Land Use[2] (miles crossed)	
Open Water	0.61 mi.
Developed (low and medium density)	6.39 mi.
Deciduous forest	1.39 mi.
Evergreen forest	0.05 mi.
Grassland/herbaceous	66.25 mi.
Pasture/hay	1.57 mi.
Cultivated crops	94.04 mi.
Forested wetlands	0.21 mi.
Herbaceous/riverine/open water wetlands	0.89 mi.

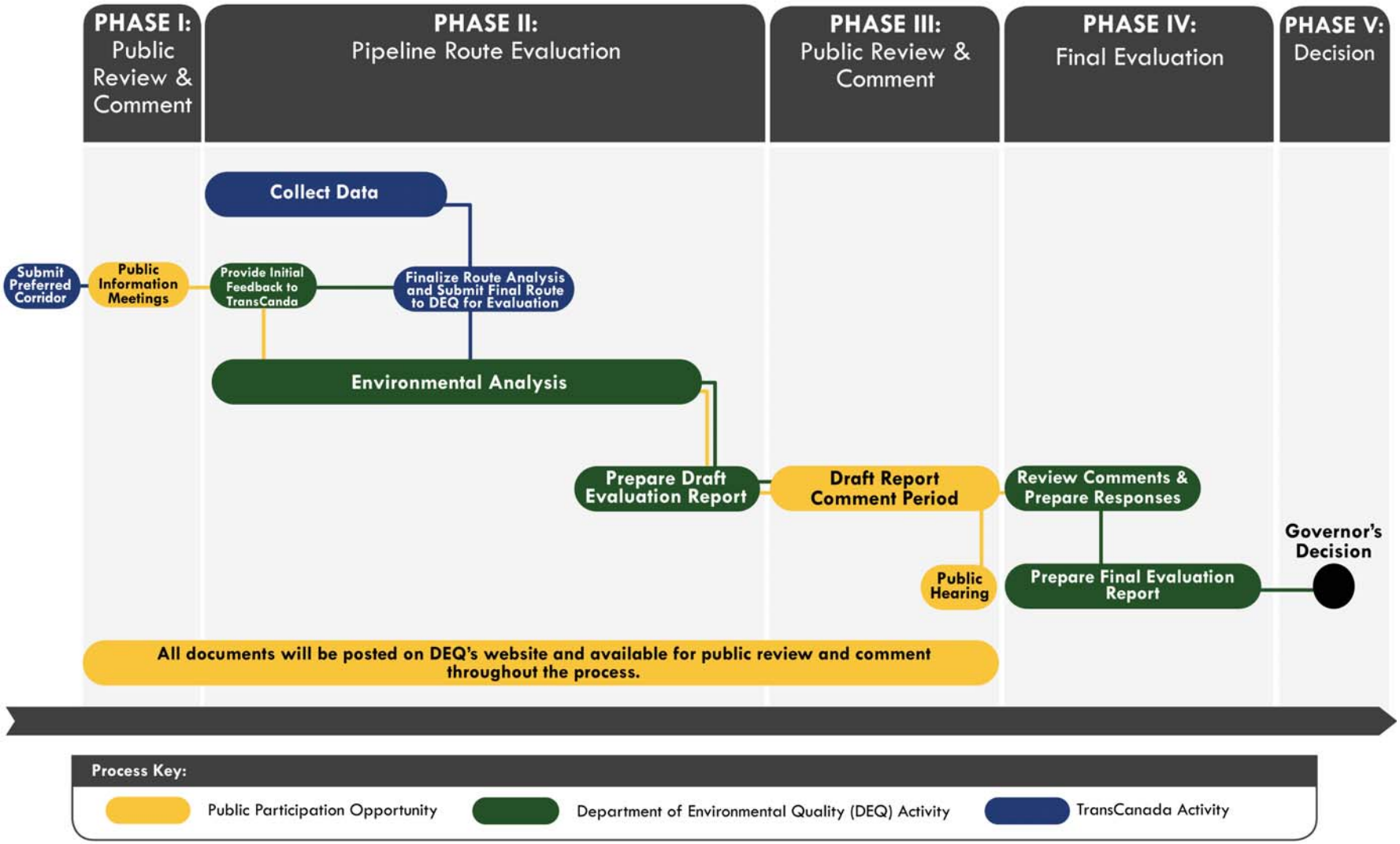
1 Determined from Nebraska Department of Natural Resources (NDNR) well data.
2 Land use from NLCD data coverage for US.
3 The USDOT HCA database designates the entire Niobrara River as wild and scenic, which is not the case where these corridors cross the river according to the National Park Service.



Source: TransCanada Keystone XL Pipeline Project - Initial Report Identifying Alternative and Preferred Corridors for Nebraska Reroute, dated April 18, 2012

Thank you for joining us and sharing your opinions.

Pipeline Evaluation Process



Process Key:

- Public Participation Opportunity
- Department of Environmental Quality (DEQ) Activity
- TransCanada Activity

Nebraska's Keystone XL Pipeline Evaluation

There are multiple ways to submit comments:

- Written Comments: Complete and submit this form at the public meeting or follow the directions on the reverse side to mail your comments.
- Electronic Comments: Submit comments by visiting https://ecmp.nebraska.gov/deq-seis or by emailing NDEQ.SEISpubliccomment@nebraska.gov.
- Phone Comments: Call 800-295-8912 to submit comments through our project information line.

Comments:

All comments will be posted to NDEQ's website.

Date: _____

Name: _____

Street Address: _____

City, State, Zip: _____

Phone: _____

Email: _____

Contact Preference: ☐ Direct Mail ☐ Email ☐ Do Not Contact

Please fold, fasten with tape and mail. No envelope necessary. Do not staple.

Place
Stamp
Here

Nebraska Pipeline Review Project
PO Box 98922
Lincoln, NE 68509-8922

Welcome

Comments

Search Comments

Post Comment

Frequently Asked Questions

Public Documents Search

Meeting Documents Search

Press Releases

All comments are available for public review 4 days after submission

POST A COMMENT

Thank you for your interest in the Nebraska SEIS Project. To leave a comment, please complete the form below. **NOTE:** any submissions to the agency, including telephone and e-mail inquiries and comments, will become part of the public record. Comments and identities will not be kept confidential.

There are two options for posting a comment:

- **Guest** – will require a couple pieces of information for geographic reference, no personal information, and an optional email address, if you would like to receive your comment number and updates as the comment is processed.
- **Registered User** – will require more detailed information and allow you to establish a user ID and password to use for future comment submissions.

Comments received will be evaluated in the Draft SEIS. All comments are available for public review 4 days after submission. Click on Comment Search in the left panel to view submitted comments.

Post Comment As: Guest Registered User

City:

State / Province: Nebraska

Zip Code:

Email: (Optional)

Comment: (0 of 1000 Characters Used)

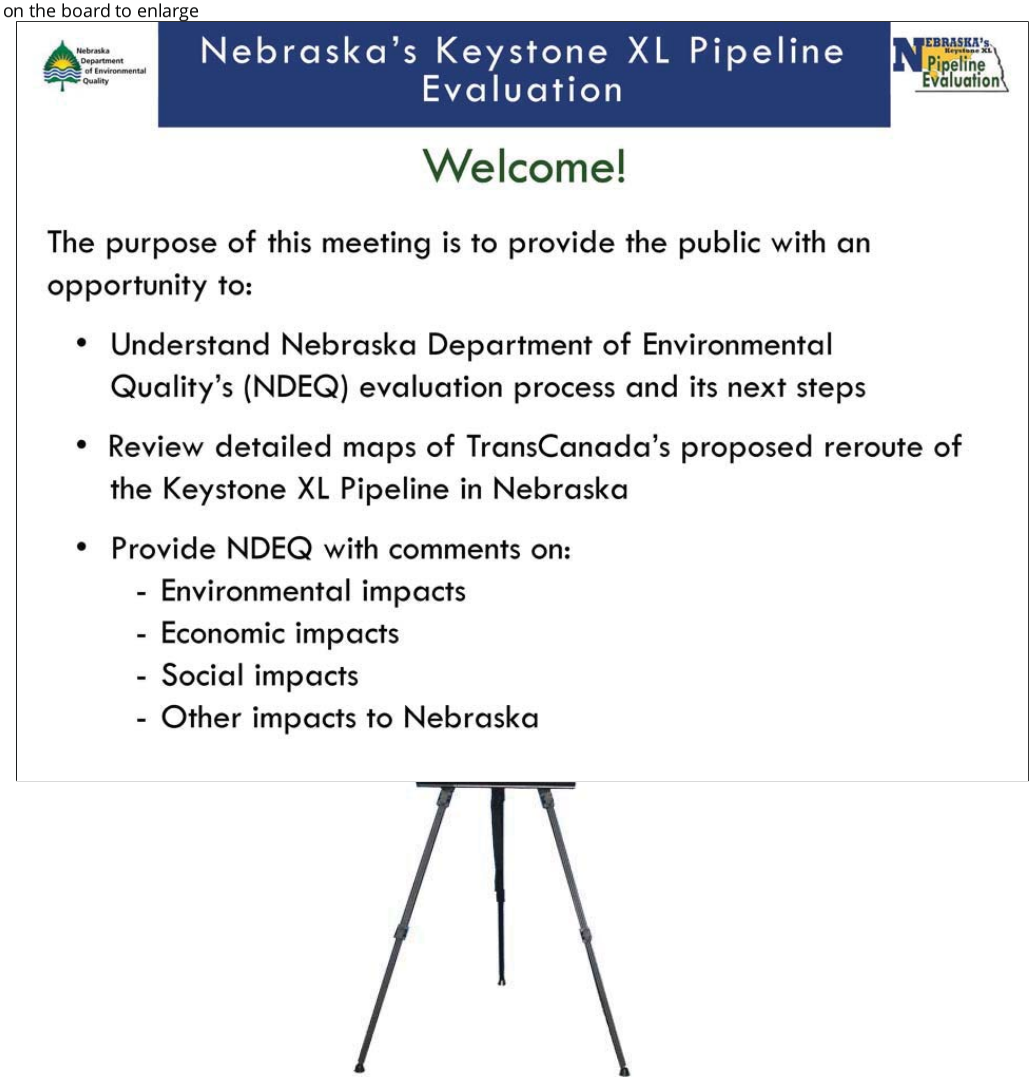
Enter the code shown:

Can't read? Try different words.

Submit

Nebraska Department of Environmental Quality 1200 "N" Street, Suite 400 P.O. Box 98922 Lincoln, Nebraska 68509 (402) 471-2186

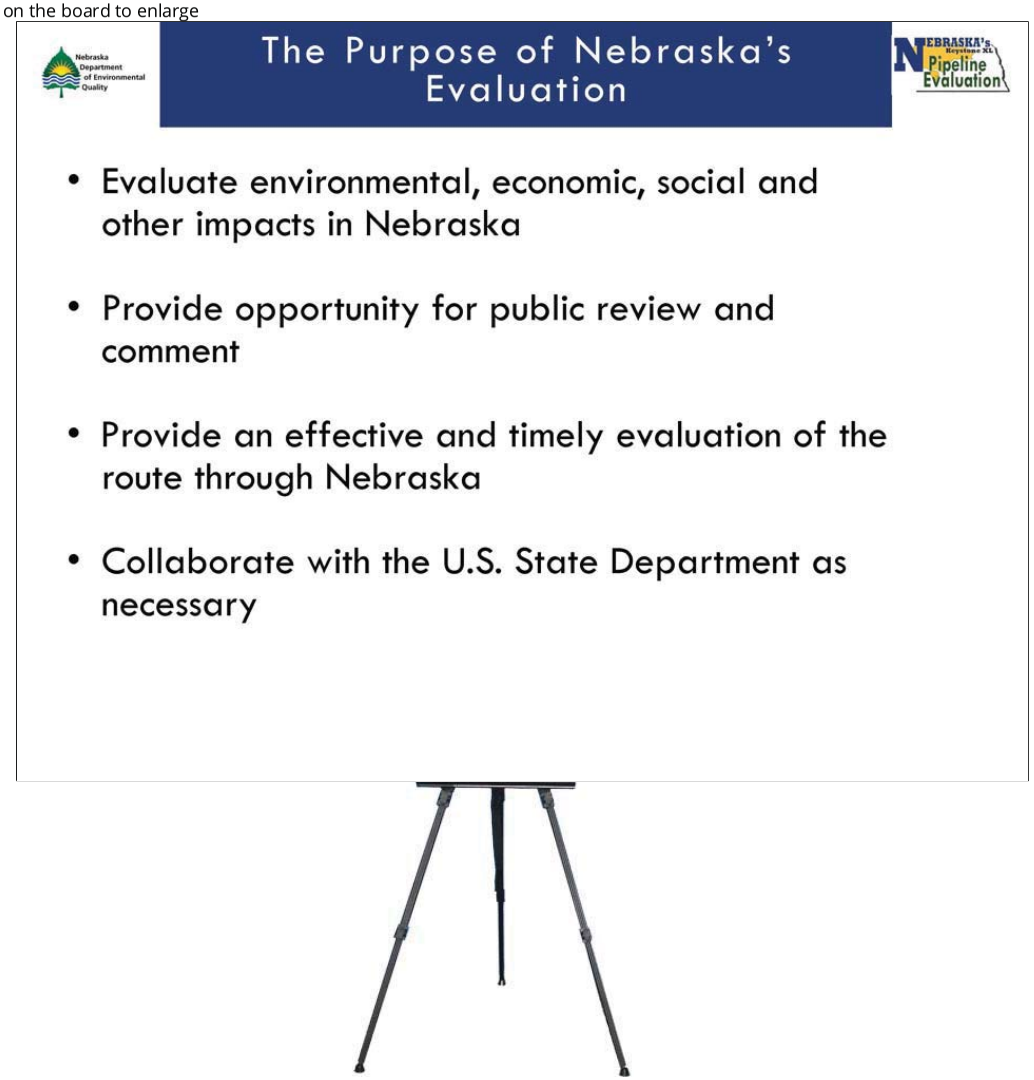
Click on the board to enlarge



Feedback will be submitted to TransCanada soon. Please submit your comments to NDEQ by June 15th, 2012 for inclusion in our feedback to TransCanada. However, comments are encouraged and can be submitted to Nebraska DEQ throughout the entire evaluation.

Nebraska Department of Environmental Quality

Click on the board to enlarge

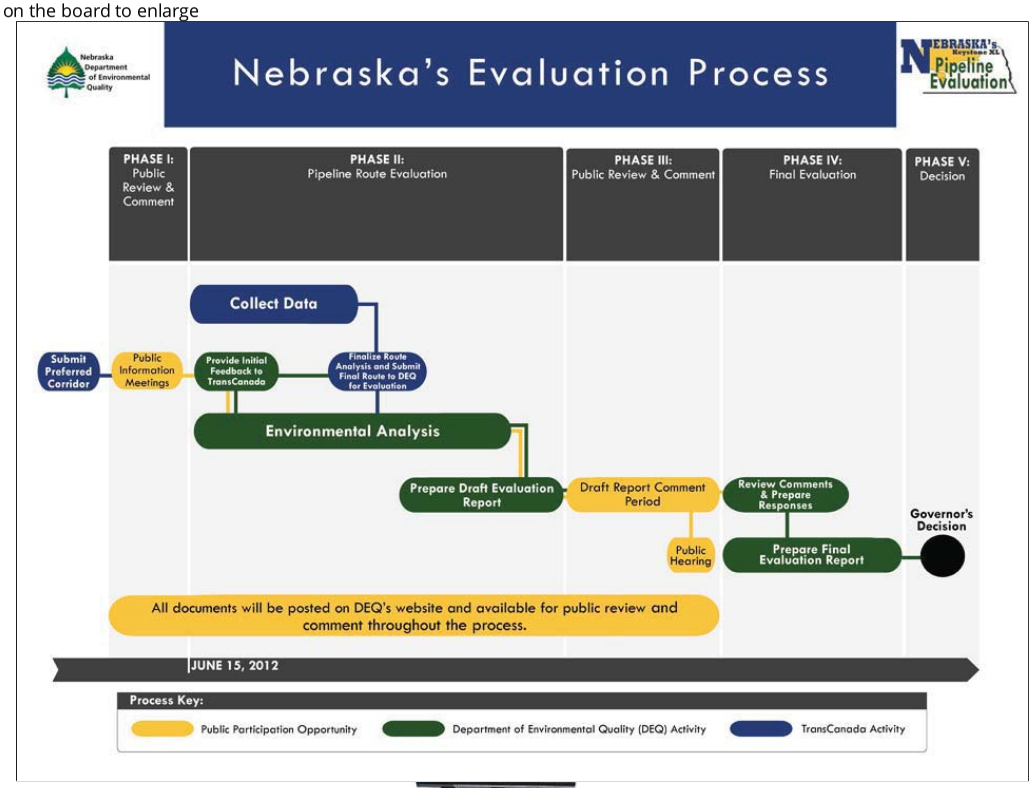


Purpose of the Reroute

NDEQ's job, as determined by the Nebraska Legislature, is straightforward. The agency is to provide an effective and timely evaluation of the route through Nebraska by evaluating environmental, economic, social and other impacts, providing opportunity for public review and comment, and collaborating with the U.S. State Department as necessary.

The NDEQ has been in ongoing communication with the U.S. State Department (DOS) regarding their analysis of the full Keystone XL pipeline. Nebraska's review and findings is a separate process and Nebraska's final evaluation report may be included in the DOS's final review of the full pipeline. The NDEQ signed a Memorandum of Understanding (MOU) with the DOS May 24, 2012.

Click on the board to enlarge



Nebraska's Process

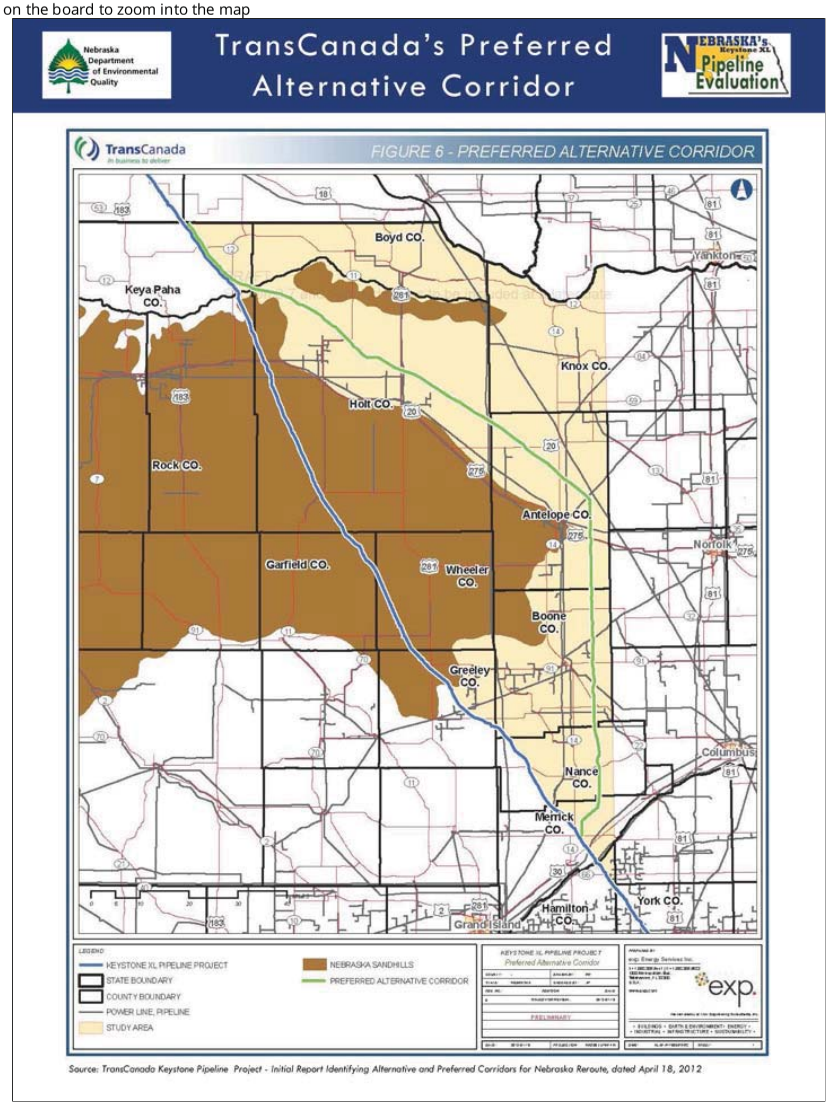
This evaluation is intended to be an open process with two distinct comment periods, however public comments are welcome in **all** phases except the final phase. We are currently in the first phase of the evaluation and held open public information sessions in O'Neill, Neligh, Albion and Central City, Nebraska to provide the public interaction and comment.

At the conclusion of Phase I, June 15, 2012, the NDEQ will review all of the comments received and provide feedback to TransCanada who will finalize the route it would like Nebraska to review.

During Phase II, the agency will be leading an environmental analysis of the alternative route on its specific impacts to Nebraska. The findings will be detailed in a draft evaluation report that will be available to the public for review until the end of Phase III. A public hearing will be held to take final comments on the draft evaluation report and at the conclusion of the hearing, public comment will be closed.

During Phase IV, the agency will revise the draft evaluation report based on public review and comment and will submit the final report to Governor who will make the final determination of the acceptability of the Keystone XL pipeline route through Nebraska.

Click on the board to zoom into the map



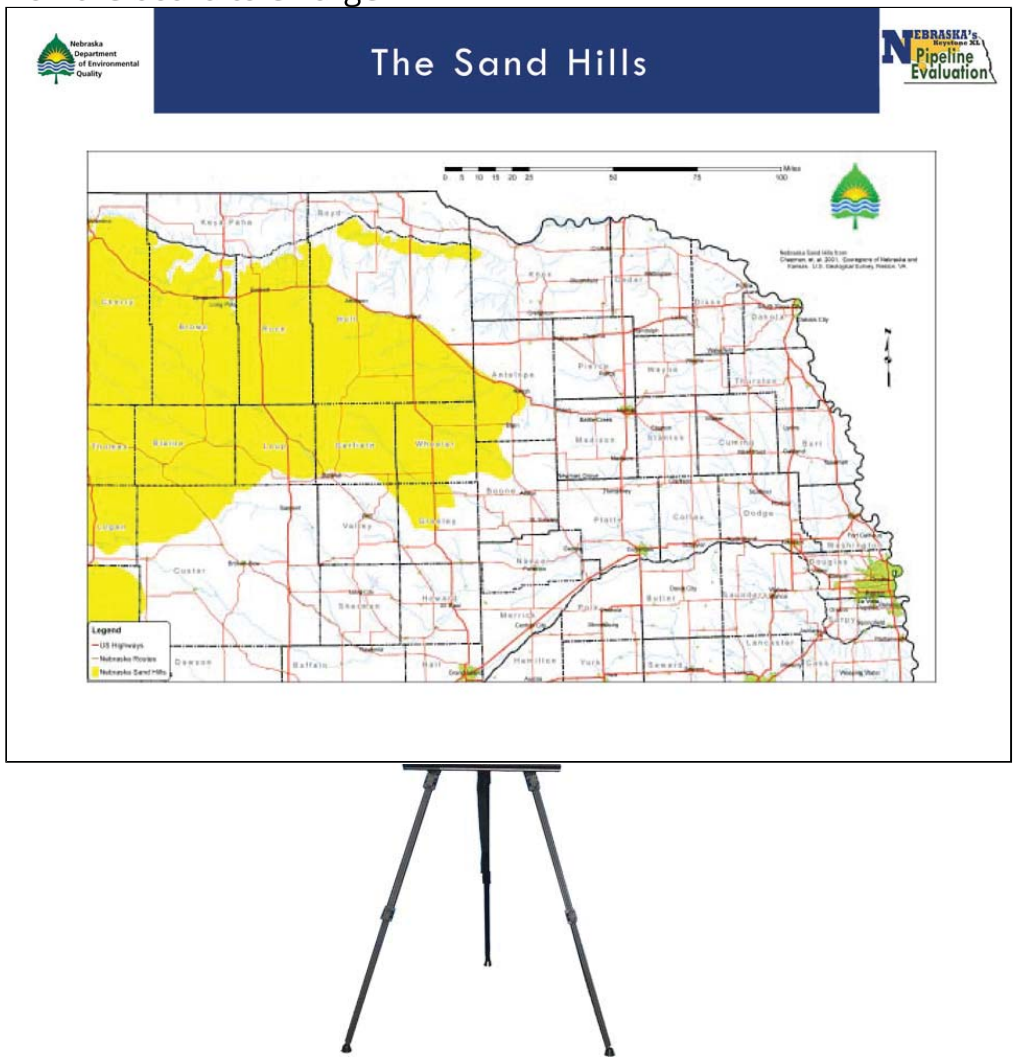
title="TransCanada's Preferred Alternative Route Corridor." alt="TransCanada's Preferred Alternative Route Corridor." />

TransCanada's Preferred Alternative Route Corridor

This figure was taken directly from TransCanada's April 18th report to Nebraska. The original proposed route is shown in blue and the new preferred alternative corridor proposed by TransCanada is show in green. The NDEQ is only evaluating the corridor shown in green.

Detailed maps of the 2,000 foot wide study corridor proposed by TransCanada have been developed to aid with the public's review. Click anywhere on the board to the left to open a map in another window then click on a numbered box close to your area of interest to enlarge one of the detailed study maps for easier viewing.

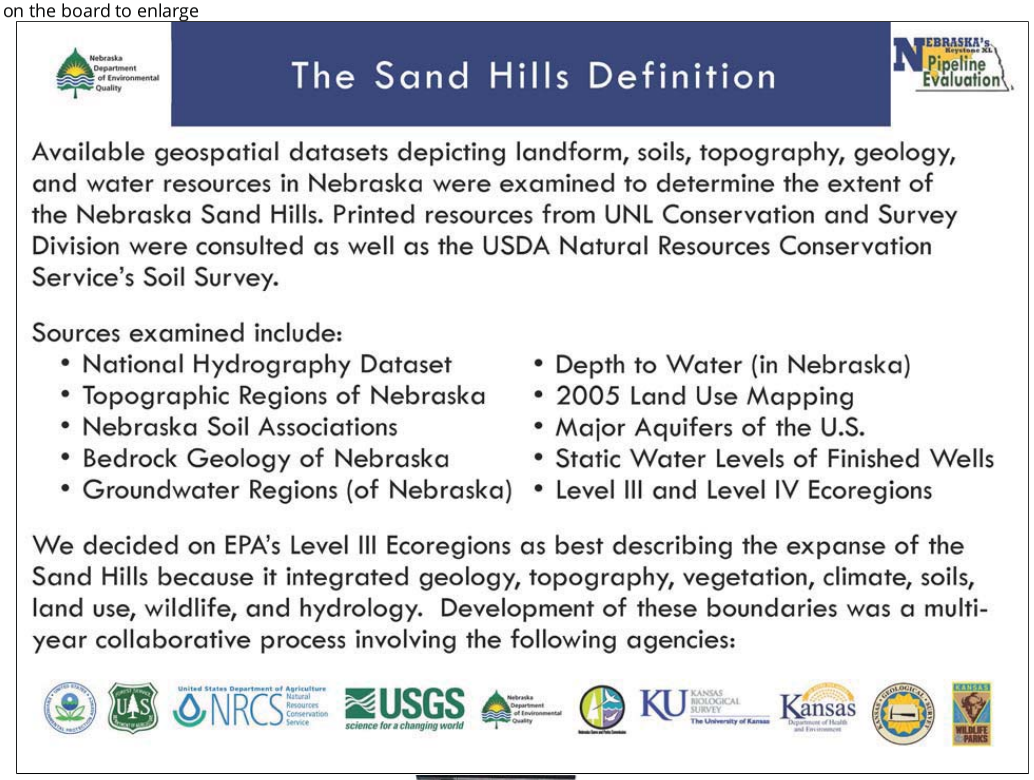
Click on the board to enlarge



Sand Hills

This map shows the location of the Sand Hills in Nebraska. Click to the next screen for more information on how the area was defined.

Click on the board to enlarge



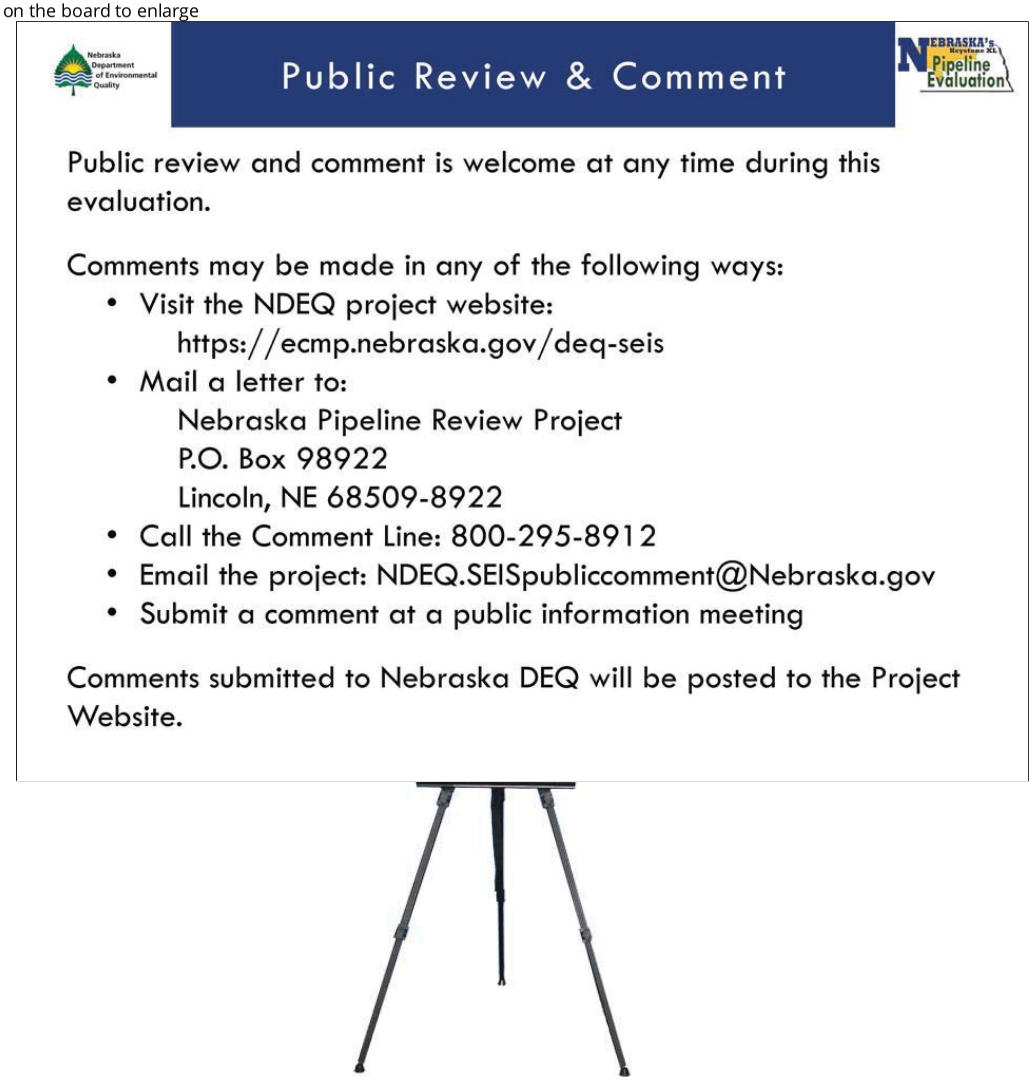
Sand Hills Definition

The NDEQ participated in a multi-year, multi-agency effort to define ecoregions in Nebraska and Kansas. One of those ecoregions identified the Sand Hills. The information sources listed on the board were examined by the following agencies:

- U.S. Environmental Protection Agency
- U.S. Forest Service
- U.S. Geological Service
- U.S. Natural Resources Conservation Service
- Nebraska Department of Environmental Quality
- Nebraska Game and Parks Commission
- Kansas Biological Survey
- Kansas Department of Health and Environment
- Kansas Geological Survey
- Kansas Wildlife and Parks

A summary of their analysis is located on EPA's website

Click on the board to enlarge



Public Review & Comment

Public review and comment is welcome at any time during this evaluation. This board describes the five ways to submit formal comments for inclusion in the evaluation – comments will be posted on the project website.

Ecoregions of Nebraska and Kansas

Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources; they are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. Ecoregions are directly applicable to the immediate needs of state agencies, including the development of biological criteria and water quality standards, and the establishment of management goals for nonpoint-source pollution. They are also relevant to integrated ecosystem management, an ultimate goal of most federal and state resource management agencies.

The approach used to compile this map is based on the premise that ecological regions can be identified through the analysis of the patterns of biotic and abiotic phenomena that reflect differences in ecosystem quality and integrity (Wiken, 1986; Omernik, 1987, 1995). These phenomena include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. The relative importance of each characteristic varies from one ecological region to another regardless of the hierarchical level. A Roman numeral hierarchical scheme has been adopted for different levels of ecological regions. Level I and level II divide the North American continent into 15 and 52 regions, respectively (Commission for Environmental Cooperation Working Group 1997). At level III, the continental United States contains 104 regions (United States Environmental Protection Agency [US EPA], 2000). However, depending on the objectives of a particular project, ecoregions may be aggregated within levels of the hierarchy for data analysis and interpretation. Explanations of the methods used to define the US EPA's ecoregions are given in Omernik (1995), Griffith and others (1994), and Gallant and others (1989).

This level III and IV ecoregion map was compiled at a 1:250,000-scale; it depicts revisions and subdivisions of earlier level III ecoregions that were originally compiled at a smaller scale (US EPA, 1999; Omernik, 1987). This poster is the product of a collaborative effort primarily between the US EPA Region VII, the US EPA National Health and Environmental Effects Research Laboratory (Corvallis, Oregon), the Nebraska Department of Environmental Quality (NDEQ), the Nebraska Game and Parks Commission (NGPC), the Kansas Biological Survey (KBS), the Kansas Geological Survey (KGS), the Kansas Department of Health and Environment, Division of Environment (KDHE), Kansas Department of Wildlife and Parks (KDWP), the United States Department of Agriculture - Natural Resources Conservation Service (NRCS) (formerly the Soil Conservation Service), and the United States Department of the Interior - U.S. Geological Survey (USGS) - Earth Resources Observation Systems (EROS) Data Center.

This project is associated with an interagency effort to develop a common framework of ecological regions. Reaching that objective requires recognition of the differences in the conceptual approaches and mapping methodologies that have been used to develop the most commonly used existing ecoregion-type frameworks, including those developed by the USFS (United States Forest Service) (Bailey and others, 1994), the US EPA (Omernik, 1987, 1995), and the NRCS (United States Department of Agriculture - Soil Conservation Service, 1981). As each of these frameworks is further developed, the differences between them lessen. Regional collaborative projects such as this one in Nebraska and Kansas, where agreement can be reached among multiple resource management agencies, is a step in the direction of attaining commonality and consistency in ecoregion frameworks for the entire nation.

Literature Cited:

Bailey, R.G., Avers, P.E., King, T., and McNab, W.H., eds., 1994, Ecoregions and subregions of the United States (map) (supplementary table of map unit descriptions compiled and edited by McNab, W.H. and Bailey, R.G.): Washington, D.C., U.S. Department of Agriculture - Forest Service, scale 1:7,500,000.

Commission for Environmental Cooperation Working Group, 1997, Ecological regions of North America - toward a common perspective: Montreal, Quebec, Commission for Environmental Cooperation, 71 p.

Gallant, A.L., Whittier, T.R., Larsen, D.P., Omernik, J.M., and Hughes, R.M., 1989, Regionalization as a tool for managing environmental resources: Corvallis, Oregon, U.S. Environmental Protection Agency EPA/600/3-89/060, 152 p.

Griffith, G.E, Omernik, J.M., Wilton, T.F., and Pierson, S.M., 1994, Ecoregions and subregions of Iowa - a framework for water quality assessment and management: The Journal of the Iowa Academy of Science, v. 101, no. 1, p. 5-13.

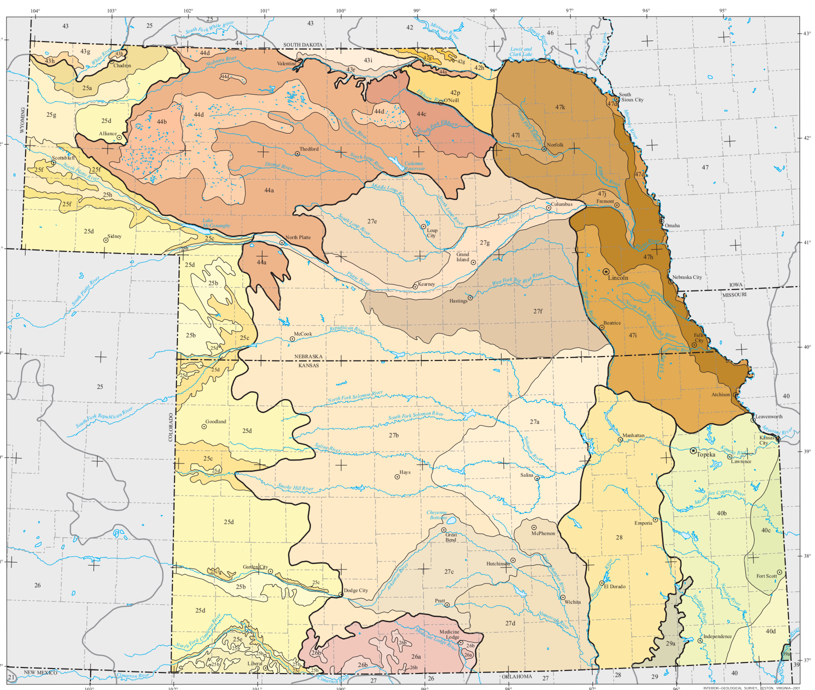
Omernik, J.M, 1987, Ecoregions of the conterminous United States (map supplement): Annals of the Association of American Geographers, v. 77, no. 1, p. 118-125, scale 1:7,500,000.

Omernik, J.M, 1995, Ecoregions - a framework for environmental management, in Davis, W.S. and Simon, T.P., eds., Biological assessment and criteria - tools for water resource planning and decision making: Boca Raton, Florida, Lewis Publishers, p. 49-62.

U.S. Department of Agriculture - Soil Conservation Service, 1981, Land resource regions and major land resource areas of the United States: Agriculture Handbook 296, 156 p.

U.S. Environmental Protection Agency, 2000, Level III ecoregions of the continental United States (revision of Omernik, 1987): Corvallis, Oregon, U.S. Environmental Protection Agency - National Health and Environmental Effects Research Laboratory Map M-1, various scales.

Wiken, E, 1986, Terrestrial ecozones of Canada: Ottawa, Environment Canada, Ecological Land Classification Series no. 19, 26 p.



25 Western High Plains
- 25a Pine Ridge Escarpment
- 25b Rolling Sand Plains
- 25c Moderate Relief Rangeland
- 25d Flat to Rolling Cropland
- 25e Rolling Cropland and Range
- 25f Scotts Bluff and Wildcat Hills
- 25g Sandy and Silty Tablelands
- 25h North and South Platte Valley and Terraces

26 Southwestern Tablelands
- 26a Cimarron Breaks
- 26b Flat Tablelands and Valleys

27 Central Great Plains
- 27a Smoky Hills
- 27b Rolling Plains and Breaks
- 27c Great Bend Sand Prairie
- 27d Wellington-McPherson Lowland
- 27e Central Nebraska Loess Plains
- 27f Rainwater Basin Plains
- 27g Platte River Valley

28 Flint Hills
- 28 Flint Hills

29 Central Oklahoma/Texas Plains
- 29a Cross Timbers

39 Ozark Highlands
- 39a Springfield Plateau

40 Central Irregular Plains
- 40b Osage Cuestas
- 40c Wooded Osage Plains
- 40d Cherokee Plains

42 Northwestern Glaciated Plains
- 42g Ponca Prairie
- 42h Southern River Breaks
- 42p Holt Tablelands

43 Northwestern Great Plains
- 43g Semiarid Pierre Shale Plains
- 43h White River Badlands
- 43i Keya Paha Tablelands
- 43r Niobrara River Breaks

44 Nebraska Sand Hills
- 44a Sand Hills
- 44b Alkaline Lakes Area
- 44c Wet Meadow and Marsh Plain
- 44d Lakes Area

47 Western Corn Belt Plains
- 47d Missouri Alluvial Plain
- 47h Nebraska/Kansas Loess Hills
- 47i Loess and Glacial Drift Hills
- 47j Lower Platte Alluvial Plain
- 47k Northeastern Nebraska Loess Hills
- 47l Transitional Sandy Plain

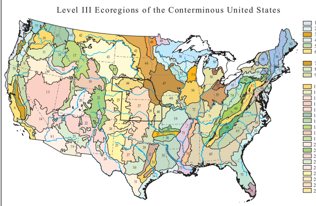
Level III ecoregion — Level IV ecoregion — County boundary — State boundary

SCALE 1:1 950 000

20 10 0 40 80 mi
40 30 20 10 0 80 160 km

Albers equal area projection
Standard parallels 38° N and 42° N

Level III Ecoregions of the Conterminous United States



1 Coast Range; 2 Puget Lowland; 3 Willamette Valley; 4 Cascades; 5 Sierra Nevada; 6 Southern and Central California Chaparral and Oak Woodlands; 7 Central California Valley; 8 Southern California Mountains; 9 Eastern Cascades Slopes and Foothills; 10 Columbia Plateau; 11 Blue Mountains; 12 Snake River Plain; 13 Central Basin and Range; 14 Mojave Basin and Range; 15 Northern Rockies; 16 Idaho Batholith; 17 Middle Rockies; 18 Wyoming Basin; 19 Wasatch and Uinta Mountains; 20 Colorado Plateaus; 21 Southern Rockies; 22 Arizona/New Mexico Plateau; 23 Arizona/New Mexico Mountains; 24 Chihuahuan Deserts; 25 Western High Plains; 26 Southwestern Tablelands; 27 Central Great Plains; 28 Flint Hills; 29 Central Oklahoma/Texas Plains; 30 Edwards Plateau; 31 Southern Texas Plains; 32 Texas Blackland Prairies; 33 East Central Texas Plains; 34 Western Gulf Coastal Plain; 35 South Central Plains; 36 Ouachita Mountains; 37 Arkansas Valley; 38 Boston Mountains; 39 Ozark Highlands; 40 Central Irregular Plains; 41 Canadian Rockies; 42 Northwestern Glaciated Plains; 43 Northwestern Great Plains; 44 Nebraska Sand Hills; 45 Piedmont; 46 Northern Glaciated Plains; 47 Western Corn Belt Plains; 48 Lake Agassiz Plain; 49 Northern Minnesota Wetlands; 50 Northern Lakes and Forests; 51 North Central Hardwood Forests; 52 Driftless Area; 53 Southeastern Wisconsin Till Plains; 54 Central Corn Belt Plains; 55 Eastern Corn Belt Plains; 56 Southern Michigan/Northern Indiana Drift Plains; 57 Huron/Erie Lake Plains; 58 Northeastern Highlands; 59 Northeastern Coastal Zone; 60 Northern Appalachian Plateau and Uplands; 61 Erie Drift Plain; 62 North Central Appalachians; 63 Middle Atlantic Coastal Plain; 64 Northern Piedmont; 65 Southeastern Plains; 66 Blue Ridge Mountains; 67 Ridge and Valley; 68 Southwestern Appalachians; 69 Central Appalachians; 70 Western Allegheny Plateau; 71 Interior Plateau; 72 Interior River Lowland; 73 Mississippi Alluvial Plain; 74 Mississippi Valley Loess Plains; 75 Southern Coastal Plain; 76 Southern Florida Coastal Plain; 77 North Cascades; 78 Klamath Mountains; 79 Madrean Archipelago; 80 Northern Basin and Range; 81 Sonoran Basin and Range; 82 Laurentian Plains and Hills; 83 Eastern Great Lakes and Hudson Lowlands; 84 Atlantic Coastal Pine Barrens

*Level III ecoregions identified in the ecoregion revision and subdivision process subsequent to the original map compilation (Omernik 1987).

PRINCIPAL AUTHORS: Shannen S. Chapman (Dynamac Corporation), James M. Omernik (US EPA), Jerry A. Freeouf (USFS), Donald G. Huggins (KBS), James R. McCauley (KGS), Craig C. Freeman (KBS), Gerry Steinauer (NGPC), Robert T. Angelo (KDHE), and Richard L. Schlepp (USDA, NRCS).

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25. Western High Plains

Dryland agriculture with winter wheat as the primary crop is common in the Western High Plains (25).

In the rain shadow of the Rocky Mountains, the Western High Plains ecoregion is characterized by a semi-arid to arid climate, with annual precipitation ranging from 13 to 20 inches. Higher and drier than the Central Great Plains to the east, much of the Western High Plains comprises a smooth to slightly irregular plain having a high percentage of dryland agriculture. Potential natural vegetation is dominated by drought tolerant shortgrass prairie and large areas of mixedgrass prairie in the northwest, especially in Nebraska. Center pivot irrigation, relying on ground water from the High Plains Aquifer, has increased dramatically in recent decades. Natural gas deposits, found in the south, yield a majority of natural gas produced in the midwest.

25a Dramatic sandstone and siltstone bluffs, escarpments, areas of exposed bedrock, and Ponderosa pine woodlands are characteristic of the **Pine Ridge Escarpment**, distinguishing this region from the more level shortgrass and mixedgrass prairies of other Western High Plains regions. Ponderosa pine, in association with mixedgrass prairie, are found throughout the escarpment area on ridge tops, north-facing and east-facing slopes and, in lesser density, on south-facing and west-facing slopes.

25b The sandy plains and dune areas of the **Rolling Sand Plains** are a divergence from the mostly loess covered plains of adjacent ecoregions. Sandy soils, formed from eolian deposits, support a land use mosaic of primarily rangeland with areas of irrigated agriculture. Sandsage prairie was the potential natural vegetation type, different from the shortgrass and mixedgrass prairie of other neighboring level IV ecoregions in the Western High Plains.

25c The **Moderate Relief Rangeland** ecoregion is typified by irregular plains with slopes greater than the surrounding flat and rolling plains of 25d. Land use is predominantly rangeland, in contrast to the cropland or mosaic of cropland and rangeland of surrounding ecoregions. Soils are silty and clayey loams, formed from eolian sediments, shallower than the thicker loess-capped uplands of 25d. The region's area is limited in Nebraska and has its greatest extent in Kansas and Colorado.

25d Dryland farming with areas of irrigated cropland agriculture are extensive throughout the **Flat to Rolling Cropland** ecoregion. Winter wheat is the main cash crop, with smaller acreages in forage crops. The flat to rolling plains of this region are smoother, more level and generally have thicker loess-mantled uplands than other Western High Plains regions. Loess deposits are thickest in southwestern Nebraska and northwestern Kansas, and thinnest in the north and south. The northernmost extent of this region, just west of the Sand Hills, has a very thin loess layer with more silty and sandy soils than in the southern portion of the region.

25e A land use mosaic of irrigated and dryland agriculture, rangeland, and areas of bare ground are characteristic of the **Rolling Cropland and Range**. This region has a higher concentration of irrigated cropland and a different mix of crops: more corn, soybeans, and alfalfa than the more northern 25d. Soils are formed in eolian material derived from sediments similar to 25d, but sandier and with a thinner loess layer.

25f Bluffs, escarpments, and areas of exposed bedrock typify the **Scotts Bluff and Wildcat Hills** ecoregion. Rangeland and woodland vegetation dominate this region, a contrast to the cropland and irrigated agriculture of adjacent 25h. Sandy and loamy soils, derived from Miocene sandstone and siltstone, support a combination of mixedgrass prairie and Ponderosa pine woodlands on ridge tops and side slopes.

25g The **Sandy and Silty Tablelands** ecoregion is characterized by tablelands with areas of moderate relief, a more arid climate, with average annual precipitation ranging from only 14 to 17 inches, and a shorter growing season than most other regions in 25. Land use is predominantly rangeland, a contrast to the more extensive agriculture of neighboring 25d. Soils in this region are fine sandy and silty loams to fine sands and are formed from weathered Oligocene and Miocene sandstone (Ogallala and Arikaree Formations, and upper White River Groups). Potential natural vegetation is mainly mixedgrass prairie with scattered areas of Sand Hills prairie.

25h The **North and South Platte Valley and Terraces** region is part of the extensive Platte River system. Historically, large volumes of water from spring snowmelt would swell the river system, depositing silty and sandy alluvium in the floodplain. This runoff created the wide alluvial valley and associated terraces. Flood control and reservoir projects have regulated the spring flooding and now cropland agriculture with extensive irrigation is the predominant land use, especially along the North Platte. Crops include sugar beets, dry beans, corn, and potatoes, with alfalfa and forage crops more common in terraced areas.

Dry stream beds are common in the Western High Plains (25). Low annual precipitation combined with ground water withdrawal for irrigated agriculture have increased the occurrence. *Photo by Craig Freeman, Kansas Biological Survey*

The Swift fox, *Vulpes velox*, a species of conservation concern, was once abundant throughout the shortgrass prairie. *Photo by Mike Blair, Kansas Department of Wildlife and Parks*

The Green toad, *Bufo debilis*, has limited habitat in the arid Western High Plains (25). *Photo by Mike Blair, Kansas Department of Wildlife and Parks*

Engelmann's goldenweed, *Oönopsis engelmanii*, a member of the sunflower family, is endemic to the Western High Plains (25). *Photo by Craig Freeman, Kansas Biological Survey*

26. Southwestern Tablelands

The red, gypsum-capped buttes and scattered eastern red-cedar typify the Cimarron Breaks (26a).

During the Permian Period several thousand feet of brick-red shales, siltstone, sandstones, and gypsum were deposited in this region. Erosion has exposed these deposits giving the region its characteristic red butte and mesa appearance. Unlike most adjacent Great Plains ecoregions, little of this region is in cropland and much of its elevated tableland area is in sub-humid grassland and semiarid rangeland. The region has many spring-fed streams, and stream bottoms tend to be sandy, and the water is more mineralized than in adjacent regions.

26a Irregular, dissected slopes, bluffs, and gypsum-capped red buttes typify the **Cimarron Breaks**. Cedar hills prairie and bluestem grama prairie cover much of the rugged landscape. Rangeland and grassland are the dominant land use and land cover with cattle grazing throughout the area.

26b The **Flat Tablelands and Valleys** region is more level than the irregular slopes of adjacent 26a. Soils are silty alluvium and more sandy than the reddish-brown silts and loams of the Cimarron Breaks. Cropland is much more common in this region, with forage crops grown on the level tabletop areas.

28. Flint Hills

28 The Flint Hills ecoregion is the largest remaining intact tallgrass prairie in the Great Plains. This region is characterized by rolling hills composed of shale and cherty limestone, rocky soils, and by humid, wet summers. Average annual precipitation ranges from 28 to 35 inches. The Flint Hills marks the western edge of the tallgrass prairie. Erosion of the softer Permian limestone has left the more resistant chert (or flint) deposits, producing the hilly topography and coarse soils of the area. This rocky surface is difficult to plow; consequently, the region has historically supported very little cropland agriculture. The natural tallgrass prairie still exists in most areas and is used for range and pasture land. However, some cropland agriculture has been implemented in river valleys and along the periphery of the Flint Hills, especially in the northwest corner where the topography is more level. This northwest edge is transitional between the cherty, rocky soils of the Flint Hills (28) and the silty, loamy, loess-formed soils of the Smoky Hills (27a).

Rolling, cherty hills and tallgrass prairie typify the Flint Hills (28).

27. Central Great Plains

A mix of irrigated and dryland cropland is found throughout the Central Great Plains (27).

The Central Great Plains are slightly lower, receive more precipitation, and are somewhat more irregular than the Western High Plains (25) to the west. Once a grassland, dominated by mixedgrass prairie with scattered low trees and shrubs in the south, much of this region is now in cropland, with the eastern boundary of the region marking the eastern limit of the major winter wheat growing area of the United States. Subsurface salt deposits and leaching contribute to the high salinity found in some streams.

27a The **Smoky Hills** ecoregion is an undulating to hilly dissected loess plain with sandstone hills underlain by the Dakota Formation. The region is transitional, with a variable climate and potential natural vegetation ranging from tallgrass prairie in the east to mixedgrass prairie in the west. Soils are silty and loamy, and formed in loess, which is thinner than in neighboring 27b, and with areas of sandy soils formed in sandstone. Land use consists of cropland and grassland with dryland winter wheat as the principal crop. Average annual precipitation ranges from 24 to 28 inches, greater than in 27b to the west.

27b The **Rolling Plains and Breaks** ecoregion was historically a mixedgrass prairie. Today, a mosaic of cropland agriculture and rangeland occurs throughout the region. Soils are silty, well drained, deep, and moderately permeable; formed in loess on uplands. The dissected plains, with broad, undulating to rolling ridge-tops are a contrast to the smoother Western High Plains (25) to the west and the broad, flat regions to the north (27g and 27f). In Kansas, this region contains extensive oil deposits.

27c The undulating to rolling sand plains of the **Great Bend Sand Prairie** are a contrast to the loess-mantled regions of 27a and 27b. A mantle of windblown sand, sandy outwash, and dunes supports a potential natural vegetation of sand prairie bunchgrass. Center pivot irrigation is implemented to a greater degree here than in surrounding regions.

27d The flat lowland topography of the **Wellington-McPherson Lowland** distinguishes this region from the sand hills of 27c to the northwest, the undulating prairie of 27a to the north, the rolling hills of 28 to the east, and the tablelands of 26 to the southwest. Loess and river valley deposits support extensive cropland agriculture of winter wheat and grain sorghum. The area is also underlain by shale, gypsum and salt from ancient Permian seas, most notably the Hutchinson salt member, which is mined for salt, and the northern area contains the alluvial Equus beds, an important aquifer.

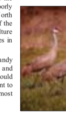
27e The rolling dissected plains of the **Central Nebraska Loess Plains** have a deeper, calcareous, loess layer than adjacent regions, increasing to more than 60 feet toward the Sand Hills. These silty soils support a natural vegetation of mixedgrass prairie and areas of red-cedar savanna intrusion in the west. land use/land cover is a mosaic of rangeland and cropland with less cropland than surrounding regions in the Central Great Plains. However, irrigated agriculture is increasing in this region.

27f Historically, the flat to rolling loess-covered plains of the **Rainwater Basin Plains** encompassed one of the largest concentrations of natural wetlands found in Nebraska. Surface water drainage in this region is poorly developed, resulting in numerous closed watersheds that drain into low depressional areas. Located in the North American Central Flyway, this region contains important wetland habitat used during waterfowl migration. Most of the wetlands have been drained for cultivation and now relatively few areas remain. In addition, cropland agriculture practices and extensive irrigation have contributed to problems with ground water contamination and major changes in ground water levels.

27g The **Platte River Valley** region is a flat, wide alluvial valley with shallow, braided stream channels on a sandy bed; a contrast to the dissected loess-covered plains of neighboring regions 27b and 27e. The alluvial sand and silty soils support cultivated cropland with much of it in center pivot irrigation. Historically, seasonal flooding would scour the valley, inhibiting any significant growth of hardwood riparian vegetation, creating sandbar habitat important to many migrating and nesting bird species. Today, with flood control and extensive water withdrawal for irrigation, most of the former river channel is occupied by hardwood trees.

Oil wells can be found throughout the southern areas of the Rolling Plains and Breaks (27b) region.

A broad, braided, sandy and silty stream bed is characteristic of the Platte River Valley (27g). *Photo by Nebraska Game and Parks Commission*



The Sandhill crane, *Grus canadensis*, uses the Platte River Valley (27g) for nesting and feeding during the early spring migration. *Photo by Nebraska Game and Parks Commission*

The Pasque flower, *Anemone patens*, is a dry mixedgrass species found in areas like the Central Nebraska Loess Plains (27e). *Photo by Nebraska Game and Parks Commission*

29. Central Oklahoma/Texas Plains

Oak savanna is characteristic of the Cross Timbers (29a) region.

The Central Oklahoma/Texas Plains ecoregion is a transitional area between prairie vegetation to the west and forested regions to the south. Kansas contains the northern extent of the region. Oak savanna and forests are common on the sandy, dry soils. The thick Pennsylvanian-aged sandstone has been eroded into a series of hills that exhibit more relief than the surrounding Osage Cuestas (40b) but less relief than the larger hills of the Flint Hills (28).

29a A dense growth of blackjack oak, post oak, and oak savanna blankets the sandstone hills of the **Cross Timbers**, separating this region from the tallgrass prairies of the Flint Hills, and the mosaic of oak-hickory forest and tallgrass prairie of the Osage Cuestas to the east. Thick sandstone-capped uplands with shale outcrops are common. Soils tend to be sandier, somewhat shallower, and drier than in surrounding regions. Woodland and rangeland are the predominant land cover/land use of this region, a change from the cropland/grassland mix that occurs to the east and the more extensive rangeland found in the Flint Hills (28) to the west.

39. Ozark Highlands

The Ozark Highlands ecoregion is a hilly and densely forested area that covers large parts of Missouri, Arkansas, and a small area in Oklahoma and Kansas. This area is not as agricultural as bordering regions; less than one fourth of the core and half or more of the periphery of this region has been cleared for pasture and cropland. Humid, wet summers are typical and precipitation is generally greater than 40 inches per year. Mississippian-aged rocks, including the Warsaw and Keokuk cherty limestones, are geologically much older than strata in adjacent northern regions.

39a The **Springfield Plateau** is a small region in Kansas. Woodlands and oak-hickory forests blanket the area and are supported by the cherty, silty, moist, and acidic soils. These soils are also highly leached, producing the least fertile area of all ecoregions in Kansas. Historically, lead and zinc mining occurred in this part of Kansas evidenced today by large remnant "chat" piles of crushed rock, which still remain where mining occurred.

The Springfield Plateau (39a) is mostly woodland although some areas have been cleared for pastureland and limited cropland.

40. Central Irregular Plains

A combination of cropland, woodland, and grassland covers the gently rolling topography of the Central Irregular Plains (40).

The Central Irregular Plains ecoregion has a variety of land use types and tends to be topographically more irregular than the Western Corn Belt Plains (47) to the north, where most of the land is in crops. The potential natural vegetation of the region is a mosaic of tallgrass prairie and oak-hickory forest, with more forested areas than 47. The climate is humid with rainfall averaging 28 to 40 inches per year, most of it falling during the growing season. Soils also differ from the Western Corn Belt Plains (47) mainly by the relative absence of glacial drift and a thinner loess mantle. The Pennsylvanian surface rock strata provide material for building stone and the manufacturing of cement and ceramics. Oil and gas fields are extensive in Kansas and Oklahoma and coal has been mined in numerous locations in the region.

40b The **Osage Cuestas** region is a gently undulating cuesta plain composed of several alternating layers of sandstone, limestone, and shale. Topography is distinct from the more dramatic rolling hills of the Flint Hills to the west. Potential natural vegetation ranges from a mosaic of mostly tallgrass prairie in the west to a mixture of tallgrass prairie and oak-hickory forest in the east, with floodplain forests along streams. The moist, silty clay loams are formed in material weathered from limestone and shale, and support a land use composite of cropland, woodland, and grassland/rangeland.

40c The **Wooded Osage Plains** is a broad transition region, shifting from a mosaic of prairie and woodland to a more extensive woodland land cover. Forest density generally increases from west to east, especially in Missouri, and land use reflects this change in the mosaic of woodland, cropland, and grassland/rangeland, with less cropland than in neighboring 40b. Precipitation, 38 to 40 inches per year, tends to be greater than in the Osage Cuestas. Soils are similar to 40b, but with a greater density of forest type soils. In addition, the limestone present in the subsurface bedrock strata is greater than in the Osage Cuestas (40b).

40d The **Cherokee Plains** region is a flat erosional plain with more poorly drained and less fertile soils than in 40b and 40c. Hardpan or claypan prairie types are common and found where soils have an impermeable or only slightly permeable, silty clayey subsoil below the loamier surface layer. Sites are seasonally wet and usually become extremely dry during the summers. Coal strip mining has been extensive and mine tailings still exist in some areas.

42. Northwestern Glaciated Plains

The Northwestern Glaciated Plains ecoregion is a transitional area between the generally more level, moister, more agricultural Northern Glaciated Plains (46) to the east and the generally more irregular, drier, Northwestern Great Plains (43) to the west and southwest. The western and southwestern boundary roughly coincides with the limits of glaciation. Nebraska contains only the southernmost tip of this region, an area that just dips into the central northeast portion of the state. This area is transitional with little, if any, glacial influence evident within Nebraska.

42g The unglaciated level to rolling plains of the **Ponca Plains** distinguish this region from the dissected topography of 42h. Row crop agriculture including soybeans, corn, and alfalfa cover the landscape. Soils are silty to loamy, tend to be sandier than 42h, and are derived from soft sandstone and Cretaceous Pierre Shale.

42h The broken topography of the **Southern River Breaks** in Nebraska is an extension of a larger region in South Dakota. The dissected hills and high relief canyons border major rivers and associated alluvial plains. This region is more heavily wooded than surrounding regions. A combination of riparian vegetation, mixedgrass prairie, and scattered woodlands provides excellent habitat for wildlife. Soils are clayey, derived from weathered Cretaceous shale, and are not as sandy as surrounding regions.

42p The **Holt Tablelands** ecoregion is a transitional area between the loamy, glaciated regions with loess soils to the east and the Sand Hills in the west and south. This region shares many characteristics with the Nebraska Sand Hills (44); however, climate, physiography, and land use are more similar to those of the Northwestern Glaciated Plains (42). Cropland agriculture occurs on the more level tablelands and in areas with loamy soils, whereas grassland is found in areas of greater relief.

Hay and forage crops are grown in areas with more loamy soils and level topography in the Northwestern Glaciated Plains (42).

43. Northwestern Great Plains

Native grasslands, used for grazing, are still found in the Northwestern Great Plains (43).

The Northwestern Great Plains ecoregion encompasses the Missouri Plateau section of the Great Plains. This semiarid rolling plain of shale, siltstone, and sandstone is punctuated by occasional buttes, and agriculture is restricted by the erratic precipitation and limited opportunities for irrigation. Native grasslands, largely replaced on level ground by spring wheat and alfalfa, persist on the broken topography of rangeland areas. The southernmost tip of this region extends into northern Nebraska, bordering the northern edges of the Nebraska Sand Hills (44) region.

43g The rolling hills and grasslands of the **Semiarid Pierre Shale Plains** are a contrast to the dramatic bluffs and pine woodlands of the Pine Ridge Escarpment (25a) to the south. This is an arid region with average annual precipitation ranging from 15 to 17 inches, and it supports mixedgrass prairie with some localized areas of scant vegetation and sagebrush. Harsh, cold winters, a short growing season, and dry, hot summers restrict agriculture potential in this region. Soils derived from Pierre Shale are more clayey than the sandier and more silty soils of neighboring 25a and 43h.

43h The **White River Badlands** in Nebraska border the northern edges of the Pine Ridge escarpment and are southern outliers of a more extensive area in South Dakota. Formed through the erosion of the soft Brule and Chadron clays, siltstones and some sandstones, topography ranges from the sheer, highly dissected landscape of areas like Toadstool Park, to lower relief toeslopes. The landscape is broken by grass-covered, perched "sod tables" that may be grazed or tilled.

43i The level to rolling sandy plains of the **Keya Paha Tablelands** contrast sharply with the adjacent steep dune topography of the Nebraska Sand Hills (44) to the south. Soils are shallow, made up of eolian and alluvial sand deposits over sandstone, and support a combination of Sand Hills prairie and gravelly mixedgrass prairie. Millet and corn are grown on the level land, but the sandy soil limits non-irrigated agriculture.

43r The **Niobrara River Breaks** ecoregion encompasses a unique mixture of mixedgrass and Sand Hills prairies and woody vegetation from the central hardwoods, northern hardwoods, and the Rocky Mountain forests. This area is a convergence of Ponderosa pine woodland, eastern red-cedar, and a scattering of basswood, black walnut, and paper birch. The dissected river valley, with steep side slopes, contains soils ranging from sandy loams to fine sands formed from weathered sandstone, siltstone, and eolian sand, and is underlain with Pierre Shale. The woodland landscape and dissected alluvial topography provide excellent wildlife habitat.

Toadstool Park, part of the White River Badlands (43h).

The Niobrara River Breaks (43r). *Photo by Nebraska Game and Parks Commission*

Pronghorn antelope, *Antilocapra americana*, are found primarily in northwestern areas like the Semiarid Pierre Shale Plains (43g). *Photo by Nebraska Game and Parks Commission*

44. Nebraska Sand Hills

Vast grass-stabilized sand sheets and undulating sand dunes typify the Nebraska Sand Hills (44).

The Nebraska Sand Hills comprises one of the most distinct and homogeneous ecoregions in North America. One of the largest areas of grass stabilized sand dunes in the world, this region is generally devoid of cropland agriculture, and except for some riparian areas in the north and east, the region is treeless. The area is very sparsely populated; however, cattle ranching is a tradition, and large ranches are found throughout the region. The fragile, sandy rangeland must be managed cautiously; wind erosion on denuded sand dunes can be a problem, and care must be taken to prevent overgrazing and vegetation loss. Numerous lakes and wetlands dot the region and parts of the region are without streams.

44a Expansive areas of sand sheets and undulating fields of grass-stabilized sand dunes cover the **Sand Hills.** Dune size, pattern, and alignment generally follow a west to east trending axis, with the larger dune hills in the west having local relief as great as 400 feet. Few lakes and streams are found in this area; however, ground water is accessible and is used for livestock.

44b The **Alkaline Lakes Area** contains sand dunes and many scattered, moderately to highly alkaline lakes. These lakes are located in what is commonly referred to as the "closed basin area". This area has limited influence from ground water sources and generally is devoid of streams. The high alkalinity restricts wetland vegetation growth with the exception of more specialized, alkaline tolerant species such as certain bulrush and saltgrass species.

44c The flat, sandy plains of the **Wet Meadow and Marsh Plain** mark a transition from the dune topography and fine sandy soils of the Sand Hills in the south and west to the more gravelly and loamy regions to the east and north. Wet meadows and marsh areas blanket the region. Unlike the strictly rangeland characteristics of other Sand Hills regions, land use in 44c is a mix of rangeland, hayed meadows, and more extensive irrigated cropland.

44d The distinct **Lakes Area** contains numerous lakes that have much lower alkalinity values than are found in lakes in region 44b. Lake and ground water interaction is prevalent in this region, unlike the lakes of 44b where interaction is limited. Few large streams and rivers occur; however, many small streams have their headwaters in this region. Potential natural vegetation is a combination of Sand Hills prairie and wetland communities that are not limited to the alkaline-tolerant species of 44b. Cattle grazing is common.

Waterfowl, such as this Blue-wing Teal, *Anas discors*, are common in the lakes and wetlands of the Nebraska Sand Hills (44). *Photo by Nebraska Game and Parks Commission*

Cattle ranching is common throughout the Nebraska Sand Hills (44).

Riparian vegetation is sparse and found only along major river drainages, such as this area on the Dismal River.

47. Western Corn Belt Plains

Extensive corn and soybean crops along with small areas of riparian vegetation along stream valleys are common on the irregular terrain of the Western Corn Belt Plains (47).

Once covered with tallgrass prairie, over 90 percent of the Western Corn Belt Plains ecoregion is now used for cropland agriculture and much of the remainder is in forage for livestock. A combination of nearly level to gently rolling glaciated till plains and hilly loess plains, ample precipitation mainly in the growing season, and fertile, warm, moist soils make this one of the most productive areas of corn and soybeans in the world. Agricultural practices have contributed to environmental concerns, including surface and ground water contamination from soil erosion, fertilizer and pesticide applications, as well as livestock concentrations.

47d The **Missouri Alluvial Plain** ecoregion is part of the large, wide, alluvial valley also found in neighboring Iowa and Missouri. The generally level alluvial plain is distinct from the more irregular topography of adjacent regions 47h and 47k. Soils are deep, silty, clayey, and sandy alluvium. They support extensive cropland, some of it irrigated. Historically the river was meandering, free flowing, and spread across the floodplain. Dams, levees, and stream channelization have profoundly altered the structure and characteristics of the river valley.

47h The greater relief and deep loess hills of the **Nebraska/Kansas Loess Hills** are markedly different from the flat alluvial valley of neighboring 47d. Dissected hills with deep, silty, well drained soils supported a potential natural vegetation of tallgrass prairie with scattered oak-hickory forests along stream valleys. Cropland agriculture is now common and ample precipitation in the growing season supports dryland agriculture, with only a few areas requiring irrigation.

47i Low, rolling loess-covered hills with areas of exposed glacial till are characteristic of the **Loess and Glacial Drift Hills**. Loess deposits are generally thinner than those in 47h, and historically there was less oak-hickory forest and more extensive tallgrass prairie than found in 47h. The flatter loess hills have a silty, clay loam soil that supports cropland, while rangeland is somewhat more extensive on the deep clay loams formed in glacial till soils.

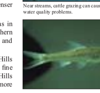
47j The **Lower Platte Alluvial Plain** is an extension of the broad Platte River Valley (27g) to the west; however, this region is within the Western Corn Belt Plains and contains a combination of vegetation, soils, and climate more similar to other areas in 47. Silty, loamy, and sandy soils are formed from alluvium, though not as sandy as the Platte River Valley (27g) to the west. Land use is mainly cropland with areas of irrigated agriculture. Tallgrass prairie, wet meadows, and scattered riparian forests are the potential natural vegetation of the area, with forests generally denser and older than in region 27g.

47k The **Northeastern Nebraska Loess Hills** have an older, coarser loess mantle that is not as weathered as in ecoregions to the south. The climate is generally cooler with slightly less annual precipitation than in southern glaciated regions. Cropland agriculture, especially corn, is common, and there is more irrigated agriculture and pastureland, but fewer scattered woodlands than in neighboring Western Corn Belt Plains (47) regions.

47l As its name implies, the **Transitional Sandy Plain** ecoregion contains some of the characteristics of Sand Hills (44a) in the west and the glaciated regions to the east. This level to rolling plain has fine sandy loams to fine sands with soils coarser and sandier than other regions in 47. Potential natural vegetation is a combination of Sand Hills (44a) prairie, tallgrass prairie, and some wet meadows, and lacks the oak-hickory forest component found in more eastern regions.

Near streams, cattle grazing can cause erosion and water quality problems.

Tallgrass prairies were once common throughout the Western Corn Belt Plains (47).



The Sicklefin chub, *Hybopis meekii*, was once common in the deeper, muddier, and swifter current streams of the Western Corn Belt Plains (47). Impoundments and channelization have significantly altered the habitat and now this fish is a species of conservation concern. *Photo by Kansas Department of Wildlife and Parks*

Summary Table: Characteristics of Ecoregions of Nebraska and Kansas

25. WESTERN HIGH PLAINS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
25a. Pine Ridge Escarpment	1135	Alternating ridges and valleys with entrenched channels. Elevations increasing from northeast to southeast. Rock outcrops.	3400-5200 / 200-1000	Sandy residuum, Miocene, Oligocene, and Eocene sandstone, and claystone (Arikaree Formation and White River Group).	Entisols (Torriorthents), Mollisols (Argiustolls, Haplustolls)	Canyon, Alliance, Rosebud, Tassel, Busher, Bridget, Oglala, Rock Outcrops	Mesic/ Aridic, Ustic	14-16	130-140	10/36; 58/90	Ponderosa pine woodlands with Rocky Mountain juniper, western snowberry, skunkbush sumac, choke cherry, and Arkansas rose. Mixedgrass prairie: little bluestem, western wheatgrass, prairie sandreed, needle-and-thread, blue grama, and threadleaf sedge.	Cattle grazing and wildlife habitat, with limited agriculture and logging. Grassland and scattered Ponderosa pine woodland.
25b. Rolling Sand Plains	2661	Sandy undulating plains with small scattered areas of active sand dunes. Few perennial streams.	2500-3500 / 10-100	Eolian sand sheets and dunes over Miocene sandstone (Ogallala Formation).	Entisols (Torripsamments, Ustorthents, Ustipsamments), Mollisols (Argiustolls, Haplustolls), Alfisols (Haplustalfs)	NE: Valent, Woodly, Jayem, Sarben KS: Manter, Santana, Optima, Eva, Vona	Mesic/ Aridic, Ustic	16-21	140-180	14/44; 63/94	Sandsage prairie: sand sagebrush, sand bluestem, prairie sandreed, and little bluestem. This community type sometimes is called "sandsage steppe" due to the presence of a dominant shrub, however, sandsage prairie is the name most frequently used in the plains.	Predominantly rangeland with irrigated agriculture.
25c. Moderate Relief Rangeland	3084	Irregular plains with moderate slope. Intermittent streams, with a few large perennial streams. Historically, perennial streams fed by isolated springs may have been more abundant, but water consumption for agriculture and the lowering of the water table have reduced flow and dried up springs and many streams.	2900-4000 / 50-200	Loess-mantled uplands. Sandy, gravelly and loamy colluvium. Miocene sandstone (Ogallala Formation).	Mollisols (Argiustolls, Haplustolls), Entisols (Ustorthents)	Kuma, Keith, Colby, Ulysses	Mesic/ Aridic, Ustic	16-20	150-160	14/42; 62/94	Combination of shortgrass and mixedgrass prairies, with mostly mixedgrass prairie in the north. Shortgrass prairie (blue grama and buffalograss) dominates on upland sites, giving way to mixedgrass prairie (little bluestem, side-oats grama) on slopes, more mesic sites along rivers and streams, and also on sites overlain by thicker loess deposits. In the south, largely on Cretaceous chalks, a unique association called the chalkflat prairie, which is a mixedgrass prairie.	Rangeland and some small areas of dryland farming with major crops of winter wheat and grain sorghum.
25d. Flat to Rolling Cropland	17882	Flat to rolling plains. Few streams, mostly intermittent.	2700-5100 / 5-150	Loess-mantled uplands with alluvial deposits. Northern area: Sandstone and siltstone (Ogallala Formation) with thin loess mantle. Also some Brule Formation (White River Group).	Mollisols (Argiustolls, Haplustolls), Entisols (Ustorthents)	NE: Alliance, Rosebud, Kuma, Santana, Keith KS: Richfield, Ulysses, Colby, Manter	Mesic/ Aridic, Ustic	15-20	130-180	14/46; 62/96	Mixedgrass prairie in the north: needle-and-thread, blue grama, threadleaf sedge, prairie sandreed, and western wheatgrass. Shortgrass prairie to the south: blue-grama, buffalograss, and scattered, isolated sites with alkali sacaton, western wheatgrass, and 'inland' saltgrass.	Dryland cropland with large areas of irrigated agriculture. Major crops include winter wheat, with corn, grain sorghum, and sugar beets grown under irrigation.
25e. Rolling Cropland and Range	765	Nearly level to rolling plains. Few streams, mostly intermittent.	2700-3500 / 10-100	Eolian deposits; thin mantle of loess, loessial alluvium, and colluvium.	Alfisols (Haplustalfs)	Dalhart, Vona	Mesic/ Aridic, Ustic	16-20	170-185	20/47; 66/96	Shortgrass prairie in loess-mantled areas with sandsage prairie in areas with coarse-textured soils.	Irrigated and dryland cropland, and rangeland with a significant amount of bare ground. Major crops include winter wheat, grain sorghum, alfalfa, and corn.
25f. Scotts Bluff and Wildcat Hills	1367	Bluffs, escarpments, and steep valley side slopes. Rock outcrops.	3700-5200 / 150-1000	Sandy residuum. Miocene and Oligocene sandstones (Ogallala and Arikaree Formations, and upper White River Group).	Entisols (Torriorthents), Mollisols (Haplustolls, Argiustolls),	Tassel, Busher, Rosebud, Canyon	Mesic/ Aridic, Ustic	14-18	125-130	12/38; 58/90	Mixedgrass prairie: needle-and-thread, blue grama, and threadleaf sedge, with Ponderosa pine woodlands on ridge tops and side slopes.	Rangeland and wildlife habitat.
25g. Sandy and Silty Tablelands	1674	Tablelands with areas of moderate relief. Some areas of isolated sand dunes, and canyons along stream valleys.	3900-4800 / 100-300	Sandy residuum. Miocene sandstone and siltstone (Ogallala and Arikaree Formations).	Mollisols (Haplustolls), Entisols (Ustorthents, Torriorthents)	Busher, Sarben, Tassel	Mesic/ Aridic, Ustic	14-17	120-130	10/36; 58/90	Mixedgrass prairie: blue grama, little bluestem, threadleaf sedge, and needle-and-thread. Some scattered Sand Hills prairie, sand reed and little bluestem.	Rangeland with limited agriculture.
25h. North and South Platte Valley and Terraces	1562	Flat alluvial valley, bluffs, and uplands.	3300-4500 / 2-100	Sandy and silty alluvial deposits. Mostly Oligocene siltstone (White River Group), but some Miocene sandstone (Ogallala Formation).	Mollisols (Haplustolls), Entisols (Torriorthents)	Tripp, Mitchel, Alice	Mesic/ Aridic Ustic	14-18	130-140	12/38; 58/90	Lowland tallgrass prairie: big bluestem, western wheatgrass, prairie cordgrass, sedges, and switch grass. Mixedgrass prairie: needle-and-thread, blue grama, and threadleaf sedge. Sandsage prairie: little bluestem, sand bluestem, needle-and-thread, prairie sandreed, and sand sagebrush. Floodplain woodlands with cottonwoods.	Irrigated cropland in the river valleys and dryland and irrigated cropland on terraces. Major crops are sugar beets with dry beans, corn and potatoes in irrigated valleys, and forage crops and alfalfa in terraced areas. Native rangeland on uplands.

26. SOUTHWESTERN TABLELANDS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
26a. Cimarron Breaks	2812	Irregular, dissected slopes, bluffs, and gypsum-capped buttes.	1700-2500 / 100-300	Red-colored Permian shale, siltstone, sandstone, salt, and gypsum deposits.	Mollisols (Argiustolls)	Shellabarger, Albion, Farnum	Thermic/ Ustic, Udic	20-28	190-200	22/46; 69/96	Mixedgrass prairie, dominated by big bluestem (on more mesic sites), little bluestem, side-oats grama, blue grama, and some hairy grama, with eastern red-cedar a dominant tree, especially in sites sheltered from fire.	Rangeland and grassland.
26b. Flat Tablelands and Valleys	779	Flat tablelands and river valleys.	1500-2200 / 10-125	Silty alluvium, sand and gravel, red-colored Permian shale, siltstone, sandstone, salt, and gypsum deposits.	Inceptisols (Haplustepts), Mollisols (Argiustolls), Alfisols (Haplustalfs), Entisols (Ustipsamments)	Vernon, Woodward, Carey, Pratt, Tivoli	Thermic/ Ustic, Udic	20-28	190-200	22/46; 69/96	Sandsage prairie common in sites with sandy or well-drained soils. Floodplain woodlands dominated by plains cottonwood, black willow, and peach-leaf willow. Common hackberry, green ash, and American elm locally common, especially in the eastern part of the region.	Cropland on flat tabletops and rangeland along the Cimarron River valley.

27. CENTRAL GREAT PLAINS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
27a. Smoky Hills	7834	Undulating to hilly dissected plain. Broad belt of low hills formed by mature dissection of Cretaceous rock layers.	1200-1800 / 100-250	Sandstone and shale, loamy colluvium, and chalky limestone. Locally mantled with thin loess over Cretaceous sandstone (Dakota Formations).	Mollisols (Argiustolls, Haplustolls, Argiudolls)	Crete, Lancaster, Geary, Hedville, Wells	Mesic/ Udic, Ustic	24-28	165-180	18/42; 68/94	Transitional from tallgrass prairie in the east to mixed-grass prairie in the west. Some floodplain forests along riparian areas.	Cropland with winter wheat as primary crop (more corn grown in irrigated areas) and areas of grassland.
27b. Rolling Plains and Breaks	24739	Dissected plains with broad undulating to rolling ridge tops and hilly to steep valley sides.	1700-3200 / 50-200	Holocene to Illinoian-aged loess on uplands with alluvium in floodplains and stream terraces. Tertiary sandstone (Ogallala Formation) and Cretaceous limestone and shale (Niobrara and Greenhorn Formations).	Mollisols (Haplustolls, Argiustolls, Calciustolls), Entisols (Ustorthents)	Coly, Uly, Harney, Holdredge, Hord	Mesic/ Ustic, Udic	20-24	150-190	16/42; 58/94	Mixedgrass prairie: big bluestem, little bluestem, blue grama, needle-and-thread, side-oats grama, and western wheatgrass. Some areas of floodplain forests along major riparian corridors.	Mosaic of predominantly cropland and rangeland. Winter wheat and grain sorghum are the major crops with large areas of corn in the north. Irrigated areas along the major rivers planted with corn, alfalfa, and small grains. Rangeland on breaks.
27c. Great Bend Sand Prairie	4118	Undulating to rolling sandy plains, dune areas.	1500-2400 / 10-175	Sandy eolian deposits, dune sand, and loamy Quaternary sediments over sandy alluvium.	Alfisols (Haplustalfs), Entisols (Ustipsamments), Mollisols (Argiustolls)	Pratt, Tivin, Naron, Farnum, Shellabarger, Albion	Mesic/ Ustic, Udic	20-26	180-190	20/44; 68/96	Sand prairie-bunch grasses: sand bluestem, sand dropseed, and sand reedgrass.	Dryland and irrigated cropland. Winter wheat is main dryland crop. Large areas of center pivot irrigation support grain sorghum and alfalfa crops. Some areas of rangeland.
27d. Wellington-McPherson Lowland	6058	Flat alluvial lowlands. Perennial streams and numerous springs.	1100-1800 / 2-75	Loess and silty, sandy, and clayey alluvium. Permian sandstone, shale, and salt deposits (Wellington Formation).	Mollisols (Argiustolls, Paleustolls, Haplustolls)	Farnum, Shellabarger, Bethany, Grant, Pond Creek, Ladysmith, Irwin, Clime	Thermic, Mesic/ Ustic, Udic	24-32	185-200	22/44; 69/96	Tallgrass prairie: big bluestem, little bluestem, and Indiangrass, with switchgrass in more mesic sites. Floodplain forests are well developed along rivers and streams and are dominated by plains cottonwood, black willow, peach-leaf willow, common hackberry, American elm, green ash, and black walnut, with bur oak becoming less abundant westward.	Extensive cropland agriculture. Major crops include winter wheat and grain sorghum. Small area of cotton cultivation.
27e. Central Nebraska Loess Plains	6617	Rolling dissected plains with deep loess layer. Perennial and intermittent streams.	1600-3100 / 50-275	Deep Quaternary calcareous loess, early Pleistocene and Pliocene alluvial sand, gravel, and lacustrine sand and silt. Tertiary sandstone (Ogallala Formation).	Entisols (Ustorthents, Ustifluvents), Mollisols (Haplustolls, Argiustolls)	Coly, Uly, Holdrege, Holder, Hobbs, Hord	Mesic/ Udic, Ustic	20-25	135-150	10/36; 62/90	Mixedgrass prairie: big bluestem, little bluestem, sideoats grama, blue grama, and western wheatgrass with areas of recent eastern red-cedar intrusion. Highest concentration of cedar is in northwest and adjacent to the Sand Hills.	Predominantly rangeland with large areas of cropland planted in winter wheat, corn, and forage crops. Irrigation agriculture continues to expand in this area.
27f. Rainwater Basin Plains	7370	Flat to gently rolling loess-covered plains. Historically, extensive rainwater basins, and wetlands.	1300-2400 / 5-100	Quaternary loess and mixed loess and sandy alluvium. Tertiary sandstone (Ogallala Formation) in the west and Cretaceous limestone and shale (Niobrara and Carlile Formations) to the east. Wind-excavated depressions.	Mollisols (Argiustolls, Argialbolls, Argiaquolls, Haplustolls), Entisols (Ustorthents)	Hastings, Fillmore, Crete, Butler, Holder, Uly, Coly	Mesic/ Ustic, Aquic, Udic	22-28	150-170	14/38; 65/92	Transitional: tallgrass prairie to the east and mixed-grass prairie in the west, dominated by big bluestem, little bluestem, and sideoats grama. Wetlands dominated by western wheatgrass, sedges, spike rushes, and slender bulrush.	Extensive cropland. Sorghum and winter wheat are the principal dryland crops. Corn and alfalfa are the principal irrigated crops. Historically, the region contained extensive rainwater basins and wetlands that provide important habitat for migrating bird species. Most of the basins have been drained for cultivation and only a few remnants still exist.
27g. Platte River Valley	3061	Flat, wide alluvial valley. Shallow, interlacing streams on a sandy bed.	1300-2900 / 2-75	Alluvial sand, silt, clay, and gravel deposits. Quaternary and Tertiary unconsolidated sand and gravel.	Mollisols (Haplustolls, Argiustolls, Endoaquolls), Entisols (Psammaquents, Fluvaquents, Ustorthents, Ustipsamments)	Cozad, Hord, Hall, Gibbon, Gothenburg, Platte, Boel, Wann, Hersh, Valentine	Mesic/ Aquic, Ustic, Udic	18-28	140-170	12/36; 64/92	Lowland tallgrass prairie with areas of wet meadow and marsh. Historically, riparian woody vegetation was minimal, however, with flood management and reduced river flow floodplain forests are increasing along the Platte River.	Extensive cropland with much of the area irrigated. Corn, grain sorghum, soybeans, and alfalfa are the principal crops. Some native rangeland and haylands. Many channelized streams and flood control structures.

28. FLINT HILLS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
28. Flint Hills	9783	Undulating to rolling hills, cuestas, cherty limestone, and shale outcrops. Perennial streams and springs common.	1000-1600 / 50-400	Cherty and clayey residuum. Interbedded cherty Permian limestone and shale. Some limited glacial drift in the northeast corner of region.	Mollisols (Haplustolls, Argiustolls, Natrustolls, Argiudolls)	Clime, Labette, Sogn, Dwight, Florence, Eram, Kenoma, Irwin, Ladysmith	Mesic, Thermic/ Udic, Ustic	28-35	160-190	22/42; 68/96	Tallgrass prairie: big bluestem, little bluestem, switchgrass, and Indiangrass. Largest area of intact, native, tallgrass prairie in the Great Plains.	Rangeland with extensive cattle grazing. Some limited areas of cropland agriculture along the river valleys and in areas with little relief.

29. CENTRAL OKLAHOMA/TEXAS PLAINS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
29a. Cross Timbers	775	Rolling hills and uplands.	700-1000 / 100-200	Sandy residuum and shale outcrops. Pennsylvanian shale with thin sandstone strata.	Alfisols (Haplustalfs, Paleustalfs)	Steedman, Niotaze, Stephenville	Thermic/ Udic, Aquic	32-36	190-205	24/46; 69/94	Cross timbers savanna: post oak, blackjack oak, hickory, and eastern red-cedar with an understory of tallgrass and mixedgrass species.	Woodland and rangeland.

39. OZARK HIGHLANDS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
39a. Springfield Plateau	56	Smooth to rolling hills.	800-1000 / 100-175	Loamy residuum. Mississippian cherty limestone.	Ultisols (Paleudults, Fragiudults)	Clarksville, Nixa	Mesic/ Udic	40-42	215-220	26/46; 68/93	Oak-hickory mixed forest. Pecan, Shumard oak, pin oak, white sassafras, and river birch are common in places along rivers and streams, with flowering dogwood on uplands. Tallgrass prairie and some sandstone and limestone glades were also found on uplands, but most prairies have been converted to cropland.	Mosaic of woodland, grassland, and small areas of cropland.

40. CENTRAL IRREGULAR PLAINS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
40b. Osage Cuestas	8988	Cuestas and gentle undulating plains. Perennial streams.	800-1200 / 50-200	Silty and clayey residuum and colluvium. Alternating layers of Pennsylvanian sandstone, limestone, and shale. Glacial drift fairly abundant in the extreme northern part of this ecoregion.	Mollisols (Argiudolls, Argiaquolls), Alfisols (Albaqualfs), Entisols (Udarents)	Kenoma, Martin, Woodson, Eram, Lula, Dennis, Parsons, Kanima, Bates	Thermic, Mesic/ Aquic, Udic	32-38	190-220	24/44; 68/94	Transitional: mostly tallgrass prairie in the west to a combination of tallgrass prairie and oak-hickory woodland in the east. Upland forests dominated by shagbark hickory, bitternut hickory, red oak, white oak, and black oak, with Ohio buckeye, American bladderpod, and pawpaw common understory trees.	Mosaic of cropland, woodland, and grassland.
40c. Wooded Osage Plains	1565	Cuestas and gentle undulating plains. Perennial streams.	900-1100 / 50-200	Silty and clayey residuum and colluvium. Alternating layers of Pennsylvanian sandstone, limestone, and shale.	Mollisols (Argiudolls), Alfisols (Albaqualfs), Entisols (Udarents)	Catoosa, Clareson, Parsons, Dennis, Kanima	Thermic/ Aquic, Udic	38-40	195-210	23/44; 68/93	Mixture of oak-hickory woodland and tallgrass prairie with a greater concentration of hardwood forest. Much like 40b, but Shumard oak, pecan, pin oak, and persimmon a bit more common, especially along the Marais des Cygnes River.	Mosaic of woodland, cropland, and grassland.
40d. Cherokee Plains	1308	Flat to gently sloping plains. Perennial streams.	800-1000 / 10-100	Sandy and clayey residuum and colluvium. Pennsylvanian sandstone, limestone, and shale (Cherokee Group).	Mollisols (Argiudolls), Alfisols (Albaqualfs), Entisols (Udarents)	Parsons, Dennis, Kanima	Thermic/ Aquic, Udic	38-40+	195-210	25/45; 68/93	A combination of mostly tallgrass prairie and oak-hickory woodland in areas of greater relief. Upland areas dominated by hardpan and claypan prairie with little bluestem, side-oats grama, varying amounts of big bluestem and Indiangrass, and a variety of forbs.	Combination of cropland and grassland, with scattered areas of woodland. Areas of historic coal strip mining, especially along the Kansas-Missouri border.

42. NORTHWESTERN GLACIATED PLAINS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
42g. Ponca Plains	143	Unglaciated. Level to rolling plains. Preglacial stream drainage.	1700-1900 / 80-140	Alluvial sand and gravel. Miocene soft sandstone (Ogallala and Arikaree Formations) and Cretaceous Pierre Shale.	Mollisols (Argiustolls, Calciustolls)	Onita, Reliance, Ree, Jansen, O'Neill	Mesic/ Ustic	21-22	145-155	10/32; 64/92	Mixedgrass prairie: little bluestem, prairie sandreed, green needlegrass, needle-and-thread, western wheatgrass, sideoats grama, blue grama, and porcupine grass.	Cropland with winter wheat, corn, sorghum, and alfalfa as principal crops.
42h. Southern River Breaks	586	Dissected hills and canyons with slopes of high relief bordering major rivers and associated alluvial plains.	1400-2000 / 250-500	Cretaceous Pierre Shale.	Inceptisols (Haplustepts), Entisols (Ustorthents)	Labu, Bristow, Sansarc	Mesic/ Ustic	20-23	145-155	10/32; 64/92	Deciduous woodland: bur oak, basswood, and eastern red-cedar in canyons and along steep north-facing slopes. Plains cottonwood, willows, green ash. Mixedgrass prairie: western wheatgrass, little bluestem, and green needlegrass on uplands.	Rangeland, wildlife habitat, with some limited cropland.
42p. Holt Tablelands	1401	Unglaciated. Tablelands with dissected slopes.	1500-2000 / 50-475	Eolian sand, alluvial sand and gravel, and lacustrine sand and silt. Miocene soft sandstone (Ogallala Formation).	Mollisols (Argiustolls, Haplustolls)	Jansen, O'Neill, Meadin, Dunday, Pivot, Valentine	Mesic/ Ustic	20-24	145-150	10/32; 62/90	Mixedgrass prairie: little bluestem, switchgrass, sideoats grama, blue grama, sand dropseed, needle-and-thread, prairie sandreed, and sand bluestem.	Cropland on more level tablelands; grassland occurs in areas of greater relief. Crops include grain sorghum, winter wheat, and alfalfa.

43. NORTHWESTERN GREAT PLAINS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
43g. Semiarid Pierre Shale Plains	759	Unglaciated. Undulating to rolling plains. Steep-sided, incised stream channels.	3200-4100 / 100-300	Cretaceous Pierre Shale to Greenhorn Graneros Shale.	Vertisols (Haplusterts), Entisols (Ustorthents)	Pierre, Samsil, Kyle	Mesic/ Aridic	15-17	135-140	10/36; 58/90	Mixedgrass prairie: western wheatgrass, green needlegrass, blue grama, fringed sage, big sagebrush, and buffalograss.	Cattle grazing, some limited dryland farming with winter wheat as principal crop.
43h. White River Badlands	223	Unglaciated. Highly dissected landscape of eroded walls and escarpments, isolated buttes and badlands. Dendritic drainage pattern; ephemeral streams highly erosive.	3100-4100 / 225-450	Oligocene, Brule, and Eocene Chadron claystone formations (White River Group) over Cretaceous Pierre Shale.	Vertisols (Haplusterts), Entisols (Torriorthents), Alfisols (Haplustalfs)	Buffon, Orella, Norrest	Mesic/ Aridic, Ustic	15-17	130-140	10/35; 60/91	Silver sagebrush, western wheatgrass, saltbush, rabbitbrush, thickspike wheatgrass, greasewood, and poverty weed.	Cattle grazing.
43i. Keya Paha Tablelands	680	Unglaciated. Level to rolling, sandy plains, isolated gravelly buttes. Dissected near streams.	1900-2400 / 20-400	Eolian and alluvial sand and silt over Miocene soft sandstone (Ogallala Formation).	Entisols (Ustipsamments, Torriorthents, Psammaquents), Mollisols (Argiustolls, Haplustolls)	Valentine, Tassel, Elsmere, Tryon, Hennings, Ronson	Mesic/ Ustic, Aridic	19-20	130-155	10/32; 62/90	Mosaic of Sand Hills transition prairie and gravelly mixedgrass prairie: little bluestem, prairie sandreed, threadleaf sedge, and needle-and-thread.	Rangeland with areas of cropland. Alfalfa, winter wheat, millet, and corn are principal crops.
43r. Niobrara River Breaks	490	Unglaciated. Dissected canyons with slopes of high relief bordering river.	1700-2700 / 200-600	Sandy residuum. Miocene soft sandstone over Cretaceous Pierre Shale.	Entisols (Torriorthents, Ustipsamments)	Tassel, McKelvie, Rock Outcrop	Mesic/ Ustic	19-20	130-155	10/32; 62/90	Ponderosa pine woodlands with eastern red-cedar on south-facing bluffs and canyon slopes. Deciduous woodlands: bur oak, basswood, green ash, and some paper birch on north-facing bluffs and lower canyon slopes. Plains cottonwoods and eastern red-cedar on floodplains and mixedgrass and Sand Hills prairies through the valley.	Rangeland with scattered cropland in valley bottom. Recreational use.

44. NEBRASKA SAND HILLS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
44a. Sand Hills	14726	Sand sheets and extensive fields of barchanoid, parabolic, and domal sand dunes. High water table.	2200-3900 / 50-400	Eolian dune sand and Pliocene and Pleistocene alluvial silt, sand, and gravel over Miocene soft sandstone (Ogallala Formation).	Entisols (Ustipsamments)	Valentine	Mesic/ Ustic	17-23	120-150	10/35; 60/90	Sand Hills mixedgrass prairie: prairie sandreed, little bluestem, sand bluestem, switchgrass, sand lovegrass, needle-and-thread, blue grama, and hairy grama.	Rangeland.
44b. Alkaline Lakes Area	1438	Sand sheets and dunes interspersed with numerous alkaline lakes. No rivers or streams.	3800-4100 / 50-300	Eolian dune sand over Miocene soft sandstone (Ogallala Formation).	Entisols (Ustipsamments), Inceptisols (Halaquepts)	Valentine, Els, Wildhorse	Mesic/ Ustic, Aquic	17-19	120-135	12/37; 60/90	Sand Hills mixedgrass prairie: prairie sandreed, little bluestem, sand bluestem, switchgrass, sand lovegrass, needle-and-thread, blue grama, and hairy grama. Alkaline tolerant grass species in wetlands: alkali sacaton, alkaline bulrush, and inland saltgrass.	Rangeland.
44c. Wet Meadow and Marsh Plain	1899	Flat, sandy plain. Numerous marshes and wetlands.	1900-2400 / 10-50	Eolian dune sand, sand sheets, and Pliocene and Pleistocene alluvial silt, sand, and gravel over Miocene soft sandstone (Ogallala Formation).	Entisols (Ustipsamments), Mollisols (Endoaquolls, Haplustolls)	Els, Valentine, Ipage, Loup, Elsmere	Mesic/ Ustic, Aquic	17-21	140-145	10/33; 62/90	Sand Hills transition mixedgrass prairie: prairie sandreed, little bluestem, sand bluestem, sun sedge, porcupine grass, needle-and-thread, blue grama, and hairy grama. Wetlands: big bluestem, bluejoint, prairie cordgrass, and sedges.	Grassland with a small acreage used for cultivated crops. Some center-pivot irrigation.
44d. Lakes Area	4277	Sand sheets and dunes. Numerous lakes, few rivers or streams.	2300-3900 / 50-200	Eolian dune sand and Pliocene and Pleistocene alluvial silt, sand, and gravel over Miocene soft sandstone (Ogallala Formation).	Entisols (Ustipsamments, Psammaquents), Mollisols (Haplustolls)	Valentine, Elsmere, Tryon	Mesic/ Ustic, Aquic	20-24	120-150	10/36; 60/90	Sand Hills mixedgrass prairie: prairie sandreed, prairie lovegrass, little bluestem, sand bluestem, switchgrass, sand lovegrass, needle-and-thread, blue grama, and hairy grama. Aquatic plants in marshes.	Rangeland.

47. WESTERN CORN BELT PLAINS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
47d. Missouri Alluvial Plain	559	Glaciated. Level floodplain alluvium. Riparian wetlands largely drained.	800-1200 / 2-50	Alluvial deposits over Cretaceous sandstone and shale (Carlile shale through Dakota sandstone) in the north, and Pennsylvanian shale, sandstone, and limestone to the south.	Entisols (Fluvaquents, Udifluvents, Udipsamments)	Albaton, Haynie, Sarpy, Onawa	Mesic/ Aquic	23-35	135-180	15/35; 66/91	Northern floodplain forest: cottonwood, green ash, boxelder, and elm, with lowland tallgrass prairie: big bluestem, prairie cordgrass, switchgrass, and sedges.	Intensively farmed for corn and soybeans. Transportation corridor with most areas drained by surface ditches, land grading, or protected by dams or levees.
47h. Nebraska/ Kansas Loess Hills	3333	Glaciated. Deep, rolling loess-covered hills. Perennial streams.	1000-1500 / 100-300	Loess mantle with underlying calcareous glacial till on Pennsylvanian shale, sandstone, and limestone.	Mollisols (Argiudolls, Argialbolls, Hapludolls), Entisols (Udorthents)	Fillmore, Marshall, Ponca, Monona, Ida, Askarben	Mesic/ Udic	26-34	150-190	16/38; 66/92	Tallgrass prairie: big bluestem, Indiangrass, switchgrass, and little bluestem. Scattered oak-hickory forests and some floodplain woodlands along rivers and streams: bur oak, basswood, black walnut, green ash, plains cottonwoods, and willows.	Principally in cropland except on the steep slopes, which are in trees and pasture. Corn, soybeans, small grains, and alfalfa are typical crops.
47i. Glacial Drift Hills	6460	Glaciated. Rolling low hills. Perennial streams.	1000-1600 / 100-300	Loess and clay loam calcareous glacial till. Loess is variable. Generally loess depth decreases with distance from source rivers. Pennsylvanian shale, sandstone, and limestone and Permian shale and limestone.	Mollisols (Argiudolls), Entisols (Udorthents)	Wymore, Pawnee, Burchard, Askarben, Steinauer, Morrel	Mesic/ Udic	27-35	150-190	14/34; 66/92	Tallgrass prairie with cottonwood-dominated forests along floodplains and oak-hickory forests on bluffs.	Predominately cropland on the flatter loess hills with main crops of wheat and corn, and some areas in grain sorghum, soybeans, and alfalfa. Pasture land is more extensive on till soils.
47j. Lower Platte Alluvial Plain	437	Flat, alluvial plain.	1100-1400 / 2-50	Calcareous alluvium, silt, clay, sand, and gravel. Cretaceous sandstone.	Mollisols (Endoaquolls), Entisols (Psammaquents, Fluvaquents)	Gibbon, Zook, Gothenburg, Platte	Mesic/ Udic, Aquic	27-29	160-170	13/34; 65/91	Lowland tallgrass prairie: big bluestem, prairie cordgrass, switchgrass, and sedges. Floodplain forests: plains cottonwoods with marshes dominated by aquatic plant species.	Irrigated cropland with primary crops of corn, grain sorghum, and alfalfa. A small area is in native hay meadows.
47k. Northeastern Nebraska Loess Hills	5401	Glaciated. Rolling low hills. Perennial streams.	1100-1900 / 100-300	Deep calcareous loess. Cretaceous sandstone, shale, and limestone. Some Miocene soft sandstone (Ogallala Formation).	Mollisols (Haplustolls), Entisols (Ustorthents)	Nora, Crofton, Moody, Judson	Mesic/ Udic	23-28	140-165	10/32; 64/90	Predominately tallgrass prairie with a transition to mixedgrass prairie in the west: big bluestem, little bluestem, porcupine grass, side-oats grama, switchgrass, and Indiangrass. Wet meadows and cottonwood woodland in floodplains.	Cropland, except on the steeper slopes. Principal crops are corn, soybeans, oats, grain sorghum, and alfalfa.
47l. Transitional Sandy Plain	1044	Level to rolling plains.	1400-2000 / 5-150	Alluvial sand, gravel, and lacustrine silt and sediments. Miocene soft sandstone (Ogallala Formation).	Mollisols (Haplustolls, Argiustolls)	Thurman, Boelus, Nora, Bazile	Mesic/ Udic	23-27	145-160	10/32; 64/40	Tallgrass prairie and Sand Hills border mixedgrass prairie: sand bluestem, little bluestem, prairie sandreed, and needle-and-thread. Wet meadows along stream valleys.	Cropland, both dryland and irrigated. Corn and alfalfa are the principal crops, with a smaller acreage of winter wheat, oats, and grain sorghum.

SOURCES:

Abrams, M.D., 1986, Historical development of gallery forests in northeast Kansas: Vegetation, v. 65, p. 29-37.

Anderson, J.R., 1970, Major land uses (map), *in*: The National Atlas of the United States of America, pp. 158-159. Revised from a map by F.J. Marschner, U.S. Geological Survey, scale 1:7,500,000.

Aughey, S., 1880, Sketches of the physical geography and geology of Nebraska: Omaha, Nebraska, Daily Republican book and job office, 318 p.

Bailey, R.G., 1976, Ecoregions of the United States (map): Ogden, Utah, U.S. Department of Agriculture, Forest Service, scale 1:7,500,000.

Bailey, R.G., Avers, P.E., King, T., and McNab, W.H., eds., 1994, Ecoregions and subregions of the United States (supplementary table of map unit descriptions compiled and edited by W.H. McNab and R.G. Bailey): Washington D.C., U.S. Department of Agriculture, Forest Service, scale 1:7,500,000.

Baltensperger, B.H., 1985, Nebraska, a geography: Boulder, Colorado, Westview press, 310 p.

Baughman, R.W., 1961, Kansas in maps: Topeka, Kansas, The Kansas State Historical Society, 104 p.

Bleed, A., and Flowerday, C., eds., 1990, An atlas of the Sand Hills: Conservation and Survey Division, Institute of Agriculture and Natural Resources, Lincoln, Nebraska, University of Nebraska, Resource Atlas no. 5a, 265 p.

Bradford, H.E., and Spidel G. A., 1940, Nebraska: Its geography and agriculture: New York, Macmillan, 375 p.

Bryce, S.A., Omernik, J.A., Pater, D.E., Ulmer, M., Schaar, J., Freeouf, J., Johnson, R., Kuck, P., and Azevedo, S.H., 1998, Ecoregions of North Dakota and South Dakota (color poster with map, descriptive text, summary table and photographs): Reston, Virginia, U.S. Geological Survey, (map scale 1:1,500,000).

Buchanan, R.C., ed., 1984, Kansas geology, an introduction to landscapes, rocks, minerals, and fossils: Lawrence, Kansas, University Press of Kansas, 208 p.

Buchanan, R.C., McCauley, J.R., 1988, Roadside Kansas, a traveler's guide to its geology and landmarks: Lawrence, Kansas, University Press of Kansas, 365 p.

Buckwalter, D.W., 1983, Monitoring Nebraska's Sandhills Lakes: Lincoln, Nebraska, Conservation and Survey Division, Institute of Agriculture and Natural Resources, University of Nebraska, Resource report no. 10, 42 p.

Coupland, R.T., ed., 1993, Natural grasslands, introduction and western hemisphere: Amsterdam, The Netherlands, Elsevier Science Publishers, Ecosystems of the world series v. 8a, 401 p.

Department of Agronomy and the National Drought Mitigation Center, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln (draft) 1998, Soil organic matter provinces of Nebraska croplands (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service, map series no. 98-0101, scale 1:1,000,000.

Diffendal, R.F., Jr., and Voorhies, M.R., 1994, Geologic framework of the Niobrara River drainage basin and adjacent areas in South Dakota generally east of the 100th meridian west longitude and west of the Missouri River: Lincoln, Nebraska, Conservation and Survey Division, Institute of Agriculture and Natural Resources University of Nebraska, Nebraska Geological Survey Report of investigations no. 9, 13 p.

Dort, W., Jr. and Jones, J.K., Jr., eds., 1970, Pleistocene and recent environments of the Central Great Plains: Lawrence, Kansas, The University Press of Kansas, Department of Geography special publication no. 3, 433 p.

Dugan, J.T., 1984, Hydrologic characteristics of Nebraska soils: U.S. Geological Survey water supply paper no. 2222, map supplements, various scales, 19 p.

Dugan, J.T., and Cox, D.A., 1994, Water level changes in the High Plains Aquifer - predevelopment to 1993: Lincoln, Nebraska, U.S. Geological Survey, Water resources investigations report no. 94-4157, 60 p.

Elder, J.A., 1969, Soils of Nebraska: Lincoln, Nebraska, University of Nebraska, Conservation and Survey Division, resource report no. 2, 60 p.

Engberg, R.A., and Spalding R.F., 1978, Groundwater quality atlas of Nebraska: Lincoln, Nebraska, Conservation and Survey Division, Institute of Agriculture and Natural Resources, University of Nebraska, Resource Atlas no. 3, 39 p.

Evans, C.S., 1995, From sea to prairie, a primer of Kansas geology: Lawrence, Kansas, Kansas Geological Survey, Educational Series no. 6, 60 p.

Evans, K.E., and Probasco G.E., 1977, Wildlife of the prairies and plains: St. Paul, Minnesota, U.S. Department of Agriculture, Forest Service, North Central Experiment Station, General technical report NC-29, 18 p.

Fenneman, N.E., 1931, Physiography of the Western United States: New York, McGraw-Hill, 534 p.

Freeouf, J. A. (compiled and edited by), 1996 (revised June 1998), Ecoregions and subregions of region 2 - subsection (map): Lakewood, Colorado, U.S. Department of Agriculture, Forest Service, scale 1:500,000.

Frensel, S.A., Swanson, R.B., Huntsinger, T.L., Stamer, J.K., Emmons, P.J., and Zelt, R.B., 1998, Water quality in the central Nebraska basins, 1992-1995: Lincoln, Nebraska, U.S. Geological Survey, circular no. 1163, 33 p.

Frye, J.C., and Schoewe, W.H., 1953, The basis for physiographic subdivision of Kansas: Transactions of the Kansas Academy of Science. v. 56, no. 2, p. 246-252.

Gallant, A.L., and Omernik, J.M., 1989, Ecological subregions of Colorado (map): Corvallis, Oregon, U.S. Evironmental Protection Agency. Environmental Research Laboratory, scale 1:1,400,000.

Gogel, T., 1981, Discharge of saltwater from Permian rocks to major stream aquifer systems in central Kansas: Lawrence, Kansas, Kansas Geological Survey and U.S. Geological Survey, University of Kansas, Chemical quality series no. 9, (map supplement) 59 p.

Goodin, D.G., Mitchell, J.E., Knapp, M.C., and Bivens, R.E., 1995, Climate and weather atlas of Kansas, an introduction: Lawrence, Kansas, Kansas Geological Survey, Educational Series no. 12, 24 p.

Griffith, G.E., Omernik, J.M., Wilton, T.F., and Pierson, S.M., 1994, Ecoregions and subregions of Iowa, a framework for water quality assessment and management: The Journal of the Iowa Academy of Sciences, v. 101, no. 1, p. 5-13.

Gutentag, E.D., Heimes, F.J., Krothe, N.C., Luckey, R.R., and Weeks, J.B., 1984, Geohydrology of the High Plains Aquifer in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming: U.S. Geological Survey Professional Paper 1400-B, 63 p.

Ham, G.E., and Higham, R., eds., 1987, The rise of the wheat state, a history of Kansas agriculture: Manhattan, Kansas, Sunflower University Press, 94 p.

Hammond, E.H., 1970, Classes of land surface form (map), *in*: The National Atlas of the United States of America: U.S. Geological Survey, scale 1:7,500,000, p. 62-63.

Huntzinger, T.L., and Ellis, M.J., 1993, Central Nebraska river basins, Nebraska: Water Resources Bulletin, v. 29, no. 4, p. 533-573.

Jiuming, L., Eve, D., and Merchant, J.W., 1997, Satellite view of Nebraska (map): Lincoln, Nebraska, Center for Advanced Land Management Information Technologies (CALMIT), scale 1:1,000,000.

Joem, A., and Keller, K.H., eds., 1995, The changing prairie, North American grasslands: New York, New York, Oxford University Press, 244 p.

Kansas Applied Remote Sensing Program (KARS), 1996, Vegetation index greeness, July 21 - Aug 3, 1995 (map): Lawrence, Kansas, scale (approximate) 1:1,300,000.

Kansas Biological Survey (KBS) and Kansas Applied Remote Sensing Program (KARS), 1998, Draft: Satellite view of Kansas (map): Lawrence, Kansas, scale 1:750,000.

Kansas Biological Survey (KBS) and Kansas Applied Remote Sensing Program (KARS), 1991, Kansas land cover patterns (map): Lawrence, Kansas, scale 1:750,000.

Kansas Geological Survey, 1988, Geologic highway map of Kansas (map): Lawrence, Kansas, scale 1:1,000,000.

Kansas Geological Survey, 1982, Geothermal resources of Kansas (map): Lawrence, Kansas, scale 1:500,000.

Kansas Geological Survey, 1982, Saturated thickness and specific yield of Cenozoic deposits in Kansas (map): Lawrence, Kansas, scale 1:1,000,000.

Kaul, R.B., 1975, Vegetation of Nebraska, circa 1850 (map): Lincoln, Nebraska, Conservation and Survey Division, Institute of Agricultural and Natural Resources, The University of Nebraska, scale 1:1,000,000.

Kaul, R.B., and Rolfsmeier, S.B., 1993, Native vegetation of Nebraska (map): Lincoln, Nebraska, Conservation and Survey Division, Institute of Agricultural and Natural Resources, The University of Nebraska, scale 1:1,000,000.

Keech, C.F., and Bentall, R., 1988, Dunes on the Plains, the Sand Hills region of Nebraska: Lincoln, Nebraska, Conservation and Survey Division, Institute of Agriculture and Natural Resources, The University of Nebraska, resource report no. 4, 18 p.

Keys, J.E. Jr., Carpenter, C.A., Hooks, S.L., Koenig, F.G., McNab, W.H., Russell, W.E., and Smith, M.L., 1995, Ecological units of the eastern United States - first approximation: Atlanta, Georgia, U.S. Department of Agriculture, Forest Service, Technical Publication R8-TP 21, scale 1:3,500,000.

Knight, C.L., Briggs, J.M., and Nellis, M.D., 1994, Expansion of gallery forest on Konza Prairie Research Natural Area, Kansas: Landscape Ecology v. 9, p. 117-125.

Krothe, N.C., Oliver, J.W., and Weeks, J.B., 1982, Dissolved solids and sodium in water from the high plains aquifer in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming (map): Denver, Colorado, U.S. Geological Survey, Atlas HA-658, scale 1:2,500,000.

Küchler, A.W., 1970, Potential natural vegetation (map), *in*: The National Atlas of the United States of America: U.S. Geological Survey, scale 1:7,500,000, p. 89-91.

Küchler, A.W., 1964, Potential natural vegetation of the conterminous United States (map and manual): New York, New York, American Geographical Society Special publication no. 36, scale 1:3,168,000.

Küchler, A.W., 1967, Some geographic features of the Kansas prairie: The Transactions of the Kansas Academy of Science, v. 70, no. 3, p. 388-401.

Küchler, A.W., 1969, The vegetation of Kansas on maps: The Transactions of the Kansas Academy of Science, v. 72, no.1, p. 141-166.

Küchler, A.W., 1970, A biogeographical boundary, the Tastchl line: The Transactions of the Kansas Academy of Science. v. 73, no. 3, p. 298-301.

Küchler, A.W., 1974, A new vegetation map of Kansas (map and supplement): Ecology, v. 55, p. 586-604, scale 1:800,000.

Licht, D.S., 1997, Ecology and economics of the Great Plains: Lincoln, Nebraska, University of Nebraska press, 225 p.

Loveland, T.R., Merchant, J.W., Brown, J.F., Ohlen, D.O., Reed, B.C., Olsen, P., and Hutchinson, J., 1995, Seasonal land-cover regions of the United States (map supplement): Annals of the Association of American Geographers, v. 85, no. 2, p. 339-335.

Lugn, A.L., 1962, The origin and sources of loess in the central great plains and adjoining areas of the central lowland (map supplement): Lincoln, Nebraska, University of Nebraska Press, series no. 26, 105 p.

Macfarlane, P.A., 1997, The Dakota aquifer system in Kansas: Lawrence, Kansas, Kansas Geological Survey, Geologic Extension, The University of Kansas, Public information circular no. 7, 5 p.

Malin, J.C., (edited by Swierenga, R.P.), 1984, History and ecology, studies of the grassland: Lincoln, Nebraska, University of Nebraska press, 376 p.

McCarraher, D.B., 1977, Nebraska's Sandhills lakes: Lincoln, Nebraska., Nebraska Game and Parks Commission, 67 p.

McIntosh, C.B., 1996, The Nebraska Sand Hills, the human landscape: Lincoln, Nebraska, The University of Nebraska Press, 238 p.

Nebraska Conservation and Survey Division, 1993, Flat Water, a history of Nebraska and its water: Lincoln, Nebraska, Institute of Agriculture and Natural Resources, University of Nebraska, Resource report No. 12, 291 p.

Nebraska Conservation and Survey Division, 1990, General soil map of Nebraska (map): Lincoln, Nebraska, Nebraska Conservation and Survey Division, Institute of Agricultural and Natural Resources, The University of Nebraska, scale 1:1,000,000.

Nebraska Conservation and Survey Division, 1990, Center-pivot irrigation systems in Nebraska, 1988 (map): Lincoln, Nebraska, Nebraska Conservation and Survey Division, Institute of Agricultural and Natural Resources, The University of Nebraska, scale 1:1,000,000.

Nebraska Conservation and Survey Division, 1991, Groundwater vulnerability to contamination in Nebraska using the DRASTIC method (map): Lincoln, Nebraska, Nebraska Conservation and Survey Division, Institute of Agricultural and Natural Resources, The University of Nebraska, scale 1:1,000,000.

Omernik, J.M., 1987, Ecoregions of the conterminous United States: Annals of the Association of American Geographers. v. 77, p. 118-125, scale 1:7,500,000.

Omernik, J.M., 1995, Ecoregions: a spatial framework for environmental management, *in*: Davis, W. S. and Simon, T.P., eds., Biological assessment and criteria - tools for water resource planning and decision making: Boca Raton, Florida, Lewis Publishers, p. 49–62.

Pettijohn, R.A., and Chen, H., 1983, Geohydrology of the High Plains Aquifer system in Nebraska (maps): Lincoln, Nebraska., U.S. Geological Survey, Water resources investigations open file report 82-502, scale 1:750,000.

Rafferty, M.D., 1983, Missouri, a geography: Boulder, Colorado, Westview Press, 262 p.

Reichman, O.J., and Mulligan, S., 1995, Living landscapes of Kansas: Lawrence, Kansas, University Press of Kansas, 154 p.

Risser, P.G., 1988, Diversity in and among grasslands, *in* Wilson, E.O., ed., Biodiversity: Washington D.C., National Academy Press, p. 176-180.

Risser, P.G., Birney, E.C., Blocker, H.D., May, S.W., Parton, W.J., and Wiens J.A., 1981, The true prairie ecosystem: Stroudsburg, Pennsylvania, Hutchinson Ross Publishing Co., 557 p.

Ross, J. A., compiler, 1991, Geologic map of Kansas (map): Lawrence, Kansas, Kansas Geological Survey, University of Kansas, Map M-23, scale 1:500,000.

Sampson, F., and Knopf, F., 1994, Prairie conservation in North America: BioScience, v. 44, no. 6, p. 418 - 422.

Schimel, D.S., Kittel, T.G., Knapp, A.K., Seastedt, T.R., Parton, W.M., and Brown, V.B., 1991, Physiological interactions along resource gradients in a tallgrass prairie: Ecology, v. 72, p. 672-684.

Schoewe, W.H., 1949, The Geography of Kansas, part II physical geography: Transactions of the Kansas Academy of Science, v. 52, no. 3, p. 261-333.

Schoewe, W.H., 1953, The Geography of Kansas, part III hydrogeography: Transactions of the Kansas Academy of Science, v. 56, no. 2, p. 131-190.

Schultz, C.B., and Frye, J.C., 1965, Loess and related eolian deposits of the world (map supplements): Lincoln, Nebraska, University of Nebraska Press, Proceedings VIIth congress of International Association for Quaternary Research, vol. 12, 316 p.

Self, H., 1978, Environment and man in Kansas, a geographical analysis: Lawrence, Kansas, Regents Press of Kansas, 288 p.

Sinclair, H.R., Waltman, W.J., Svoboda, M.D., and Mortensen, D.A., (draft) 7/08/98, Inherent soil quality of Nebraska landscapes (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, map series no. 98-0117, scale 1:1,000,000.

Sinclair, H.R., Waltman, W.J., Waltman, S.W., Terpstra, H.P., and Reed-Margetan, D., (draft) 11/27/98, Soil survey atlas of agroecology - Northern Plains division; Root zone available water capacity - SRPG (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, scale 1:3,500,000.

Spinazola, J.M., Gillespie, J.B., and, Hart, R.J., 1985, Groundwater flow and solute transport in the Equus beds area, south-central Kansas, 1940-79: Lawrence, Kansas, USGS water resources investigations report 85-4336, map supplement, U.S. Geological Survey and Kansas Geological Survey, 68 p.

State Geological Survey of Kansas, 1967, General availability of groundwater in Kansas (map): State Geological Survey of Kansas, Lawrence, Kansas, scale 1:500,000.

State Geological Survey of Kansas, 1964, Geologic map of Kansas (map): State Geological Survey of Kansas, Lawrence, Kansas, scale 1:500,000.

Steeples, D.W. and Buchanan, R.C., 1983, Kansas geomaps: Lawrence, Kansas, Educational Series no. 6, 30 p.

Stevens, W.C., 1948, Kansas wild flowers: Lawrence, Kansas, University Press of Kansas, 461 p.

Swinehart, J.B., Souders, V.L., DeGraw, H.M., Diffendal, R.F., Jr., 1985, Cenozoic Paleogeography of western Nebraska from Paleogeography of west-central United States, *in* Flores, R.M., and Kaplan, S.S., eds., Proceedings of Rocky Mountain Paleogeography Symposium 3: Denver, Colorado, p. 209–229.

Swinehart, J.B., and Diffendal, R.F., Jr., 1997, Geologic map of the Scottsbluff 1° x 2° quadrangle, Nebraska and Colorado (map): Lincoln, Nebraska, U.S. Department of the Interior, U.S. Geological Survey, Map I-2545, scale 1:250,000.

Tanner, D.Q., and Steele, G., 1991, Groundwater quality in the Nemaha natural resources district, southeastern Nebraska: Lincoln, Nebraska, U.S. Department of the Interior, U.S. Geological Survey, Water resources investigations report 90-4184, 52 p.

Thompson, M.C., and Ely, C. 1989. Birds in Kansas, Lawrence Kansas: University of Kansas Museum of Natural History, Public education series v. 1, no. 11, 404 p.

Tolsted, L.L., and Swineford, A., 1986, Kansas rocks and minerals: Lawrence, Kansas, Kansas Geological Survey, Educational Series no. 2, 64 p.

Trimble, D.E., 1980, The geologic story of the Great Plains: Washington D.C., U.S. Dept. of the Interior, U.S. Geological Survey, Geologic survey bulletin 1493, 55 p.

U.S. Department of Agriculture - Natural Resources Conservation Service, 1998, draft: Ecological framework map tile 5 (Nebraska and Kansas) Major land resource area concepts - STATSGO vs. MLRA (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center in cooperation with CALMIT - University of Nebraska, scale 1:1,000,000.

U.S. Department of Agriculture - Natural Resources Conservation Service (formerly the Soil Conservation Service). Various county soil surveys of Kansas and Nebraska.

U.S. Department of Agriculture - Soil Conservation Service, 1981, Land Resource Regions and Major Land Resource Areas of the United States: Washington D.C., U.S. Department of Agriculture, Soil Conservation Service, Agriculture Handbook no. 296, 156 p. with folded map in pocket.

U.S. Department of Agriculture - Soil Conservation Service, 1986, General Soil Map of Kansas (map): Ft. Worth, Texas, U.S. Department of Agriculture, Soil Conservation Service - National Mapping Division, scale 1: 1,000,000.

U.S. Fish and Wildlife Service, 1978, Stream evaluation map, state of Kansas: Denver, Colorado, U.S. Fish and Wildlife Service, Office of Biological Sciences, scale 1:500,000.

U.S. Fish and Wildlife Service, 1978, Stream evaluation map, state of Nebraska: Denver, Colorado, U.S. Fish and Wildlife Service, Office of Biological Sciences, scale 1:500,000.

U.S. National Oceanic and Atmospheric Administration, 1974, Climates of the States; a practical reference containing basic climatological data of the United States, v. II, Western States, including Alaska and Hawaii: Port Washington, New York, Water Information Center, 975 p.

Unklesbay, A.G., and Vineyard, J.D., 1992, Missouri Geology, three billion years of volcanoes, seas, sediments, and erosion: Columbia, Missouri, University of Missouri Press, 189 p.

Vankat, J.L., 1979, The natural vegetation of North America, an introduction: New York, John Wiley & Sons, 261 p.

Verstraeten, I.M., Sibray, S.S., Cannia, J.C., and Tanner, D.Q., 1995, Reconnaissance of ground-water quality in the North Platte natural resources district, Western Nebraska, June-July 1991: Lincoln, Nebraska, U.S. Geological Survey, Water resources investigations report no. 94-4057, 114 p.

Waltman, W.J., Svoboda, M.D., and Mortensen, D.A., draft 7/16/98, Annual water balance across Nebraska landscapes (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, map series no. 98-0120, scale 1:1,000,000.

Waltman, W.J., Svoboda, M.D., and Mortensen, D.A., draft 7/16/98, Growing degree days across Nebraska landscapes (map):, Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, map series no. 98-0121, scale 1:1,000,000.

Waltman, W.J., Svoboda, M.D., and Mortensen, D.A., draft 7/16/98, Mean annual precipitation across Nebraska landscapes (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, map series no. 98-0119, scale 1:1,000,000.

Waltman, W.J., Svoboda, M.D., and Mortensen, D.A., draft 7/24/98, Mean summer water balance across Nebraska croplands (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, map series no. 98-0125, scale 1:1,000,000.

Waltman, W.J., Waltman, S.W., and Mortensen, D.A., draft 7/22/98, Irrigated and rainfed croplands of Nebraska (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, map series no. 98-0125, scale 1:1,000,000.

Waltman, W.J., Zhou, Y., Craig, M., and Waltman, S.W., draft 11/27/98, Soil survey atlas of agroecology-Northern Plains division, Growing degree days base 50°F 1961-1990 (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, scale 1:3,500,000.

Weaver, J.E., 1954, North American Prairie: Lincoln, Nebraska, Johnsen publishing company, 348 p.

Weaver, J.E., 1965, Native Vegetation of Nebraska: Lincoln, Nebraska, University of Nebraska Press, 185 p.

Weaver, J.E., 1968, Prairie plants and their environment; a fifty-year study in the Midwest: Lincoln, Nebraska, University of Nebraska Press, 276 p.

Weaver, J.E., and Bruner, W.E., 1954, Nature and place of transition from true prairie to mixed prairie: Ecology, v. 35, no. 2, p. 117-126.

Weeks, J.B., and Gutentag, E.D., 1981, Bedrock geology, altitude of base and 1980 saturated thickness of the High Plains aquifer in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming (maps): Denver, Colorado, U.S. Geological Survey, Hydrologic investigations atlas HA-648, scale 1:2,500,000.

Wilson. F.W., 1978, Kansas Landscapes- a geological diary: Lawrence, Kansas, Kansas Geological Survey, Educational Series no. 5, 58 p.

Zhou, Y., Craig, M., and Waltman, S.W., draft 11/27/98, Soil survey atlas of agroecology-Northern Plains division, AVHRR Normalized Difference Vegetative Index- NDVI March 91, April 91, May 91, June 91, July 91, Aug. 91, Sept. 91, Oct. 91 (separate maps for each month): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, scale 1:3,500,000.

Zhou, Y., Narumalani, S., Waltman, W.J., and Waltman, S.W., draft 1997, Spatial framework of ecological units for the U.S., Agrozones of Nebraska (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, scale 1:1,632,613.

Appendix G.3

Mapbook Covers

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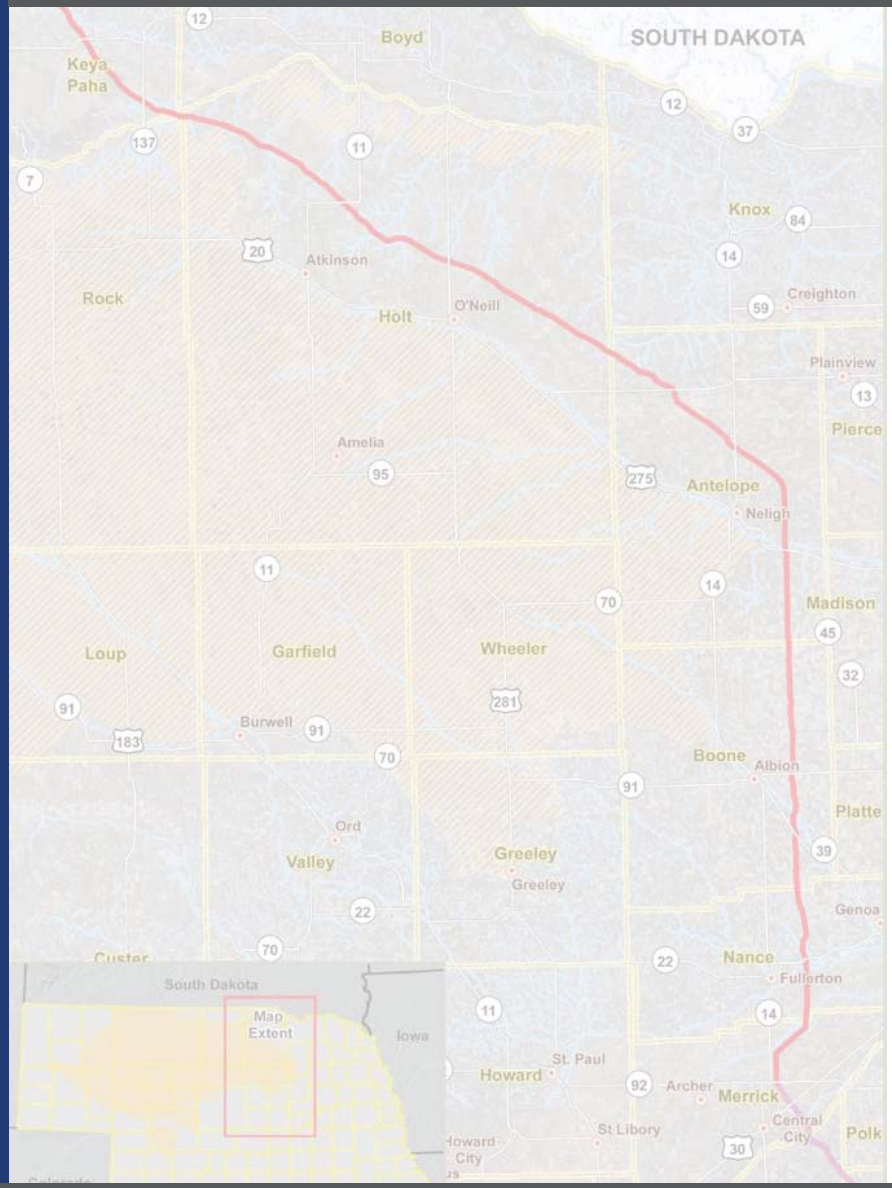
Mapbook Cover 5/2012

Mapbook Cover 9/2012



Nebraska's Keystone XL Pipeline Evaluation

Nebraska Department of Environmental Quality

Pipeline Route Resource Maps For Public Review

Nebraska's Keystone XL Pipeline Evaluation

Pipeline Route Maps

Thank you for your interest in the Nebraska Department of Environmental Quality's (NDEQ) Keystone XL Pipeline Evaluation. The following maps are being provided as a response to participant requests at the informational open house meetings held in O'Neill, Neligh, Albion, and Central City, Nebraska in May 2012. For more detail, the maps can also be found online at the NDEQ's project website at https://ecmp.nebraska.gov/deq-seis, or can be requested by completing and mailing in a map request card. Pipeline Evaluation Map Request Cards can be obtained from library staff members. Please feel free to contact NDEQ with comments using one of the five methods described in the grey box in the bottom corner.

In addition to the maps, public information meeting materials and other project reference materials can be found online.

Nebraska's Evaluation Process:

The purpose of Nebraska's evaluation is to:

- Evaluate environmental, economic, social and other impacts
- Provide opportunity for public review and comment
- Provide an effective and timely evaluation of the route through Nebraska
- Collaborate with the U.S. State Department as necessary

The State of Nebraska is responsible for protecting its natural resources, agricultural resources, aesthetics, economy, and communities through reasonable regulation for the common good and welfare. As such, the state is responsible for ensuring that an oil pipeline proposed to be located within, through, or across Nebraska is in compliance with all state laws, rules, and regulations relating to water, air, and wildlife under the Constitution of Nebraska and state law.

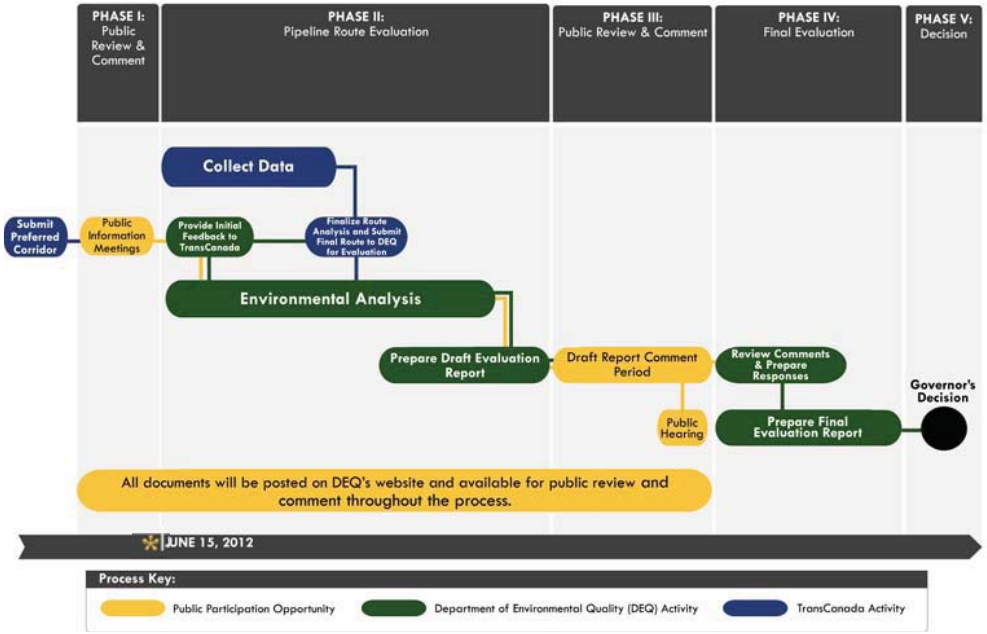
-Legislative Bill 4

After these information sessions are completed, NDEQ will provide initial feedback to TransCanada, based on an initial technical review and public input. TransCanada will then finalize the route that it wishes to have evaluated by the state, and will conduct more in-depth and on-the-ground definition of the proposed route. NDEQ will then evaluate the route through a review process that would consider the environmental, economic, social, and other impacts of the proposed pipeline. The draft evaluation report that is developed by NDEQ will be posted on the agency website and made available for public review and comment.

After the draft evaluation report is made public, NDEQ will announce the public hearing date. Following the public hearing and review of public comments, NDEQ will develop a final evaluation report, which will be presented to the Governor; this information will also be posted on NDEQ's website. The Governor will decide whether he approves the route evaluated in the state's final report.

Keystone XL Pipeline Project Overview

The Keystone XL Pipeline Project is a proposed approximate 854-mile, 36-inch diameter pipeline to transport crude oil from Hardisty, Alberta, Canada to Steele City, Nebraska. From that point, the project would connect with the existing Keystone pipeline - Cushing Extension. At the terminus of the Cushing Extension, the oil would be delivered into a new 36-inch pipeline to be constructed as the Keystone Pipeline Gulf Coast Project for transportation to refinery markets in the Gulf Coast area of the United States. The Project would have an initial nominal throughput capacity of 700,000 barrels per day (bpd) and can be expanded to an ultimate nominal capacity of 830,000 bpd through the installation of additional pumping capacity.



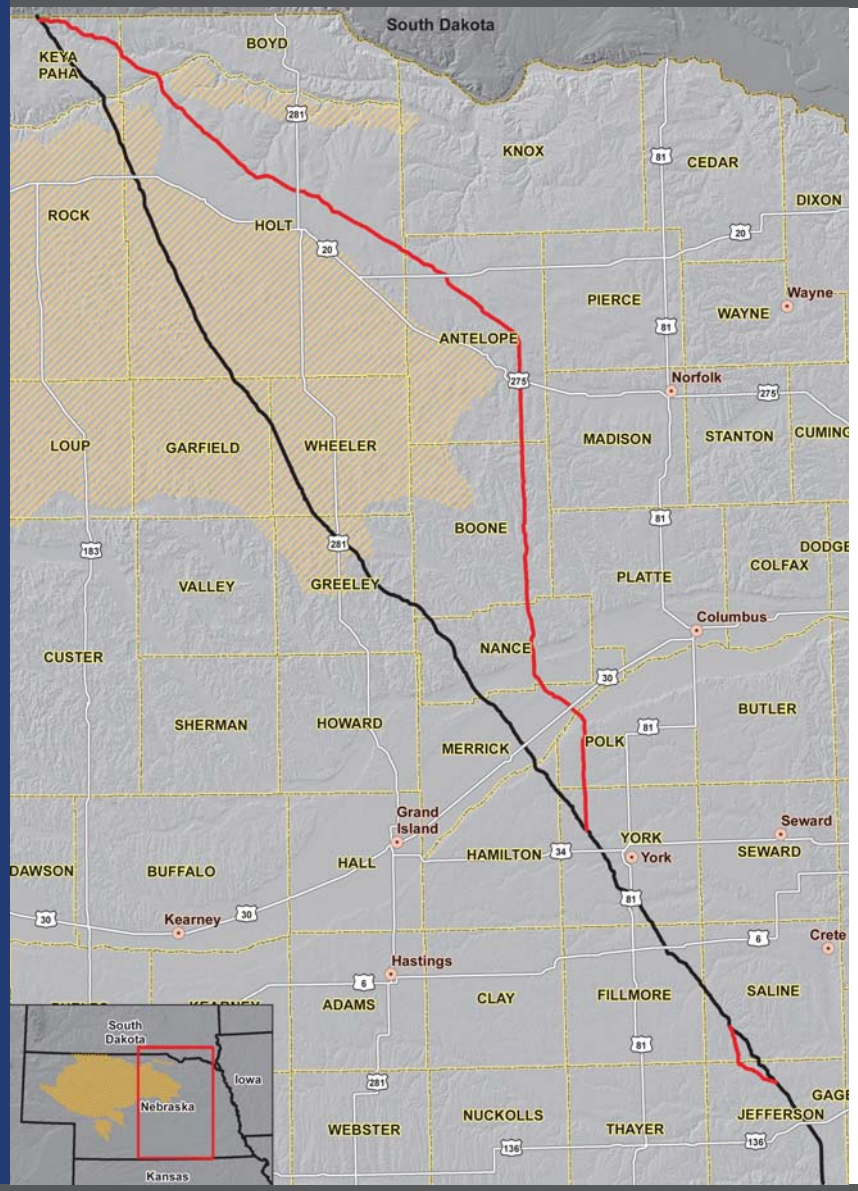
Public Review and Comment

In addition to providing comments during the two specific rounds of public reviews and meetings, NDEQ also welcomes public review and comment at any time during this evaluation. All comments will be posted to NDEQ's website.

* Feedback will be submitted to TransCanada soon. Please submit your comments to NDEQ by June 15th, 2012 for inclusion in our feedback to TransCanada. However, comments are encouraged and can be submitted to Nebraska DEQ throughout the entire evaluation.

Comments may be made in any of the following ways:

- Visit the NDEQ project website: https://ecmp.nebraska.gov/deq-seis
- Mail a letter to:
  Nebraska Pipeline Review Project
  P.O. Box 98922
  Lincoln, NE 68509-8922
- Call the Comment Line: 800-295-8912
- Email the project at NDEQ.SEISpubliccomment@nebraska.gov



Nebraska's Keystone XL Pipeline Evaluation

Nebraska Department of Environmental Quality

Pipeline Route Resource Maps

Nebraska's Keystone XL Pipeline Evaluation

Pipeline Route Resource Maps

Thank you for your interest in the Nebraska Department of Environmental Quality's (NDEQ) Keystone XL Pipeline Evaluation. On September 5, 2012, Keystone filed a Supplemental Environmental Report (SER) with the NDEQ. In the SER, Keystone revised their route to respond to comments raised by NDEQ and the public. The following maps are being provided to allow the public to review Keystone's revised preferred route. The maps, as well as other project reference materials, can also be found online on the NDEQ's project website at https://ecmp.nebraska.gov/deq-seis, or can be requested by completing and mailing a map request card. Pipeline Evaluation Map Request Cards can be obtained from library staff members. Please feel free to contact NDEQ with comments using one of the methods described in the grey box in the bottom corner.

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The State of Nebraska is responsible for protecting its natural resources, agricultural resources, aesthetics, economy, and communities through reasonable regulation for the common good and welfare. As such, the state is responsible for ensuring that an oil pipeline proposed to be located within, through, or across Nebraska is in compliance with all state laws, rules, and regulations relating to water, air, and wildlife under the Constitution of Nebraska and state law.

-Legislative Bill 4

The first phase of the process included NDEQ holding informational open house meetings in O'Neill, Neligh, Albion, and Central City, Nebraska in May 2012. NDEQ then responded to Keystone in a Feedback Report, in July 2012, based on a technical review and public input. Keystone incorporated NDEQ and the public's feedback, conducted more in-depth and on-the-ground data collection, and provided the SER in September 2012.

In the SER Keystone presented a preferred route addressing comments from Nebraskans and NDEQ as presented in the Feedback Report. In addition to various minor refinements, the SER identifies three significant route modifications:

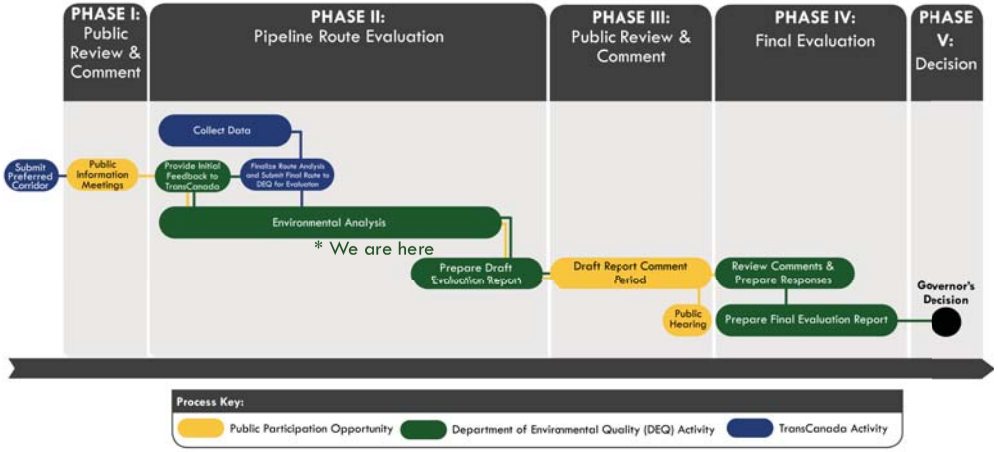
- Numerous comments from landowners and the NDEQ indicated that there are areas outside the defined Sand Hills that include sand dune-like features and areas with sandy, highly erodible soils with a thin organic layer of topsoil. According to Keystone, the new Reroute minimizes impact on these areas.
- During the public comment period, and through NDEQ review, Nebraskans suggested that TransCanada avoid routing the pipeline west of the village of Clarks because the route would cross an area up gradient (or upstream) of the shallow Clarks Wellhead Protection Area (WPA). The Reroute is now down gradient (or down stream) from the Clarks WPA.
- After the Final Environmental Impact Statement (FEIS) was published in August 2011, an expanded WPA was defined for the village of Western. The revised WPA overlapped the FEIS proposed pipeline route. In response, Keystone has re-routed west to avoid the Western WPA.

NDEQ will now evaluate the route Keystone produced through a review process that will consider the environmental, economic, social, and other impacts of the proposed pipeline route. The Draft Evaluation Report (DER) that is developed by NDEQ will be posted on the agency website listed below and made available for public review and comment.

After the DER is made public, NDEQ will announce the public hearing date. Following the public hearing and review of public comments, NDEQ will develop a Final Evaluation Report (FER), which will be presented to the Governor; this information will also be posted on NDEQ's website. The Governor will decide whether he approves the route evaluated in the State's FER.

Keystone XL Pipeline Project Overview

The Keystone XL Pipeline Project is a proposed approximate 854-mile, 36-inch diameter pipeline to transport crude oil from Hardisty, Alberta, Canada to Steele City, Nebraska. From that point, the Project would connect with the existing Keystone pipeline - Cushing Extension. At the terminus of the Cushing Extension, the oil would be delivered into a new 36-inch pipeline to be constructed as the Keystone Pipeline Gulf Coast Project (currenltly under construction) for transportation to refinery markets in the Gulf Coast area of the United States. The Project would have an initial nominal throughput capacity of 700,000 barrels per day (bpd) and potential to be expanded to an ultimate nominal capacity of 830,000 bpd through the installation of additional pumping capacity.



Public Review and Comment

In addition to providing comments during the two specific rounds of public reviews and meetings, NDEQ also welcomes public review and comment at any time during this evaluation. All comments will be posted to NDEQ's website.

Comments may be submitted in any of the following ways:

- Visit the NDEQ project website: https://ecmp.nebraska.gov/deq-seis
- Mail a comment to:
  Nebraska Pipeline Review Project
  P.O. Box 98922
  Lincoln, NE 68509-8922
- Email your comment to: NDEQ.SEISpubliccomment@nebraska.gov

Appendix G.4

Post-Draft Evaluation Report – Final Evaluation Report Outreach Materials

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Postcard Mailer

Community Poster

Press Release 10/30/2012

Public Notices

- Albion News
- Atkinson Graphic
- Beatrice Sun
- Butte Gazette
- Central City Republican
- Columbus Telegram
- Genoa Leader-Times
- Holt Co. Independent
- Lincoln Journal Star
- Nance Co. Journal-Fullerton
- Neligh News
- Omaha World Herald
- Polk Co. News Stromsburg
- Spencer Advocate
- Springview Herald
- York News-Times

Online Meeting

Radio Public Service Announcement

NDEQ DRAFT EVALUATION REPORT PUBLISHED – PIPELINE REROUTE PUBLIC HEARING ANNOUNCED

The Nebraska Department of Environmental Quality (NDEQ) has prepared a Draft Evaluation Report (DER) for the proposed Nebraska Reroute that is now available for review. The purpose of the DER is to determine if Keystone's rerouted alignment avoids the Sand Hills, to evaluate the environmental, economic, social and other impacts of the proposed pipeline, and to provide an opportunity for the public to review and comment. NDEQ asks that the public review the DER and provide comments regarding the potential effects and commitments to reduce impacts. The DER can be reviewed online at https://ecmp.nebraska.gov/deq-seis/ or at ten libraries in the Reroute counties:

- Albion Public Library in Boone County
- Fullerton Public Library in Nance County
- Stromsburg Public Library in Polk County
- Springview Public Library in Keya Paha County
- O'Neill Public Library in Holt County
- Neligh Public Library in Antelope County
- Central City Public Library in Merrick County
- Fairbury Public Library in Jefferson County
- Struckman-Baatz Public Library in Saline County
- Kilgore Memorial Library in York County

PLEASE JOIN US!

NDEQ will conduct an Information Session and Public Hearing to solicit public input. This Information Session and Public Hearing will be the final opportunities for NDEQ to discuss the evaluation findings and the next steps in the pipeline review process with interested persons. **The Information Session and Public Hearing will be held:**

Tuesday, December 4, 2012 | Boone County Fairgrounds
2616 Fairgrounds Road | Albion, Nebraska

Information Session | *Informal Open House Format*	**Public Hearing** | *Formal Testimony Format*
Casey's Building, 3:00–5:30 p.m.	Event Center, 6:00 p.m.

WE WANT YOUR INPUT!

The public hearing will provide for the receipt of oral testimony and written comments. Comments received by the close of the public hearing on December 4, 2012 will be considered as the Agency develops the Final Evaluation Report. NDEQ appreciates your participation and feedback.

Website: https://ecmp.nebraska.gov/deq-seis/ **Email:** NDEQ.SEISpubliccomment@Nebraska.gov
U.S. Mail: Nebraska Department of Environmental Quality |1200 N Street, Suite 400 | PO Box 98922 | Lincoln, NE 68509

To find out more about the process and to review documents, you are encouraged to visit NDEQ's website that focuses on the pipeline review at: https://ecmp.nebraska.gov/deq-seis/. A link to this website can also be found on NDEQ's home page, at www.deq.ne.gov.

Groups or individuals will not be allowed to provide any handouts and/or set-up tables inside the facility for the Information Session and/or Public Hearing.

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Nebraska Department
of Environmental Quality

1200 N Street, Suite 400
PO Box 98922
Lincoln, NE 68509
84-50-29

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Albion, Nebraska

Information Session
Informal Open House Format
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Public Hearing
Formal Testimony Format
Event Center, 6:00 p.m.

November 2012

Nebraska Department
of Environmental Quality

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Lincoln, NE 68509
84-50-29

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Public Hearing
Formal Testimony Format
Event Center, 6:00 p.m.

November 2012

Nebraska Department of Environmental Quality

NEBRASKA'S Keystone XL Pipeline Evaluation

NEBRASKA'S KEYSTONE XL PIPELINE EVALUATION

DRAFT EVALUATION REPORT

AVAILABLE FOR REVIEW

INFORMATION SESSION & PUBLIC HEARING ANNOUNCED

TUESDAY, DECEMBER 4, 2012

LOCATION

Boone County Fairgrounds | 2616 Fairgrounds Road | Albion, Nebraska

INFORMATION SESSION

Informal Open House Format from 3:00–5:30 p.m.
Casey's Building

PUBLIC HEARING

Formal Testimony Format at 6:00 p.m.
Event Center

The public hearing will provide for the receipt of oral and written statements. Comments received through December 4, 2012 will be considered as the Agency develops the Final Evaluation Report.

Comments can be submitted by:

ONLINE COMMENT FORM
Evaluation Website (listed to the right)

EMAIL
NDEQ.SEISpubliccomment@Nebraska.gov

DIRECT MAIL
Nebraska Department of Environmental Quality
1200 N Street, Suite 400
PO Box 98922
Lincoln, NE 68509

INFORMATION SESSION AND/OR PUBLIC HEARING

For online access to the Draft Evaluation Report, online meeting, and comment form: ***Visit Nebraska's Keystone XL Pipeline Evaluation website at*** https://ecmp.nebraska.gov/deq-seis/

The NDEQ appreciates your participation and feedback.

For more information:
Visit the Nebraska Department of Environmental Quality (NDEQ) website at www.deq.ne.gov

PRESS RELEASE

from the Nebraska Department of Environmental Quality

For more information, contact
Brian McManus (402) 471-4223, or
Jim Bunstock (402) 471-4243

For Immediate Release
October 30, 2012

NDEQ Releases Pipeline Draft Evaluation Report

Public Hearing, Information Session to be Held in Albion Dec. 4

The Nebraska Department of Environmental Quality (NDEQ) has completed its Draft Evaluation Report for Keystone's proposed Nebraska Reroute of the Keystone XL Pipeline. This report is available on NDEQ's web site.

The agency is also announcing that a public hearing and information session will be held in Albion on Dec. 4, 2012 at the Boone County Fairgrounds.

"Input from Nebraskans has been tremendously helpful for our work so far," said Mike Linder. "Prior to finalizing the report and submitting it to the Governor, we will carefully consider all additional comments made through the end of the hearing."

TransCanada Keystone Pipeline, LP (Keystone), proposes to construct, operate, and maintain an 875 mile long, 36-inch diameter crude oil pipeline from Hardisty, Alberta, Canada, to Steele City, Nebraska, referred to as the Keystone XL Pipeline Project. Keystone submitted a new proposed route on April 18, 2012. Based on public and agency input, Keystone refined the route in the Supplemental Environmental Report, which was submitted to NDEQ on Sept.5, 2012. NDEQ evaluated Keystone's proposed refined Nebraska Reroute and has completed its Draft Evaluation Report.

Summary of Evaluation Report

The Draft Evaluation Report provides the state's analysis, prepared by NDEQ and its contractor, HDR Engineering of Omaha.

The 600-page draft report provides findings to date regarding Keystone's submissions. Among the findings:

- The Nebraska Reroute avoids the region that was identified as the Sand Hills by NDEQ, which is based on extensive research conducted by various state and federal agencies several years ago.
- Keystone provided some route alternatives in the Supplemental Environmental Report which reduces the amount of fragile soils that are crossed in the northern portion of Nebraska.
- The revised route also establishes greater distances from the sources of drinking water in the communities of Clarks and Western.
- The report details environmental, economic, social and other impacts along the Nebraska Reroute.
- Numerous construction and operational mitigation measures would be incorporated to protect groundwater and surface water.
- Keystone would pay for an independent public employee to act as a liaison to facilitate the exchange of information between Keystone and landowners, local communities, and residents.
- Keystone would provide baseline water well testing for domestic and livestock water wells within 300 feet of the center line of the route.
- Keystone would adhere to 57 special pipeline safety conditions that had been previously agreed upon with the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration.

- Keystone would be responsible for developing an Emergency Response Plan for a product release associated with the operation of the Keystone XL Pipeline and ancillary facilities.
- Keystone has identified five variations of crude oil that would be transported at various times through the pipeline from Alberta, Canada and from the Bakken Formation in Montana and North Dakota. The report contains the general characteristics of the crude oil, which are similar to other crude oils from around the world. In the event of a spill, the appropriate authorities would have immediate access to the product's Material Safety Data Sheet.
- In addition to complying with all relevant state and federal cleanup requirements, Keystone will provide evidence that it is carrying $200 million in third party liability insurance to cover cleanup costs for incidents in Nebraska.

Public Hearing and Information Session

The public hearing will begin at 6 p.m. on Dec. 4, 2012 in the Event Center at the Boone County Fairgrounds, 2616 Fairgrounds Road, Albion. This is a formal public hearing to obtain testimony or comment regarding the state's Draft Evaluation Report and Keystone's Nebraska Reroute. To ensure all testifiers have the opportunity to speak, the hearing officer may set time limits on testimony. Those with more extensive comments are urged to submit them in writing, so all of their comments can be reviewed and considered by the agency.

The hearing will be preceded by an information session from 3:00 p.m. to 5:30 p.m. in the Casey's Building at the Boone County Fairgrounds. The information session will be an opportunity for the public to meet and talk with those from the agency involved in the review, in an informal "open house" format.

Viewing Report and Submitting Comments

To view a copy of the draft Environmental Report, go to NDEQ's new web site at http://deq.ne.gov/ and click on the link to the pipeline project review page, located at: https://ecmp.nebraska.gov/deq-seis/

Public comments will continue to be accepted through Dec. 4, 2012. Comments may be submitted electronically at the pipeline web site, or submitted via e-mail to NDEQ.SEISpubliccomment@Nebraska.gov. Written comments can be mailed to: NDEQ Pipeline Project Comments, P.O. Box 98922, Lincoln, NE 68509-8922. Written comments can also be submitted at the information session on Dec. 4, 2012. Written testimony can be provided at the public hearing.

AFFIDAVIT OF PUBLICATION

State of Nebraska, Boone County, ss

JAMES E. & JULIANNE K. DICKERSON

Being first duly sworn, deposes and says that they are the

PUBLISHERS

of the **Albion News,** a legal newspaper having a bona fide subscription list and circulation of more than **twenty-five hundred** copies each that said newspaper is printed in whole or in part in an office maintained in Albion, in said county; that the whole of the printed matter therein is in the English language; that same has been published for more than fifty-two consecutive weeks immediately prior to the first date of publication stated in this affidavit; that the advertisement, or notice a true and correct copy of which is hereto attached, was printed in each, and in all of each of the regular editions, and not in supplement of said paper **one** successive

Week(s), more particularly stated as follows:

In the issue of:

November 21, 2012

Julianne K. Dickerson

SUBSCRIBED in my presence and sworn to before me on

this **21st** Day of **November, 2012**

Wendy L. Carraher

Notary Public

GENERAL NOTARY State of Nebraska WENDY L. CARRAHER My Comm. Exp. Nov. 11, 2013

Lines **131**

Printer's fee $ **47.16**

Federal I.D.#26-0839358

PUBLIC NOTICE NEBRASKA DEPARTMENT OF ENVIRONMENTAL QUALITY DRAFT EVALUATION REPORT PUBLISHED; PIPELINE PUBLIC HEARING ANNOUNCED

The Nebraska Department of Environmental Quality (NDEQ) has prepared a Draft Evaluation Report for the proposed Nebraska Reroute of the Keystone XL Pipeline Project. The report is available for public review, and public comment will be accepted through Dec. 4, 2012.

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RECEIVED

NOV 26 2012

Nebraska Dept of Environmental Quality

By: _____DEQ# 158_____

This is a formal public hearing to obtain testimony or comment regarding the state's Draft Evaluation Report and the Keystone Nebraska Reroute. To ensure all testifiers have the opportunity to speak, the hearing officer may set time limits on testimony.

Comments received through December 4, 2012 will be considered as the Agency develops the Final Evaluation Report. Comments can be sent to: website: https://ecmp.nebraska.gov/deq-seis; email: NDEQ.SEIS-publiccomment@Nebraska.gov; U.S. Mail: Nebraska Department of Environmental Quality, 1200 N Street, Suite 400, PO Box 98922, Lincoln, NE 68509-8922.

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Publish November 21, 2012c

AFFIDAVIT OF PUBLICATION

STATE OF NEBRASKA
COUNTY OF HOLT } SS

Roxanne G. Hollingsworth, being duly sworn upon her oath, deposes and says that she is the publisher of The Atkinson Graphic, a legal newspaper under the Statutes of Nebraska and printed and published weekly in Atkinson, Holt County, Nebraska, and of general circulation in said county. That said Atkinson Graphic at all times herein stated has been printed in the English language and has a bona fide circulation of more than 300 copies weekly, and that said newspaper has been published within the County of Holt for more than fifty-two weeks prior to the first publication of the annexed notice, and that said newspaper is printed in part in an office maintained by said Atkinson Graphic at Atkinson, Holt County, Nebraska.

That the annexed notice was published in said newspaper for one successive weeks in the regular and entire issue of said newspaper and not in any supplement thereof, the first publication of said notice being in the issue of this

22 day of November 20 12

the last publication being in the issue of the

_____ day of _____ 20 ____

Publication fee: $ 51.93

Roxanne G. Hollingsworth
Publisher

Subscribed and sworn to before me this

22 day of Nov. 20 12

Cynthia L. Poessnecker
Notary Public

My Commission Expires 10-24 20 15

GENERAL NOTARY - State of Nebraska
CYNTHIA L. POESSNECKER
My Comm. Exp. October 24, 2015

PUBLIC NOTICE
NEBRASKA DEPARTMENT OF ENVIRONMENTAL QUALITY
DRAFT EVALUATION REPORT PUBLISHED; PIPELINE PUBLIC HEARING ANNOUNCED

The Nebraska Department of Environmental Quality (NDEQ) has prepared a Draft Evaluation Report for the proposed Nebraska Reroute of the Keystone XL Pipeline Project. The report is available for public review, and public comment will be accepted through Dec. 4, 2012. NDEQ is also announcing that a public hearing and information session will be held in Albion on December 4, 2012 at the Boone County Fairgrounds.

TransCanada Keystone Pipeline, LP (Keystone), proposes to construct, operate, and maintain an 875 mile long, 36-inch diameter crude oil pipeline from the U.S.-Canadian border to Steele City, Nebraska, referred to as the Keystone XL Pipeline Project. Keystone submitted a new proposed route on April 18, 2012. Based on public and agency input, Keystone refined the route in the Supplemental Environmental Report, which was submitted to NDEQ on September 5, 2012. NDEQ evaluated the proposed refined Nebraska Reroute proposed by Keystone and has completed its Draft Evaluation Report.

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Website: https://ecmp.nebraska.g,ov/deq-seis

E-mail: NDEQ.SEISpubliccomment@Nebraska.gov

U.S. Mail: Nebraska Department of Environmental Quality, 1200 N Street, Suite 400, PO Box 98922, Lincoln, NE 68509-8922

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Published November 22, 2012 47

RECEIVED

NOV 26 2012

Nebraska Dept of Environmental Quality
By: _____DEQ# 158_____

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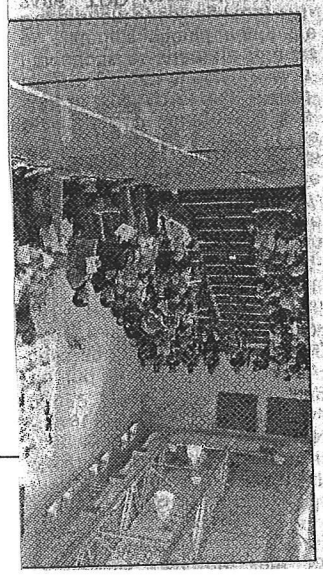
2012.

Norris Middle School, Twenty-three Norris High School seniors with per



AFFIDAVIT OF PUBLICATION

STATE OF NEBRASKA }SS.
GAGE COUNTY

Sheri Hibbert being first duly sworn on oath, says that she he/she is the Chief Clerk of the Beatrice Daily Sun, a legal daily newspaper printed & published in Gage County, Nebraska, and having a bonafide circulation of more than 300 copies of each issue; that the notice, a true copy of which is hereto attached was published on Friday for 1 insertion beginning on the 9th day of November 2012 and the last publication being on the 9th day of November 2012 said newspaper had been published in whole or part in the office of said county from which distribution took place, for more than 52 consecutive weeks prior to the publication of said notice.

RECEIVED
NOV 13 2012
Nebraska Dept of Environmental Quality
By: DEQ# 158

Sheri Hibbert

Subscribed in my presence and sworn to before me this 9th day of November, 2012.

Notary Public

My commission expires

GENERAL NOTARY - State of Nebraska
LEVI HAMILTON
My Comm. Exp. July 12, 2015

lst week.....	$57.15
Subsequent Weeks.....	$
Balance Due	$57.15

AFFIDAVIT OF PUBLICATION

THE STATE OF NEBRASKA
YORK COUNTY

York News-Times

RECEIVED

NOV 15 2012

Nebraska Dept of Environmental Quality
By: _____DEQ# 005_____

DEPT. OF ENVIRONMENTAL QUALITY
P.O. Box 98922
LINCOLN NE 685098922

REFERENCE: 20007540
20224029
PUBLIC NOTICE Nebraska Department of Environmental Quality Draft Evaluation Report Published; Pipeline Public Hearing Announced The Nebraska Department of Environmental Quality (NDEQ) has prepared a Draft Evaluation Report for the proposed Nebraska Rero

Kathy Larson being first duly sworn on his/her oath, deposes and says that he/she is the Ad Manager of the York York News-Times, a newspaper printed and published at York, in York County, Nebraska, and of general circulation in York County, Nebraska, and as such has charge of the records and files of the York York News-Times, and affiant knows of his/her own personal knowledge that said newspaper has a bona fide circulation of more than 500 copies of each issue, has been published at York, Nebraska, for more than 52 weeks successively prior to the first publication of the annexed printed notice, and is a legal newspaper under the statutes of the State of Nebraska.

Kathy Larson
Signature

Subscribed in my presence and sworn to before me this 13 th day of November, 2012.

PUBLISHED ON:
11/14/12

TOTAL COST: 55.81 AD SPACE: Lines: 197

My commission expires March 18, 20 16

Tammi J Eikenhorst
Notary Public, York County, Nebraska

GENERAL NOTARY - State of Nebraska
TAMMI J EIKENHORST
My Comm. Exp. March 18, 2016

PUBLIC NOTICE
Nebraska Department of Environmental Quality
Draft Evaluation Report Published; Pipeline Public Hearing Announced

The Nebraska Department of Environmental Quality (NDEQ) has prepared a Draft Evaluation Report for the proposed Nebraska Reroute of the Keystone XL Pipeline Project. The report is available for public review, and public comment will be accepted through Dec. 4, 2012. NDEQ is also announcing that a public hearing and information session will be held in Albion on December 4, 2012 at the Boone County Fairgrounds.

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Struckman- Baatz Public Library in Saline County; Kilgore Memorial Library in York County.

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E-mail: NDEQ.SEISpubliccomment@Nebraska.gov

U.S. Mail: Nebraska Department of Environmental Quality

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38-1t
ZNEZ

RECEIVED

NOV 19 2012

Nebraska Dept of Environmental Quality
By: _____DEQ# 182_____

Affidavit of Publication

State of Nebraska,
Merrick County } ss.

I, Penni Jensen, being first duly sworn, depose and say that I am the publisher of The Central City Republican-Nonpareil, a weekly newspaper published in an office maintained at Central City, in said county and state, and in general circulation in said county, and that said newspaper has a bona fide circulation of more than three hundred copies weekly, and that it has been published in said county for fifty-two consecutive weeks next prior to the publication of the attached notice, and that said notice was published in said newspaper 1 consecutive weeks, the first publication thereof having been made in the issue of said paper dated the 15 day November, 2012.

Penni Jensen

Subscribed in my presence and sworn to before me this 16 day of November, 2012.

Laura M Lovejoy
Notary Public.

My commission expires June 4, 2013

Publication fee $ 45.60

GENERAL NOTARY - State of Nebraska
LAURA M. LOVEJOY
My Comm. Exp. June 4, 2013

RECEIVED

NOV 19 2012

Nebraska Dept of Environmental Quality
By: _____DEQ# 182_____

THE STATE OF NEBRASKA }
ANTELOPE COUNTY } ss.

Joan Wright, being first duly sworn on oath, says that she is the Editor of the Neligh News and Leader, a weekly and legal newspaper of general circulation in said county; that the annexed notice, which is part of this proof of publication, was published each week at Neligh, Antelope County, Nebraska, for ..1.... successive weeks, the first publication being on the ..14.... day of ....November.....A.D., 20 12.., and the last publication being on the 14... day of .....November.....A.D., 20 12..; that said newspaper was published in Neligh, within said county for more than fifty-two consecutive weeks immediately prior to the commencement of the publication of said notice and every week consecutively since that time; that during all of said times said newspaper had a bona fide circulation of more than 300 copies weekly and was printed in the English language and in an office maintained by the publisher at said place of publication. I have personal knowledge of the facts herein.

.....Joan M. Wright ss.....
Joan Wright

Subscribed and sworn to before me this .15th.... day of .November.... A.D., ..2012..

Publication fee is $....50.40....

Sandra Clarkson
Notary Public

GENERAL NOTARY - State of Nebraska
SANDRA CLARKSON
My Comm. Exp. Aug. 9, 2014

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Publish November 14, 2012
ZNEZ

AFFIDAVIT OF PUBLICATION

CASE NO. _____

RECEIVED

NOV 20 2012

Nebraska Dept of Environmental Quality
By: _____DEQ# 182_____

Boyd County
State of Nebraska } ss.
ss.

I, John WELLS, being first duly sworn depose and say that I am the publisher of

THE BUTTE GAZETTE
BOX 6
BUTTE, NE 68722

a legal newspaper under the statutes of Nebraska, printed and published weekly in Boyd County, Nebraska, and of general circulation in said county; that said newspaper at all times herein stated has been printed in the English language, and that said newspaper is printed wholly or in part in offices maintained in Butte and Spencer in said county; that the annexed notice which is made a part of this affidavit was published in said newspaper for

1 successive weeks in the regular and entire issues of said newspaper and not in any supplement thereof, the first publication of said notice being made in the issue of the 15 day of November 2012 and the last publication being made in the issue of the 15 day of November, 2012.

John Wells
Publisher

Subscribed and sworn to before me this 19 day of November A.D., 2012.

Roberta Hermsen
Notary Public

GENERAL NOTARY - State of Nebraska
ROBERTA HERMSEN
My Comm. Exp. April 11, 2013

Publication Fee $47.13

PUBLIC NOTICES

PUBLIC NOTICE
Nebraska Department of Environmental Quality Draft Evaluation Report Published; Pipeline Public Hearing Announced

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To find out more about the process and to review

PUBLIC NOTICE

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ZNEZ

RECEIVED

NOV 19 2012

Nebraska Dept of Environmental Quality
By: DEQ# 182

Affidavit of Publication

State of Nebraska,
Merrick County } ss.

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Penni Jensen

Subscribed in my presence and sworn to before me this 16 day of November, 2012.

Laura M. Lovejoy
Notary Public.

My commission expires June 4, 2013

Publication fee $ 45.60

GENERAL NOTARY - State of Nebraska
LAURA M. LOVEJOY
My Comm. Exp. June 4, 2013

COPY

RECEIVED

NOV 19 2012

Nebraska Dept of Environmental Quality

DEQ# 171

COLUMBUS TELEGRAM

P.O. Box 648 Columbus, NE 68602-0648 (402)5642741 (800)279-1123

AFFIDAVIT OF PUBLICATION

NOTICE OF INTENT TO CERTIFY
DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER QUALITY DIVISION
LINCOLN, NEBRASKA

In accordance with Section 401 of the federal Clean Water Act (33 U.S.C. Par. 1251 et seq.), certification that State Water Quality Standards (Title 117, Nebraska Administrative Code) will not be violated has been applied for to the Nebraska Department of Environmental Quality (NDEQ) by the persons listed below for discharges requiring federal permits or licenses.

The Loup River Public Power District has applied to the Federal Energy Regulatory Commission (FERC) for a new operating license of its existing 53.4-megawatt generation project on the Loup River in Platte and Nance Counties, Nebraska. The District is requesting Section 401 Water Quality Certification for Project discharge to the lower Platte River during the proposed 30-year licensing period.

In order to evaluate the impacts of this project on the water resources of the State, the Department of Environmental Quality encourages interested citizens to submit favorable or unfavorable written comments. Persons may comment upon or object to the application, or may request a public hearing by writing Pat Rice, NDEQ, P.O. Box 98922, Lincoln, NE 68509-8922, within 30 days after this publication date. Persons may request information about the application from Jason Garber, at the same address. Please notify the Department of Environmental Quality if alternate formats of materials are needed. Contact phone number is 402/471-2186. TDD users please call 711 and ask the relay operator to call us at 402/471-2186.

A request of petition for hearing must state the nature of the issues to be raised and all arguments and actual grounds supporting such position. Such comments shall be considered prior to making a final decision regarding the application. Copies of all materials are available for inspection and copying at NDEQ offices, the Atrium, 4th Floor, 1200 N Street, Lincoln, NE between 8:00 a.m. and 5:00 p.m., weekdays.

State of Nebraska
Platte County } SS

Amy Bell, being first duly sworn, deposes and says that she is the Controller of the Columbus Telegram, a legal newspaper, having a bona fide subscription list and circulation of more than three thousand copies each day; that said newspaper is published in whole or in part in an office maintained in Columbus, in said county; that the whole of the printed matter therein is in the English language; that same has been published for more than fifty-two consecutive weeks immediately prior to the first date of publication stated in this affidavit; that the advertisement, or notice, a true and correct printed copy of which is hereto attached was printed in each, and in all of each of the regular editions, (and not in supplement) of said paper for successive weeks, more particularly stated as follows:

In the issue of:
November 15, 2012

Amy Bell

Printer's Fee, $ 27.90

Subscribed and sworn to before me this 15 day of NOV, 2012

STATE OF NEBRASKA GENERAL NOTARY
CINDY FOWLKES
MY COMMISSION EXPIRES
June 10, 2016

Cindy Fowlkes
Notary Public

(SEAL)

20300320

20120072036

the potential effects and commitments to reduce impacts. The Draft Evaluation Report can be reviewed online at https://ecmp.nebraska.gov/deq-seis/ or at ten libraries in the Reroute counties: Albion Public Library in Boone County; Fullerton Public Library in Nance County; Stromsburg Public Library in Polk County; Springview Public Library in Keya Paha County; O'Neill Public Library in Holt County; Neligh Public Library in Antelope County; Central City Public Library in Merrick County; Fairbury Public Library in Jefferson County; Struckman-Baatz Public Library in Saline County; Kilgore Memorial Library in York County.

The Information Session and Public Hearing will be held Tuesday, Dec. 4, 2012 at the Boone County Fairgrounds, 2616 Fairgrounds Road, Albion, NE. The information session will be from 3:00 to 5:30 p.m. in the Casey's Building at the Fairgrounds. This session provides an opportunity for the public to meet and talk with those from the agency involved in the review, in an informal "open house" format. The public hearing will begin at 6 p.m. in the Fairgrounds' Event Center. This is a formal public hearing to obtain testimony or comment regarding the state's Draft Evaluation Report and the Keystone Nebraska Reroute. To ensure all testifiers have the opportunity to speak, the hearing officer may set time limits on testimony.

Comments received through December 4, 2012 will be considered as the Agency develops the Final Evaluation Report. Comments can be sent to:

Website: https://ecmp.nebraska.gov/deq-seis

E-mail: NDEQ.SEISpubliccomment@Nebraska.gov

U.S. Mail: Nebraska Department of Environmental Quality, 1200 N Street, Suite 400, PO Box 98922, Lincoln, NE 68509-8922

To find out more about the process and to review documents, you are encouraged to visit NDEQ's website that focuses on the pipeline review at: https://ecmp.nebraska.gov/deq-seis/. A link to this website can also be found on NDEQ's home page, at http://deq.ne.gov/. Groups or individuals will not be allowed to provide any handouts and/or set-up tables inside the facility for the Information Session or Public Hearing.

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11:08:12

Public Notice
Nebraska Department of Environmental Quality
Draft Evaluation Report Published; Pipeline Public Hearing Announced

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TransCanada Keystone Pipeline, LP (Keystone), proposes to construct, operate, and maintain an 875 mile long, 36-inch diameter crude oil pipeline from the U.S.-Canadian border to Steele City, Nebraska, referred to as the Keystone XL Pipeline Project. Keystone submitted a new proposed route on April 18, 2012. Based on public and agency input, Keystone refined the route in the Supplemental Environmental Report, which was submitted to NDEQ on September 5, 2012. NDEQ evaluated the proposed refined Nebraska Reroute proposed by Keystone and has completed its Draft Evaluation Report.

The purpose of the Draft Evaluation Report is to determine if Keystone's rerouted alignment avoids the Sand Hills, to evaluate the environmental, economic, social and other impacts of the proposed pipeline, and to provide an opportunity for the public to review and comment. NDEQ asks that the public review the Draft Evaluation Report and provide comments regarding

BUS
LEGRAM

RECEIVED
NOV 13 2012
Nebraska Dept of Environmental Qual
By: _____DEQ# 158_____

P.O. Box 648 NE 68602-0648 (402)5642741 (800)279-1123

AFFIDAVIT OF PUBLICATION

braska
ty } ss

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In the issue of:
November 8, 2012

Printer's Fee, $ 52.52

Subscribed and sworn to before me this 8 day of Nov, 2012

GENERAL NOTARY STATE OF NEBRASKA
CINDY FOWLKES
MY COMMISSION EXPIRES
June 10, 2016

Notary Public

(SEAL)

Order No. 20299479

Public Notice
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E-mail: NDEQ.SEISpubliccomment@Nebraska.gov

U.S. Mail: NebraskaDepartmentof EnvironmentalQuality.1200 N Street Suite 400, PO Box 98922, Lincoln, NE 68509-8922

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Publish November 21, 2012

RECEIVED

NOV 26 2012

Nebraska Dept of Environmental Quality
By: DEQ# 158

Proof of Publication

State of Nebraska)
) ss.
County of Nance)

MARY KAY JOHNSON, being duly first sworn, deposes and says she is the editor of . . .

The Genoa Leader-Times

a weekly legal newspaper having a bona fide circulation of more than 300 copies published in Genoa, Nebraska 68640; and said newspaper has been published for at least 52 consecutive weeks prior to publication of attached notice; that said publication is of general circulation; that attached

notice was published 1 time (s) on

November 21. 2012
(Dates)

Mary Kay Johnson
(Signature)

Subscribed to in my presence and sworn to before me

this 21 day of November 2012

Susann M Czarnik
(Notary Public)

Publication Fee $ 74.58

STATE OF NEBRASKA GENERAL NOTARY
SUSANN M. CZARNIK
MY COMMISSION EXPIRES
June 18, 2013

NOV 1 9 2012

Nebraska Dept of Environmental Quality
By: DEQ# 182

AFFIDAVIT OF PUBLICATION

THE STATE OF NEBRASKA, Holt County, ss:

James T. Miles being first duly sworn upon his oath deposes and says that he is the Editor of the Holt County Independent, a legal newspaper under the Statutes of Nebraska and printed and published weekly in O'Neill, Holt County, Nebraska, and of general circulation in said county. That the said Holt County Independent at all times herein stated has been printed in the English language and has a bona fide circulation of more than 300 copies weekly, and that said newspaper has been published within the County of Holt for more than fifty-two weeks prior to the first publication of the annexed notice, and that said newspaper is printed wholly or in part in an office maintained by said Holt County Independent, at O'Neill, Holt County, Nebraska. That the annexed notice was published in said newspaper for 1 successive week in the regular and entire issue of said newspaper and not in any supplement thereof, the first publication of said notice being in the issue of the 15th day of November, 2012, the last publication being in the issue of the 15th day of November, 2012.

And further affiant saith not.

Subscribed and sworn to before me this 15th day of November, 2012.

Mardell J. Shoemaker
Notary Public

Lines 120 @ Rate $.39274 Publisher's Fees $47.13.

GENERAL NOTARY - State of Nebraska
MARDELL J. SHOEMAKER
My Comm. Exp. August 16, 2015

PUBLIC NOTICE
Nebraska Department of Environmental Quality Draft Evaluation Report Published; Pipeline Public Hearing Announced

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E-mail: NDEQ.SEISpubliccomment@Nebraska.gov

U.S. Mail: Nebraska Department of Environmental Quality, 1200 N Street, Suite 400, PO Box 98922, Lincoln, NE 68509-8922

To find out more about the process and to review documents, you are encouraged to visit NDEQ's website that focuses on the pipeline review at: https://ecmp.nebraska.gov/deq-seis/. A link to this website can also be found on NDEQ's home page, at http://deq.ne.gov/.

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Published November 15, 2012 46

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Groups or individuals will not be

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1-Nov. 14

ZNEZ

RECEIVED

NOV 19 2012

Nebraska Dept of Environmental Quality
By: _____DEQ# 005_____

WORKING COPY

AFFIDAVIT OF PRINTER

STATE OF NEBRASKA) SS.
NANCE COUNTY)

I, William H. Thompson, publisher of the Nance County Journal, a legal newspaper published weekly at Fullerton, Nance County, Nebraska, and having actual knowledge of the fact of such publication, do solemnly swear that a copy of the attached clipping was published weekly in their regular and entire issue of said newspaper

and not in any supplement thereof, for **ONE**

consecutive week(s) commencing with the

issue dated _____ and ending

with the issue dated **November 14, 2012** and

that said newspaper is a legal newspaper under

the statutes of the State of Nebraska.

Wm H Thompson

Notary Public:

Barbara A Micek

My commission expires Nov. 5, 2015

PRINTER'S FEE: $69.44
OTHER: $

GENERAL NOTARY-State of Nebraska
BARBARA A. MICEK
My Commission Expires Nov. 5, 2015

RECEIVED

NOV 19 2012

Nebraska Dept of Environmental Quality
By: _____DEQ# 182_____

PUBLIC NOTICE
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Publish November 14, 2012
ZNEZ

THE STATE OF NEBRASKA
ANTELOPE COUNTY } ss.

Joan Wright, being first duly sworn on oath, says that she is the Editor of the Neligh News and Leader, a weekly and legal newspaper of general circulation in said county; that the annexed notice, which is part of this proof of publication, was published each week at Neligh, Antelope County, Nebraska, for 1 successive weeks, the first publication being on the 14 day of November A.D., 20 12, and the last publication being on the 14 day of November A.D., 20 12; that said newspaper was published in Neligh, within said county for more than fifty-two consecutive weeks immediately prior to the commencement of the publication of said notice and every week consecutively since that time; that during all of said times said newspaper had a bona fide circulation of more than 300 copies weekly and was printed in the English language and in an office maintained by the publisher at said place of publication. I have personal knowledge of the facts herein.

Joan M. Wright
Joan Wright

Subscribed and sworn to before me this 15th day of November A.D., 2012.

Publication fee is $ 50.40

Sandra Clarkson
Notary Public

GENERAL NOTARY - State of Nebraska
SANDRA CLARKSON
My Comm. Exp. Aug. 9, 2014

WORKING COPY

RECEIVED

NOV - 9 2012

Nebraska Dept of Environmental Quality
By: _____DEQ# 171_____

Place Ad Here

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Comments received through December 4, 2012 will be considered as the Agency develops the Final Evaluation Report. Comments can be sent to:

Website: https://ecmp.nebraska.gov/deq-seis
E-mail: NDEQ.SEISpubliccomment@Nebraska.gov
U.S. Mail: Nebraska Department of Environmental Quality, 1200 N Street, Suite 400, PO Box 98922, Lincoln, NE 68509-8922

To find out more about the process and to review documents, you are encouraged to visit NDEQ's website that focuses on the pipeline review at: https://ecmp.nebraska.gov/deq-seis/ A link to this website can also be found on NDEQ's home page, at http://deq.ne.gov/.

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Individuals requiring special accommodations or alternate formats of materials should notify the Department by calling (402) 471-2186. TDD users should call (800) 833-7352 and ask the relay operator to call the Department at (402) 471-2186.

Proof of publication

AFFIDAVIT

State of Nebraska, County of Douglas, ss:

Kiley Petersen, being duly sworn, deposes and says that she is an employee of The Omaha World-Herald, a legal daily newspaper printed and published in the county of Douglas and State of Nebraska, and of general circulation in the Counties of Douglas, and Sarpy and State of Nebraska, and that the attached printed notice was published in the said newspaper on the 7 day of November 2012, and that said newspaper is a legal newspaper under the statutes of the State of Nebraska. The above facts are within my personal knowledge. The Omaha World-Herald has an average circulation of 145,620 Daily and 179,203 Sunday, in 2012.

(Signed) _____ Title: **Account Executive**

Subscribed in my presence and sworn to before me this 7 day of November, 2012.

_____
Notary Public

GENERAL NOTARY-State of Nebraska
HILLARY ADDISON
My Comm. Exp. November 23, 2015

Printer's Fee $ _____
Affidavit _____
Paid By _____

PUBLIC NOTICE
Nebraska Department of Environmental Quality
Draft Evaluation Report Published; Pipeline Public Hearing Announced

The Nebraska Department of Environmental Quality (NDEQ) has prepared a Draft Evaluation Report for the proposed Nebraska Reroute of the Keystone XL Pipeline Project. The report is available for public review, and public comment will be accepted through Dec. 4, 2012. NDEQ is also announcing that a public hearing and information session will be held in Albion on December 4, 2012 at the Boone County Fairgrounds.

TransCanada Keystone Pipeline, LP (Keystone), proposes to construct, operate, and maintain an 875 mile long, 36-inch diameter crude oil pipeline from the U.S.-Canadian border to Steele City, Nebraska, referred to as the Keystone XL Pipeline Project. Keystone submitted a new proposed route on April 18, 2012. Based on public and agency input, Keystone refined the route in the Supplemental Environmental Report, which was submitted to NDEQ on September 5, 2012. NDEQ evaluated the proposed refined Nebraska Reroute proposed by Keystone and has completed its Draft Evaluation Report.

The purpose of the Draft Evaluation Report is to determine if Keystone's rerouted alignment avoids the Sand Hills, to evaluate the environmental, economic, social and other impacts of the proposed pipeline, and to provide an opportunity for the public to review and comment. NDEQ asks that the public review the Draft Evaluation Report and provide comments regarding the potential effects and commitments to reduce impacts. The Draft Evaluation Report can be reviewed online at https://ecmp.nebraska.gov/deq-seis/ or at ten libraries in the Reroute counties: Albion Public Library in Boone County; Fullerton Public Library in Nance County; Stromsburg Public Library in Polk County; Springview Public Library in Keya Paha County; O'Neill Public Library in Holt County; Neligh Public Library in Antelope County; Central City Public Library in Merrick County; Fairbury Public Library in Jefferson County; Struckman-Baatz Public Library in Saline

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PUBLISHER'S AFFIDAVIT

RECEIVED
DEC 3 2012
Nebraska Dept of Environmental Qu
By: _____ DEQ# 158

STATE OF NEBRASKA, POLK COUNTY } SS

I [signature],

editor/publisher of **The Polk County News**, a legal weekly newspaper in said County of Polk, State of Nebraska, being duly sworn, say on my oath that I know of my own knowledge that the notice hereto attached was published in **The Polk County News** for one week; the publication having been made on the

15th day of November, 2012.

[signature]
Editor/Publisher

Subscribed in my presence and sworn to before me

this 15th day of November, 2012.

Sandra Thompson
Notary Public

Printer's fee $ 54.57
Affidavit fee $ _____

GENERAL NOTARY - State of Nebraska
SANDRA THOMPSON
My Comm. Exp. Jan. 25, 2014

AFFIDAVIT OF PUBLICATION

CASE NO. _____

RECEIVED

NOV 20 2012

Nebraska Dept of Environmental Quality
By: _____DEQ# 182_____

Boyd County
State of Nebraska } ss.
ss.

I, John Wells, being first duly sworn depose and say that I am the publisher of

The Spencer Advocate
SPENCER, NEBRASKA 68777

a legal newspaper under the statutes of Nebraska, printed and published weekly in Boyd County, Nebraska, and of general circulation in said county; that said newspaper at all times herein stated has been printed in the English language, and that said newspaper is printed wholly or in part in offices maintained in Butte and Spencer in said county; that the annexed notice which is made a part of this affidavit was published in said newspaper for

1 successive weeks in the regular and entire issues of said newspaper and not in any supplement thereof, the first publication of said notice being made in the issue of the 15 day of November 2012 and the last publication being made in the issue of the 15 day of November, 2012.

John Wells
Publisher

Subscribed and sworn to before me this 19 day of November A.D., 2012.

Roberta Hermsen
Notary Public

GENERAL NOTARY - State of Nebraska
ROBERTA HERMSEN
My Comm. Exp. April 11, 2013

Publication Fee $ 47.13

PUBLIC NOTICES

PUBLIC NOTICE
Nebraska Department of Environmental Quality Draft Evaluation Report Published; Pipeline Public Hearing Announced

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E-mail: NDEQ.SEISpubliccomment@Nebraska.gov

U.S. Mail: Nebraska Department of Environmental Quality, 1200 N Street, Suite 400, PO Box 98922, Lincoln, NE 68509-8922.

To find out more about the process and to review documents, you are encouraged to visit NDEQ's website that focuses on the pipeline review at: http://ecmp.nebraska.gov/

FORM 2004

Proof of Publication

State of Nebraska }
} ss.
County of Keya Paha }

Amy Johnson, being first duly
(name)

sworn, deposes and says she is
the (he or she)

Managing Editor of Springview Herald
(position) (name of publication)

a weekly legal newspaper having a bona
(weekly, daily, etc.)

fide circulation of more than 300 copies published in
Springview,
(name of town)

Nebraska; and said newspaper has been published for at least 52 consecutive weeks prior to publication of attached notice; that said publication is of general circulation; that attached notice was published 1 time(s) on

11/21/12
(dates)

Amy Johnson
(signature)

Subscribed to in my presence
and sworn to before me this
3rd day of December 20 12

Vicki J. Ferguson
Notary Public

Publication Fee $48.11

STATE OF NEBRASKA GENERAL NOTARY
VICKI J. FERGUSON
MY COMMISSION EXPIRES
April 6, 2014

PUBLIC NOTICE

Nebraska Department of Environmental Quality Draft Evaluation Report Published; Pipeline Public Hearing Announced

The Nebraska Department of Environmental Quality (NDEQ) has prepared a Draft Evaluation Report for the proposed Nebraska Reroute of the Keystone XL Pipeline Project. The report is available for public review, and public comment will be accepted through Dec. 4, 2012. NDEQ is also announcing that a public hearing and information session will be held in Albion on December 4, 2012 at the Boone County Fairgrounds.

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The purpose of the Draft Evaluation Report is to determine if Keystone's rerouted alignment avoids the Sand Hills, to evaluate the environmental, economic, social and other impacts of the proposed pipeline, and to provide an opportunity for the public to review and comment. NDEQ asks that the public review the Draft Evaluation Report and provide comments regarding the potential effects and commitments to reduce impacts. The Draft Evaluation Report can be reviewed online at https://ecmp.nebraska.gov/deq-seis or at ten libraries in the Reroute counties: Albion Public Library in Boone County; Fullerton Public Library in Nance County; Stromsburg Public Library in Polk County; Springview Public Library in Keya Paha County; O'Neill Public Library in Holt County; Neligh Public Library in Antelope County; Central City Public Library in Merrick County; Fairbury Public Library in Jefferson County; Struckman-Baatz Public Library in Saline County; Kilgore Memorial Library in York County.

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Website: https://ecmp.nebraska.gov/deq-seis

E-mail: NDEQ.SEISpubliccomment@Nebraska.gov

U.S. Mail: Nebraska Department of Environmental Quality, 1200 N Street, Suite 400, PO Box 98922, Lincoln, NE 68509-8922.

To find out more about the process and to review documents, you are encouraged to visit NDEQ's website that focuses on the pipeline review at https://ecmp.nebraska.gov/deq-seis/. A link to this website can also be found on NDEQ's home page, at http://deq.ne.gov/.

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ZNEZ

AFFIDAVIT OF PUBLICATION

THE STATE OF NEBRASKA
YORK COUNTY

York News-Times

RECEIVED

NOV 15 2012

Nebraska Dept of Environmental Quality
By: _____DEQ# 005_____

DEPT. OF ENVIRONMENTAL QUALITY
P.O. Box 98922
LINCOLN NE 685098922

REFERENCE: 20007540
20224029

PUBLIC NOTICE Nebraska Department of Environmental Quality Draft Evaluation Report Published; Pipeline Public Hearing Announced The Nebraska Department of Environmental Quality (NDEQ) has prepared a Draft Evaluation Report for the proposed Nebraska Rero

Kathy Larson being first duly sworn on his/her oath, deposes and says that he/she is the Ad Manager of the York York News-Times, a newspaper printed and published at York, in York County, Nebraska, and of general circulation in York County, Nebraska, and as such has charge of the records and files of the York York News-Times, and affiant knows of his/her own personal knowledge that said newspaper has a bona fide circulation of more than 500 copies of each issue, has been published at York, Nebraska, for more than 52 weeks successively prior to the first publication of the annexed printed notice, and is a legal newspaper under the statutes of the State of Nebraska.

Kathy Larson
Signature

Subscribed in my presence and sworn to before me this 13 th day of November, 2012.

PUBLISHED ON:
11/14/12

TOTAL COST: 55.81 AD SPACE: Lines: 197

My commission expires March 18 ,20 16

Tammi J Eikenhorst
Notary Public, York County, Nebraska

GENERAL NOTARY - State of Nebraska
TAMMI J EIKENHORST
My Comm. Exp. March 18, 2016

PUBLIC NOTICE
Nebraska Department of Environmental Quality
Draft Evaluation Report Published; Pipeline Public Hearing Announced

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Email: NDEQ.SEISpubliccomment@Nebraska.gov

U.S. Mail: Nebraska Department of Environmental Quality, 1200 N Street, Suite 400, PO Box 98922, Lincoln, NE 68509-8922.

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November 14

Official Nebraska Government Website

NEBRASKA'S Keystone XL Pipeline Evaluation

Nebraska Department of Environmental Quality

- Welcome Page
- Draft Evaluation Report
- Nebraska Reroute Maps
- Evaluation Process
- Information Session and Public Hearing
- Submit Comments

Online Meeting: Welcome and Overview

Welcome! In anticipation of the agency's upcoming Information Session and Public Hearing regarding the Draft Evaluation Report for the proposed Keystone XL project, we are presenting this online meeting to update the public on the agency's findings and solicit public comments.

The Information Session and Public Hearing will be held in Albion, NE on December 4, 2012 .

In the left panel, you can:

1. View the **Draft Evaluation Report** ;
2. Review detailed enlargements of the proposed **Nebraska Reroute**;
3. Review the **Evaluation Process**;
4. find out details on the **December Information Session and Public Hearing**; and
5. Submit **comments** to be considered by the agency as the Final Evaluation Report is completed.

The comment period will be open until: December 4, 2012

Nebraska Department of Environmental Quality
1200 "N" Street, Suite 400
P.O. Box 98922
Lincoln, Nebraska 68509
(402) 471-2186 FAX (402) 471-2909

Welcome Page

Draft Evaluation Report

Nebraska Reroute Maps

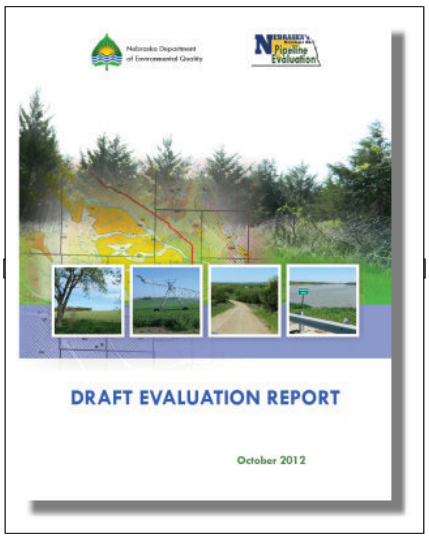
Evaluation Process

Information Session and Public Hearing

Submit Comments

Online Meeting: Draft Evaluation Report

The Nebraska Department of Environmental Quality made the Draft Evaluation Report available to the public on October 30, 2012. This report provides the state's analysis, prepared by NDEQ and its contractor, HDR Engineering of Omaha, following the review of Keystone's Supplemental Environmental Report, which was submitted September 5, 2012. By clicking on the photo to the right, you can view and download the Draft Evaluation Report, which has been broken down into chapters and subchapters for ease in downloading.



Click here to view the Report

Click here to view Executive Summary

The Draft Evaluation Report provides findings to date regarding TransCanada's submissions. Among the findings:

- The Nebraska Reroute avoids the region that was identified as the Sand Hills by NDEQ, which is based on extensive research conducted by several state and federal agencies several years ago.
- Keystone provided some route alternatives in the Supplemental Environmental Report which reduces the amount of fragile soils that are crossed in the northern portion of Nebraska.
- The revised route also establishes greater distances from the sources of drinking water in the communities of Clarks and Western.
- The report details environmental, economic, social and other impacts along the Nebraska Reroute.
- Numerous construction and operational mitigation measures would be incorporated to protect groundwater and surface water.
- Keystone will pay for an independent public employee to act as a liaison to facilitate the exchange of information between Keystone and landowners, local communities, and residents.
- Keystone will provide baseline water well testing for domestic and livestock water wells within 300 feet of the center line of the route.
- Keystone will adhere to 57 special pipeline safety conditions that had been previously agreed upon with the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (those conditions are included in Appendix F-2 of Nebraska's draft report).
- Keystone would be responsible for developing an Emergency Response Plan for a product release associated with the operation of the Keystone XL Pipeline and ancillary facilities.
- Keystone has identified several variations of crude oil that would be transported at various times through the pipeline from Alberta, Canada and from the Bakken Formation in Montana and North Dakota. The report contains the general characteristics of the crude oil, which are similar to other crude oils from around the world. In the event of a spill, the appropriate authorities would have immediate access to the product's Material Safety Data Sheet.
- In addition to complying with all relevant state and federal cleanup requirements, Keystone will provide evidence that it is carrying $200 million in third party liability insurance to cover cleanup costs for incidents in Nebraska.

Welcome Page

Draft Evaluation Report

Nebraska Reroute Maps

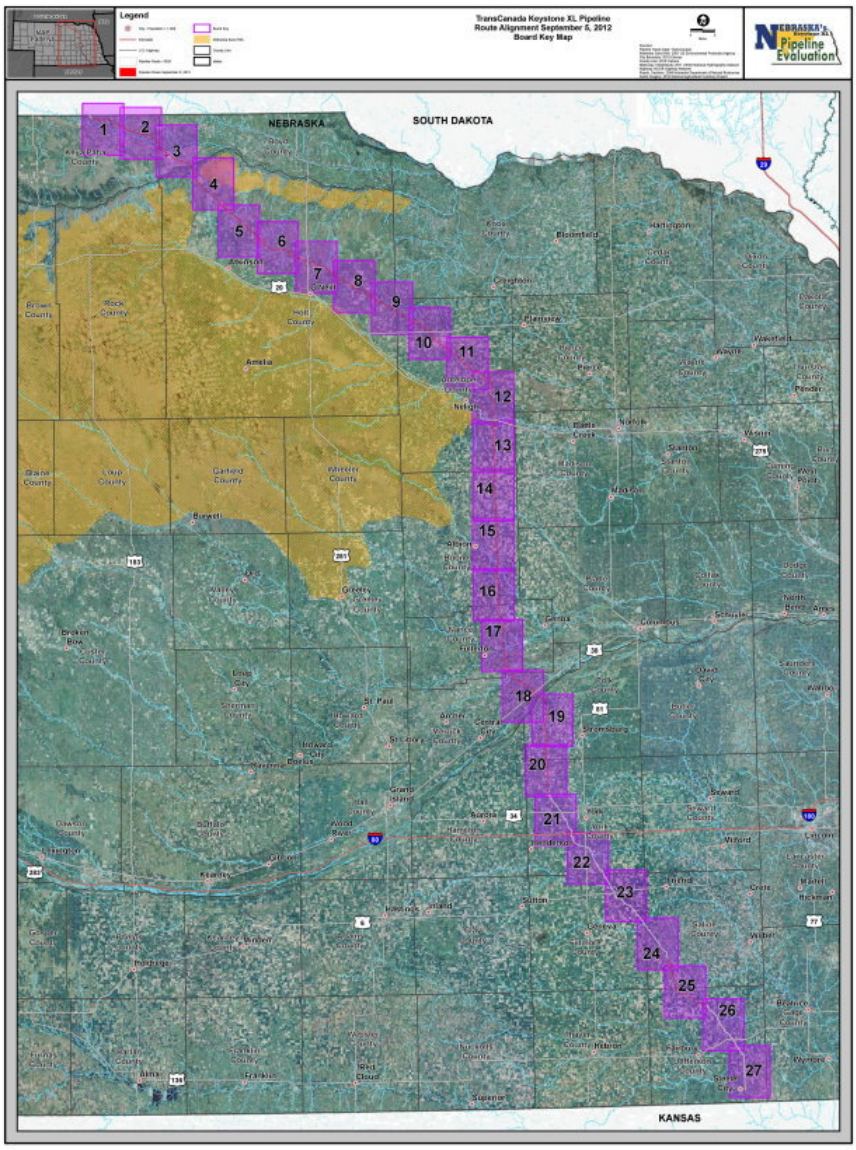
Evaluation Process

Information Session and Public Hearing

Submit Comments

Online Meeting: Nebraska Reroute Maps

Click on the map below to link to the key map of the revised route submitted by TransCanada on September 5 2012. Then click on the numbered box close to your area of interest to enlarge one of the detailed study maps easier viewing.



Nebraska Department of Environmental Quality
1200 "N" Street, Suite 400
P.O. Box 98922
Lincoln, Nebraska 68509
(402) 471-2186 FAX (402) 471-2909

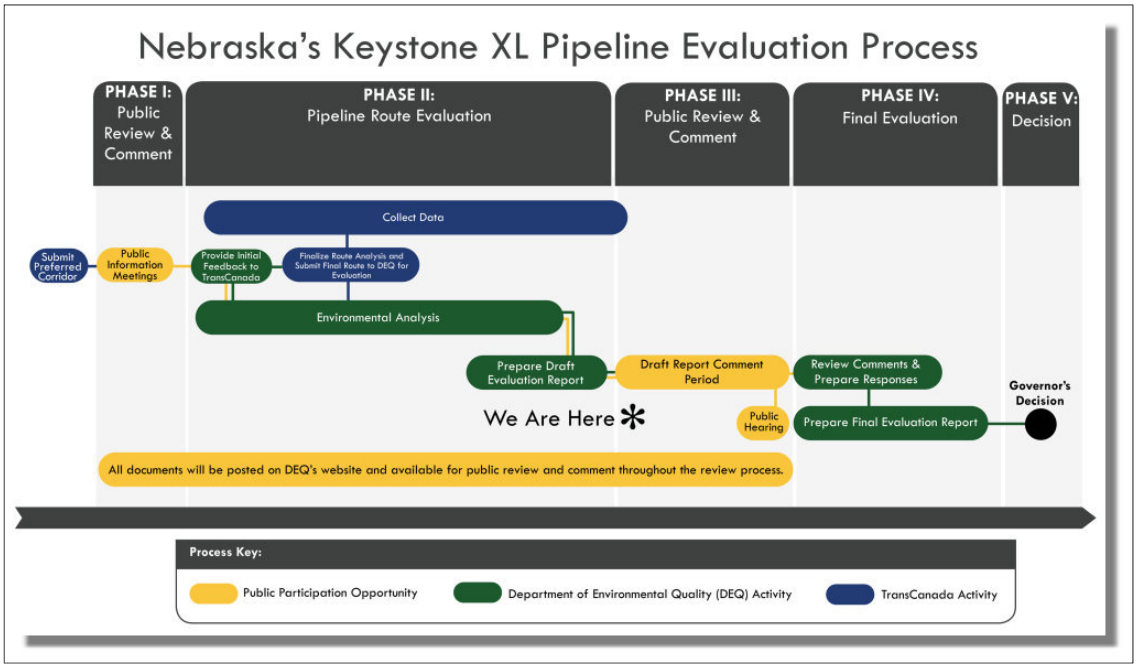
Official Nebraska Government Website

NEBRASKA'S Keystone XL Pipeline Evaluation

Nebraska Department of Environmental Quality

Online Meeting: Evaluation Process Timeline

On October 30, 2012, NDEQ completed the Draft Evaluation Report for the proposed Keystone XL project, and announced the date for the public hearing. The chart below shows that this moves the process into Phase III. The comment period for the Draft Evaluation Report will end at the close of the public hearing on December 4, 2012. At that point, NDEQ will review and consider all comments as the agency prepares the Final Evaluation Report.



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Lincoln, Nebraska 68509
(402) 471-2186 FAX (402) 471-2909

Welcome Page

Draft Evaluation Report

Nebraska Reroute Maps

Evaluation Process

Information Session and Public Hearing

Submit Comments

Online Meeting: Information Session and Public Hearing

Date:
December 4, 2012
Location:
Boone County Fairground
2616 Fairgrounds Road
Albion, NE

The **Information Session** will be open from 3:00 p.m. to 5:30 p.m. in the Casey's Building at the Fairgrounds. The information session will be an opportunity for the public to meet and talk with those from the agency involved in the review, in an informal "open house" format.

The **Public Hearing** will begin at 6:00 p.m. in the Event Center at the Fairgrounds . The public hearing is a formal meeting held to obtain public and agency testimony or comment regarding the state's Draft Evalualtion Report and the Nebraska Reroute of the proposed pipeline project. To ensure all testifiers have the opportunity to speak, the hearing officer may set time limits on testimony. All interested parties are urged to submit all oral comments also in written form, so all of their comments can be reviewed and considered by the agency in preparation for the Final Evaluation Report.

In the event of inclement weather, please call the project telephone information line for updates - (800) 295-8912.

Submitting Comments

Public comments will continue to be accepted through the close of the hearing on December 4, 2012. Comments may be submitted electronically by clicking on the **Submit Comment** box in the left panel. E-mail comments may be sent to NDEQ.SEISpubliccomment@Nebraska.gov. Written comments can be mailed to: NDEQ Pipeline Project Comments, P.O. Box 98922, Lincoln, NE 68509-8922. Written testim ony can also be submitted Information Session and Public Hearing on December 4, 2012.

Nebraska Department of Environmental Quality
1200 "N" Street, Suite 400
P.O. Box 98922
Lincoln, Nebraska 68509
(402) 471-2186 FAX (402) 471-2909

Welcome

Comments

Search Comments

Post Comment

Frequently Asked Questions

Public Documents Search

Meeting Documents Search

Press Releases

All comments are available for public review 4 days after submission

POST A COMMENT

Thank you for your interest in the Nebraska SEIS Project. To leave a comment, please complete the form below. **NOTE:** any submissions to the agency, including telephone and e-mail inquiries and comments, will become part of the public record. Comments and identities will not be kept confidential.

There are two options for posting a comment:

- **Guest** – will require a couple pieces of information for geographic reference, no personal information, and an optional email address, if you would like to receive your comment number and updates as the comment is processed.
- **Registered User** – will require more detailed information and allow you to establish a user ID and password to use for future comment submissions.

Comments received will be evaluated in the Draft SEIS. All comments are available for public review 4 days after submission. Click on Comment Search in the left panel to view submitted comments.

Post Comment As: Guest Registered User

City:

State / Province: Nebraska

Zip Code:

Email: (Optional)

Comment: (0 of 1000 Characters Used)

Enter the code shown:

Can't read? Try different words.

Submit

Nebraska Department of Environmental Quality 1200 "N" Street, Suite 400 P.O. Box 98922 Lincoln, Nebraska 68509 (402) 471-2186

Nebraska Department
of Environmental Quality

NEBRASKA's Keystone XL Pipeline Evaluation

Public Service Announcement

The Nebraska Department of Environmental Quality will host an information session and public hearing on the Nebraska Keystone XL Pipeline Evaluation on Tuesday, December 4 at the Boone County Fairgrounds in Albion. Review environmental findings from the Draft Evaluation Report at the information session from 3 to 5:30 pm. The public hearing will start at 6:00 p.m., and will provide the opportunity for public spoken and written testimony. For more information about the Project, please visit NDEQ's website at w-w-w.d-e-q.state.n-e.u-s.

Appendix G.5

Information Session & Public Hearing Meeting Materials

TABLE OF CONTENTS

Information Session & Public Hearing Media Sign-In Sheets

Information Session & Public Hearing Handout

Information Session Display Boards

Information Session Comment Form

Public Hearing Display Boards

Comment Extension Notice

Public Hearing Written Testimony Form

Public Hearing Written Testimony Template

NEBRASKA's Keystone XL Pipeline Evaluation

Media Sign-in Sheet
Nebraska's Keystone XL Pipeline Evaluation

Meeting Name:

Date:

Name (Please Print)	Organization	Address (Please supply Zip Code)	Email	Phone
1. GREG AWTRY	YORK NEWS-TIMES	PO. BOX 279 YORK, NE 68467	greg.awtry@yorknewstimes.com	402/362-4478
2. JOSH EGBERT	KHAS-TV	6475 Osborne Dr. W Hastings NE 68901	josh.egbert@khastv.com	402-463-1321
3. Megan Johnson	KOLN/KGIN 10/11	123 N Locust, 2nd Floor, Grand Island, NE	megan.johnson@1011now.com	402.440.9753
4. FRANCIS SILVAGGIO	GLOBAL NATIONAL	222-23 ST. NE CALGARY, AB T2E 7N2	FRANCIS.SILVAGGIO@GLOBALNEWS.CA	403-607-6054
5. Art Hovey	Lincoln Journal Star	926 P St Lincoln, NE	ahovey@journalstar.com	402-473-7223
6. LuAnn Schindler	Norfolk Daily News	Norfolk, NE 68701	regional@norfolkdailynews.com luannr@gpcom.net	371-1020
7. Fred Knapp	NET	1800 N 33rd Lincoln, NE	fknapp@netnebraska.org	4024729333 ext 470
8. Kietryn Zychal	The Reader	2314 M. St Omaha NE 68107	Kietryn@yahoo.com	570-977-4164
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NEBRASKA's Keystone XL Pipeline Evaluation

Media Sign-in Sheet
Nebraska's Keystone XL Pipeline Evaluation

Meeting Name:

Date:

Name (Please Print)	Organization	Address (Please supply Zip Code)	Email	Phone
1. Marty Stuhlhausen	Freelance	9205 SW 27th St	mstuhlhausen@nebirr.com	402 470 7763
2. Nick Beres	Aurora News-Register	1320 K St Aurora, NE	sparte@hamilton.net	402 694 2131
3. Jim Dickerson	Albion News	328 W. Church Albion, NE	albnnuz@frontiernet.net	402-395-2115
4. Eric McKay	KNOW KNSO KTIV	214 N. 7th St. Norfolk NE	news@us92.com	402 371.0100
5. Melanie Wilkinson	York News Times	4th & Platte, York 68467	news@yorknewstimes.com	402-362-4478
6. MIKE GILL	GLOBAL NATIONAL	222 23 ST NE. CALGARY AB.	mike.gill@globalnews.ca	4036609359
7. Val Murray		1935 S. 37 St. Omaha, NE 68105		402 345-5668
8. Adrian Oliver	Sierra Club-NE	4100 Garfield St	aoliver@windstream.net	402-310-8060
9. Julie Baker Amen	KBRX	O'Neill NE	julie@kbrx.com	336-8203
10.				
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NEBRASKA's Keystone XL Pipeline Evaluation

Media Sign-in Sheet
Nebraska's Keystone XL Pipeline Evaluation

Meeting Name:

Date:

Name (Please Print)	Organization	Address (Please supply Zip Code)	Email	Phone
1. Melissa Ashes	YST	PO Box 1153 Wagner, SD 57380	mashes=62269@hotmail.com	605-491-1584
2. Francis Silvaggio	Global National	222-23 St NE Calgary, AB T2E 7N2	Francis.Silvaggio@globalnews.ca	403-607-6054
3. Mike Gill	Global National	" "	—	" "
4. Brad Gardner	Lincoln Journal Star	926 P St	—	—
5. Megan Palera	KLKN	3240 S. 10th St. Lincoln, NE	mpalera@klkntv.com	605 436-2258
6. Keith Steuven	KLKN	" "	ksteuven@klkntv.com	605 436-2258
7. Marty Steinhausen	Freelance Journ.	9205 SW 27th St Lincoln NE 68523	msteinhausen@neb.rr.com	402-450-7963
8. Ashley Nodgaard	KETV			
9. Natalie Gluckich	" "		news@ketv.com	
10. Paul Hammel	OWH			
11. Derek Vinik	Nebraska Legislature			
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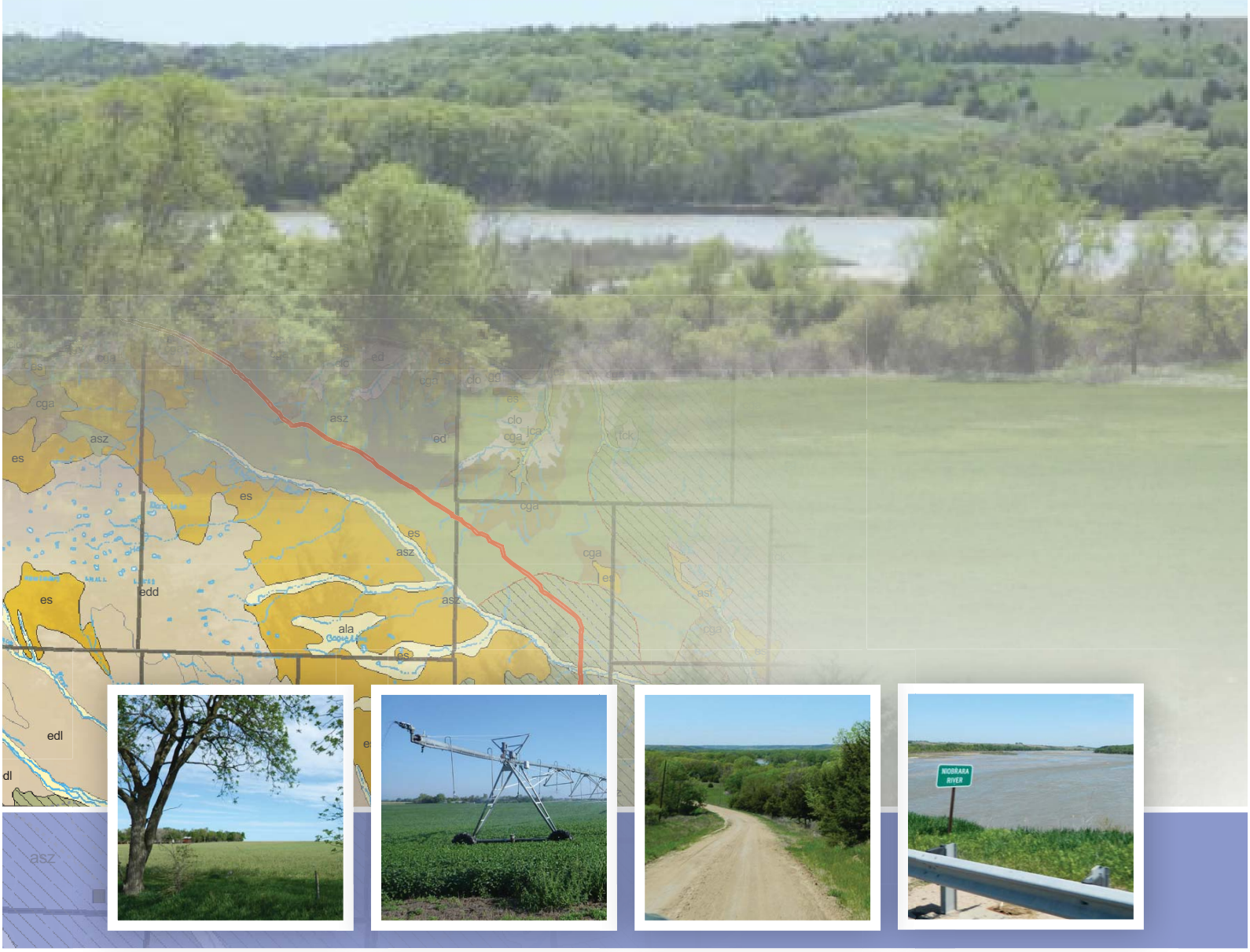
Nebraska Department
of Environmental Quality

NEBRASKA'S Keystone XL Pipeline Evaluation

NEBRASKA'S KEYSTONE XL PIPELINE EVALUATION

Information Session and Public Hearing

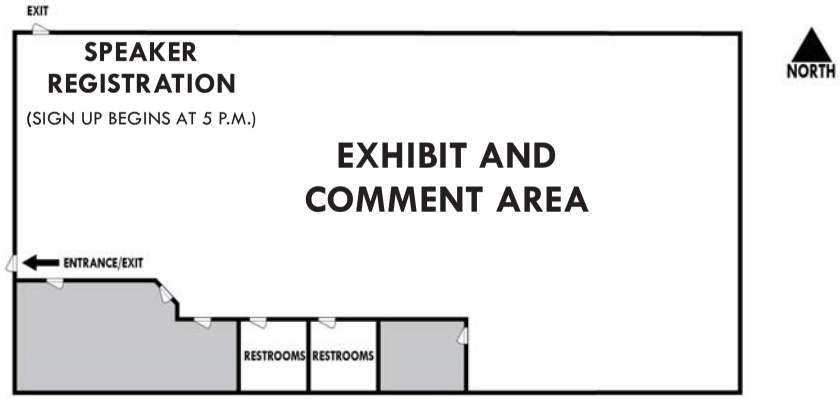


Prepared by:
Nebraska Department of Environmental Quality
1200 "N" Street, Suite 200
PO Box 98922
Lincoln, Nebraska 68509-8922

December 4, 2012

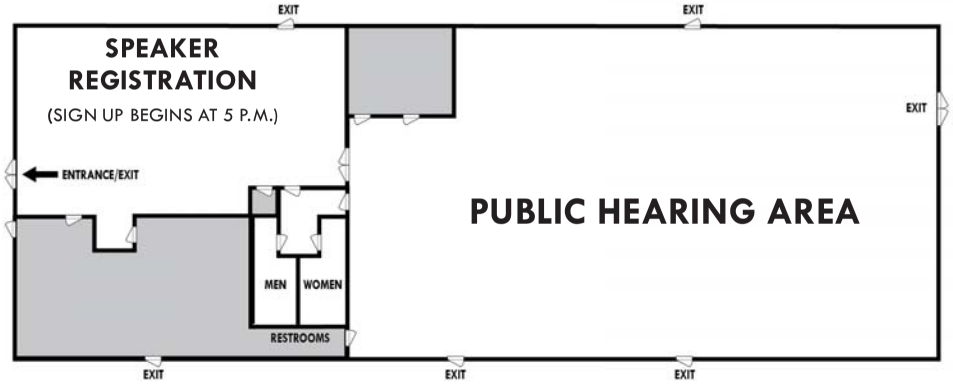
Information Session | Casey's Building

3:00 p.m. to 5:30 p.m.



Public Hearing | Events Center

Begins at 6:00 p.m.



Information Session and Public Hearing

The purpose of the information session is to provide the public with an opportunity to meet and talk with those from the Nebraska Department of Environmental Quality (NDEQ) involved in the review, in an informal "open house" format.

A formal public hearing will also be held tonight to obtain public testimony regarding the State's *Draft Evaluation Report* and the proposed Keystone Nebraska Reroute. To ensure all testifiers have the opportunity to speak, the hearing officer has set a time limit of 5 minutes for testimony. Those with more extensive testimony are urged to submit them in writing, so all of their testimony can be reviewed and considered by the agency in preparation of the *Final Evaluation Report*.

> *The State of Nebraska is responsible for protecting its natural resources, agricultural resources, aesthetics, economy, and communities through reasonable regulation for the common good and welfare. As such, the State is responsible for ensuring that an oil pipeline proposed to be located within, through, or across Nebraska is in compliance with all state laws, rules, and regulations relating to water, air, and wildlife under the Constitution of Nebraska and state law.*
>
> —Legislative Bill 1161

Thank You For Your Input

"Input from Nebraskans has been tremendously helpful for our work so far," said Mike Linder, NDEQ Director. "Prior to finalizing the report and submitting it to the Governor, we will carefully consider all additional comments made through the end of the hearing."

Nebraska's Evaluation Process

The purpose of Nebraska's evaluation is to:

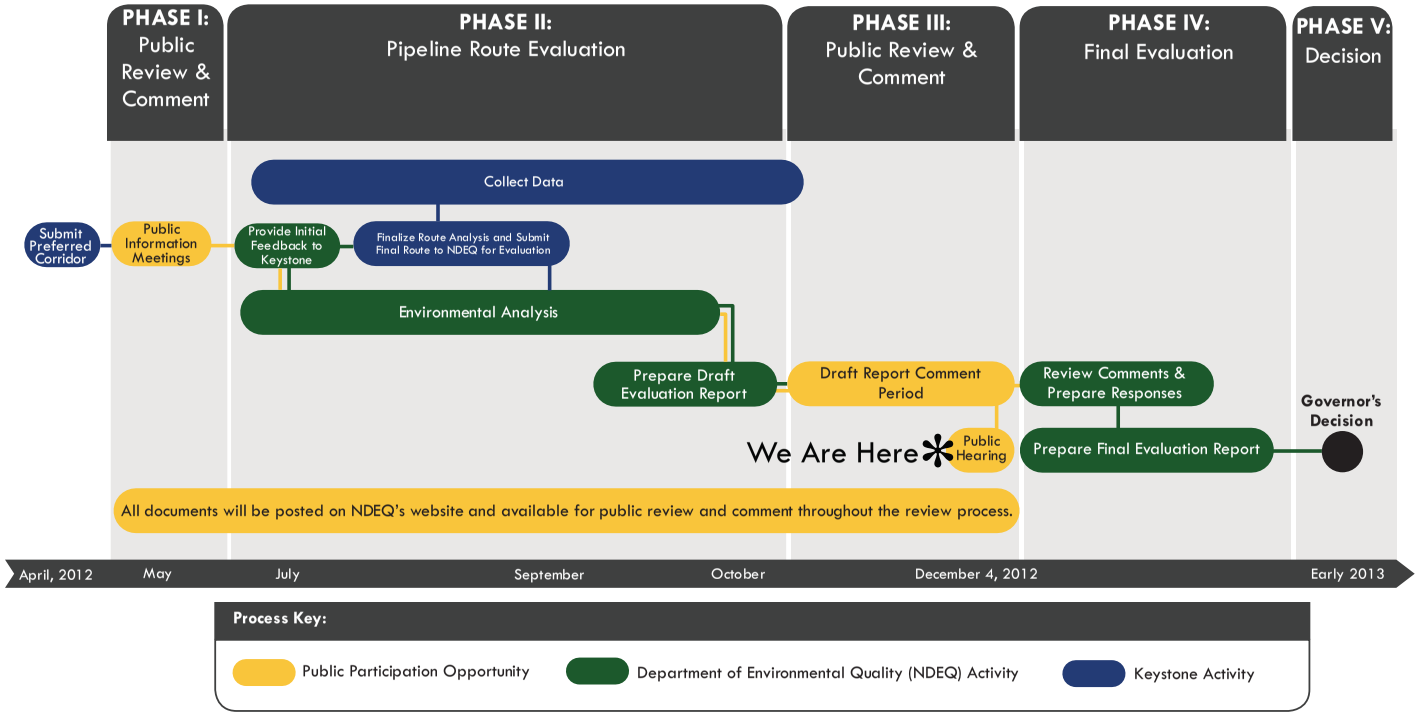
- Provide an effective and timely evaluation of the route through Nebraska
- Evaluate environmental, economic, social and other impacts
- Provide an opportunity for public review and comment
- Collaborate with the U.S. Department of State as necessary

The first phase of the process included NDEQ holding public information meetings in O'Neill, Neligh, Albion, and Central City, Nebraska in May 2012 to gather public comments on the proposed April reroute. During the second phase, NDEQ then responded to Keystone in a *Feedback Report* in July 2012, based on a technical review and public input. Keystone incorporated NDEQ and the public's feedback, conducted more in-depth study and on-the-ground data collection, and submitted the *Supplemental Environmental Report* in September 2012. NDEQ then evaluated the proposed September route Keystone submitted through a review process that considered the environmental, economic, social, and other impacts of the proposed pipeline route and published the *Draft Evaluation Report* in October 2012.

During the third phase of the process, NDEQ invited the public to review its report and provide comments regarding the potential effects and proposed mitigation measures. This informational meeting and public hearing allow the public a final opportunity to contribute to the *Final Evaluation Report*.

In the fourth phase, NDEQ will develop a *Final Evaluation Report* utilizing all other information, comments, and testimony it has received. The report will then be submitted to the Governor and posted on NDEQ's website. The Governor will decide if he approves the route evaluated in the State's *Final Evaluation Report* and forward his decision to the U.S. Department of State for their use in final decision-making on the project.

Nebraska's Keystone XL Pipeline Evaluation Process



Keystone XL Project Overview

TransCanada Keystone Pipeline, LP (Keystone), proposes to construct, operate, and maintain an 875 mile long, 36-inch diameter crude oil pipeline from the U.S.-Canadian border, to Steele City, Nebraska, referred to as the Keystone XL Pipeline Project. From that point, the project will connect with the existing Keystone Pipeline - Cushing Extension (Steele City to Cushing, OK). At the terminus of the Cushing Extension, the oil may continue its journey south in a new 36-inch pipeline currently under construction called the Gulf Coast Project, with final delivery to refinery markets in the Gulf Coast area of the United States.

Keystone submitted a new proposed route on April 18, 2012. NDEQ sought out public comments on Keystone's new alignment and provided feedback to Keystone on July 17, 2012. Keystone considered this information and further refined its Nebraska Reroute in response to those concerns.

Keystone's September 5, 2012, *Supplemental Environmental Report* proposes three further refinements to the Nebraska Reroute. Keystone made refinements at two of these locations to address environmental concerns raised by the public and NDEQ.

- The Northern Alternative was developed to avoid other areas of fragile soils that were not a part of the defined Sand Hills.
- The Clarks Alternative was developed to address NDEQ's concerns regarding the location of Keystone's preferred reroute corridor in an area where the aquifer is very thin, wells are shallow, and bedrock is close to the surface. This area is upgradient (west) of the boundary of the Clarks Wellhead Protection Area (WHPA). The Clarks Alternative would route the proposed pipeline downgradient (east) of the WHPA.
- A third refinement is also proposed in the *Supplemental Environmental Report*. This adjustment to the Keystone XL Pipeline alignment is located near Western, Nebraska, in Saline and Jefferson Counties, and is southeast of the Nebraska Reroute. This route variation was developed by Keystone to avoid crossing the expanded wellhead protection area for the village of Western.

NDEQ's Actions

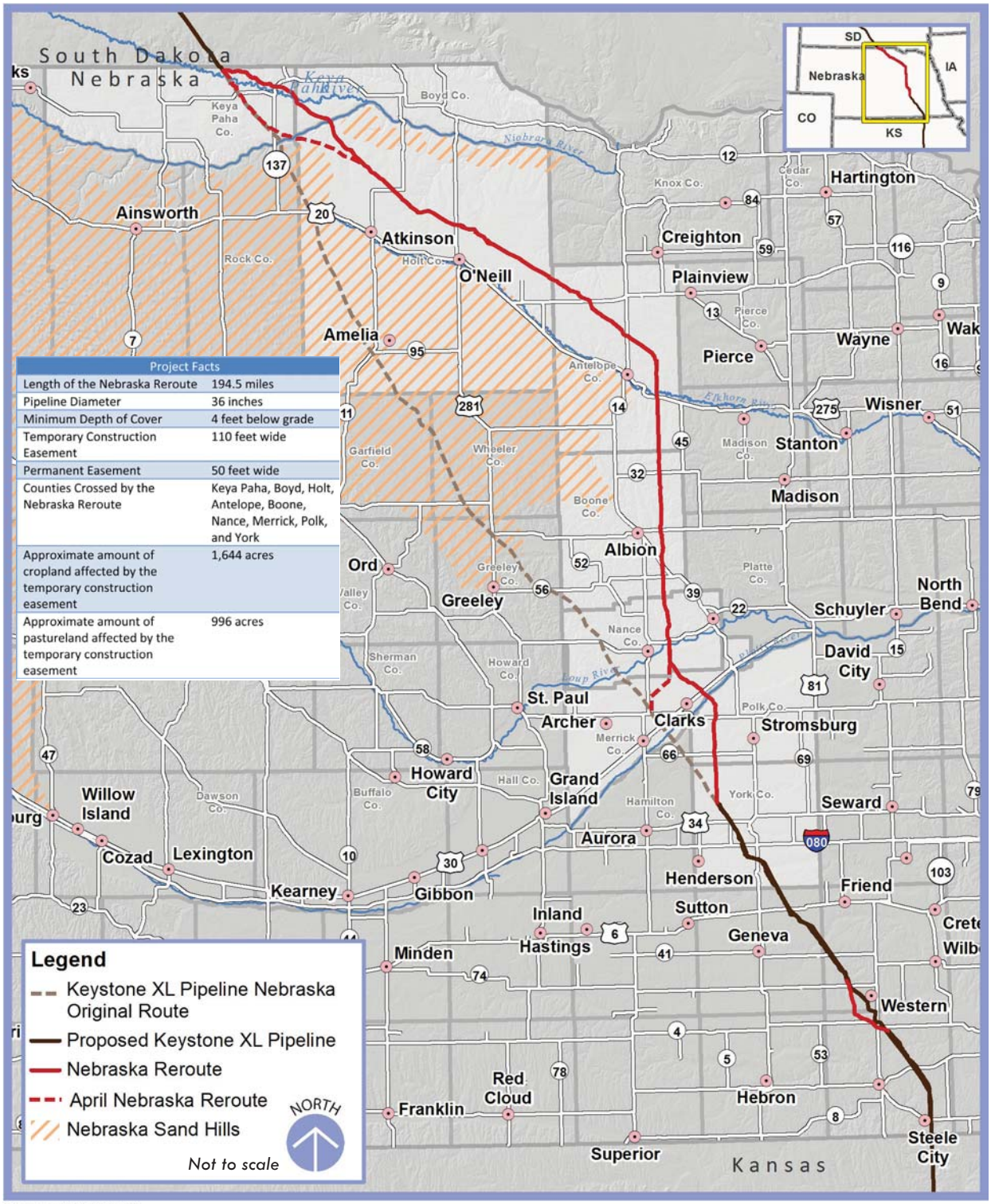
Consistent with the requirements of LB 1161, NDEQ has taken steps to evaluate the proposed route of the Project. To date, the NDEQ has:

- Provided Keystone with a map of the Sand Hills in Nebraska.
- Listened to the public and gathered their concerns regarding the Nebraska Reroute.
- Communicated the public's concerns to Keystone in NDEQ's *Feedback Report*, which resulted in a revised pipeline route.
- Coordinated the evaluation of the Nebraska Reroute with the U.S. Department of State.
- Met with multiple state and federal agencies to address their concerns.
- Published the *Draft Evaluation Report*. The purposes of the report are:
  - To determine if Keystone's rerouted alignment avoids the Sand Hills as defined by NDEQ in its press release of December 29, 2011.
  - To evaluate the environmental, economic, social, and other impacts of the proposed pipeline.
  - To provide an opportunity for the public to review and comment on the proposed pipeline.

NDEQ observed an oil boom deployment training exercise held by Keystone on September 27, 2012, in Yankton, South Dakota, near the location where the existing Keystone oil pipeline crosses under the Missouri River.

Proposed Keystone XL Pipeline in Nebraska

On April 18, 2012, Keystone submitted a revised alignment, with the goal of avoiding the Sand Hills. NDEQ sought out public comments on Keystone's new alignment and provided feedback to Keystone. Keystone considered this information and further refined its Nebraska Reroute in response to the environmental concerns raised by the public and NDEQ.



Project Facts	
Length of the Nebraska Reroute	194.5 miles
Pipeline Diameter	36 inches
Minimum Depth of Cover	4 feet below grade
Temporary Construction Easement	110 feet wide
Permanent Easement	50 feet wide
Counties Crossed by the Nebraska Reroute	Keya Paha, Boyd, Holt, Antelope, Boone, Nance, Merrick, Polk, and York
Approximate amount of cropland affected by the temporary construction easement	1,644 acres
Approximate amount of pastureland affected by the temporary construction easement	996 acres

Source: NDEQ 2012

NDEQ Findings

NDEQ's evaluation of the proposed pipeline reroute has resulted in multiple findings. The following are highlights from each of the evaluation focus areas:

Social

- The closest communities are Polk and Royal, which are approximately 1.6 miles away from the pipeline right-of-way.
- The Cowboy Trail will be crossed by the Reroute east of Neligh.
- There are 9 potential historic sites identified to date along the Reroute.
- There will be no disproportionate impacts to disadvantaged populations.

Economic

- Nebraska construction benefits on an *annualized* basis:
  - 110 local construction jobs
  - Support up to 2,740 new or existing jobs
  - Estimated payroll: $102.1 million
- Total net sales of goods and services of $278 million from construction-related activities.
- Secondary effects of operation could support up to 50 jobs per year in Nebraska.
- $11–13 million estimated in real estate property tax in first full year to Nebraska (taxable value depreciates over 15 years).

Mechanized pipe welding tent on the Gulf Coast Segment 2

Environmental

- The Reroute avoids the region that was identified as the Sand Hills.
- Construction impacts will occur, but will be mitigated. Numerous design, construction, testing, operational and maintenance mitigation measures would be incorporated to protect groundwater, surface water, fragile soils, and T&E species.
- The five major rivers along the Reroute will be drilled a minimum of 25 ft below the bottom to limit disturbance.
- The characteristics of diluted bitumen products are generally within the range of other heavy sour crude oils. Keystone has identified five general categories of crude oil that would be transported through the pipeline, including: Dilbit, Synthetic crude oil, Synbit, Dilsynbit, and Conventional light crude oil.
- Benzene content is typically much lower in the crude oils proposed to ship in the pipeline than in conventional gasoline (for additional Canadian crude oil details, see: www.crudemonitor.ca).
- The High Plains Aquifer (which includes the Ogallala Group) will still be crossed by the Reroute. Impacts to these aquifers from a release would be localized and Keystone must restore the aquifer to its original quality.
- U.S. Department of State and U.S. Fish and Wildlife Service have entered into formal consultation under the Endangered Species Act. NDEQ and Nebraska Game and Parks Commission are participating in discussions.
- Formal consultation with Nebraska Game and Parks Commission is not required; informal consultation continues.
- Agriculture is the primary land use along the Reroute; farming operations will be able to resume the season after construction is complete.

Residential Water Well Testing

Gulf Coast Segment 2 under construction

Keystone 1 post-construction after restoration

Completing the Evaluation

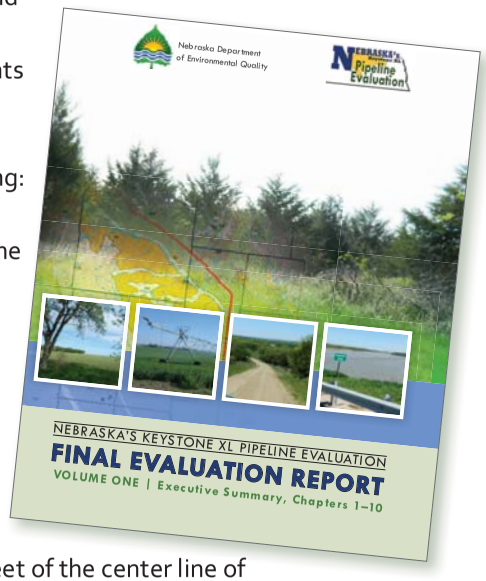
Important milestones in completing the evaluation include:

- Keystone submitted the Nebraska Reroute (April 18, 2012).
- Public Comment Period (April 19 – December 4, 2012).
- NDEQ held Public Information Meetings (May, 2012).
- NDEQ submitted a Feedback Report to Keystone (July 17, 2012).
- Keystone submitted its *Supplemental Environmental Report* and revised Nebraska Reroute (September 5, 2012).
- NDEQ published the *Draft Evaluation Report* (October 30, 2012).
- NDEQ will hold a Public Hearing and Information Session (December 4, 2012).
- NDEQ will review and incorporate the public's comments on the *Draft Evaluation Report* and the Nebraska Reroute into the *Final Evaluation Report*.
- NDEQ will submit the *Final Evaluation Report* to Governor Heineman (Early 2013)
- In accordance with the process directed in LB 1161, the Governor will indicate to U.S. Department of State "whether he or she approves any of the routes reviewed in the supplemental environmental impact statement" [LB 1161, Sec. 3. (4)] regarding the Nebraska Reroute.
- U.S. Department of State will complete its *Final Supplemental Environmental Impact Statement* and incorporate the Governor's decision.

Nebraska's Keystone XL Pipeline Evaluation Website

For online access to the *Draft Evaluation Report* and online meeting, visit:
https://ecmp.nebraska.gov/deq-seis/
The *Final Evaluation Report* will also be posted on NDEQ's website when it is made available to the public in early 2013.

What to Expect in the *Final Evaluation Report*



- Analysis and identification of impacts and findings.
- Summary of agency and public comments and responses to comments.
- Keystone's commitments to protect Nebraska's interests include the following:
  - Develop an Emergency Response Plan for a crude oil release associated with the operation of the Keystone XL Pipeline and ancillary facilities.
  - In the event of a release, the appropriate authorities would have fast access to the product's Material Safety Data Sheet.
  - Provide baseline water well testing prior to construction for domestic and livestock water wells within 300 feet of the center line of the route at landowner request.
  - Provide for an independent public employee to act as a liaison between Keystone and landowners, local communities, and residents to facilitate an open exchange of information.
  - Keystone would adhere to 57 special pipeline safety conditions developed in coordination with the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA). These conditions include more rigorous pipeline design, construction, testing, operational, and maintenance standards than currently required by PHMSA in 49 CFR Parts 190-199.
  - In the event of a release, Keystone is responsible for all costs associated with state and federal cleanup requirements. In addition, Keystone would provide evidence that it is carrying $200 million in third party liability insurance to cover cleanup costs for incidents in Nebraska.

Comment Opportunities

Information Session

"Open house" format: Informally meet with agency representatives.

- Fill out an online comment form at the Comment Station
- Submit written comments

Only written and online comment forms will be accepted during the Information Session

Public Hearing

"Formal hearing" format: Provide written or spoken testimony.

Only written and spoken testimony will be accepted during the Public Hearing

All comments and testimony will be reviewed and considered in the *Final Evaluation Report*

Public Hearing Ground Rules

- Please be kind, courteous, and respectful to all participants.
- Please do not interrupt a testifier when they are speaking.
- Please refrain from applause or other forms of support or opposition during the hearing.
- Please silence all cell phones and electronic equipment.
- If you wish to visit, please move to the room adjacent to the hearing room.
- No displays, signs, banners, or noisemakers may be carried inside the meeting spaces.

Public Hearing Speaker Protocol

- Spoken testimony will be taken in order of registration.
- Reserved seating for the next three speakers in the lineup is located in the front row. Please take a seat in a reserved chair when your name is called.
- Prior to spoken testimony, please speak and spell your name for the court reporter.
- Please provide the hearing officer any exhibit material you want to be included in the hearing record.
- Speakers will be limited to 5 minutes of testimony.
- If a speaker misses his/her turn in the lineup, he/she will be given one opportunity, then moved to the bottom of the speaker lineup.
- All written and spoken testimony must take place during the public hearing. Written testimony can be provided throughout the evening.
- Each participant will be allowed one spoken testimony opportunity at the public hearing.
- No speakers will be allowed to cede their time to someone else.

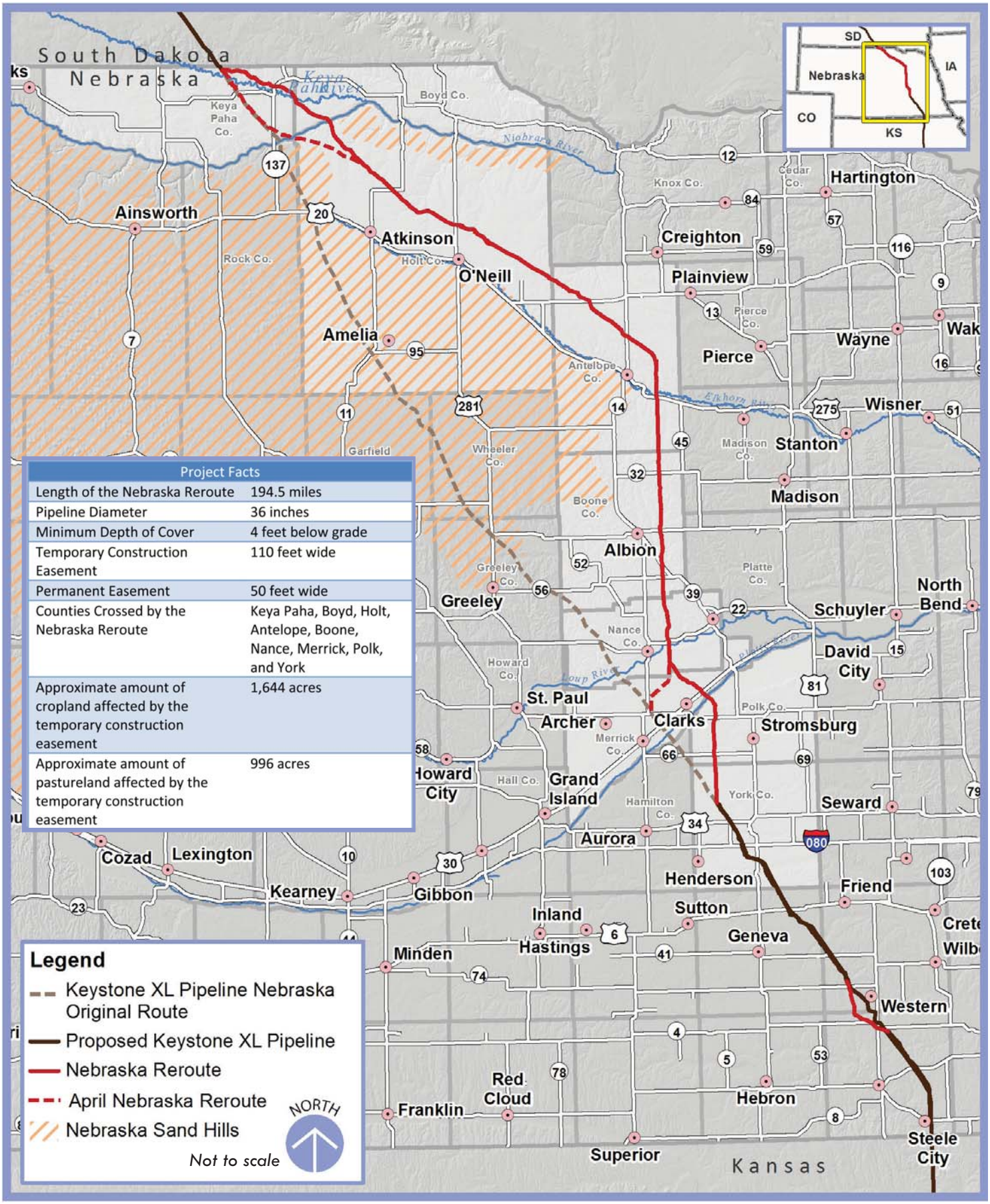
Welcome!

- The purpose of the Information Session is to update the public on the agency's findings in the Keystone XL *Draft Evaluation Report* published October 30, 2012.
- You will have an opportunity to:
  - Discuss the *Draft Evaluation Report* findings
  - Review detailed display maps of the Nebraska Reroute
  - View the evaluation process and timeline
  - Speak with Nebraska Department of Environmental Quality (NDEQ) team representatives
  - Provide written comments to be considered by the agency as they complete the *Final Evaluation Report*

Nebraska Department of Environmental Quality

Proposed Keystone XL Pipeline in Nebraska

Nebraska's Keystone XL Pipeline Evaluation

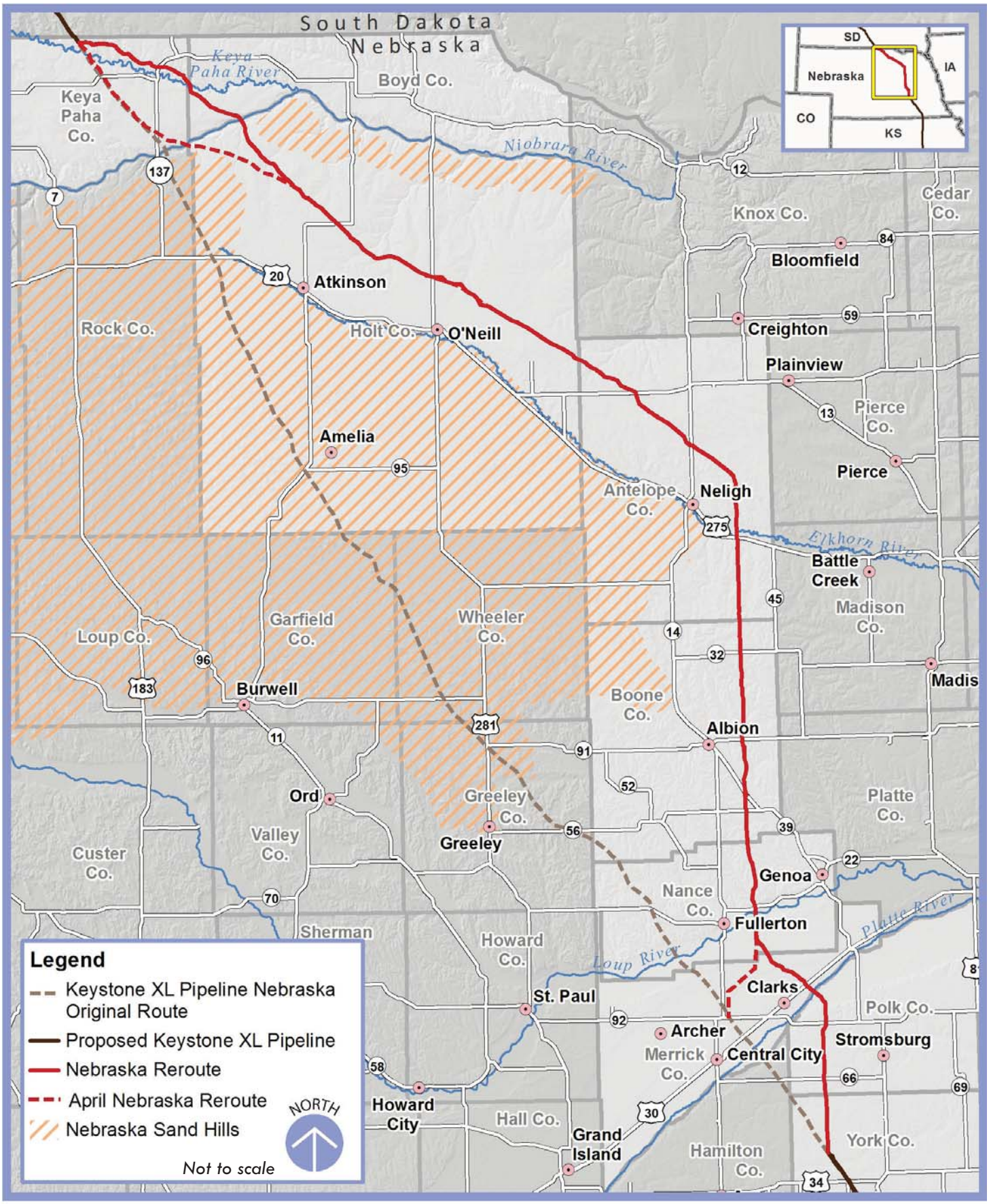


Source: NDEQ 2012

Nebraska Department of Environmental Quality

The Nebraska Reroute

NEBRASKA's Keystone XL Pipeline Evaluation



Source: NDEQ 2012

Nebraska Department of Environmental Quality

Nebraska Department of Environmental Quality Actions

NEBRASKA's Keystone XL Pipeline Evaluation

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—Legislative Bill 1161

Nebraska Department of Environmental Quality

NDEQ's Findings

NEBRASKA's Keystone XL Pipeline Evaluation

NDEQ's evaluation of the proposed pipeline reroute has resulted in several findings. The following are highlights for each of the evaluation focus areas:

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Mechanized pipe welding tent on the Gulf Coast Segment 2

Nebraska Department of Environmental Quality

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- U.S. Department of State and U.S. Fish and Wildlife Service have entered into formal consultation under the Endangered Species Act. NDEQ and Nebraska Game and Parks Commission are participating in discussions.
- Formal consultation with Nebraska Game and Parks Commission is not required; informal consultation continues.

Gulf Coast Segment 2 under construction

Keystone 1 post-construction after restoration

Nebraska Department of Environmental Quality

Keystone Mitigation Commitments

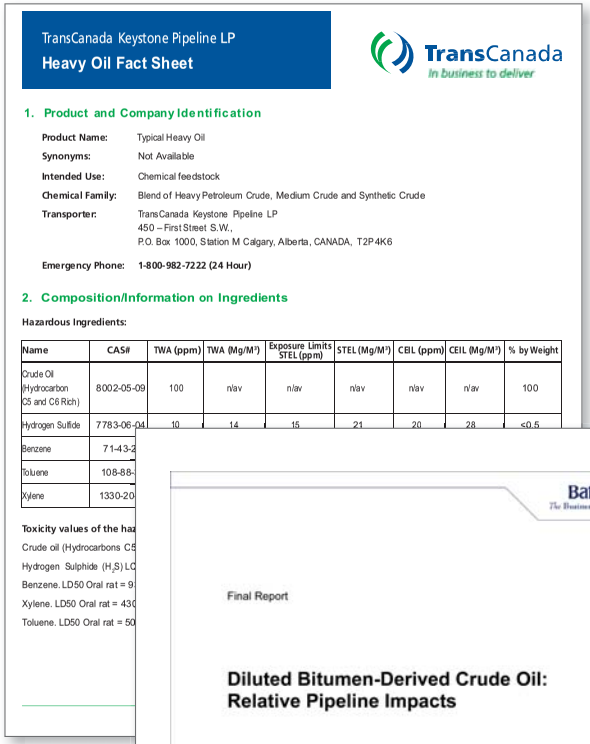
Nebraska's Keystone XL Pipeline Evaluation

- Keystone's commitments to protect Nebraska's interests include the following:
  - Keystone would develop an Emergency Response Plan with procedures for responding to a crude oil release associated with the operation of the Keystone XL Pipeline and ancillary facilities.
  - In the event of a release, the appropriate authorities would have fast access to the product's Material Safety Data Sheet.
  - Keystone would provide baseline water well testing prior to construction for domestic and livestock water wells within 300 feet of the center line of the route at landowner request.
  - Keystone would pay for an independent public employee to act as a liaison between Keystone and landowners, local communities, and residents to facilitate an open exchange of information.
  - Keystone would adhere to 57 special pipeline safety conditions developed in coordination with the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA). These conditions include more rigorous pipeline design, construction, testing, operational, and maintenance standards than currently required by PHMSA in 49 CFR Parts 190-199.
  - In the event of a release, Keystone is responsible for all costs associated with state and federal cleanup requirements. In addition, Keystone would provide evidence that it is carrying $200 million in third party liability insurance to cover cleanup costs for incidents in Nebraska.

Residential Water Well Testing

Characteristics of Oil Transported in Pipeline

- The characteristics of diluted bitumen products are generally within the range of other heavy sour crude oils. Keystone has identified five general categories of crude oil that would be transported through the pipeline:
  - Dilbit, produced from the Alberta oil sands in Canada (Diluent added for shipping)
  - Synthetic crude oil, produced from the Alberta oil sands (Processed [upgraded] bitumen)
  - Synbit, produced from the Alberta oil sands (Mix of bitumen and synthetic crude)
  - Dilsynbit, produced from the Alberta oil sands (Mix of bitumen, synthetic crude, and diluent)
  - Conventional light crude oil, produced from the Bakken Formation in Montana and North Dakota
- Benzene content is typically much lower in the crude oils proposed to ship in the pipeline than in conventional gasoline (for additional Canadian crude oil details, see: www.crudemonitor.ca).



TransCanada Keystone Pipeline LP
Heavy Oil Fact Sheet

TransCanada
In business to deliver

1. Product and Company Identification

Product Name: Typical Heavy Oil
Synonyms: Not Available
Intended Use: Chemical feedstock
Chemical Family: Blend of Heavy Petroleum Crude, Medium Crude and Synthetic Crude
Transporter: TransCanada Keystone Pipeline LP
450 – First Street S.W.,
P.O. Box 1000, Station M Calgary, Alberta, CANADA, T2P4K6
Emergency Phone: 1-800-982-7222 (24 Hour)

2. Composition/Information on Ingredients

Hazardous Ingredients:

Name	CAS#	TWA (ppm)	TWA (Mg/M³)	Exposure Limits STEL (ppm)	STEL (Mg/M³)	CEIL (ppm)	CEIL (Mg/M³)	% by Weight
Crude Oil (Hydrocarbon C5 and C6 Rich)	8002-05-09	100	n/av	n/av	n/av	n/av	n/av	100
Hydrogen Sulfide	7783-06-04	10	14	15	21	20	28	<0.5
Benzene	71-43-2							
Toluene	108-88-							
Xylene	1330-20							

Toxicity values of the haz
Crude oil (Hydrocarbons C5
Hydrogen Sulphide (H_2S) LC
Benzene. LD50 Oral rat = 9
Xylene. LD50 Oral rat = 430
Toluene. LD50 Oral rat = 50

Battelle
The Business of Innovation

Final Report

Diluted Bitumen-Derived Crude Oil: Relative Pipeline Impacts

Battelle Memorial Institute
505 King Avenue
Columbus, OH 43201

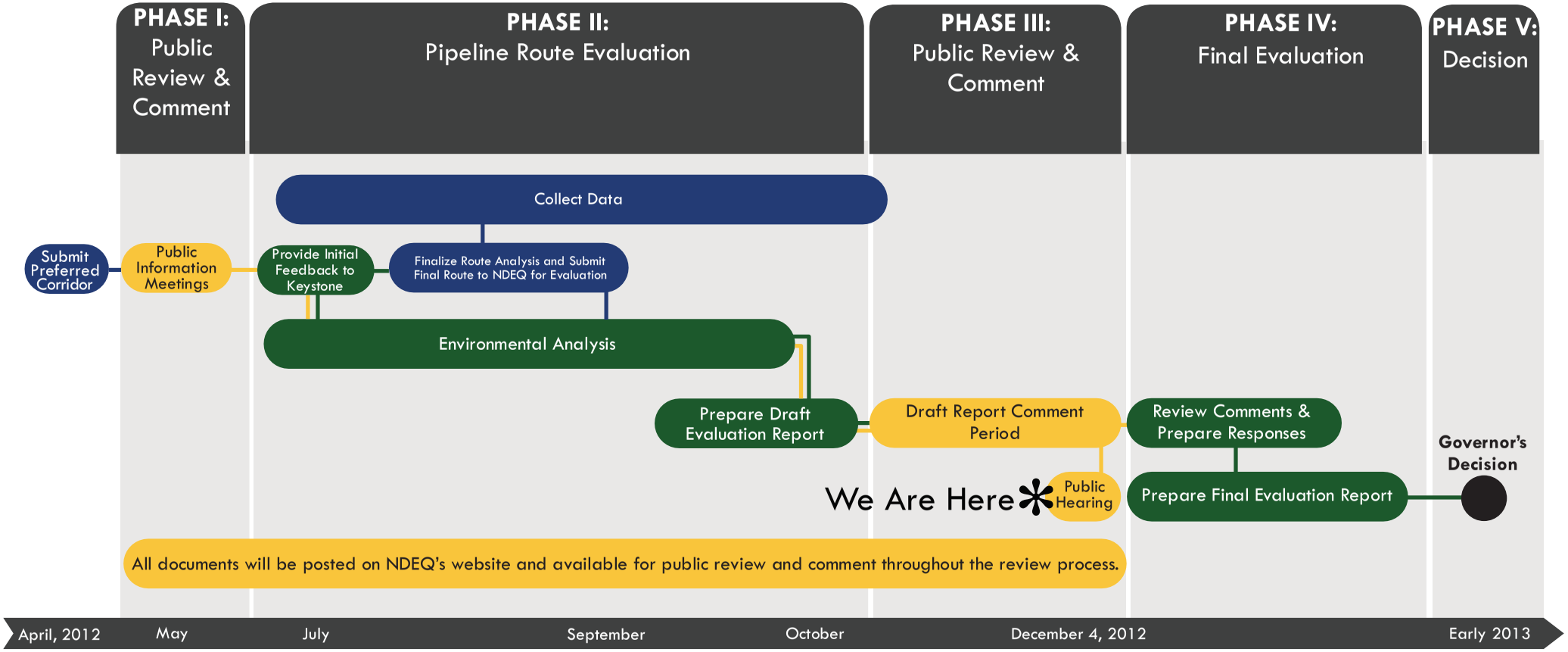
By
Barry Hindin
Brian Leis

July 20, 2012

Nebraska Department of Environmental Quality

Nebraska's Keystone XL Pipeline Evaluation Process

NEBRASKA's Keystone XL Pipeline Evaluation



Process Key:

- Public Participation Opportunity
- Department of Environmental Quality (NDEQ) Activity
- Keystone Activity

Nebraska Department of Environmental Quality

Comment Opportunities

NEBRASKA's Keystone XL Pipeline Evaluation

Information Session | 3:00 p.m. to 5:30 p.m. | Casey's Building

"Open house" format: Informally meet with agency representatives.

Fill out an online comment form at the Comment Station

Submit written comments

Only written and online comment forms will be accepted during the Information Session

Public Hearing | 6:00 p.m. | Event Center

"Formal hearing" format: Provide written or spoken testimony.

Only written and spoken testimony will be accepted during the Public Hearing

All comments and testimony will be reviewed and considered in the *Final Evaluation Report*

Nebraska Department of Environmental Quality

MSDS Exercise
Operation Cornhusker (Continued)

Nebraska's Keystone XL Pipeline Evaluation

- 12:34: TransCanada's Oil Control Centre (OCC) in Calgary is notified of the release. OCC states that it is shutting down the line and contacting the nearest on-scene responder, who will go to the location of the release.
- 12:39: OCC calls the TransCanada Omaha Regional Office and activates the Emergency Operations Center (EOC). The Regional EOC Manager assembles personnel in the EOC area, which is equipped with computers, telephones, maps, pagers, and large displays of emergency procedures and notification flow charts.
- 12:41: Regional EOC Manager activates the emergency conference bridge (telephone conference call).
- 12:44: The on-scene responder calls in and verifies that there is a release. Regional EOC Manager informs the on-scene responder that OCC is determining the contents of the batch traveling through the pipeline at the release location, and that OCC will provide a Material Safety Data Sheet (MSDS).
- 12:44: OCC controller calls in and confirms the release and the initiation of shutdown procedures.
- 12:46: Regional EOC Manager requests that OCC email a MSDS for the batch of crude oil in the line at the point of the release. OCC controller states that the location of the release is near the interface of two batches of oil and that he will send two MSDSs.
- 12:48: Regional EOC personnel receive the two MSDS by email. One is for Surmont Heavy Blend (SHB), a heavy sour synbit. The second MSDS is for Access Western Blend (AWB), a heavy sour dilbit.
- 12:48: The on-scene responder confirms that he has received the MSDSs by email.
- 12:49: Regional EOC Logistics manager printed the two MSDSs for review by the exercise observers.
- 12:51: MSDSs were emailed to the Nebraska Emergency Management Agency, the Wayne County Sheriff, the Wayne County Local Emergency Planning Committee (LEPC), and the PSAP (Public Safety Answering Point, or 911).

  Exercise complete.

During the exercise, TransCanada was able to provide the MSDS to Emergency Responders in 17 minutes.

Nebraska Department of Environmental Quality

MSDS Exercise
Operation Cornhusker

Nebraska's Keystone XL Pipeline Evaluation

Exercise Scenario: On Tuesday, November 20, 2012, based on a hypothetical location provided by NDEQ (approximately 2 miles north of Hoskins, NE), third-party excavation caused a release in the existing Keystone Pipeline. In the scenario, a landowner was excavating on his property, but did not call 811 prior to beginning work. The landowner struck the pipeline and immediately smelled and saw crude oil flowing out of the line into his trench.

The landowner saw a pipeline right-of-way marker at a nearby road, and called TransCanada's Toll-Free Emergency Line to report the incident.

Upon receiving notification of the release, TransCanada's Toll-Free Emergency Line (operated by a subcontractor, PDL, who provides multi-lingual operators) interviewed the landowner to complete a standard 12-question form and an electronic record was made of the call. PDL then notified TransCanada's Oil Control Centre (OCC) in Calgary.

(Exercise details are continued on the accompanying board)

NDEQ observed an exercise testing TransCanada's ability to provide the applicable MSDS to affected state agencies and other local authorities expeditiously in the event of a release.

A Material Safety Data Sheet (MSDS) is intended to provide workers and emergency personnel with procedures for handling or working with that substance in a safe manner, and includes information such as physical data, toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment, and spill-handling procedures.

Nebraska's Keystone XL Pipeline Evaluation

COMMENT FORM – INFORMATION SESSION USE ONLY

Comment forms will be accepted at the Information Session. Please submit your comments to any agency representative or insert into one of the comment boxes located throughout the room. All comments will be posted on the Nebraska Department of Environmental Quality's website.

Name: _____

Organization: _____

Street Address: _____

City, State Zip: _____

Email: _____

Welcome!

- The purpose of the Public Hearing is to obtain public testimony regarding the State's *Draft Evaluation Report* and the proposed Keystone Nebraska Reroute.
- To ensure all testifiers have the opportunity to speak, the hearing officer has set a time limit of 5 minutes for testimony.
- Those with more extensive testimony are urged to submit them in writing, so all of their testimony can be reviewed and considered by the agency in preparation of the *Final Evaluation Report*.
- Stations are available in the Speaker Registration area for you to prepare written testimony.

Nebraska Department of Environmental Quality

Public Hearing Ground Rules

NEBRASKA's Keystone XL Pipeline Evaluation

1. Please be kind, courteous, and respectful to all participants.
2. Please do not interrupt a testifier when they are speaking.
3. Please refrain from applause or other forms of support or opposition during the hearing.
4. Please silence all cell phones and electronic equipment.
5. If you wish to visit, please move to the room adjacent to the hearing room.
6. No displays, signs, banners, or noisemakers may be carried inside the meeting spaces.

Nebraska Department of Environmental Quality

Public Hearing Speaker Protocol

NEBRASKA's Keystone XL Pipeline Evaluation

1. Spoken testimony will be taken in order of registration.
2. Reserved seating for the next three speakers in the lineup is located in the front row. Please take a seat in a reserved chair when your name is called.
3. Prior to spoken testimony, please speak and spell your name for the court reporter.
4. Please provide the hearing officer any exhibit material you want to be included in the hearing record.
5. Speakers will be limited to 5 minutes of testimony.
6. If a speaker misses his/her turn in the lineup, he/she will be given one opportunity, then moved to the bottom of the speaker lineup.
7. All written and spoken testimony must take place during the public hearing. Written testimony can be provided throughout the evening.
8. Each participant will be allowed one spoken testimony opportunity at the public hearing.
9. No speakers will be allowed to cede their time to someone else.

Nebraska Department of Environmental Quality

Nebraska's Keystone XL Pipeline Evaluation

Please submit Public Testimony by

5pm (central) Friday, December 7, 2012

to:

Hearing Officer
Nebraska Department of
Environmental Quality
PO Box 98922
Lincoln, NE 68509

Nebraska's Keystone XL Pipeline Evaluation

WRITTEN TESTIMONY FORM – PUBLIC HEARING USE ONLY

Written testimony will be accepted at the Public Hearing. Please submit your written testimony to an agency representative at the written testimony tables. All testimony will become part of the hearing transcript.

Name: _____

Organization: _____

Street Address: _____

City, State Zip: _____

Email: _____

Nebraska's Keystone XL Pipeline Evaluation

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