Antidegradation Review: Cottonwood/Wilberg Mine

Energy West Mining Company

ANTIDEGRADATION REVIEW FORM
UTAH DIVISION OF WATER QUALITY

Instructions

The objective of antidegradation rules and policies is to protect existing high quality waters and set forth a process for determining where and how much degradation is allowable for socially and/or economically important reasons. In accordance with Utah Administrative Code (UAC R317-2-3), an antidegradation review (ADR) is a permit requirement for any project that will increase the level of pollutants in waters of the state. The rule outlines requirements for both Level I and Level II ADRs, as well as public comment procedures. This review form is intended to assist the applicant and Division of Water Quality (DWQ) staff in complying with the rule but is not a substitute for the complete rule in R317-2-3.5. Additional details can be found in the *Utah Antidegradation Implementation Guidance* and relevant sections of the guidance are cited in this review form.

ADRs should be among the first steps of an application for a UPDES permit because the review helps establish treatment expectations. The level of effort and amount of information required for the ADR depends on the nature of the project and the characteristics of the receiving water. To avoid unnecessary delays in permit issuance, the Division of Water Quality (DWQ) recommends that the process be initiated at least one year prior to the date a final approved permit is required.

DWQ will determine if the project will impair beneficial uses (Level I ADR) using information provided by the applicant and whether a Level II ADR is required. The applicant is responsible for conducting the Level II ADR. For the permit to be approved, the Level II ADR must document that all feasible measures have been undertaken to minimize pollution for socially, environmentally or economically beneficial projects resulting in an increase in pollution to waters of the state.

For permits requiring a Level II ADR, this antidegradation form must be completed and approved by DWQ before any UPDES permit can be issued. Typically, the ADR form is completed in an iterative manner in consultation with DWQ. The applicant should first complete the statement of social, environmental and economic importance (SEEI) in Part C and determine the parameters of concern (POC) in Part D. Once the POCs are agreed upon by DWQ, the alternatives analysis and selection of preferred alternative in Part E can be conducted based on minimizing degradation resulting from discharge of the POCs. Once the applicant and DWQ agree upon the preferred alternative, the review is considered complete, and the form must be signed, dated, and submitted to DWQ.

For additional clarification on the antidegradation review process and procedures, please contact Nicholas von Stackelberg (801-536-4374) or Jeff Ostermiller (801-536-4370).

Antidegradation Review Form

Part A: Applicant Information

Facility Name: Cottonwood/Wilberg Mine

Facility Owner: PacifiCorp, Energy West Mining Company

Facility Location: North of Hwy 29 (12 miles northwest of Orangeville)

Form Prepared By: CH2M HILL, 215 South State St, SLC, UT 84111

Outfall Number: 001, 003, 004 and 005

Receiving Water: Grimes Wash and Cottonwood Canyon Creek, tributaries to Cottonwood Creek

What Are the Designated Uses of the Receiving Water (R317-2-6)?
Domestic Water Supply: 1C
Recreation: 2B - Secondary Contact
Aquatic Life: 3A - Cold Water Aquatic Life
Agricultural Water Supply: 4
Great Salt Lake: None

Category of Receiving Water (R317-2-3.2, -3.3, and -3.4): Category ~~2~~ 1

UPDES Permit Number (if applicable): UT0022896

Effluent Flow Reviewed: 35 gpm
Typically, this should be the maximum daily discharge at the design capacity of the facility. Exceptions should be noted.

What is the application for? (check all that apply)

☐ A UPDES permit for a new facility, project, or outfall.

☐ A UPDES permit renewal with an expansion or modification of an existing wastewater treatment works.

☐ A UPDES permit renewal requiring limits for a pollutant not covered by the previous permit and/or an increase to existing permit limits.

☒ A UPDES permit renewal with no changes in facility operations.

Part B. Is a Level II ADR required?

This section of the form is intended to help applicants determine if a Level II ADR is required for specific permitted activities. In addition, the Executive Secretary may require a Level II ADR for an activity with the potential for major impact on the quality of waters of the state (R317-2-3.5a.1).

B1. The receiving water or downstream water is a Class 1C drinking water source.

☒ **Yes** A Level II ADR is required (Proceed to Part C of the Form)

☐ **No** (Proceed to Part B2 of the Form)

B2. The UPDES permit is new <u>or</u> is being renewed and the proposed effluent concentration and loading limits are higher than the concentration and loading limits in the previous permit and any previous antidegradation review(s).

☐ **Yes** (Proceed to Part B3 of the Form)

☐ **No** No Level II ADR is required and there is <u>no need to proceed further with review questions</u>.

B3. Will any pollutants use assimilative capacity of the receiving water, i.e. do the pollutant concentrations in the effluent exceed those in the receiving waters at critical conditions? For most pollutants, effluent concentrations that are higher than the ambient concentrations require an antidegradation review? For a few pollutants such as dissolved oxygen, an antidegradation review is required if the effluent concentrations are less than the ambient concentrations in the receiving water. (Section 3.3.3 of Implementation Guidance)

☐ **Yes** (Proceed to Part B4 of the Form)

☐ **No** No Level II ADR is required and there is <u>no need to proceed further with review questions</u>.

B4. Are water quality impacts of the proposed project temporary <u>and</u> limited (Section 3.3.4 of Implementation Guidance)? Proposed projects that will have temporary and limited effects on water quality can be exempted from a Level II ADR.

☐ **Yes** Identify the reasons used to justify this determination in Part B4.1 and proceed to Part G. No Level II ADR is required.

☒ **No** A Level II ADR is required (Proceed to Part C)

B4.1 Complete this question only if the applicant is requesting a Level II review exclusion for temporary <u>and</u> limited projects (see R317-2-3.5(b)(3) and R317-2-3.5(b)(4)). For projects requesting a temporary and limited exclusion please indicate the factor(s) used to justify this determination (check all that apply and provide details as appropriate) (Section 3.3.4 of Implementation Guidance):

☐ Water quality impacts will be temporary and related exclusively to sediment or turbidity and fish spawning will not be impaired.

Factors to be considered in determining whether water quality impacts will be temporary and limited:

a) The length of time during which water quality will be lowered: ☐
b) The percent change in ambient concentrations of pollutants: ☐
c) Pollutants affected: ☐
d) Likelihood for long-term water quality benefits: ☐
e) Potential for any residual long-term influences on existing uses: ☐
f) Impairment of fish spawning, survival and development of aquatic fauna excluding fish removal efforts: ☐

Additional justification, as needed: ☐

Level II ADR

Part C, D, E, and F of the form constitute the Level II ADR Review. The applicant must provide as much detail as necessary for DWQ to perform the antidegradation review. Questions are provided for the convenience of applicants; however, for more complex permits it may be more effective to provide the required information in a separate report. Applicants that prefer a separate report should record the report name here and proceed to Part G of the form.

Optional Report Name: *Antidegradation Review and Statement of Social, Environmental, and Economic Importance: Cottonwood/Wilberg Mine*

Part C. Is the degradation from the project socially and economically necessary to accommodate important social or economic development in the area in which the waters are located?

The applicant must provide as much detail as necessary for DWQ to concur that the project is socially and economically necessary when answering the questions in this section. More information is available in Section 6.2 of the Implementation Guidance.

C1. Describe the social and economic benefits that would be realized through the proposed project, including the number and nature of jobs created and anticipated tax revenues.

See Attachment A

C2. Describe any environmental benefits to be realized through implementation of the proposed project.

See Attachment A

C3. Describe any social and economic losses that may result from the project, including impacts to recreation or commercial development.

See Attachment A

C4. Summarize any supporting information from the affected communities on preserving assimilative capacity to support future growth and development.

See Attachment A

C5. Please describe any structures or equipment associated with the project that will be placed within or adjacent to the receiving water.

See Attachment A

Part D. Identify and rank (from increasing to decreasing potential threat to designated uses) the parameters of concern. *Parameters of concern are parameters in the effluent at concentrations greater than ambient concentrations in the receiving water. The applicant is responsible for identifying parameter concentrations in the effluent and DWQ will provide parameter concentrations for the receiving water. More information is available in Section 3.3.3 of the Implementation Guidance.*

Parameters of Concern:

Rank	Pollutant	Ambient Concentration	Effluent Concentration
1	Total suspended solids	56 mg/L	3 mg/L (outfall 001)
2	Total dissolved solids	292 mg/L	749 mg/L (001)
3	Iron	0.01 mg/L dissolved	0.03 mg/L (001)
4	Cadmium	Non-detect	0.004 mg/L (001)
5			

Pollutants Evaluated that are not Considered Parameters of Concern:

Pollutant	Ambient Concentration	Effluent Concentration	Justification
Oil and grease	No data	Non-detect	Not detected in historical monitoring
Arsenic, copper, chromium, lead, mercury, nickel, selenium, and zinc	See Attachment A	See Attachment A	Effluent is non-detect or below ambient concentrations

Part E. Alternative Analysis Requirements of a Level II Antidegradation Review. *Level II ADRs require the applicant to determine whether there are feasible less-degrading alternatives to the proposed project. More information is available in Section 5.5 and 5.6 of the Implementation Guidance.*

E1. The UPDES permit is being renewed without any changes to flow or concentrations. Alternative treatment and discharge options including changes to operations and maintenance were considered and compared to the current processes. No economically feasible treatment or discharge alternatives were identified that were not previously considered for any previous antidegradation review(s).

☐ **Yes** (Proceed to Part F)

☒ **No or Does Not Apply** (Proceed to E2)

E2. Attach as an appendix to this form a report that describes the following factors for all alternative treatment options (see 1) a technical description of the treatment process, including construction costs and continued operation and maintenance expenses, 2) the mass and concentration of discharge constituents, and 3) a description of the reliability of the system, including the frequency where recurring operation and maintenance may lead to temporary increases in discharged pollutants. Most of this information is typically available from a Facility Plan, if available.

Report Name: *Antidegradation Review and Statement of Social, Environmental, and Economic Importance: Cottonwood/Wilberg Mine*

E3. Describe the proposed method and cost of the baseline treatment alternative. The baseline treatment alternative is the minimum treatment required to meet water quality based effluent limits (WQBEL) as determined by the preliminary or final wasteload analysis (WLA) and any secondary or categorical effluent limits.

E4. Were any of the following alternatives feasible and affordable?

Alternative	Feasible	Reason Not Feasible/Affordable
Pollutant Trading	Yes	
Water Recycling/Reuse	No	Mine uses no water
Land Application	No	Suitable land is not available near the mine
Connection to Other Facilities	No	No treatment capacity or suitable processes are available
Upgrade to Existing Facility	Yes	
Total Containment	Yes	
Improved O&M of Existing Systems	No	Mine drain is passive system
Seasonal or Controlled Discharge	No	Mine operation requires year round discharge
New Construction	Yes	
No Discharge	No	Mine operation requires water discharge

E5. From the applicant's perspective, what is the preferred treatment option?

Outfall 001 in-mine sedimentation

E6. Is the preferred option also the least polluting feasible alternative?

☐ **Yes**

☒ **No**

If no, what were less degrading feasible alternative(s)? See Attachment A

If no, provide a summary of the justification for not selecting the least polluting feasible alternative and if appropriate, provide a more detailed justification as an attachment.

See Attachment A

Part F. Optional Information

F1. Does the applicant want to conduct optional public review(s) in addition to the mandatory public review? Level II ADRs are public noticed for a thirty day comment period. More information is available in Section 3.7.1 of the Implementation Guidance.

☒ **No**

☐ **Yes**

F2. Does the project include an optional mitigation plan to compensate for the proposed water quality degradation?

☒ **No**

☐ **Yes**

Report Name: ☐

Part G. Certification of Antidegradation Review

G1. Applicant Certification

The form should be signed by the same responsible person who signed the accompanying permit application or certification.

Based on my inquiry of the person(s) who manage the system or those persons directly responsible for gathering the information, the information in this form and associated documents is, to the best of my knowledge and belief, true, accurate, and complete.

Print Name: Rick Poulson

Signature: [signature]

Date: 11-15-2013

G2. DWQ Approval

To the best of my knowledge, the ADR was conducted in accordance with the rules and regulations outlined in UAC R-317-2-3.

Water Quality Management Section

Print Name: NICHOLAS VON STACKELBERG

Signature: [signature]

Date: 11/19/13

Errata sheet for ADR Application Form
Cottonwood/Wilberg Mine

1. Page 1 – Designated Uses of the Receiving Water

   Cottonwood Canyon Creek

   Domestic Water Supply: 1C

   Recreation: 2B – Secondary Contact

   Aquatic Life: 3A – Cold Waster Aquatic Life

   Agricultural Water Supply: 4

   Great Salt Lake: None

   Grimes Wash

   Domestic Water Supply: None

   Recreation: 2B – Secondary Contact

   Aquatic Life: 3C – Non-game Fish

   Agricultural Water Supply: 4

   Great Salt Lake: None

2. Response to Item E.3 – See Attachment A

Attachment A

Antidegradation Review and Statement of Social, Environmental, and Economic Importance: Cottonwood/Wilberg Mine

Prepared for

Utah Division of Water Quality on behalf of Energy West Mining Company

November 2013

Prepared by

CH2MHILL.

215 South State Street, Suite 1000
Salt Lake City, Utah 84111

Attachment A

Antidegradation Review and Statement of Social, Environmental, and Economic Importance: Cottonwood/Wilberg Mine

Submitted to

Utah Division of Water Quality on behalf of Energy West Mining Company

November 2013

CH2MHILL.

Contents

Tables

Appendix

Acronyms and Abbreviations

μg/L	microgram per liter
ADR	antidegradation review
C&D	construction and demolition
CFR	*Code of Federal Regulations*
CWA	Clean Water Act
EPA	U.S. Environmental Protection Agency
ft^3	cubic feet
kW	kilowatt
lb/d	pound per day
lb/yr	pound per year
lb-eq/yr	pound equivalent per year
LS	lump sum
mg/L	milligram per liter
mgd	million gallons per day
MW	megawatt
NAAQS	National Ambient Air Quality Standards
O&M	operation and maintenance
POC	parameter of concern
POTW	publicly owned treatment works
RO	reverse osmosis
SEEI	Social, Environmental, and Economic Importance
TDS	total dissolved solids
TRC	total residual chlorine
TSS	total suspended solids
TWF	toxic weighting factor
UAC	Utah Administrative Code
UDWQ	Utah Division of Water Quality
UPDES	Utah Pollutant Discharge Elimination System
ZLD	zero liquid discharge

1.0 Introduction and Purpose

Energy West Mining Company (Energy West), a subsidiary of PacifiCorp, owns the Cottonwood/Wilberg Mine, located about 12 miles northwest of Orangeville in Emery County, Utah. Since mining was suspended in 2001, the mine portals have been sealed and there has been no mining activity or personnel on site.

Energy West has a Utah Pollution Discharge Elimination System (UPDES) permit to discharge to Grimes Wash and Cottonwood Canyon Creek, from its Cottonwood/Wilberg Mine. UPDES Permit Number UT0022896 was renewed to PacifiCorp – Energy West Mining Company in 2007 and expired on November 30, 2012. PacifiCorp's application for reissuance was submitted in a timely manner in early 2012, by its wholly-owned subsidiary Energy West Mining Company. Energy West anticipates reissuance activity by the Utah Division of Water Quality (DWQ) in 2013.

In accordance with UAC R317-2-3, an antidegradation review (ADR) is a permit requirement for any project that will increase the level of pollutants in waters of the State. It is considered one of the first steps in obtaining a new or revised UPDES permit. In this case, Energy West does not anticipate such an increase for its upcoming permit reissuance. However, Cottonwood Creek is classified as a 1C water body, and DWQ requested that Energy West prepare a Level II evaluation for use during the permitting process. The Outfall 001 discharge enters a Category 1 segment of Cottonwood Canyon Creek. Outfall 003 discharges to a Category 1 segment of Grimes Wash since the stream segment is within the U.S. Forest Service boundary. However, the Outfall 001 discharge is a grandfathered flow, since the outfall was permitted in 1978 and existed before the rule establishing Category 1 waters was promulgated in February 1994. Outfall 003 was permitted in the fall of 1980 and is also grandfathered. The discharge monitoring report for Outfall 001 for the period April 1, 1978 to July 1, 1978, and Outfall 003 for the period October 1, 1978 to December 31, 1980, was submitted to DWQ with the Parameter of Concern memorandum, dated January 17, 2013, to document that the outfalls were permitted before February 1994. Outfall 005 has never discharged and the discharge point is outside the Forest Service boundary.

A Level II ADR review is intended to review the permitted discharge to ensure that the project is both economically and socially important to local and regional communities and that feasible treatment alternatives have been analyzed. This *Antidegradation Review and Statement of Social, Environmental, and Economic Importance: Cottonwood/Wilberg Mine* (Attachment A) is intended to supplement the information being provided by Energy West in the Level II ADR application. Specifically, it identifies the parameters of concern (POCs) for the mine effluent, identifies and analyzes feasible treatment alternatives, and provides a justification for the determination that the facility is socially and economically necessary for the local and regional communities.

2.0 Project Description

2.1 Site and Facility Description

The Cottonwood/Wilberg Mine is located in Emery County, about 12 miles northwest of Orangeville, Utah. The Cottonwood/Wilberg Mine acted as a transfer station for the coal produced from the adjacent Trail Mountain Mine. Coal was transferred via beltline through the Cottonwood/Wilberg Mine to the surface loading facilities. The coal was loaded onto trucks and hauled to the Hunter Power Plant where it was used to produce electricity. This mine was idled in 2001. This mine encompasses approximately 6,800 acres with a combination of fee, federal, and state leases.

The UPDES permit for the Cottonwood/Wilberg Mine authorizes discharge from four outfalls: 1) Outfall 001 is a discharge of groundwater from a sealed mine portal into the Cottonwood Canyon Creek drainage, 2) Outfall 003 is a discharge to Grimes Wash from the sediment pond which treats surface runoff from the mine site, 3) Outfall 004 is a minor groundwater seep in Miller Canyon to the Cottonwood Canyon Creek drainage (this outfall has been eliminated and will not be included in the reissued permit), and 4) Outfall 005 is the discharge from a waste rock sedimentation pond to Grimes Wash. Outfalls 003, 004 and 005 did not discharge during the previous permit term. The outfalls discharge to either Grimes Wash or Cottonwood Canyon Creek upstream of their confluence with Cottonwood Creek. Grimes Wash and Cottonwood Canyon Creek above the mine outfalls are both ephemeral streams. The effluent from outfall 001 discharges to Cottonwood Canyon Creek, where it percolates into the ground before reaching any downstream water. The sediment pond outfalls (003 and 005) have not discharged during the last 5 years and are not expected to discharge in the foreseeable future.

Water quality characteristics of the discharges relative to background quality in Cottonwood Canyon Creek and Cottonwood Creek are lower quality due to their total dissolved solids concentration. The mines in the coal fields of the Wasatch Plateau tend to act as interceptor drains. However, the groundwater that is brought to the surface has a lower dissolved solids content than would have occurred were the water to continue its downward movement through the shale layers, dissolving increased amounts of salt with distance (Danielson, 1981)[1]. Because Outfall 001 contains elevated TDS, it has been determined[2] that degradation of Cottonwood Canyon Creek water quality could occur with continued discharge, and therefore that this POC analysis and subsequent ADR should focus on water quality in Cottonwood Canyon Creek and Cottonwood Creek and the discharge from Outfall 001.

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[1] Danielson, T.W., Remillard, M.D., Fuller, R.H., Hydrology of the Coal Resource Areas in the Upper Drainages of Huntington and Cottonwood Creeks, Central Utah, U.S. Geological Survey Water Resource Investigations, Open-file Report 81-539.

[2] This was determined in the September 13, 2012 ADR meeting between Energy West and DWQ in DWQ's Salt Lake City office.

3.0 Identification of the Parameters of Concern

As per Utah Administrative Code (UAC) R317-2.3.5, both Level I and Level II anti-degradation reviews (ADRs) are to be conducted on a "parameter-by-parameter basis." An important component of the ADR process is for the applicant and the Utah Division of Water Quality (UDWQ) to agree on the parameters of concern (POCs) for a wastewater discharge. The following technical memorandum provides a list of the parameters that were considered as potential POCs for the Cottonwood/Wilberg Mine and the screening process that was used to select the POCs for the Cottonwood/Wilberg Mine ADR analysis.

3.1.1 Selection of Potential POCs

Section 4.0 of the *Utah Antidegradation Reviews: Implementation Guidance, Version 1.1* (dated May 2012) (*ADR Implementation Guidance*) provides six considerations that should be addressed when an applicant is considering what pollutants to consider as potential POCs. The primary source of pollutants that must be considered is the list of priority pollutants provided in the EPA Form 2C – Application for Permit to Discharge Wastewater. Based on the nature of operations at underground coal mines such as Cottonwood/Wilberg Mine, the facility has the potential to discharge priority pollutants in its effluent. Applicable technology based standards for Coal Mining-Alkaline Mine Drainage are found in 40 CFR 434 Subpart D, and establish effluent limits for pH, total iron, and total suspended solids (TSS). These parameters have been included in the list of potential POCs to be considered for the Cottonwood/Wilberg Mine ADR analysis. In addition to using the list of priority pollutants, the *ADR Implementation Guidance* also recommends that the following factors be considered when selecting pollutants to screen as potential POCs:

1. *Are there any parameters in the effluent or expected to be in the effluent that exceed ambient concentrations in the receiving water?* Ambient water quality data for Cottonwood Creek upstream of the confluence with Grimes Wash that was collected within the past 10 years was reviewed. These data are compared to Cottonwood/Wilberg Mine effluent data in Table 3-1. Since the mine is inactive, historical data were used for Outfall 001 and 003. Metals data for the mine potable water supply, which was supplied by the mine water discharged through Outfall 001, was also reviewed and compared to data for Cottonwood Creek.

2. *Is the parameter/pollutant already included in an existing UPDES permit?* The existing Cottonwood/Wilberg Mine UPDES permit contains limits for the following parameters for Outfalls 001, 003, 004, and 005:

    - pH, total iron, oil & grease, total suspended solids (TSS), and total dissolved solids (TDS).

3. *Are parameter concentrations and/or loads exceeding or projected to exceed the current permitted load or design basis?* Wastewater effluent from the Cottonwood/Wilberg Mine is not expected to exceed the current permit limits. No increases in plant capacity are planned for the permit duration.

4. *Are there any parameters that are considered to be important by UDWQ or the general public? For instance, nutrients or bioaccumulative compounds?* To Energy West's knowledge, there are no parameters/pollutants that have been identified as "important" through public comment or other public input forums for discharges to Cottonwood Creek. TDS is a POC under the Colorado River Salinity Control Forum.
5. *Are there any parameters in the effluent that are known to potentially degrade the beneficial uses of the receiving water?* Yes, there are several parameters potentially in the Cottonwood/Wilberg Mine effluent discharge that have the potential to degrade the existing beneficial uses of Cottonwood Creek, including TSS and TDS. However, the discharge to Cottonwood Canyon Creek percolates into the ground before reaching Cottonwood Creek. Groundwater drained from the mine also has a lower TDS concentration than would occur were the water to continue down through the shale layers and eventually discharge to the surface.
6. *Is the receiving water listed as impaired for any parameters?* No.

Based on the above-referenced considerations, the following list of preliminary parameters/pollutants was established as potential POCs for further consideration in the Cottonwood/Wilberg Mine ADR analysis:

1) Total Suspended Solids
2) Totals Dissolved Solids
3) Oil & Grease
4) Iron
5) pH
6) Temperature
7) Metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn)

3.1.2 Selection of Final POCs for ADR Analysis

The criteria listed in Section 3.1 of the *ADR Implementation Guidance* are used to screen the large number of potential parameters/pollutants that may be present in the facility's wastewater effluent to develop a preliminary list of potential POCs that must be considered for the Cottonwood/Wilberg Mine ADR analysis. To select the final POCs to be incorporated into the Cottonwood/Wilberg Mine ADR analysis from the list of potential parameters listed above, Section 4.0 of the *ADR Implementation Guidance* indicates that "only parameters in the discharge effluent that exceed, or potentially exceed, ambient concentrations [in the receiving water body] should be considered".

Table 3-1 below provides a summary of the preliminary list of POCs that were considered and whether or not each potential POC was selected as a final POC for the Cottonwood/Wilberg Mine ADR analysis. The final POCs identified in Table 3-1 will be used to aid in the selection of effluent treatment and discharge alternatives that will be analyzed in detail in the final ADR analysis. In addition, the POCs will also be used by UDWQ as a factor in evaluating the potential effects on Cottonwood Canyon Creek and Cottonwood Creek from the discharge and in their renewal of the UPDES permit for the facility.

TABLE 3-1
Summary of Final POCs for the Cottonwood/Wilberg Mine ADR Analysis
Energy West Cottonwood/Wilberg Mine

Potential POC Being Considered	Cottonwood Creek above Grimes Wash (average 2002 – 2008)[1]	Grimes Wash above Mine (average 2008—2012)[2]	Cottonwood Canyon Creek, 1 mile above Outfall 001 (Average 2007-2012)[2]	Outfall 001 – Mine Discharge (average 2008 – 2012)	Outfall 003 – Sedimentation Pond Discharge (average 1977 – 2001)	Final Parameter of Concern (Yes/No)	Rationale
1. Total Suspended Solids (mg/L)	56[3]	34	19	3	20	**Yes**	Current permit limit
2. Total Dissolved Solids (mg/L)	292	490	547	749	1960	**Yes**	Current permit limit
3. Oil & Grease (mg/L)	No data[4]	Non-detect	Non-detect	No visible sheen	No visible sheen	No	Not detected by historical effluent monitoring.
4. pH (s.u.)	6.6 – 8.8	8.3 – 8.5	7.6 – 8.5	7.0 – 7.6	7.6 – 8.6	No	Effluent within permit limits and meet WQ criteria
5. Iron, Total (mg/L)	0.010[5]	0.52	0.31	0.03	0.29	**Yes**	Current permit limit
6. Temperature (C)	9.8	17.7	12.3	11.3	6.3	No	Temperature lower than upstream segment temperature
7 Arsenic (mg/L)	Non-detect[6]	No data[4]	<0.01	<0.002[9]	No data[4]	No	Not detected
8 Cadmium (mg/L)	Non-detect[6]	No data[4]	<0.001	0.004[9]	No data[4]	**Yes**	Above ambient
9 Chromium (mg/L)	0.006	No data[4]	No data[4]	<0.006[9]	No data[4]	No	Not detected
10 Copper (mg/L)	<0.0012[7]	No data[4]	<0.01	<0.009[9]	No data[4]	No	Not detected
11 Lead (mg/L)	Non-detect[6]		<0.01	<0.0025[9]	No data[4]	No	Not detected
12 Mercury (mg/L)	Non-detect[6]	No data[4]	No data[4]	<0.00008[9]	No data[4]	No	Not detected

TABLE 3-1
Summary of Final POCs for the Cottonwood/Wilberg Mine ADR Analysis
Energy West Cottonwood/Wilberg Mine

Potential POC Being Considered	Cottonwood Creek above Grimes Wash (average 2002 – 2008)[1]	Grimes Wash above Mine (average 2008—2012)[2]	Cottonwood Canyon Creek, 1 mile above Outfall 001 (Average 2007-2012)[2]	Outfall 001 – Mine Discharge (average 2008 – 2012)	Outfall 003 – Sedimentation Pond Discharge (average 1977 – 2001)	Final Parameter of Concern (Yes/No)	Rationale
13 Nickel (mg/L)	Non-detect[6]	No data[4]	No data[4]	<0.019[9]	No data[4]	No	Not detected
14 Selenium (mg/L)	Non-detect[6]	No data[4]	No data[4]	<0.0027[9]	No data[4]	No	Not detected
15 Zinc (mg/L)	<0.017[8]	No data[4]	0.004	No data[4]	No data[4]	No	No data

1. Utah DWQ Station ID 4930950 (sampling location is at the Utah Highway 57 bridge and Cottonwood Creek.)
2. Energy West surface water monitoring location
3. Average of reported values for 7 samples and half of the estimated reporting limit (0.5 x 4 mg/L) for 9 samples.
4. No monitoring data within the last 10 years.
5. Results reported as dissolved iron. Average of reported values for 2 samples, and half of the estimated reporting limit (0.5 x 5 µg/L) for 4 samples.
6. Results reported as dissolved metals and no reporting limit was provided.
7. One result of 0.0012 mg/L dissolved copper and five non-detect samples with no reporting limit provided.
8. One results of 0.017 mg/L dissolved zinc and five non-detect samples with no reporting limit provided.
9. Data for mine potable water supply (2000-2001).

4.0 Alternatives Analysis

Energy West has submitted a request to renew the UPDES permit for the Cottonwood/Wilberg Mine. The existing UPDES permit includes four discharge points, Outfalls 001, 003, 004 and 005. Outfall 001 is a discharge of groundwater from a sealed mine portal into the Cottonwood Canyon Creek drainage. Outfall 003 is a discharge to Grimes Wash from the sediment pond which treats surface runoff from the mine site. Outfall 004 is a minor groundwater seep in Miller Canyon to the Cottonwood Canyon Creek drainage (this outfall has been eliminated and will not be included in the reissued permit). Outfall 005 is the discharge from a waste rock sedimentation pond to Grimes Wash. Outfalls 003, 004 and 005 have not discharged during the 2007 renewed permit. The alternatives analysis considered only Outfall 001.

The intent of this section is to evaluate whether there are any reasonable nondegrading or less degrading alternatives when compared with the discharge alternative for handling of water from the Cottonwood/Wilberg Mine. The section provides an initial screening of potential alternatives based on their feasibility followed by a detailed screening of those alternatives deemed feasible based on their total financial costs, pollution/POC reduction, and performance based on several criteria, including reliability, operability, maintainability, sustainability, and adaptability to future regulatory changes. The analysis is followed by identification of Energy West's preferred treatment alternative and the justification for selection of that treatment alternative.

4.1 Initial Screening of Alternatives

The requirements found in UAC R317-2-3.5 stipulate the following alternatives should be considered, evaluated, and implemented to the extent feasible:

a) Innovative or alternative treatment options

b) More effective treatment options or higher treatment levels

c) Connection to other wastewater treatment facilities

d) Process changes or product or raw material substitution

e) Seasonal or controlled discharge options to minimize discharging during critical water quality periods

f) Pollutant trading

g) Water conservation

h) Water recycle and reuse

i) Alternative discharge locations or alternative receiving water bodies

j) Land application

k) Total containment

l) Improved operation and maintenance (O&M) of existing treatment systems

m) Other appropriate alternatives

Section 5.2 of the Implementation Guidance indicates that the feasibility of all treatment alternatives should be examined before the alternatives are included for further consideration as part of the ADR analysis. Based on this requirement, many of the alternatives listed in UAC R317-2-3.5 can be excluded from further consideration as part of this ADR analysis based on their impracticality or inability to be implemented at the Cottonwood/Wilberg Mine. The following are treatment alternatives from the above list that are excluded from further consideration along with the justifications for exclusion:

- **Alternative B – Higher treatment levels**: Ion exchange and reverse osmosis are demonstrated treatment processes for removing TDS from effluent. However, these processes concentrate the salt ions into a reverse osmosis membrane reject stream or an ion exchange resin regeneration brine, and do not reduce the mass of TDS requiring discharge to surface or disposal by other methods. Due the cost and complexity of managing reject and regeneration wastes, higher level treatment processes were not considered further.
- **Alternative C—Connection to other wastewater treatment facilities:** The Castle Valley Special Service District operates a sanitary wastewater treatment facility near Castle Dale, UT, which is the only wastewater treatment works facility located in proximity to the Cottonwood/Wilberg Mine. The District's treatment system does not have the capacity or the treatment technology to effectively handle the wastewater flow.
- **Alternative D—Process changes or product or raw material substitution:** The Cottonwood/Wilberg Mine is an underground coal mine. Outfall 001 is required to manage groundwater discharges from the sealed mine. Outfalls 003 and 005 are required to manage surface runoff from the mine site.
- **Alternative E—Seasonal or controlled discharge options:** Water cannot be stored within the mine. Year-round discharges are required to maintain the mine portal seal.
- **Alternative F—Pollutant trading:** The discharge is located within the Colorado River basin, and is subject to the Colorado River Basin Salinity Control Forum's policies for TDS. The Forum policy allows permitting authorities to allow industrial sources of salinity to conduct or finance salinity offset projects. Purchasing salinity offsets is a potential alternative to reduce the TDS discharge from the facility to <1 ton per day (tpd). However, Outfall 001 is the only discharge from the facility since 2007, and its TDS load is below the 1 tpd salinity credit threshold. Salinity credits are not available for the Cottonwood/Wilberg Mine.
- **Alternative G—Water conservation:** The mine is inactive and does not use water. The discharges result from surface runoff and groundwater intercepted by the underground mine workings. Neither source of discharge is controllable. There are no practical options for further water conservation at the mine.

- **Alternative I—Use of alternative discharge locations or alternative receiving water bodies:** The only receiving water body in proximity to the Cottonwood/Wilberg Mine is Grimes Wash and Cottonwood Canyon Creek.
- **Alternative J—Land application:** The facility is located in a relatively narrow canyon and property suitable for an effluent storage pond and land application sprays fields is not available.
- **Alternative L—Improved operation and maintenance of existing treatment systems:** Not applicable. Outfall 001 relies on in-mine sedimentation pools to remove TSS and iron, and does not have the capability to remove TDS.

After excluding these treatment alternatives deemed infeasible from further consideration, the following alternatives listed in UAC R317-2-3.5 are being carried forward for further analysis as part of this ADR:

Outfall 001 – Mine Discharge

- **Baseline Alternative for Comparison Purposes (hereafter referred to as Alternative 1):** The existing in-mine sedimentation is the baseline alternative for comparison and evaluation of feasible treatment alternatives.
- **Alternative A – Alternative treatment option (hereafter referred to as Alternative 2):** Enhanced alumina adsorption is carried forward for evaluation as an alternative to the existing in-mine sedimentation.
- **Alternative K—Total containment (hereafter referred to as Alternative 3):** Options for total containment include an evaporation pond, deep well injection, and thermal evaporation using a mechanical concentrator and crystallizer. However, the construction of holding or evaporation ponds or other containment structures would require about 80 acres of suitable, undeveloped land to operate effectively. Based on the rugged topography surrounding the mine site and limited undeveloped areas with moderate slopes, total containment using evaporation ponds is not considered for the Cottonwood/Wilberg Mine.

  Total containment using deep well injection is used at some locations to dispose of effluent streams. However, the geology and hydrogeology is not well known at the depth and area of interest for the Cottonwood/Wilberg Mine site, and the risks associated with siting, permitting, and drilling a successful well are high. The cost of installing an injection well is difficult to determine, but an estimate for drilling the injection well and associated monitoring well is $600,000 or more. Well completion and injection pumps would increase the capital cost to over $2 million. Total containment using an injection well is not considered for the Cottonwood/Wilberg Mine.

  A mechanical concentrator and crystallizer treatment system is being carried forward for evaluation as an alternative to the existing sedimentation pond

As mentioned previously, these three alternatives will be analyzed and compared in detail in Section 4.2 based on several criteria, including the following:

- Construction and O&M costs

- Ability to minimize degradation and increase pollutant reduction
- Several performance criteria, including reliability, maintainability, operability, sustainability, and adaptability

4.2 Detailed Analysis of Feasible Alternatives Outfall 001

4.2.1 Alternative 1 – Existing In-Mine Sedimentation

Sedimentation within the mine is used to remove iron and TSS from groundwater intercepted by the mine before discharge via Outfall 001. Energy West strategically selects abandoned mine workings to provide adequate storage volume to achieve a minimum retention time to allow for the settling of solids particles in intercepted groundwater. Collected groundwater is typically retained in the abandoned mine workings for at least 24 hours. This time frame allows suspended sediment to settle prior to discharging to the surface drainage. Flow is by gravity and exits a sealed portal in Cottonwood Canyon.

Alternative 1—Expected Pollutant Removal

Table 4-1 presents the estimated POC removal by the sedimentation within the mine. Some POCs have been weighted to reflect that their removal from the effluent is more critical than other POCs. The relative weight of each POC was determined using EPA toxic weighting factors (TWFs). In the majority of cases, TWFs are derived from both chronic freshwater aquatic criteria and human health criteria for consumption of fish. A higher TWF indicates a more toxic pollutant and thus a higher POC weight.

TABLE 4-1
Estimated Pollutant Removal by Outfall 001 Alternative 1 – In-Mine Sedimentation
Energy West Cottonwood/Wilberg Mine

Parameter	Influent (mg/L)	Influent (lb/d)	Effluent (mg/L)	Effluent (lb/d)	Removal (lb/yr)	Removal	TWF	Removal (lb-eq/yr)
TSS	25	11	3	1.3	3,375	88%	-	-
TDS	749	315	749	315	0	0%	-	-
Iron	1	0.4	0.03	0.01	149	97%	0.0056	0.8
Cadmium	0.004	0.002	0.004	0.002	0	0%	2.6	0

NOTES:
lb/d = pound per day
lb/yr = pound per year
lb-eq/yr = equivalent toxics removal; mass removal in lb/yr multiplied by the toxic weighting factor (TWF)
mg/L = milligram per liter
Influent TSS = 25 mg/L and influent iron = 1 mg/L are engineering estimates.(In-mine influent has not been sampled for results listed)
Mass loads are based on an average flow of 50,400 gallons per day.
Toxic weighting factors from EPA-HQ-OW-2004-0032-0853.

Alternative 1—Cost Analysis

Mine drainage flows by gravity through underground workings completed during mining activities. The effluent monitoring station was the primary additional capital expense for the mine drainage to Outfall 001 and had an estimated cost of $15,000. The primary operating cost of the in-mine sedimentation is routine monitoring. The estimated annualized cost of in-mine sedimentation is approximately $10,000/year.

4.2.2 Alternative 2 – Enhanced Alumina Adsorption

The Outfall 001 TSS and iron concentrations are lower than the permit limits and also lower than the effluent quality provided by media filtration and iron oxidation and filtration processes. Therefore, additional treatment for TSS and iron removal was not considered. Enhanced alumina adsorption is proposed to reduce the effluent cadmium concentration. Enhanced alumina adsorption use proprietary media that bonds trace metals to its active sites and removes the constituent from the effluent. An adsorption system includes the following equipment:

- Influent pumps
- Enhanced alumina adsorption vessels
- Backwash holding tank

The adsorption system would be installed at the outlet of the existing mine discharge. A skid-mounted pressure vessel system with integral controls is possible, and would need to be installed in a building to provide freeze protection.

Alternative 2—Expected Pollutant Removal

Table 4-2 presents the estimated POC removal provided by enhanced alumina adsorption.

TABLE 4-2
Estimated Pollutant Removal by Outfall 001 Alternative 2 – Enhanced Alumina Adsorption
Energy West Cottonwood/Wilberg Mine

Parameter	Influent (mg/L)	Influent (lb/d)	Effluent (mg/L)	Effluent (lb/d)	Removal (lb/yr)	Removal	TWF	Removal (lb-eq/yr)
TSS	25	11	3	1.3	3,375	88%	-	-
TDS	749	315	749	315	0	0%	-	-
Iron	1	0.4	0.03	0.01	149	97%	0.0056	0.8
Cadmium	0.004	0.002	0.001	0.0004	0.5	75%	2.6	1.2

NOTES:
lb/d = pound per day
lb/yr = pound per year
lb-eq/yr = equivalent toxics removal; mass removal in lb/yr multiplied by the toxic weighting factor (TWF)
mg/L = milligram per liter
Influent TSS = 25 mg/L and influent iron = 1 mg/L are engineering estimates. (In-mine influent has not been sampled for results listed)
Mass loads are based on an average flow of 50,400 gallons per day.
Toxic weighting factors from EPA-HQ-OW-2004-0032-0853.

Enhanced alumina adsorption is used in industrial wastewater treatment systems and is effective for cadmium and other metals removal and meeting effluent limits. However, enhanced alumina will not remove TDS. With proper maintenance and operator training, the reliability of a adsorption system is high.

Alternative 2—Cost Analysis

The estimated total installed cost for an effluent enhanced alumina adsorption system is $630,000. The treatment system is sized to a flow of 35 gpm. The cost estimate worksheet is presented in the Appendix. Table 4-3 presents the estimated annual O&M costs and annualized capital cost for the adsorption alternative.

TABLE 4-3
Total Annualized Cost for Outfall 001 Alternative 2—Enhanced Alumina Adsorption
Energy West Cottonwood/Wilberg Mine

Item	Quantity	Cost
Labor	832 hours/year	$41,600
Laboratory analysis	LS	$3,000
Electricity	10 kW	$4,400
Maintenance	3% of equipment cost	$2,900
Media replacement and disposal	7,000 lb/yr	$35,400
Annual Total O&M Cost		**$87,300**
Cost of capital	$630,000 at 7% over 20 years	$59,500
Total Annualized Cost		**$146,800**

NOTES:
kW = kilowatt
LS = lump sum

4.2.3 Alternative 3: Total Containment

Total containment can be provided using a system consisting of media filtration pretreatment, reverse osmosis (RO) to concentrate the wastewater and evaporative crystallization of the RO concentrate. This process is a zero liquid discharge (ZLD) system; water is recovered for reuse or discharged, and salt is dried. The RO permeate and condensate from the crystallizer can be returned to the process. Salt cake is disposed of in an offsite landfill.

The following processes are included in the ZLD system:

- Influent pumps
- Granular media pressure filters
- Reverse osmosis system
- Chemical feed systems
- Membrane clean-in-place systems
- Mechanical recompression brine crystallizer
- Salt cake filter press
- Brine equalization tank

The cost estimate in the Appendix presents the size or capacity of major equipment.

Alternative 3—Expected Pollutant Removal

Table 4-4 presents the estimated POC removal provided by a ZLD system. A ZLD system provides the highest level of treatment and eliminates the liquid discharge from the facility. However, a ZLD system is a complex treatment system and has significantly higher capital and operating costs than other treatment options. In addition, the ZLD system requires a significant amount of power for operation and steam for start-up. The ZLD unit processes are reliable, and the processes are currently used at other mines and electric generating facilities to manage high TDS streams. Zero liquid discharge systems are typically used when no surface water bodies are available to accept an effluent discharge.

TABLE 4-4
Estimated Pollutant Removal by Outfall 001 Alternative 3 – Zero Liquid Discharge
Energy West Cottonwood/Wilberg Mine

Parameter	Influent (mg/L)	Influent (lb/d)	Effluent (mg/L)	Effluent (lb/d)	Removal (lb/yr)	Removal	TWF	Removal (lb-eq/yr)
TSS	25	11	0	0	3,836	100%	0	0
TDS	749	315	25	11	111,078	97%	0	0
Iron	1	0.4	0	0	153	100%	0.0056	0.9
Cadmium	0.004	0.002	0	0	0.6	100%	2.6	1.6

NOTES:
lb/d = pound per day
lb/yr = pound per year
lb-eq/yr = equivalent toxics removal; mass removal in lb/yr multiplied by the toxic weighting factor (TWF)
mg/L = milligram per liter
Influent TSS = 25 mg/L and influent iron = 1 mg/L are engineering estimates. (In-mine influent has not been sampled for results listed)
Mass loads are based on an average flow of 50,400 gallons per day.
Toxic weighting factors from EPA-HQ-OW-2004-0032-0853.

Alternative 3—Cost Analysis

The estimated total installed cost for a ZLD system is $7,600,000. The treatment system is sized to a flow of 35 gpm. The cost estimate worksheet is presented in the Appendix. Table 4-5 presents the estimated annual O&M costs and annualized capital cost for this alternative.

TABLE 4-5
Total Annualized Cost for Outfall 001 Alternative 3—Zero Liquid Discharge
Energy West Cottonwood/Wilberg Mine

Item	Quantity	Cost
Labor	4,380 hours/year	$219,000
Laboratory analysis	LS	$25,000
Electricity	120 kW	$52,600
Maintenance	3% of equipment cost	$48,200
Membrane Replacement	Escrow for 5 yr membrane life	$16.500
Chemicals	LS	$7,000
Solids disposal	1460 tons/year	$5,200
Annual Total O&M Cost		**$373,500**
Cost of capital	$7,600,000 at 7% over 20 years	$714,550
Total Annualized Cost		**$1,088,050**

4.3 Cost of Achieving Effluent Reduction

To evaluate the cost effectiveness of treatment technologies, the EPA considers the cost per pound of toxic pollutant removed from effluent. Equivalent pounds of toxic pollutant are determined by multiplying the actual or estimated pounds removed by a toxic weighting factor (TWF). The equivalent pounds of pollutant removed are presented in the previous discussion of each treatment alternative. Once the equivalent pounds of pollutant removed have been determined, the incremental cost effectiveness of an option can be calculated as the incremental annual cost of the alternative divided by the incremental pounds-equivalent removed by that alternative as compared to the base case. TDS and TSS are also a POC selected for the ADR evaluation, and do not have an established TWF. Therefore, the treatment effectiveness was also evaluated based on the total mass removal for TDS and TSS.

Conceptual level unit process sizing and equipment selection was completed to support preparation of order-of-magnitude cost estimates for each treatment alternative. The cost estimates presented in Section 4.2 are considered Class 5 estimates as defined by the Association for the Advancement of Cost Engineering, with actual costs not more than 100 percent or less than 50 percent of the estimated total value. Actual project costs will depend on the selected project scope, actual labor and material costs, competitive market conditions, actual site conditions, productivity, schedule, and other variables. As a result, the costs for these treatment alternatives will vary from the estimates prepared, within the stated accuracy range.

4.3.1 Outfall 001 Cost Effectiveness

Table 4-6 presents a summary of the cost effectiveness evaluation for the three treatment alternatives described for Outfall 001. In developing categorical treatment standards for the metal product and machinery industries, the EPA compared the selected technologies by comparing their cost-per-pound equivalents with those of the previous industrial categories (EPA, 2000). These cost-effectiveness factors for the effluent limitation guidelines in various industrial categories are presented in the Appendix, converted from 1999 dollars to 2013 dollars, using the Construction Cost Index from *Engineering News-Record*. For comparison, the cost effectiveness used to select treatment technologies ranges from less than $3 per pound equivalent to $1097 per pound equivalent in 2013 dollars.

TABLE 4-6
Outfall 001 Cost Effectiveness
Energy West Cottonwood/Wilberg Mine

	Alt 1 – In-Mine Sedimentation Pool	Alt 2 – Enhanced Alumina Adsorption	Alt 3 - ZLD
Capital Cost	$15,000	$630,000	$7,600,000
O&M ($/yr)	$10,000	$97,300	$373,500
Total annualized Cost ($/yr)	$11,400	$156,800	$1,088,050
Incremental annualized cost ($/yr)	$11,400	$145,400	$1,076,650
Removal (lb-eq/yr)	0.8	2.0	2.5
Incremental removal (lb-eq/yr)	0.8	1.2	1.7
Cost effectiveness ($/lb-eq removed)	$14,250	$121,167	$6,334,324
TDS Removal (tpy)	0	0	56
TDS Cost Effectiveness ($/ton TDS)	-	-	$19,226
TSS Removal (tpy)	1.69	1.69	1.92
Incremental TSS Removal (tpy)	1.69	0	0.23
TSS Cost Effectiveness ($/ton TSS)	$6.745	--	$4,681.087

NOTES:
Incremental annualized cost and incremental removal are a comparison to the in-mine sedimentation alternative.

Table 4-6 presents the estimated cost-effectiveness for each of the treatment technologies reviewed in this report for POC removal from Outfall 001. By this analysis, the existing sedimentation within the mine has the lowest annualized cost and is the most cost effective based on the cost per pound of toxic equivalents removed. The toxic equivalent removal cost effectiveness of the other alternatives is higher by a factor of 10 to 50. The cost effectiveness for each alternative on a pound equivalent basis is also significantly higher than the range established by EPA, due to the low mass of toxic equivalents discharged by the outfall.

The cost effectiveness of TDS removal was also reviewed. Only alternative 3 includes provisions to reduce TDS discharges the receiving water. The incremental capital cost and annual operating and maintenance cost a ZLD system is $7.6 million and $1.1 million per year, respectively. The incremental annualized cost for TDS removal is 9,400 percent (ZLD) higher than Alternative 1. The total annual cost for TDS removal in Alternative 3 is $19,226 per ton of TDS. Alternative 3 (ZLD) would remove approximately 0.23 tpy of TSS from the discharge, with an incremental cost of over $4 million per ton of TSS. TSS removal in the current in-mine sedimentation pool is the most cost effective option for suspended solids.

As demonstrated, providing additional treatment to remove POCs provides limited improvement in the effluent quality and has a high incremental annual cost. The current in-mine sedimentation alternative more than meets the State's guidance for cost-effective treatment and is the recommended treatment approach for the Cottonwood/Wilberg Mine Outfall 001 based on costs considerations.

4.4 Performance Criteria Analysis

Table 4-7 presents a comparison of the three Outfall 001 treatment alternatives based on a series of performance criteria. These criteria were equally weighted to determine the overall performance of each alternative.

TABLE 4-7
Comparison of Outfall 001 Alternatives Using Performance Criteria
Energy West Cottonwood/Wilberg Mine

Performance Criterion	Alt 1 – In-Mine Sedimentation	Alt 2 – Alumina Adsorption	Alt 3 – ZLD
Reliability	High	Medium	High
Maintainability	High	High	Low
Operability	High	Medium	Low
Sustainability	High	Medium	Low
Adaptability	Low	Medium	High
Overall Performance	**High**	**Medium/High**	**Low/Medium**

NOTES:
High = more favorable
Low = less favorable

The reliability for the existing in-mine sedimentation system will be high with proper O&M practices. The maintainability and operability of the in-mine sedimentation alternative is considered more favorable because the alternative includes the least equipment and require the lowest amount of operator attention. A ZLD system will have the most equipment and involve the most complex unit processes and due to this is rated low (less attractive) for maintainability and operability.

The in-mine sedimentation process is a simple system and is integral to the mine portal closure. It requires no electrical power and is rated more favorably for sustainability. The ZLD system has high chemical and energy usage, and is rated low for sustainability. ZLD will also require a larger site footprint and generate solids requiring offsite disposal. Although the ZLD does produce water suitable for reuse, the significant energy use by the ZLD process determined the low rating.

As for adaptability to future regulatory changes, sedimentation will require additional treatment processes to address POCs beyond TSS, iron, and TDS, and is rated low for adaptability to future permit conditions. A ZLD system eliminates the wastewater discharge entirely and would not be affected by future limits or regulatory changes, resulting in the highest rating of the three alternatives for adaptability.

4.5 Preferred Treatment Alternative

Based on the preceding analysis, Energy West's preferred alternatives remains in-mine sedimentation for Outfall 001 which is the current process at the Cottonwood/Wilberg Mine.

Outfall 001

Based on the comparison of the three treatment alternatives for Outfall 001 against the performance criteria, Alternative 1, in-mine sedimentation, is rated as more favorable than the three other alternatives in overall performance—particularly in reliability, maintainability, operability, and sustainability. The incremental cost of the treatment options is 1,275 (enhanced alumina adsorption) to 9,400 percent (ZLD) higher than the operating cost of the existing in-mine sedimentation system. The incremental cost of the enhanced alumina and ZLD treatment options exceeds the 20% threshold established by Utah regulation. Given that Alternative 1 is the most cost-effective alternative, Alternative 1 (in-mine sedimentation) is the recommended treatment alternative for Outfall 001 at the Cottonwood/Wilberg Mine.

5.0 Statement of Social, Environmental, and Economic Importance

The requirement for applicants to complete a Statement of Social, Environmental, and Economic Importance (SEEI) originates in the *Code of Federal Regulations*, Chapter 40, Part 131.12(a)(2) [40 CFR 40.131.12(a)(2)]. It requires applicants to demonstrate that allowing lower water quality is necessary to accommodate social or economic development in the area in which the waters to be degraded are located. In UAC R317-2-3.5(c)(4), the State of Utah defines the minimum information that an applicant must provide to demonstrate that degradation is necessary, which includes the following:

- Impacts on employment
- Increases in production
- Improved community tax base
- Impacts on housing
- Correction of an environmental or public health problem

In addition, the Implementation Guidance further clarifies these minimum considerations as well as further considerations that should be included in an applicant's SEEI analysis, including the following:

- Effects on public and social services, including the identification of public or social services that would be provided to the community or required of the community in the affected area as well as effects on health/nursing care, police/fire protection, infrastructure, housing, and public education

- Effects on public health and safety, including any health and safety services that will be provided or required in the affected areas as well as identification of potential project benefits that will enhance food or drinking water quality, control disease vectors, or improve air quality, industrial hygiene, occupational health, and public safety

- Effects on quality of life of residents of affected area, including educational, cultural, and recreational opportunities, daily life experience (in regards to dust, noise, traffic, etc.), and aesthetics (views cape)

- Effects on employment and tax revenues in the affected areas

- Effects on tourism, including the creation or enhancement of tourist attractions or impacts resulting from elimination or reduction of existing tourist attractions

- The pros and cons of preserving assimilative capacity for future industry and development in the affected areas (which is to include the approval/disapproval of local communities for the proposed project)

The purpose of this section is to provide an SEEI that addresses the requirements provided in state and federal regulations as well as the recommendations provided in the ADR

Implementation Guidance in an effort to demonstrate that potential degradation, however minor, of Cottonwood Creek from the Cottonwood/Wilberg Mine operations is necessary to accommodate economic and social development.

5.1 Description of Affected Communities

Cottonwood/Wilberg Mine is located in Emery County, Utah approximately 12 miles northwest of Orangeville, Utah. The 2011 population of Orangeville was 1,471 residents (www.city-data.com/city/Orangeville-Utah.html). The 2009 median household income was $36,969. In August 2012, the unemployment rate within incorporated areas of Orangeville was 7.5 percent (www.city-data.com/city/Orangeville-Utah.html).

Orangeville was established along Cottonwood Creek, which continues to supply irrigation water to the community. Agriculture and mining have been a large part of Orangeville's history and the local economy continues to reflect the trends of these industries.

5.2 Effects on Community Resources from Cottonwood/Wilberg Mine

The Cottonwood/Wilberg Mine has been in temporary cessation since 2001 and no employees are located at the mine site. Energy West continues to make property tax and lease payments for the site. The discharge is a result of legacy mining activities that were socially and economically important at that time, and need to occur to maintain the option to restart operations in the future, which would have social and economic importance.

Coal mining has occurred in the area for over 60 years and is an established part of Emery County. Future operation of the mine is not expected to require additional community services, place additional infrastructure and education demands on the community, or consume assimilative capacity in Cottonwood Creek that is needed for other projects. Future workforce requirements can be supported by Orangeville and other nearby communities, and would be an economic benefit for the communities. Future operation of the mine is not expected to impact existing area tourism activities.

6.0 References

Orangeville, Utah, (UT84528) Profile, www.city-data.com/city/Orangeville-Utah.html, Accessed July 8, 2013.

U.S. Environmental Protection Agency (EPA). 2000. *Cost-Effectiveness Analysis of Proposed Effluent Limitations Guidelines and Standards for the Metal Products and Machinery Industry*. EPA-821-B-00-007. Washington, D.C.

APPENDIX

Cost Worksheets for Treatment Alternatives

Order-of-magnitude Level Construction Cost Estimate
Cottonwood/Wilber Mine Outfall 001 Sorption Media

Item	Design Criteria	Quantity	Basis	Cost per Unit	Estimated Cost
Influent pumps	35 gpm x 75 ft TDH, VFDs	2	Prior experience	$1,000	2,000
Media Adsorption Vessels	3-ft diam CS vessels	4	Prior experience	$20,000	80,000
Filter Backwash Holding Tank	7500 gals CS API 650	1	Prior experience	$2.00 per gallon	15,000
Total Equipment Cost (TEC)					$97,000
Freight and Taxes		10%	of TEC		10,000
Equipment Delivery Adjustment: Schedule		0%	of TEC		0
Equipment Delivery Adjustment: Location		0%	of TEC		0
Purchased Equipment Cost - Delivered (PEC-D)					$107,000
Equipment Installation (a)		30%	of PEC-D		32,000
Piping		25%	of PEC-D		27,000
Heat Tracing and Insulation		10%	of PEC-D		11,000
Instrumentation and Controls		15%	of PEC-D		16,000
Electrical		18%	of PEC-D		19,000
Buildings		0%	of PEC-D		0
Yard Improvements (b)		5%	of PEC-D		5,000
Service Facilities (c)		5%	of PEC-D		5,000
Subtotal					$222,000
Other Direct Costs:					
Filter Building	20 ft x 25 ft Pre-Egr Building	500	Prior Experience	$125 per sq ft	62,500
Adsorption Media		7000		$5 per lb	35,000
Total Direct Costs (TDC)					$319,500
Engineering (d)	excludes geotech and speciality services	10%	of TDC		32,000
Other Indirect Costs (e)		10%	of PEC-D		11,000
Total Direct + Indirect Costs (TD+I)					$362,500
Contractor's Fee		10%	of TD+I		40,000
Contingency (f)		25%	of TD+I		90,000
Total Construction Cost (TCC)					$492,500
Bond/Insurance		2%	of TCC		$10,000
Owners Costs		10%	of TCC		$50,000
Pilot Testing		LS			$25,000
Services During Construction		6%	of TCC		30,000
O&M Manual/Startup Plan		2%	of TCC		10,000
Startup Expenses (g)		2%	of TCC		10,000
Escalation	no escalation included	0.0%			0
Total Estimated Cost (h)					**$630,000**
Annualized Cost of Capital	7% over 20 years				$59,468

(a) Includes costs for labor, foundations, supports, platforms, construction expenses, and other factors directly related to the erection of purchased equipment.
(b) Includes fencing, grading, roads, sidewalks, and similar items.
(c) Includes required improvements to steam, water, compressed air, waste disposal, fire protection, and other plant services.
(d) Engineering costs include process design, detailed design, basic specifications/data sheets.
(e) Includes temporary construction and operations, construction tools and rental, home office personnel in field, field payroll, travel and living expenses, taxes and insurance, startup materials and labor, and overhead.
(f) Does not include scope contingency.
(g) Includes preparation of startup plan and O&M plan, and startup of facilities. Analytical costs are not included.
(h) This cost estimate has been prepared for guidance in project evaluation and implementation and was based on information available at the time that the estimate was prepared. Final costs for the project, and the project's resulting feasibility will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, implementation schedule, and other variable factors. As a result, the final project cost will vary from the estimate prepared. Because of these factors, project feasibility, benefit/cost ratios, risks, and funding needs must be carefully reviewed before making specific financial decisions or establishing project budgets in order to help ensure proper project evaluation and adequate funding.

Note: Factors from Plant Design and Economics for Chemical Engineers, Fourth Edition, M.S.Peters

Annual O&M Costs

		Quantity		Unit Rate	Total
Labor	16 hr/wk	832	hr/yr	$50 per hr	41,600
Laboratory analysis		1		LS	3,000
Electricity		10	kW	$0.05 per kWhr	4,400
Media replacement		7000	lbs	$5.00 per lb	35,000
Spent media disposal	assume non-hazardous	4.2	tons	$100 per ton	400
Maintenance	3% of total equipment costs	$97,000		3%	2,900
Total					$87,300

Order-of-magnitude Level Construction Cost Estimate
Cottonwood/Wilberg Mine Outfall 001 Zero Liquid Discharge (RO/Brine Crystalizer)

Item	Design Criteria	Quantity	Basis	Cost per Unit	Estimated Cost
Influent pumps	35 gpm x 75 ft TDH, VFDs	2	Prior experience	$10,000	20,000
RO Feed Tank	5000 gals CS API 650	1	Prior experience	$2.50 per gallon	12,500
RO Feed Pumps	35 gpm @900 psi, 30 hp	2	Prior experience	$1000 per hp	60,000
Media Filter Vessels	3-ft diam CS vessels	3	Prior experience	$20,000	60,000
Filter Backwash Holding Tank	5000 gals CS API 650	1	Prior experience	$2.00 per gallon	10,000
RO Cartridge Filter Skid	FRP housing, 3 @ 50%	1	Prior experience	$10,000	10,000
RO Skid	35 gpm skid, 3x2x1 array	2	Prior experience	$100,000	200,000
RO Acid Feed System	1000 gal tank w/ pump skid	1	Prior experience	$30,000	30,000
RO Anti-scale Feed	vendor package	1	Prior experience	$10,000	10,000
CIP System	vendor package	1	Prior experience	$50,000	50,000
Brine Crystallizer	3.5 gpm avg, 0.75% TDS feed	1	Prior experience	$1,000,000	1,000,000
Brine Diversion Tank	Rubber lined carbon steel, 50,000 gal	1	Prior experience	$2.00 per gallon	100,000
Soda Ash Feed System	Bulk bag feed system	1	prior experience	$25,000	25,000
Distillate Storage Tank	Stainless steel, 5,000 gals	1	prior experience	$4.00 per gallon	20,000
Total Equipment Cost (TEC)					$1,607,500
Freight and Taxes		10%	of TEC		161,000
Equipment Delivery Adjustment: Schedule		0%	of TEC		0
Equipment Delivery Adjustment: Location		0%	of TEC		0
Purchased Equipment Cost - Delivered (PEC-D)					$1,768,500
Equipment Installation (a)		30%	of PEC-D		531,000
Piping		20%	of PEC-D		354,000
Heat Tracing and Insulation		5%	of PEC-D		88,000
Instrumentation and Controls		15%	of PEC-D		265,000
Electrical		18%	of PEC-D		318,000
Buildings		0%	of PEC-D		0
Yard Improvements (b)		5%	of PEC-D		88,000
Service Facilities (c)		5%	of PEC-D		88,000
Subtotal					$3,500,500
Other Direct Costs:					
Membrane Building	40 ft x 50 ft Pre-Egr Building	2000	Prior Experience	$125 per sq ft	250,000
Total Direct Costs (TDC)					$3,750,500
Engineering (d)	excludes geotech and speciality services	10%	of TDC		375,000
Other Indirect Costs (e)		10%	of PEC-D		177,000
Total Direct + Indirect Costs (TD+I)					$4,302,500
Contractor's Fee		10%	of TD+I		430,000
Contingency (f)		25%	of TD+I		1,080,000
Total Construction Cost (TCC)					$5,812,500
Bond/Insurance		2%	of TCC		$120,000
Owners Costs		10%	of TCC		$580,000
Pilot Testing		LS			$500,000
Services During Construction		6%	of TCC		320,000
O&M Manual/Startup Plan		2%	of TCC		120,000
Startup Expenses (g)		2%	of TCC		120,000
Escalation	no escalation included	0.0%			0
Total Estimated Cost (h)					$7,570,000
Annualized Cost of Capital	7% over 20 years				$714,554

(a) Includes costs for labor, foundations, supports, platforms, construction expenses, and other factors directly related to the erection of purchased equipment.
(b) Includes fencing, grading, roads, sidewalks, and similar items.
(c) Includes required improvements to steam, water, compressed air, waste disposal, fire protection, and other plant services.
(d) Engineering costs include process design, detailed design, basic specifications/data sheets.
(e) Includes temporary construction and operations, construction tools and rental, home office personnel in field, field payroll, travel and living expenses, taxes and insurance, startup materials and labor, and overhead.
(f) Does not include scope contingency.
(g) Includes preparation of startup plan and O&M plan, and startup of facilities. Analytical costs are not included.
(h) This cost estimate has been prepared for guidance in project evaluation and implementation and was based on information available at the time that the estimate was prepared. Final costs for the project, and the project's resulting feasibility will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, implementation schedule, and other variable factors. As a result, the final project cost will vary from the estimate prepared. Because of these factors, project feasibility, benefit/cost ratios, risks, and funding needs must be carefully reviewed before making specific financial decisions or establishing project budgets in order to help ensure proper project evaluation and adequate funding.

Note: Factors from Plant Design and Economics for Chemical Engineers, Fourth Edition, M.S.Peters

Annual O&M Costs

		Quantity	Unit Rate	Total
Labor	12 hr/d, 7 d/wk	4380 hr/yr	$50 per hr	219,000
Laboratory analysis		1	LS	25,000
Electricity		120 kW	$0.05 per kWhr	52,600
Maintenance	3% of total equipment costs	1607500	3%	48,200
Citric Acid	membrane cleaning	1.5 ton/yr	$2500 per ton	3,800
Scale Inhibitor	2.5 ppm dose	1 lb/d	$2.20 per lb	800
Sodium EDTA	membrane cleaning	0.5 ton/yr	$1250 per ton	600
Sulfuric acid	20 ppm dose	8 lb/d	$0.08 per lb	200
Sodium hydroxide	membrane cleaning	1 ton/yr	$800 per ton	400
Antifoam	20 ppm dose	2 lb/d	$2.20 per lb	1,200
Solids disposal	85% solids cake from crystalizer	0.19 ton/day	$75 per ton	5,200
Total				$357,000
RO membrane replacement	5 yr replacement cycle	30	550	$16,500

APPENDIX
Summary of Cost-effectiveness Factors for Various Categorical Standard Effluent Guidelines
Energy West Deer Creek Mine

Industry	Cost-effectiveness ($/lb-Equivalent Removed)	
	1999$	2013$
Aluminum Forming	208	328
Battery Manufacturing	3	5
Can Making	17	27
Centralized Waste Treatment	9–12	14-19
Coastal Oil and Gas		
- Produced Water	5	8
- Drilling Waste	503	793
- Treatment, workover, and completion fluids	344	542
Coil Coating	84	132
Copper Forming	46	73
Electronics I	696	1097
Foundries	145	229
Inorganic Chemicals I	<2	<3
Inorganic Chemicals II	10	16
Iron and Steel	3	5
Metal Finishing	21	33
Nonferrous Metals Forming	118	186
Nonferrous Metals Manufacturing I	7	11
Nonferrous Metals Manufacturing II	10	16
Offshore Oil and Gas	57	90
Organic Chemicals, Plastics	9	14
Pesticide Manufacturing (1993)	26	41
Pharmaceuticals	2	3
Porcelain Enameling	10	16
Pulp and Paper	67	106
Transportation Equipment Cleaners	554	873

NOTES:

Cost effectiveness factors takes from United States Environmental Protection Agency (USEPA). 2000. *Cost-Effectiveness Analysis of Proposed Effluent Limitations Guidelines and Standards for the Metal Products and Machinery Industry.* EPA-821-B-00-007. Washington, D.C.

Cost effectiveness factors for the effluent limitation guidelines in various industrial categories were converted from 1999 dollars to February 2012 dollars, using the Construction Cost Index (CCI) from the *Engineering News-Record.* 1999 CCI = 6059 and July 2013 CCI = 9552.