



# Closure Plan Tecumseh Energy Center Industrial Landfill #0322

Prepared for:

Westar Energy

Tecumseh Energy Center

Tecumseh, Kansas

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## Plan Review/Amendment Log §257.102(b)(3)

Date of Review	Reviewer Name	Amendment Required (YES/NO)	Sections Amended and Reason



## CCR Regulatory Requirements

USEPA CCR Criteria 40 CFR 257.102	Tecumseh Energy Center (TEC) Industrial Landfill Closure Plan
<p>§257.102(a) stipulates:</p> <p><i>(a) Closure of a CCR landfill, CCR surface impoundment, or any lateral expansion of a CCR unit must be completed either by leaving the CCR in place and installing a final cover system or through removal of the CCR and decontamination of the CCR unit, as described in paragraphs (b) through (j) of this section. Retrofit of a CCR surface impoundment must be completed in accordance with the requirements in paragraph (k) of this section.</i></p>	<p>Section 1.0, Page 1</p>
<p>§257.102(b)(1) stipulates:</p> <p><i>(b) Written closure plan—(1) Content of the plan. The owner or operator of a CCR unit must prepare a written closure plan that describes the steps necessary to close the CCR unit at any point during the active life of the CCR unit consistent with recognized and generally accepted good engineering practices. The written closure plan must include, at a minimum, the information specified in paragraphs (b)(1)(i) through (vi) of this section.</i></p>	<p>Section 4.0, Page 7</p>
<p>§257.102(b)(1)(i) stipulates:</p> <p><i>(i) A narrative description of how the CCR unit will be closed in accordance with this section.</i></p>	<p>Section 4.1, Page 7</p>



USEPA CCR Criteria 40 CFR 257.102	Tecumseh Energy Center (TEC) Industrial Landfill Closure Plan
<p>§257.102(b)(1)(iii) stipulates:</p> <p><i>(iii) If closure of the CCR unit will be accomplished by leaving CCR in place, a description of the final cover system, designed in accordance with paragraph (d) of this section, and the methods and procedures to be used to install the final cover. The closure plan must also discuss how the final cover system will achieve the performance standards specified in paragraph (d) of this section.</i></p>	<p>Section 4.2, Page 7</p>
<p>§257.102(b)(1)(iv) stipulates:</p> <p><i>(iv) An estimate of the maximum inventory of CCR ever on-site over the active life of the CCR unit.</i></p>	<p>Section 3.5, Page 5</p>
<p>§257.102(b)(1)(v) stipulates:</p> <p><i>(v) An estimate of the largest area of the CCR unit ever requiring a final cover as required by paragraph (d) of this section at any time during the CCR unit's active life</i></p>	<p>Section 3.6, Page 6</p>



USEPA CCR Criteria 40 CFR 257.102	Tecumseh Energy Center (TEC) Industrial Landfill Closure Plan
<p>§257.102(b)(1)(vi) stipulates:</p> <p><i>(vi) A schedule for completing all activities necessary to satisfy the closure criteria in this section, including an estimate of the year in which all closure activities for the CCR unit will be completed. The schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR unit, including identification of major milestones such as coordinating with and obtaining necessary approvals and permits from other agencies, the dewatering and stabilization phases of CCR surface impoundment closure, or installation of the final cover system, and the estimated timeframes to complete each step or phase of CCR unit closure. When preparing the written closure plan, if the owner or operator of a CCR unit estimates that the time required to complete closure will exceed the timeframes specified in paragraph (f)(1) of this section, the written closure plan must include the site-specific information, factors and considerations that would support any time extension sought under paragraph (f)(2) of this section.</i></p>	<p>Section 8.0, Page 13</p>
<p>§257.102(b)(2)(i) stipulates:</p> <p><i>(2) Timeframes for preparing the initial written closure plan – (i) Existing CCR landfills and existing CCR surface impoundments. No later than October 17, 2016, the owner or operator of the CCR unit must prepare an initial written closure plan consistent with the requirements specified in paragraph (b)(1) of this section.</i></p>	<p>Report submitted prior to October 17, 2016</p>



USEPA CCR Criteria 40 CFR 257.102	Tecumseh Energy Center (TEC) Industrial Landfill Closure Plan
<p>§257.102(b)(2)(iii) stipulates:</p> <p><i>(iii) The owner or operator has completed the written closure plan when the plan, including the certification required by paragraph (b)(4) of this section, has been placed in the facility's operating record as required by §257.105(i)(4).</i></p>	<p>Section 9.0, Page 14</p>
<p>§257.102(b)(3) stipulates:</p> <p><i>(3) Amendment of a written closure plan.</i></p> <p><i>(i) The owner or operator may amend the initial or any subsequent written closure plan developed pursuant to paragraph (b)(1) of this section at any time.</i></p> <p><i>(ii) The owner or operator must amend the written closure plan whenever:</i></p> <p><i>(A) There is a change in the operation of the CCR unit that would substantially affect the written closure plan in effect; or</i></p> <p><i>(B) Before or after closure activities have commenced, unanticipated events necessitate a revision of the written closure plan.</i></p> <p><i>(iii) The owner or operator must amend the closure plan at least 60 days prior to a planned change in the operation of the facility or CCR unit, or no later than 60 days after an unanticipated event requires the need to revise an existing written closure plan. If a written closure plan is revised after closure activities have commenced for a CCR unit, the owner or operator must amend the current closure plan no later than 30 days following the triggering event.</i></p>	<p>Section 9.1, Page 14</p>



USEPA CCR Criteria 40 CFR 257.102	Tecumseh Energy Center (TEC) Industrial Landfill Closure Plan
<p>§257.102(b)(4) stipulates:</p> <p><i>(4) The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the initial and any amendment of the written closure plan meets the requirements of this section.</i></p>	<p>Section 9.2, Page 15</p>
<p>§257.102(d)(1) stipulates:</p> <p><i>(d) Closure performance standard when leaving CCR in place – (1) The owner or operator of a CCR unit must ensure that, at a minimum, the CCR unit is closed in a manner that will:</i></p> <p><i>(i) Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate or contaminated run-off to the ground or surface waters or to the atmosphere;</i></p> <p><i>(ii) Preclude the probability of future impoundment of water, sediment or slurry;</i></p> <p><i>(iii) Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period;</i></p> <p><i>(iv) Minimize the need for further maintenance of the CCR unit; and</i></p> <p><i>(v) Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.</i></p>	<p>Section 7.0 – 7.5, Page 12</p>



USEPA CCR Criteria 40 CFR 257.102	Tecumseh Energy Center (TEC) Industrial Landfill Closure Plan
<p>§257.102(d)(3)(i) stipulates:</p> <p><i>(3) Final cover system. If a CCR unit is closed by leaving CCR in place, the owner or operator must install a final cover system that is designed to minimize infiltration and erosion, and at a minimum, meets the requirements of paragraph (d)(3)(i) of this section, or the requirements of the alternative final cover system specified in paragraph (d)(3)(ii) of this section. (i) The final cover system must be designed and constructed to meet the criteria in paragraphs (d)(3)(i)(A) through (D) of this section. The design of the final cover system must be included in the written closure plan required by paragraph (b) of this section.</i></p> <p><i>(A) The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than <math>1 \times 10^{-5}</math> cm/sec, whichever is less.</i></p> <p><i>(B) The infiltration of liquids through the closed CCR unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.</i></p> <p><i>(C) The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.</i></p> <p><i>(D) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.</i></p>	<p>Section 4.2 and 5.0, Pages 7 and 9</p>



USEPA CCR Criteria 40 CFR 257.102	Tecumseh Energy Center (TEC) Industrial Landfill Closure Plan
<p>§257.102(d)(3)(ii) stipulates:</p> <p><i>(ii) The owner or operator may select an alternative final cover system design, provided the alternative final cover system is designed and constructed to meet the criteria in paragraphs (f)(3)(ii)(A) through (D) of this section. The design of the final cover system must be included in the written closure plan required by paragraph (b) of this section.</i></p> <p><i>(A) The design of the final cover system must include an infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in paragraphs (d)(3)(i)(A) and (B) of this section.</i></p> <p><i>(B) The design of the final cover system must include an erosion layer that provides equivalent protection from wind or water erosion as the erosion layer specified in paragraph (d)(3)(i)(C) of this section.</i></p> <p><i>(C) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.</i></p>	<p>Section 4.2, Page 7</p>
<p>§257.102(d)(3)(iii) stipulates:</p> <p><i>(iii) The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the design of the final cover system meets the requirements of this section.</i></p>	<p>Section 11.0, Page 18</p>



USEPA CCR Criteria 40 CFR 257.102	Tecumseh Energy Center (TEC) Industrial Landfill Closure Plan
<p>§257.102(e)(1) stipulates:</p> <p><i>(e) Initiation of closure activities. Except as provided for in paragraph (e)(4) of this section and §257.103, the owner or operator of a CCR unit must commence closure of the CCR unit no later than the applicable timeframes specified in either paragraph (e)(1) or (2) of this section. (1) The owner or operator must commence closure of the CCR unit no later than 30 days after the date on which the CCR unit either:</i></p> <p><i>(i) Receives the known final receipt of waste, either CCR or any non-CCR waste stream; or</i></p> <p><i>(ii) Removes the known final volume of CCR from the CCR unit for the purpose of beneficial use of CCR.</i></p>	<p>Section 8.0, Page 13</p>
<p>§257.102(e)(3) stipulates:</p> <p><i>(3) For purposes of this subpart, closure of the CCR unit has commenced if the owner or operator has ceased placing waste and completes any of the following actions or activities:</i></p> <p><i>(i) Taken any steps necessary to implement the written closure plan required by paragraph (b) of this section;</i></p> <p><i>(ii) Submitted a completed application for any required state or agency permit or permit modification; or</i></p> <p><i>(iii) Taken any steps necessary to comply with any state or other agency standards that are prerequisite, or are otherwise applicable, to initiating or completing the closure of a CCR unit.</i></p>	<p>Section 8.0, Page 13</p>



USEPA CCR Criteria 40 CFR 257.102	Tecumseh Energy Center (TEC) Industrial Landfill Closure Plan
<p>§257.102(f)(1) stipulates:</p> <p><i>(f) Completion of closure activities. (1) Except as provided for in paragraph (f)(2) of this section, the owner or operator must complete closure of the CCR unit:</i></p> <p><i>(i) For existing and new CCR landfills and any lateral expansion of a CCR landfill, within six months of commencing closure activities.</i></p> <p><i>(ii) For existing and new CCR surface impoundments and any lateral expansion of a CCR surface impoundment, within five years of commencing closure activities.</i></p>	<p>Section 8.0, Page 13</p>



USEPA CCR Criteria 40 CFR 257.102	Tecumseh Energy Center (TEC) Industrial Landfill Closure Plan
<p>§257.102(f)(2)(i) stipulates:</p> <p><i>(2)(i) Extensions of closure timeframes. The timeframes for completing closure of a CCR unit specified under paragraphs (f)(1) of this section may be extended if the owner or operator can demonstrate that it was not feasible to complete closure of the CCR unit within the required timeframes due to factors beyond the facility's control. If the owner or operator is seeking a time extension beyond the time specified in the written closure plan as required by paragraph (b)(1) of this section, the demonstration must include a narrative discussion providing the basis for additional time beyond that specified in the closure plan. The owner or operator must place each completed demonstration, if more than one time extension is sought, in the facility's operating record as required by §257.105(i)(6) prior to the end of any two-year period. Factors that may support such a demonstration include:</i></p> <p><i>(A) Complications stemming from the climate and weather, such as unusual amounts of precipitation or a significantly shortened construction season;</i></p> <p><i>(B) Time required to dewater a surface impoundment due to the volume of CCR contained in the CCR unit or characteristics of the CCR in the unit;</i></p> <p><i>(C) The geology and terrain surrounding the CCR unit will affect the amount of material needed to close the CCR unit; or</i></p> <p><i>(D) Time required or delays caused by the need to coordinate with and obtain necessary approvals and permits from a state or other agency.</i></p>	<p>Section 8.0, Page 13</p>



USEPA CCR Criteria 40 CFR 257.102	Tecumseh Energy Center (TEC) Industrial Landfill Closure Plan
<p>§257.102(f)(2)(ii) stipulates:</p> <p>(2)(ii) <i>Maximum time extensions.</i></p> <p>(A) <i>CCR surface impoundments of 40 acres or smaller may extend the time to complete closure by no longer than two years</i></p> <p>(B) <i>CCR surface impoundments larger than 40 acres may extend the timeframe to complete closure of the CCR unit multiple times, in two-year increments. For each two-year extension sought, the owner or operator must substantiate the factual circumstances demonstrating the need for the extension. No more than a total of five two-year extensions may be obtained for any CCR surface impoundment.</i></p> <p>(C) <i>CCR landfills may extend the timeframe to complete closure of the CCR unit multiple times, in one-year increments. For each one-year extension sought, the owner or operator must substantiate the factual circumstances demonstrating the need for the extension. No more than a total of two one-year extensions may be obtained for any CCR landfill.</i></p>	<p>Section 8.0, Page 13</p>



USEPA CCR Criteria 40 CFR 257.102	Tecumseh Energy Center (TEC) Industrial Landfill Closure Plan
<p>§257.102(f)(2)(iii) stipulates:</p> <p><i>(iii) In order to obtain additional time extension(s) to complete closure of a CCR unit beyond the times provided by paragraph (f)(1) of this section, the owner or operator of the CCR unit must include with the demonstration required by paragraph (f)(2)(i) of this section the following statement signed by the owner or operator or an authorized representative:</i></p> <p><i>I certify under penalty of law that I have personally examined and am familiar with the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.</i></p>	<p>Section 8.0, Page 13</p>
<p>§257.102(f)(3) stipulates:</p> <p><i>(3) Upon completion, the owner or operator of the CCR unit must obtain a certification from a qualified professional engineer verifying that closure has been completed in accordance with the closure plan specified in paragraph (b) of this section and the requirements of this section.</i></p>	<p>Section 11.0, Page 18</p>
<p>§257.102(g) stipulates:</p> <p><i>(g) No later than the date the owner or operator initiate closure of a CCR unit, the owner or operator must prepare a notification of intent to close a CCR unit. The notification must include the certification by a qualified professional engineer for the design of the final cover system as required by §257.102(d)(3)(iii), if applicable. The owner or operator has completed the notification when it has been placed in the facility's operating record as required by §257.105(i)(7).</i></p>	<p>Section 9.3, Page 15</p>



USEPA CCR Criteria 40 CFR 257.102	Tecumseh Energy Center (TEC) Industrial Landfill Closure Plan
<p>§257.102(h) stipulates:</p> <p><i>(h) Within 30 days of completion of closure of the CCR unit, the owner or operator must prepare a notification of closure of a CCR unit. The notification must include the certification by a qualified professional engineer as required by §257.102(f)(3). The owner or operator has completed the notification when it has been placed in the facility's operating record as required by §257.105(i)(8).</i></p>	<p>Section 9.4, Page 16</p>
<p>§257.102(i) stipulates:</p> <p><i>(i) Deed notations. (1) Except as provided by paragraph (i)(4) of this section, following closure of a CCR unit, the owner or operator must record a notation on the deed to the property, or some other instrument that is normally examined during title search. (2) The notation on the deed must in perpetuity notify any potential purchaser of the property that: (i) The land has been used as a CCR unit; and (ii) Its use is restricted under the post-closure care requirements as provided by §257.104(d)(1)(iii).</i></p>	<p>Section 9.5, Page 16</p>
<p>§257.102(j) stipulates:</p> <p><i>(j) The owner or operator of the CCR unit must comply with the closure recordkeeping requirements specified in §257.105(i), the closure notification requirements specified in §257.106(i), and the closure Internet requirements specified in §257.107(i).</i></p>	<p>Section 9.0, Page 14</p>



## 1.0 INTRODUCTION

CB&I Environmental and Infrastructure, Inc. (CB&I) has prepared the following Closure Plan (Plan) at the request of Westar Energy (Westar) for the Industrial Landfill No. 0322 (Landfill) located at the Tecumseh Energy Center (TEC) in Tecumseh, Kansas. TEC is a coal-fired power plant that has been in operation since 1925. The Landfill has been deemed to be a regulated coal combustion residue unit by the United States Environmental Protection Agency (USEPA) through the Disposal of Coal Combustion Residuals (CCR) from the Electric Utilities Final Rule (CCR Rule) 40 CFR §257 and §261.

This Plan details the closure requirements outlined in §257.102, for CCR units closed in place. The criteria for conducting the closure or retrofit of CCR units for the Landfill are detailed in Section 2.0. Additionally, the following Plan details the necessary steps to close the Landfill at any point in its active life, based on recognized and good engineering practices. All closure processes have been established to control, minimize, and eliminate infiltration of liquids into waste and release of leachate.



## 2.0 REGULATORY OVERVIEW OF CCR CLOSURE PLAN REQUIREMENTS

On April 17, 2015, the USEPA published the CCR Rule under Subtitle D of the Resource Conservation and Recovery Act (RCRA) as 40 CFR Part §257 and §261. The purpose of the CCR Rule is to regulate the management of CCR in regulated CCR units for landfill and surface impoundments. The Landfill has been deemed to be a regulated CCR unit at TEC.

Section 257.102(b) of the CCR Rule requires owners or operators of CCR landfills to prepare a written closure plan describing the closure of the unit and schedule for implementation of the plan. The following citations from the CCR Rule are applicable for the Landfill discussed in this Plan:

§257.102(b)(1) stipulates:

*(b) Written closure plan – (1) Content of the plan. The owner or operator of a CCR unit must prepare a written closure plan that describes the steps necessary to close the CCR unit at any point during the active life of the CCR unit consistent with recognized and generally accepted good engineering practices. The written closure plan must include, at a minimum, the information specified in paragraphs (b)(1)(i) through (vi) of this section*

- (i) A narrative description that discusses of how the CCR unit will be closed in accordance with this section.*
- (ii) If closure of the CCR unit will be accomplished through removal of CCR from the CCR unit, a description of the procedures to remove the CCR and decontaminate the CCR unit in accordance with paragraph (c) of this section.*
- (iii) If closure of the CCR unit will be accomplished by leaving CCR in place, a description of the final cover system, designed in accordance with paragraph (d) of this section, and methods and procedures to be used to install the final cover. The closure plan must also discuss how the final cover system achieves the performance standards specified in paragraph (d) of this section.*
- (iv) An estimate of the maximum inventory of CCR ever on-site over the active life of the CCR unit.*
- (v) An estimate of the largest area of the CCR unit ever requiring a final cover as required by paragraph (d) of this section at any time during the CCR unit's active life.*
- (vi) A schedule for completing all activities necessary to satisfy the closure criteria in this section, including an estimate of the year in which all closure activities for the CCR unit will be completed. The schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR unit, including identification of major milestones such as coordinating with and obtaining necessary approvals and permits from other agencies, the dewatering and stabilization phases of CCR surface impoundment closure, or installation of the final cover system, and the estimated timeframes to complete each step or phase of CCR unit closure. When preparing the written closure plan, if the owner or operator of a CCR unit estimates that the time required to complete closure will exceed the timeframes specified in paragraph (f)(1) of this section, the written closure plan must include the site-specific information, factors and considerations that would support any time extension sought under paragraph (f)(2) of this section.*



§257.102(b)(iii) outlines closure performance standards for closure of units where CCR material will be left in place. The section requires a description of the final cover system

and the design, methods, and procedures to be used to install the final cover to ensure that it will achieve the performance standards specified in and §257.102(d), which stipulates:

*(d) Closure performance standard when leaving CCR in place – (1) The owner or operator of a CCR unit must ensure that, at a minimum, the CCR unit is closed in a manner that will:*

- (i) Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or the atmosphere;*
- (ii) Preclude the probability of future impoundment of water, sediment or slurry;*
- (iii) Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during closure and post-closure period;*
- (iv) Minimize the need for further maintenance of the CCR unit; and*
- (v) Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.*

Moreover, the final cover system has been planned in accordance with the following requirements of §257.102(d)(3), which stipulates:

*(3) Final cover system. If a CCR unit is closed by leaving CCR in place the owner or operator must install a final cover system that is designed to minimize infiltration and erosion, and at a minimum, meets the requirements of paragraph (d)(3)(i) of this section, or the requirements of the alternative final cover system specified in paragraph (d)(3)(ii) of this section.*

- (i) The final cover system must be designed and constructed to meet the criteria in paragraphs (d)(3)(i)(A) through (D) of this section. The design of the final cover system must be included in the written closure plan required by paragraph (b) of this section.*
  - (A) The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than  $1 \times 10^{-5}$  cm/sec, whichever is less.*
  - (B) The infiltration of liquids through the CCR unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.*
  - (C) The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.*
  - (D) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.*

In addition to the above, the Plan must ensure compliance with the closure recordkeeping requirements specified in §257.105(i), the closure notification requirements specified in §257.106(i), and the closure intent requirements specified in §257.107(i). A written certification is provided in Section 11.0 from a qualified professional engineer in the State of Kansas, to certify that this Plan meets the requirements of the CCR Rule.



### 3.0 TEC LANDFILL OVERVIEW

#### 3.1 Location, Topography, and Description

Bottom ash and fly ash (CCR material) are disposed of within TEC's Landfill. The closure of the Landfill will be accomplished by leaving the CCR material in place. The following Plan was developed to satisfy the CCR Rule requirements for in-place closure §257.102(b)(1)(iii).

The Landfill is located within TEC in Tecumseh, Kansas in Shawnee County. TEC is located approximately 6.5 miles east of Topeka, Kansas and approximately 2 miles north of Highway 70. The Landfill is bounded to the north by 2<sup>nd</sup> Street, an adjacent industrial property, and the Kansas River located less than one-half mile north of the Landfill. The Landfill is bounded on the east and south by agricultural land and Highway 40 is along the southern boundary, with rural residential properties located along the western portion of the Landfill boundary. The location of the Landfill is depicted in **Figure 1**.

The Landfill footprint is approximately 56 acres total with approximately 32 acres used for CCR material disposal and management. The Landfill is being filled in three separate phases: Phase 1 (the northern phase, 7.4 acres), Phase 2 (the southern phase, 15.4 acres), and Phase 3 (the center phase, 9.2 acres) which is located between Phases 1 and 2. Phase 1 has a temporary clay cap with established vegetation. Phase 2 is operational for current CCR material disposal. Approximately 9.2 acres of the Phase 2 has a final clay cover with established vegetation which meets the CCR Rule requirements. Phase 3 was previously operational, however, has not received waste in several years. .

Topography varies across the Landfill in approximate elevations ranging from 927 feet mean sea level (ft. MSL) to 961 ft. MSL. Direct precipitation that falls onto active portions of the Landfill has historically been managed by a contact water basin located in Phase 3. The contact water basin is bounded by a 10-foot high perimeter berm designed to prevent the off-site discharge of contact water. As landfilling operations continue, the contact water basin will be drained and closed in compliance with 40 CFR Part §257.102. Once final cover is complete, the Landfill will be graded to have a 1 percent slope on the plateau to a 3.5H:1V side slope that drains into perimeter drainage channels along the toe of the Landfill. The perimeter drainage channels direct the flow to an outfall pipe located along the northern boundary of the Landfill. Existing and permitted site topography is depicted in **Figure 2** and **Figure 3**, respectively.

#### 3.2 Existing Regulatory Permits and Consents

Westar was granted an Industrial Landfill Permit (Number 0322) at TEC by the Kansas Department of Health and Environment – Bureau of Waste management (KDHE-BWM), in accordance with Kansas Statutes Annotated (KSA) 65-3407. KDHE modified the solid waste permit, per K.A.R. 28-29-6a, in response to the CCR Rule to include all on-site CCR units as disposal areas under the existing solid waste permit for TEC. The current Industrial Landfill Permit was approved on October 15, 2015. This allows CCR material generated on-site at TEC to be properly disposed of within the Landfill Permit boundary in line with the approved final grades, which are detailed in **Figure 3**.



### 3.3 CCR Material Generation, Recycling, and Disposal

CCR materials have been generated at TEC since operations began in the 1930's. CCR material generated at TEC are transported from both the surface impoundment and energy center, and hauled to the on-site Landfill for disposal. CCR material recycling rates vary annually at TEC.

Additionally, coal mill rejects, clean rubble, cooling tower basin sediments, and straight line clarifier sediments and polymers are also disposed of in Landfill. These secondary waste streams make up less than five percent of the total CCR material disposed of within the Landfill. The rate at which CCR materials are placed in the Landfill varies based on the generation station and material recycling rates.

### 3.4 Landfill Operations

CCR material and secondary waste streams are transported by trailer trucks to the Landfill area for permanent disposal from the generation station, fly ash silos, and/or the bottom ash pond. The CCR materials are placed directly on the active face until a significant quantity of material is staged. CCR material is then spread, compacted, and wetted in lifts. The landfilling of CCR material is phased until the permitted final grades have been achieved. Grading is undertaken, as required, within the active area to maintain a relatively uniform height and stable intermediate slopes.

Daily and intermediate covers are not applied as part of the operational activities for the Landfill. Weekly (7-day) and annual inspections, as well as annual reporting, are undertaken for the CCR units in line with the TEC inspection requirements in 40 CFR Part §257.84(b): Inspection Requirements for CCR Landfills. Any operational modifications which require attention will be identified as part of the inspection and reporting requirements for the Landfill.

Stormwater control measures including dikes, berms, and other features will be constructed as necessary and in accordance with the Run-on and Run-off Control Plan for the Landfill. Perimeter berms and clean soil stockpiles are placed strategically at the Landfill to prevent stormwater erosion and provide run-on and run-off control. Direct precipitation that falls onto active portions of the Landfill has historically been managed by a contact water basin bounded by a 10-foot high perimeter berm structure. The contact water basin is designed to prevent off-site discharge of contact water.

### 3.5 Remaining Landfill Volume and Life (§257.102(b)(1)(iv))

The total disposal capacity of the Landfill is approximately 934,000 cubic yards (cy), as stated in the 2015 Annual Landfill Inspection. AutoCAD Civil 3D surface comparisons were used to determine the remaining capacity of the Landfill. The top of waste elevations from the most recent survey conducted by Professional Engineering Consultants (PEC) in June 2016, illustrated in **Figure 2**, was compared to the final design top of waste elevations. The final design top of waste elevations were estimated by lowering the permitted final grades, shown in **Figure 3**, by two feet (accounting for the 18-inch infiltration layer and the 6-inch erosion control layer). From the comparison of these surfaces, the remaining capacity of the Landfill is approximately 749,944 airspace cy (ascy).



As detailed in the 2015 Annual Report, the average fill rate for the Landfill is approximately 15,425 tons per year (tons/yr) of CCR material (8,846 tons fly ash and 6,579 tons bottom

ash). The assumed dry density of the bottom ash for TEC is approximately 70 pounds per cubed feet (lb/ft<sup>3</sup>) (or 0.945 tons per cubic yard (tons/cy) dry weight) and 80 pounds per cubed feet (lb/ft<sup>3</sup>) (or 1.08 tons/cy dry weight) for fly ash. Therefore, it is determined that the average volume fill rate is approximately 15,153 cubic yards per year (cy/yr). At this fill rate and the estimated remaining capacity determined in AutoCAD, the remaining life of the Landfill was determined to be approximately 49 years (year 2065).

### **3.6 Largest Area Requiring Final Cover (§257.102(b)(1)(v))**

The Landfill has been designed, and will be operated so that contemporaneous operation and closure occurs. Therefore, the final cover will be constructed in stages so as to facilitate Landfill operational requirements. As Phase 1 has an intermediate cover and Phase 2 has a final cover over the majority of the area, which follows the CCR Rule requirements, the largest area requiring final cover at any time during the CCR units' operating period is estimated to be Phase 3 and the uncapped portion of Phase 2 (15.4 acres).



#### 4.0 CLOSURE PLAN (§257.102(b)(1))

This Plan has been prepared in accordance with requirements of the CCR Rule and includes a written certification in Section 11.0 from a qualified Professional Engineer for the State of Kansas.

#### 4.1 Narrative Description (§257.102(b)(1)(i))

Closure of the Landfill will be accomplished by leaving the CCR material in-place. The method of closure has been designed to minimize maintenance, leachate generation, and control run-on and run-off to ensure the protection of human health and the environment. The Landfill will be closed in accordance with recognized Construction Quality Assurance (CQA) procedures to ensure the final cover is designed, constructed, and installed in accordance with recognized standards and accepted good engineering practices, as detailed in the following sections.

#### 4.2 Final Cover and Subgrade Overview (§257.102 (b)(1)(iii) and §257.102(d)(3)(i))

The final cover has been designed to meet the following objectives:

- Minimize the potential post-closure infiltration of liquids into the waste;
- Minimize the potential for releases of CCR material, leachate, or contaminated run-off to the ground or surface waters or the atmosphere;
- Provide long-term slope stability to prevent the sloughing or movement of the final cover system during closure and post-closure period; and
- Minimize the need for further maintenance of the CCR unit

The final cover will be installed on top of a minimum of a 12-inch subgrade layer of compacted and graded CCR material. The top slope of the final cover will be a minimum of one percent for the Landfill, with a peak elevation of 961 ft MSL, and exterior side slopes constructed at a 3.5H:1V slope. The positive drainage will serve to minimize the potential for the infiltration of liquids into the waste material. The final cover of the Landfill will be constructed to the final grades depicted in **Figure 3**. The final cover system will comprise of the following layers, from bottom to top:

- A minimum of 18-inch of compacted soil (or) 40-mil Liner Low Density Polyethylene (LLDPE) geomembrane (or equivalent), infiltration layer; and
- A minimum 6-inch vegetated, erosion control layer.

The final cover system will meet the requirements of §257.102(d)(3)(i) and have a minimum permeability of  $1 \times 10^{-5}$  cm/sec. An alternate final may be used in lieu of the final cover system described above, and will be in accordance with §257.102(d)(3)(ii). In the event that an alternate liner system is considered, the KDHE will be notified and appropriate permitting will be secured.



#### *4.2.1 Low Permeability Subgrade Construction*

Prior to construction of the final cover, a 12-inch subgrade area comprised of hardened ash will be prepared and used to support the final cover system. The subgrade will then be compacted, then graded with a bulldozer, and smoothed to ensure a uniform subgrade surface.

After the grading and compaction of the subgrade, the area will be inspected to ensure the working surface is smooth and free from sharp objects or abrupt changes in grade, and proper sloping to allow for drainage. Upon inspection, the area will be surveyed on a minimum of a 100-foot grid prior to the commencement of the installation of the final cover.

#### *4.2.2 Infiltration Layer*

An 18-inch compacted soil layer or a 40-mil textured LLDPE geomembrane (or equivalent) may be installed at the Landfill to serve as an impermeable barrier. This layer will prevent infiltration of moisture through the final cover into the CCR material.

A total of approximately 55,176 cy of soil for the 18-inch compacted soil layer will be required, if used. The infiltration layer will be constructed from soil obtained from either local or on-site borrow sources and will be free of large particles or debris.

If the geomembrane is used, installation will follow the best practice procedures and in accordance with third-party conformance testing. Third-party conformance testing will be conducted on key parameters for the geomembrane material properties. Testing will be reported as part of the Construction Quality Assurance (CQA) for the Landfill.

#### *4.2.4 Final Cover Barrier Soils*

The 6-inch erosion control layer will be located above the infiltration layer and will be comprised of 18,392 cy of native soils capable of sustaining vegetation. After placement, the soil will be seeded to promote the establishment of a healthy stand of grass and native vegetation. The vegetation will assist in limiting the infiltration of surface waters and effects of erosion on the final cover system.

The thickness of barrier soils will be verified by surveying the top of each layer in the same locations completed on the top of subgrade. The specified thicknesses of each barrier soil layer are minimum thicknesses that will be developed in the field.



## 5.0 CONSTRUCTION CONSIDERATIONS

### 5.1 Equipment

Westar, or their contractor, is responsible for providing sufficient equipment to carry out Landfill closure operations, as designed, in a satisfactory manner. Equipment for Landfill closure operations may include any or all of the following, as described in Table 1, and potentially other equipment if deemed appropriate by Westar and their contractors:

<b>TABLE 1: CONSTRUCTION EQUIPMENT</b>	
<b>EQUIPMENT</b>	<b>PURPOSE</b>
Tracked Dozer	Spreading waste, low permeability soil, and protective or vegetative material
Excavators	Slope leveling near geomembrane tie-in at the waste boundary. Excavating soil material into haul trucks and final cover installation
Compactor	Compacting cohesive soil layer to achieve proper density
Haul Trucks	Haul cohesive soil and material into construction area
Drum Rollers	Preparing the low permeability soil layer top surface for geomembrane placement
Water Trucks	Spraying water on ash to obtain cementitious properties and TEC roads for dust suppression

### 5.2 Phased Construction

The final cover will be placed progressively as each construction phase is complete. Construction of the cover system, haul road, and fill placement will take place throughout the year as needed. The objective will be to establish the stabilized final surface as quickly as possible after the filling has been completed.

### 5.3 Stormwater Run-On and Run-Off Controls

Stormwater at the Landfill will be managed by gentle side slopes, perimeter drainage channels, and berms, which will prevent off-site migration of contact water. Direct precipitation that falls onto active portions of the Landfill has historically been managed by a contact water basin, which is designed to prevent off-site discharge of contact water. As landfilling operations continue, the contact water basin will be drained and closed in order to comply with 40 CFR Part §257.102.



Once disposal and final cover installation/closure is complete, all non-contact stormwater run-off will flow into the perimeter drainage channels. The perimeter drainage channels

convey stormwater along the east and west borders of the Landfill, joining together at an outfall location at the northern boundary of the Landfill. Stormwater run-on and stormwater run-off facility is and will continue to be directed towards the outfall location denoted Outfall 014, which consists of a 60-inch corrugated metal pipe that conveys stormwater underneath 2<sup>nd</sup> Street, towards the Kansas River. Outfall 014 is currently permitted under NPDES Permit No. I-KS72-BO01 from the KDHE. This permit covers outfall locations at TEC and allows the discharge of non-contact stormwater into the Kansas River in accordance with effluent limitations and monitoring requirements.

In order to preclude the probability of water ponding on the compacted CCR material, the final grades and relatively gentle slopes will be constructed to properly convey stormwater away from the Landfill. See the Run-on and Run-off Control System Plan for additional information on the stormwater management.

#### **5.4 Erosion Control**

Erosion control measures such as riprap, erosion control blankets, and turf reinforcing mats will be used to minimize erosion in the perimeter drainage channels. Other erosion control measures may include a relatively shallow slope of the final cover and the use of the perimeter berms, both of which will control surface run-off rates on and around the Landfill. The vegetated final cover will assist in preventing erosion of the final cover soils. Construction of erosion control measures including dikes, berms, and other features will be installed in accordance with the Run-on and Run-off Control Plan for the Landfill.

#### **5.5 Stability**

The final cover system may experience minor settlement over time relative to the base grade settlement due to waste consolidation. Only minimal CCR material consolidation is anticipated due to the physical characteristics of the material deposited, the CCR material is compacted during placement, and most of the settlement will have already occurred shortly after landfilling.

In the event future non-uniform settlement is observed to be impacting the functional design and/or operation of the Landfill and surrounding areas, minor regrading and repair of the soil component may be required. The optional geomembrane and the compacted soils are flexible and will retain its integrity under minor differential settlement.



## **6.0 OPERATIONS AND MAINTENANCE**

Following closure, the final cover will be maintained to prevent erosion and control excessive vegetative growth. Maintenance of the final cover will include periodic mowing of the vegetative cover and reseeding as necessary. The grass will be maintained at such a level as to facilitate inspection. This will help to discourage the inhabitation of burrowing animals. Mowing activities will be conducted on an as-need basis. The erosion control layer on the final cover system will be inspected, filled with soil, and regraded if the erosion channels are approximately 6-inches deep. Further details on the operations and maintenance are provided in the Post-Closure Plan for the Landfill.



## **7.0 CLOSURE PERFORMANCE STANDARDS (§257.102(d)(1))**

### **7.1 Minimization of Liquid Infiltration into CCR Material Mass (§257.102(d)(1)(i))**

As detailed above, the final cover system for the Landfill will include an infiltration layer, consisting of either compacted soils and/or a low-permeability geomembrane layer, and an erosion control layer. The compacted soils and/or geomembrane will help to minimize the potential infiltration of water to the CCR material.

The final cover system will assist in preventing the contact between the surface water and the CCR material. This will minimize the movement of potentially contaminated water to ground or surface water systems. Additionally, it will assist in controlling, minimizing and in some cases eliminating, to the maximum extent feasible, post-closure infiltration of liquids into the waste, and the potential release of CCR material and leachate, as required by the performance standards.

### **7.2 Preclusion of Future Impoundment of Water, Sediment, or Slurry (§257.102(d)(1)(ii))**

Westar does not anticipate the need for future impoundment of water, sediment, or slurry within the Landfill once the final cover system is installed. Therefore, the Landfill follows the required performance standards.

### **7.3 Measures to Maintain Slope Stability (§257.102(d)(1)(iii))**

In order to maintain slope stability of the final cover, run-off is collected and controlled in highly erodible areas, such as the side slopes and top slope. The run-off controls and shallow slopes prevent erosion, movement, and sloughing of the final cover system, as required by the performance standard. Further details on the stormwater run-on and run-off controls for the Landfill are provided in the Run-On and Run-Off Control Plan.

### **7.4 Design to Minimize Ongoing Maintenance (§257.102(d)(1)(iv))**

The incorporation of slope stability and erosion control measures will minimize the need for on-going maintenance on the Landfill. The weekly inspections assist in identifying maintenance at the earliest opportunity, so as to prevent larger maintenance requirements in the future.

Both the preventative maintenance measures in addition to the weekly inspections will minimize the requirement for larger maintenance of the Landfill, and therefore fulfills the required performance standards.

### **7.5 Engineering Good Practices (§257.102(d)(1)(v))**

The planned quick completion and phasing of final cover operations will prevent large amounts of contact water from being generated. The use of time efficiency with a high standard for quality is an example of a good engineering practice and satisfaction of the required performance standards.



## 8.0 CLOSURE ACTIVITY SCHEDULE (§257.102(b)(1)(vi))

The closure of the Landfill will be completed according to the following schedule milestones:

- Based on Section 3.5, it can be seen that the estimated closure date of the Landfill will be in 2065. As the Landfill is filled this date may change depending on the disposal rates of CCR material. Accordingly, this closure date will be updated as required as part of an amendment to this Plan.
- Notify KDHE in writing at least 60 days before closure.
- The final cover installation will be initiated as soon as possible after regulatory approval, in line with suitable weather for construction.
- Construction and analytical testing will be conducted in a systematic and timely manner. Delays will be avoided in completion. Construction and testing of the soil will generally not exceed 60 working days from beginning to completion.
- Commence closure of the Landfill, by following §257.102(e)(3), no later than 30 days after the date on which the CCR unit receives the final receipt of CCR material, per §257.102(e)(1)(i).
- Completion of the closure activities will occur within 6 months of commencing closure activities as required by §257.102(f)(1). Upon completion a certified Kansas Professional Engineer will provide KDHE with a closure certification. This will verify that the Landfill closure was performed and completed in accordance with the Plan. A request for an extension of the closure timeframe may be submitted following the guidelines in §257.102(f)(2)(i-iii).
- Within 30 days of the completion of closure of the CCR unit, the notification of closure of the CCR unit will be submitted per §257.102(h).
- Post-closure monitoring of the cap and run-on/run-off controls will be conducted on a routine schedule to identify any potential stability issues with the cap and appropriate maintenance to be undertaken. A post-closure monitoring plan for the Landfill has been detailed in the Post-Closure Plan for the Landfill.



## **9.0 RECORD KEEPING/NOTIFICATION REQUIREMENTS (§257.105(j))**

Per §257.102(j), Westar maintains an operating record consisting of the following documents specified in §257.105(i):

- Inspection records that are conducted for the disposal materials;
- Groundwater sampling and analysis results for the Bottom Ash Area, records of recycled materials, operational requirements, complaints register, associated corrective measures, and employee training records;
- A copy of the SWPPP and the SWPPP Record Forms;
- The Closure and Post-Closure Plans, as required by §257.102(b)(2)(iii), as well as the CQA certification and inspection documentation;
- Proof of financial insurance;
- A copy of the current operating permit and any subsequent addenda; and
- Copies of the permit applications and all supporting documents.

Additionally as per §257.104(f), Westar will comply with the notification requirements specified in §257.106(i). This includes submitting the following notification documents and any amendments to these documents to the state director:

- Intent to initiate closure;
- Availability of annual progress reports of closure implementation;
- Closure and Post-Closure Plan and any alternative closure requirements;
- Any required time extensions;
- Completion of closure of a CCR unit; and the
- Deed notation;

Internet requirements specified in §257.107(i) will be placed on owner and operators publicly accessible website, as per §257.104(f). These documents include any notification on the closure or post-closure intent or completion, annual progress reports, the written Closure and Post-Closure Plans and any amendments, demonstrations for time extensions, and the record of the deed.

All records that are relevant within the past 5 years will be maintained at TEC and/or by Westar. The records are available to KDHE representatives for review upon request.

### **9.1 Plan Amendments (§257.102(b)(3))**

This Plan will continue to undergo review as the Landfill continues phased construction activities. The amended Plan will be reviewed and recertified by a registered professional



engineer and will be placed in TEC's facility operating record as required per §257.105(i)(4). The amended Plan will supersede and replace any prior versions. Availability of the amended Plan will be noticed to the State Director per §257.106(i) and posted to the publicly accessible internet site per §257.107(i).

A record of Plan reviews/assessments is provided on the first page of this document, immediately following the Table of Contents. Any subsequent amendment of a written Plan will be prepared as required, such as:

- There is a change in the operation of the CCR unit that would substantially affect the written Plan in effect; or
- Before or after closure activities have commenced, unanticipated events necessitate a revision of the written Plan.

The owner or operator will amend the Plan at least 60 days prior to a planned change in the operation of TEC or CCR unit, or no later than 60 days after an unanticipated event requires the need to revise an existing written Plan. If a written Plan is revised after closure activities have commenced for a CCR unit, the owner or operator will amend the Plan no later than 30 days following the triggering event.

### **9.2 Amended Closure Plan Certification (§257.102(b)(4))**

CB&I reviewed any previously developed closure information/plans which exist for the Landfill. CB&I prepared a Plan for the Landfill to address closure with CCR materials left in place. CB&I has utilized the existing Plan in this report to minimize costs associated with development of these plans.

This Plan will continue to undergo review as the Landfill continues phased construction activities. Any future amendments to the current closure plan will be tracked in the log at the beginning of this document and will be certified by a qualified professional engineer that the amended plan meets the requirements of the applicable portions of the CCR Rule. The amended Plan will be placed in TEC's facility operating record as required per §257.105(i)(4), noticed to the State Director per §257.106(i), and posted to the publicly accessible internet site per §257.107(i)

### **9.3 Notice of Intent to Initiate Closure (§257.102(g))**

Westar will file a Notice of Intent of closure activities no later than the date of initiation of closure of the Landfill. The notification will include the certification by a registered professional engineer in the State of Kansas for the design of the final cover system as required by §257.102(d)(3)(iii).

If required, Westar may request an extension of an additional two years to initiate closure of the Landfill, and provide written documentation that the area will continue to accept waste or will start removing CCR material for the purpose of beneficial use. The documentation to extend the closure of an idle CCR unit must be supported by specific information specified in the CCR Rule. The factors that may support such a demonstration are not included in the current Plan at this time. If such an extension is needed in the future, the Plan will be amended to address this issue at a later date.



#### **9.4 Notice of Completion of Closure (§257.102(h))**

Westar will complete a Notice of Completion of closure activities within 30 (thirty) days of completion of closure of the Landfill. The notification will include the certification by a registered professional engineer as required by §257.102(f)(3).

#### **9.5 Deed Notation (§257.102(i))**

Per §257.102(i), a notation on the deed to the property that the land has been used as a CCR unit and its use is restricted under the post-closure care requirements provided within §257.104(d)(1)(iii). The following information will be recorded in accordance with the CCR Rule:

- The name and address of the person with knowledge of the contents of the Landfill
- The prior land use as a CCR unit
- The restrictions of future land use under the post-closure care requirements



## 10.0 CLOSURE COST ESTIMATE

The combined closure cost for the Landfill is estimated to be approximately \$678,953.33, as of October 2016. This includes preparing the Landfill for construction of the final cover, the cost of the actual final cover, the implementation of erosion control measures, and the reclamation costs. The maximum closure cost estimates when operating the Landfill can be found in **Appendix A**.

In providing these cost estimates, it is recognized that Westar does not have control over the costs of labor, equipment, or materials, or over a contractor's method(s) of determining prices or bidding.



**11.0 PROFESSIONAL ENGINEER CERTIFICATION (§257.102(d)(3)(iii)).**

The undersigned registered professional engineer is familiar with the requirements of §257.102 of the CCR Rule and has visited and examined TEC or has supervised examination of TEC by appropriately qualified personnel. The undersigned registered professional engineer attests that this CCR Plan has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and meets the requirements of §257.102, and that this Plan is adequate for TEC's facility. This certification was prepared as required by §257.102(d)(3)(iii).

Name of Professional Engineer: Richard Southorn

Company: CB&I

Signature: 

Date: 10/13/16

PE Registration State: Kansas

PE Registration Number: PE25201

Professional Engineer Seal:

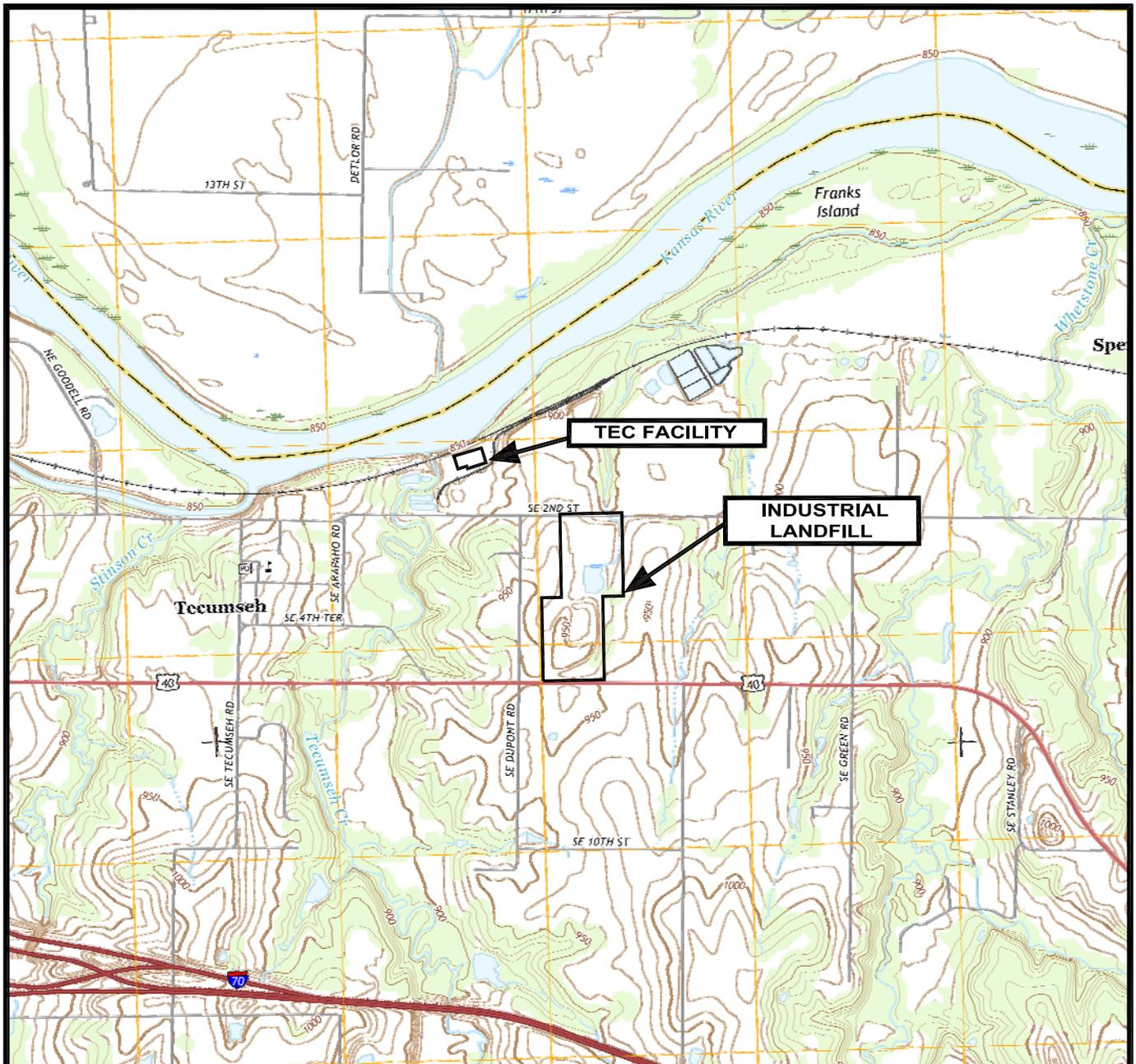


# FIGURES

Figure 1 – Tecumseh Landfill, Site Location Plan

Figure 2 – Tecumseh Landfill, Existing Site Topography

Figure 3 – Tecumseh Landfill, Permitted Final Landform



**LEGEND**

————— APPROXIMATE CCR UNIT BOUNDARY

**NOTES**

1. AERIAL TOPO OBTAINED FROM USGS 7.5-MINUTE SERIES, GRANTVILLE QUADRANGLE, KANSAS, 2014.
2. ALL BOUNDARIES ARE APPROXIMATE



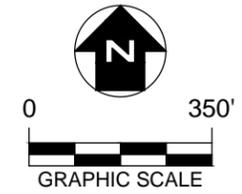
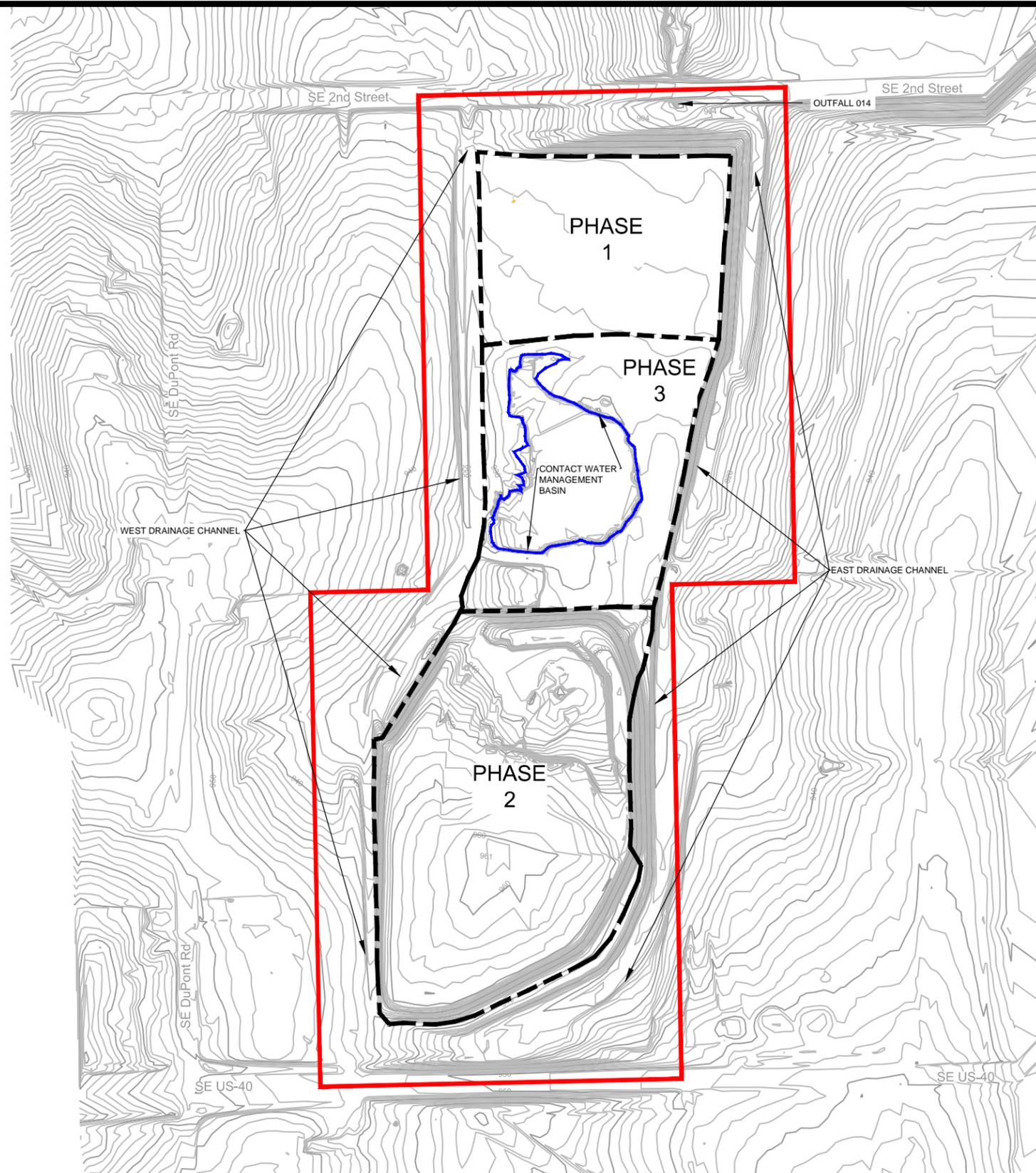
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**TECUMSEH ENERGY CENTER  
5636 SE 2nd ST., TECUMSEH, KS**

**FIGURE 1  
TECUMSEH LANDFILL  
SITE LOCATION PLAN**

APPROVED BY: MMS    PROJ. NO.: 631214397    DATE: OCTOBER 2016



**LEGEND**

- CCR UNIT BOUNDARY
- LANDFILL CELL BOUNDARY
- BERM STRUCTURE

**NOTES**

1. EXISTING CONTOURS DEVELOPED BY PROFESSIONAL ENGINEERING CONSULTANTS IN JUNE 2016.
2. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
3. CCR UNIT BOUNDARY IS APPROX. 57.3 ACRES.
4. ALL BOUNDARIES ARE APPROXIMATE.

REV. NO.	DATE	DESCRIPTION



**CB&I Environmental & Infrastructure, Inc.**

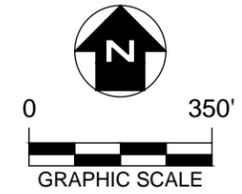
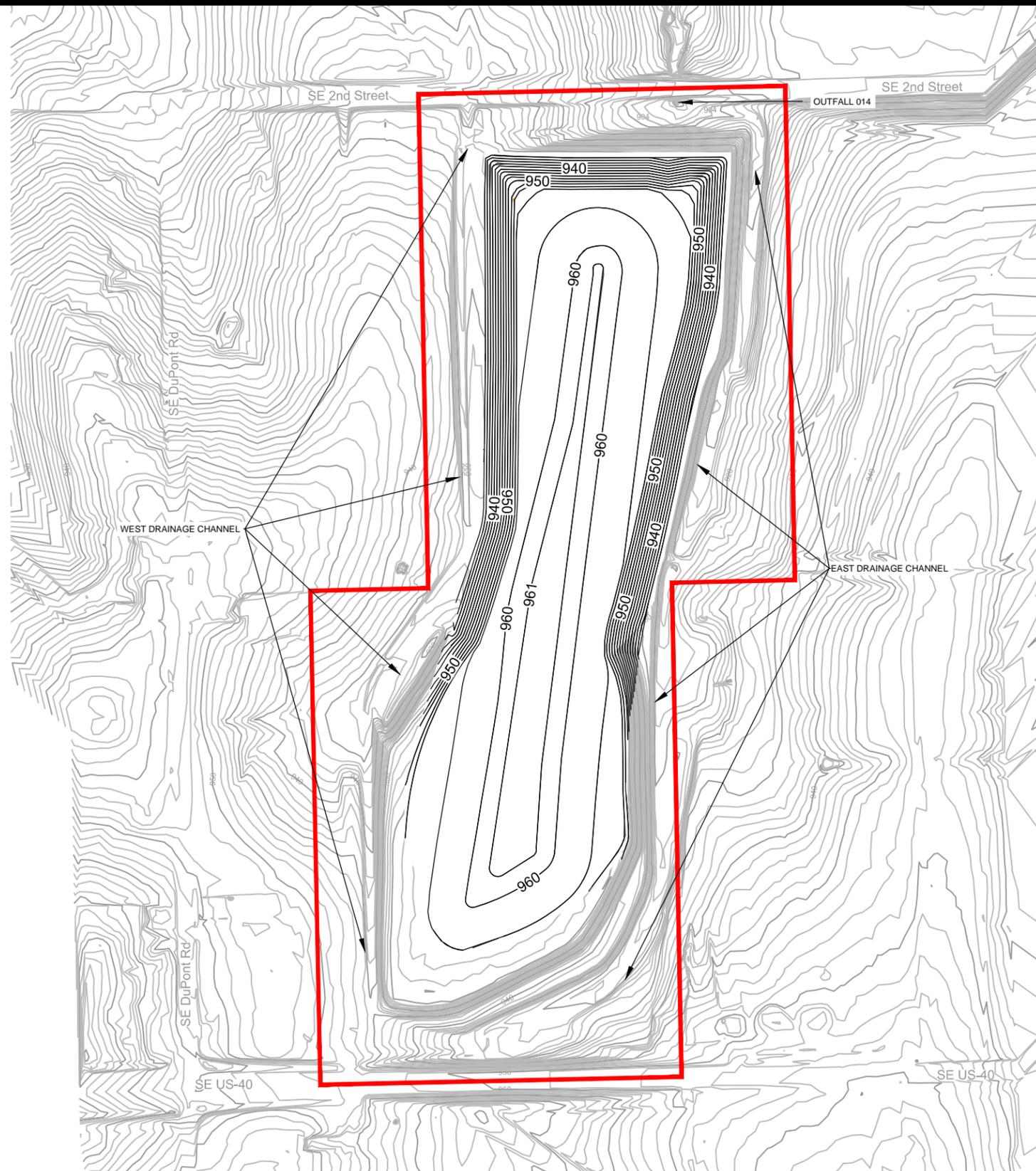
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**TECUMSEH ENERGY CENTER  
5636 SE 2nd ST., TECUMSEH, KANSAS**

**FIGURE 2  
TECUMSEH LANDFILL  
EXISTING SITE TOPOGRAPHY**

DRAWN BY: SJL APPROVED BY: MMS PROJ. NO.: 631214397 DATE: OCTOBER 2016

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**LEGEND**

- CCR UNIT BOUNDARY
- - - EXISTING SITE CONTOUR
- PROPOSED SITE CONTOUR

**NOTES**

1. EXISTING CONTOURS DEVELOPED BY PROFESSIONAL ENGINEERING CONSULTANTS IN JUNE 2016.
2. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
3. FINAL GRADES WERE TAKEN FROM KDHE-BWM INDUSTRIAL LANDFILL PERMIT NO. 0322.
4. ALL BOUNDARIES ARE APPROXIMATE.

REV. NO.	DATE	DESCRIPTION



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**TECUMSEH ENERGY CENTER  
5636 SE 2nd ST., TECUMSEH, KANSAS**

**FIGURE 3  
TECUMSEH LANDFILL  
PERMITTED FINAL LANDFORM**

DRAWN BY: SJL APPROVED BY: MMS PROJ. NO.: 631214397 DATE: OCTOBER 2016

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# APPENDICES

# APPENDIX A

## Closure Cost Estimate

# Landfill Closure - 2016 Annual Cost Estimate Worksheet - Kansas Department of Health & Environment

OWNER: <u>Westar Energy Inc.</u>	PERMIT No.: <u>322</u>
OPERATOR: <u>Westar Energy Inc.</u>	ESTIMATOR: <u>CB&amp;I Infrastructure and Environment on behalf of Westar Energy</u> DATE: <u>October2016</u>
TOTAL PERMITTED WASTE DISPOSAL <u>32</u> ACRES	Closure Plan Title: <u>Tecumseh Energy Center Landfill Closure</u> Last Revision Date: _____
TOTAL PERMITTED AREA CERTIFIED CLOSED: <u>9.6</u> ACRES	ACRES CURRENTLY OPEN: <u>22.4</u>
LARGEST ACREAGE REQUIRING FINAL COVER DURING THE RENEWAL PERIOD: <u>22.4</u>	
LANDFILL TYPE: _____ SUBTITLE D MUNICIPAL SOLID WASTE _____ SMALL ARID MUNICIPAL SOLID WASTE <u>X</u> INDUSTRIAL WASTE _____ CONSTRUCTION & DEMOLITION WASTE _____ WASTE TIRE MONOFILL _____	

## LANDFILL CLOSURE - 2016 ANNUAL COST ESTIMATE WORKSHEET

Permit No.: 322

	ITEM	QUANTITY	UNITS	UNIT COST	COST	SUBTOTALS	SOURCE OF UNIT COST INFO or NA
<b>1.0.0</b>	<b>PREPARING SITE FOR CONSTRUCTION OF FINAL COVER</b>						
<b>1.0.1</b>	Backfill below grade areas with structural backfill	18,000	CU. YD.	\$4.75	\$85,500.00		Dewater and fill Phase 3 pond (18,000 yd3) + - on-site material 102,565 yd3 available from pond area
<b>1.0.2</b>	Construct sump and install pump(s) for perpetual pumping	1	Lump Sum		\$0.00		NA
<b>1.0.3</b>	Other: Provide design and itemize	-	CU. YD.		\$0.00		
<b>1.0.4</b>	<b>Preparing Site for Construction of Final Cover Subtotal</b>					\$85,500.00	
<b>2.0.0</b>	<b>FINAL COVER</b>						
<b>2.0.1</b>	<b>Low Permeability Soil Layer</b>						
<b>2.0.2</b>	Complete soil contouring and grading for final cover	22.4	ACRE	\$1,310.00	\$29,344.00		Grade in-place material on current disposal such that cap will connect to certified closed area in Phase 3 (area taken from August 2013 Base Map by PEC), prep remainder of site for placement of final cover
<b>2.0.3</b>	Clay, On-Site (excavate, transport, place, compact) (Quantity must match earthwork balance and must be guaranteed for future availability)	54,160	CU. YD.	\$4.75	\$257,260.00		Clay required for open area - final cover 54,160 yd3 (18in fir 22.4 acres) Total Fill: Phase 1 - 17,908 yd <sup>3</sup> ; Phase 2 - 18,876 yd <sup>3</sup> ; Phase 3 - 17,376 yd <sup>3</sup>
<b>2.0.4</b>	Clay, Off-site (excavate, transport, place, compact) (Quantity must match earthwork balance)	-	CU. YD.	\$8.25	\$0.00		On-site borrow depleted, remainder to be brought in from off-site.
<b>2.0.5</b>	<b>Low Permeability Soil Layer Subtotal</b>					\$286,604.00	
<b>3.0.0</b>	<b>Geomembrane and Drainage Layer</b>						
<b>3.0.1</b>	Drainage material--sand		CU. YD.		\$0.00		NA - Not required in design.
<b>3.0.2</b>	Drainage material--geogrid		SQ. YD.		\$0.00		NA
<b>3.0.3</b>	Geomembrane		SQ. YD.		\$0.00		NA
<b>3.0.4</b>	<b>Geomembrane and Drainage Layer Subtotal</b>					\$0.00	
<b>4.0.0</b>	<b>Protective Soil and Vegetative Layer</b>						
<b>4.0.1</b>	Protective Soil, On-site (excavate, transport, place, compact) (Quantity must match earthwork balance and must be guaranteed for future availability)		CU. YD.		\$0.00		see vegetative soil
<b>4.0.2</b>	Protective Soil, Off-site (excavate, transport, place, compact) (Quantity must match earthwork balance)	0	CU. YD.	\$8.25	\$0.00		
<b>4.0.3</b>	Vegetative Soil (Topsoil), On-site (excavate, transport, place) (Quantity must match earthwork balance and must be guaranteed for future availability)	18,053	CU. YD.	\$4.75	\$85,751.75		6" erosion control layer/ vegetative soil for open area - off site soils will be utilized unless additional on-site soils are identified
<b>4.0.4</b>	Vegetative Soil (Topsoil), Off-site (excavate, transport, place) (Quantity must match earthwork balance)	-	CU. YD.	\$12.25	\$0.00		
<b>4.0.5</b>	Seeding and mulching	22.4	ACRE	\$1,200.00	\$26,880.00		Area disturbed from new placement of final cover (17.04 acres)
<b>4.0.6</b>	Fertilizer	22.4	ACRE	\$272.00	\$6,092.80		
<b>4.0.7</b>	<b>Protective Soil and Vegetative Layer Subtotal</b>					\$118,724.55	

<b>5.0.0</b>	<b>EROSION CONTROL</b>					
<b>5.0.1</b>	Terraces and letdowns	8000	Lin. FT.	\$1.00	\$8,000.00	Silt fence to minimize sediment loss from entire permitted area/ disturbed area (borrow site included).
<b>5.0.2</b>	Checkdams and filters		Lin. FT.		\$0.00	NA
<b>5.0.3</b>	Grass ditching/channels		Lin. FT.		\$0.00	NA
<b>5.0.4</b>	Riprap ditching/channels		Lin. FT.		\$0.00	NA
<b>5.0.5</b>	<b>Erosion Control Subtotal</b>				\$8,000.00	
<b>6.0.0</b>	<b>GAS SYSTEM</b>					
<b>6.0.1</b>	Gas vents, _____ # of vents, _____ average depth		Lin. FT.		\$0.00	None required.
<b>6.0.2</b>	<b>Passive System</b>					
<b>6.0.3</b>	Passive well head flare		EACH		\$0.00	NA
<b>6.0.4</b>	<b>Active System</b>					
<b>6.0.5</b>	Flare, ___ BTU/hour		EACH		\$0.00	NA
<b>6.0.6</b>	Additional Well Installation		EACH		\$0.00	NA
<b>6.0.7</b>	Ancillary gas equipment (piping, blowers, condensate collection)	1	Lump Sum		\$0.00	NA
<b>6.0.8</b>	<b>Gas System Subtotal</b>				\$0.00	
<b>7.0.0</b>	<b>GROUNDWATER MONITORING SYSTEM (applies to municipal solid waste, industrial, and some construction &amp; demolition landfills; see instructions)</b>					
<b>7.0.1</b>	Well installation		EACH		\$0.00	None
<b>7.0.2</b>	Abandon & plug wells		EACH		\$0.00	None
<b>7.0.3</b>	Upgrade or repair existing wells		EACH		\$0.00	None
<b>7.0.4</b>	Dedicated pump/sampling system installation/upgrade		EACH		\$0.00	None
<b>7.0.5</b>	Sample collection (2 events per year, _____ wells sampled per event)		EVENT		\$0.00	Included with Post-Closure Cost Estimate
<b>7.0.6</b>	Sample analysis and reporting (2 events per year, _____ wells sampled per event)		EVENT		\$0.00	Included with Post-Closure Cost Estimate
<b>7.0.7</b>	<b>Groundwater Monitoring System Subtotal</b>				\$0.00	
<b>8.0.0</b>	<b>LEACHATE COLLECTION SYSTEM</b>					
<b>8.0.1</b>	Additional/upgrades for collection piping		Lin. FT		\$0.00	NA
<b>8.0.2</b>	Additional/upgrades to pumps		EACH		\$0.00	NA
<b>8.0.3</b>	Additional/upgrades to storage containers		EACH		\$0.00	NA
<b>8.0.4</b>	Baseline sample collection		EACH		\$0.00	NA
<b>8.0.5</b>	Baseline sample analysis and reporting		EACH		\$0.00	NA
<b>8.0.6</b>	<b>Leachate Collection System Subtotal</b>				\$0.00	
<b>9.0.0</b>	<b>OPERATIONS AND INVENTORY REMOVAL</b>					
<b>9.0.1</b>	Excess solid waste		CU. YD.		\$0.00	NA
<b>9.0.2</b>	Mobile equipment/machinery (e.g., containers, tanks, etc...)	1	Lump Sum		\$0.00	NA
<b>9.0.3</b>	Stored leachate		GAL.		\$0.00	NA
<b>9.0.4</b>	Contaminated soils		CU. YD.		\$0.00	NA
<b>9.0.5</b>	<b>Operations and Inventory Removal Subtotal</b>				\$0.00	
<b>10.0.0</b>	<b>DEMOLITION/REMOVAL SITE IMPROVEMENTS</b>					
<b>10.0.1</b>	Office/shop/maintenance and other ancillary buildings	1	Lump Sum		\$0.00	NA - No buildings in vicinity of closure area
<b>10.0.2</b>	Equipment to be decommissioned (e.g., weigh scales, bulking/solidification pits, collection pits/sumps, piping, etc...)	1	Lump Sum		\$0.00	NA
<b>10.0.3</b>	Site Utilities	1	Lump Sum		\$0.00	NA
<b>10.0.4</b>	<b>Demolition/Removal Site Improvements Subtotal</b>				\$0.00	
<b>11.0.0</b>	<b>REPLACE/REBUILD SITE ACCESS CONTROLS</b>					
<b>11.0.1</b>	Fencing		Lin. FT.		\$0.00	NA
<b>11.0.2</b>	Gates		EACH		\$0.00	NA
<b>11.0.3</b>	Access barriers		EACH		\$0.00	NA
<b>11.0.4</b>	Other security equipment	1	Lump Sum		\$0.00	NA
<b>11.0.5</b>	<b>Replace/Rebuild Site Access Controls Subtotal</b>				\$0.00	
<b>12.0.0</b>	<b>BORROW AREA RECLAMATION</b>					
<b>12.0.1</b>	Grading and site preparation	1.2	ACRE	\$2,000.00	\$2,400.00	

12.0.2	Soil, On-site (excavate, transport, place, compact)		CU.YD.		\$0.00		
12.0.3	Soil, Off-site (excavate, transport, place, compact)		CU. YD.		\$0.00		
12.0.4	Seeding and mulching	1.2	ACRE	\$1,200.00	\$1,440.00		Area disturbed from excavating borrow material (1.2 acres)
12.0.5	Fertilizer	1.2	ACRE	\$272.00	\$326.40		Fertilizing disturbed area
12.0.6	<b>Borrow Area Reclamation Subtotal</b>					\$4,166.40	
13.0.0	<b>Closure Cost Subtotal</b>					\$502,994.95	
14.0.0	<b>PROFESSIONAL SERVICES [Closure cost subtotal (13.0.0) X 12% or enter costs provided by third party with sources listed in line items below]</b>						
14.0.1	Professional Services (12% of Closure Cost Subtotal)				\$60,359.39		
14.0.2	Topographic and Boundary Survey	1	Lump Sum	\$15,000.00	\$15,000.00		Topo survey of final cover placement area (Phase 2 and 3); assuming \$590 per acre for 17 acres.
14.0.3	Engineering (Design, Bid Documents, Procurement, Construction Contract Mangement)	1	Lump Sum		\$0.00		
14.0.4	Engineering Services, (Construction Oversight, Testing, Reporting, Certification)	1	Lump Sum		\$0.00		
14.0.5	<b>Professional Services Subtotal</b>					\$75,359.39	
15.0.0	<b>ADMINISTRATION AND CONTINGENCY</b>						
15.0.1	Administration Services (Closure Cost Subtotal [13.0.0] x 10%)				\$50,299.50		
15.0.2	Contingency (Closure Cost Subtotal [13.0.0] x 10%)				\$50,299.50		
15.0.3	<b>Administration and Contingency Subtotal</b>					\$100,598.99	
<b>(2016) TOTAL CURRENT CLOSURE COST</b>						<b>\$678,953.33</b>	
<b>(2017) TOTAL CURRENT CLOSURE COST</b>						<b>\$699,321.93</b>	<b>2016 Total Clouse Cost plus 3% per KDHE Guidance</b>

Estimator: Michelle Spruth on behalf of CB&I for Westar Energy

(Printed Name)

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(Signature)

Date: \_\_\_\_\_