BRAZIL MILLSITE

Brownfield to Brightfield Renewable Energy Engineering Design Project

U.S. EPA Hard Rock Mining Conference 2012: Advancing Solutions for a New Legacy

April 3 - 5, 2012

CLEAR CREEK WATERSHED FOUNDATION

advancing watershed sustainability

CLEAR CREEK WATERSHED FOUNDATION HISTORY

1983—Clear Creek/Central City Superfund Study Area designated

1990—Clear Creek Watershed Forum established, creating a "culture of cooperation"

1991—Upper Clear Creek Watershed Association (UCCWA) formed

1995—Clear Creek Watershed Advisory Group (WAG) formed

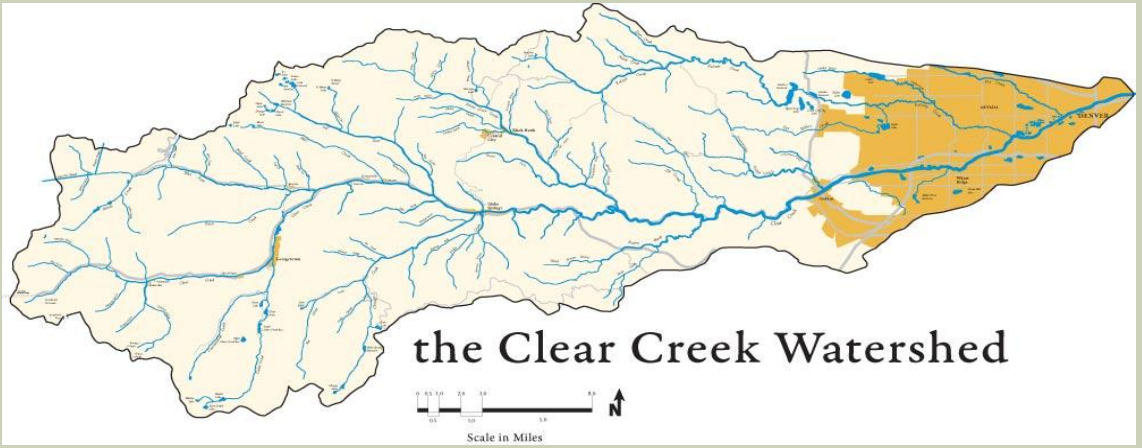
1997—Clear Creek Watershed Foundation incorporated as a 501(c)3 non-profit organization

CCWF AS GOOD SAMARITAN

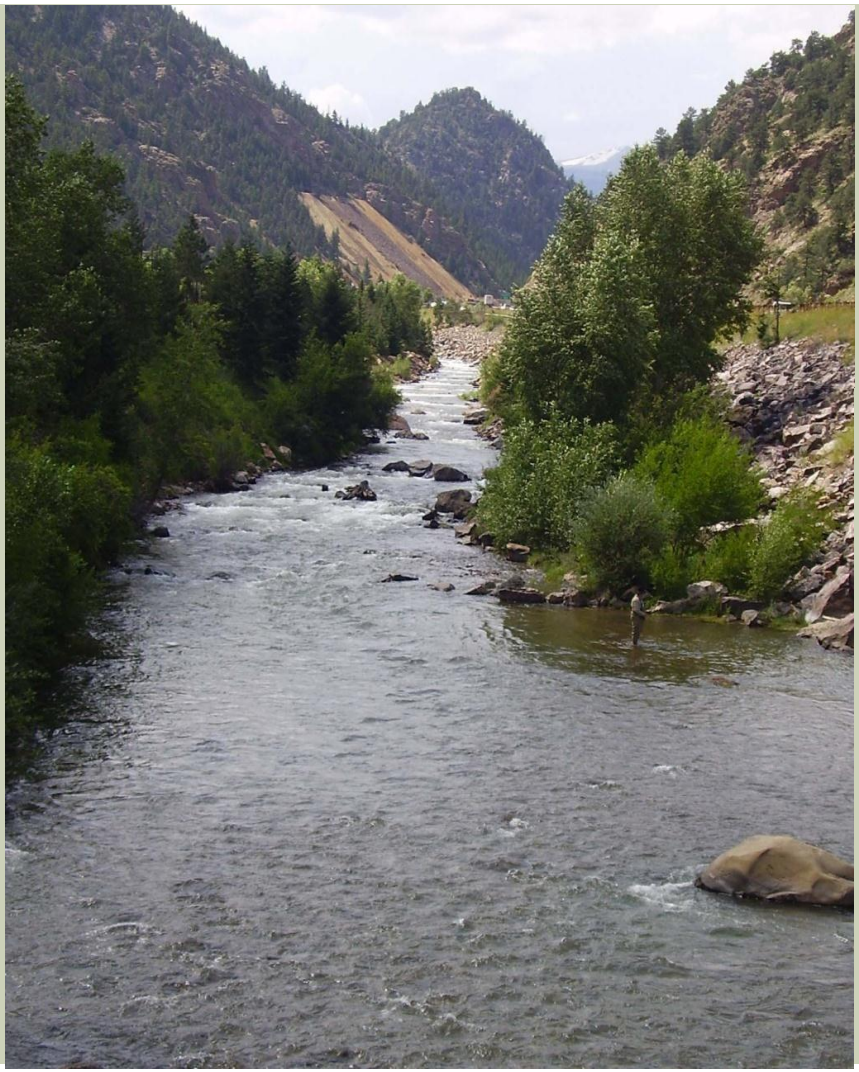
The USGS estimates that there are 1,343 inactive or abandoned mines in the Clear Creek Watershed.

As a "Good Samaritan" entity per a 2003 EPA Action Memo, CCWF has been working with numerous stakeholders to facilitate cleanup of orphan mine and mill sites not covered by the Clear Creek/Central City Superfund program:

- General Herkimer
- Little 6's
- Minnesota Mine
- McClellan Mill
- Doctor Mine
- Gem Site
- Dibbins, Sydney, and more



CCWF AWARDED
EPA REGIONAL PRIORITIES GRANT



2007 CLEAR CREEK WATERSHED REPORT

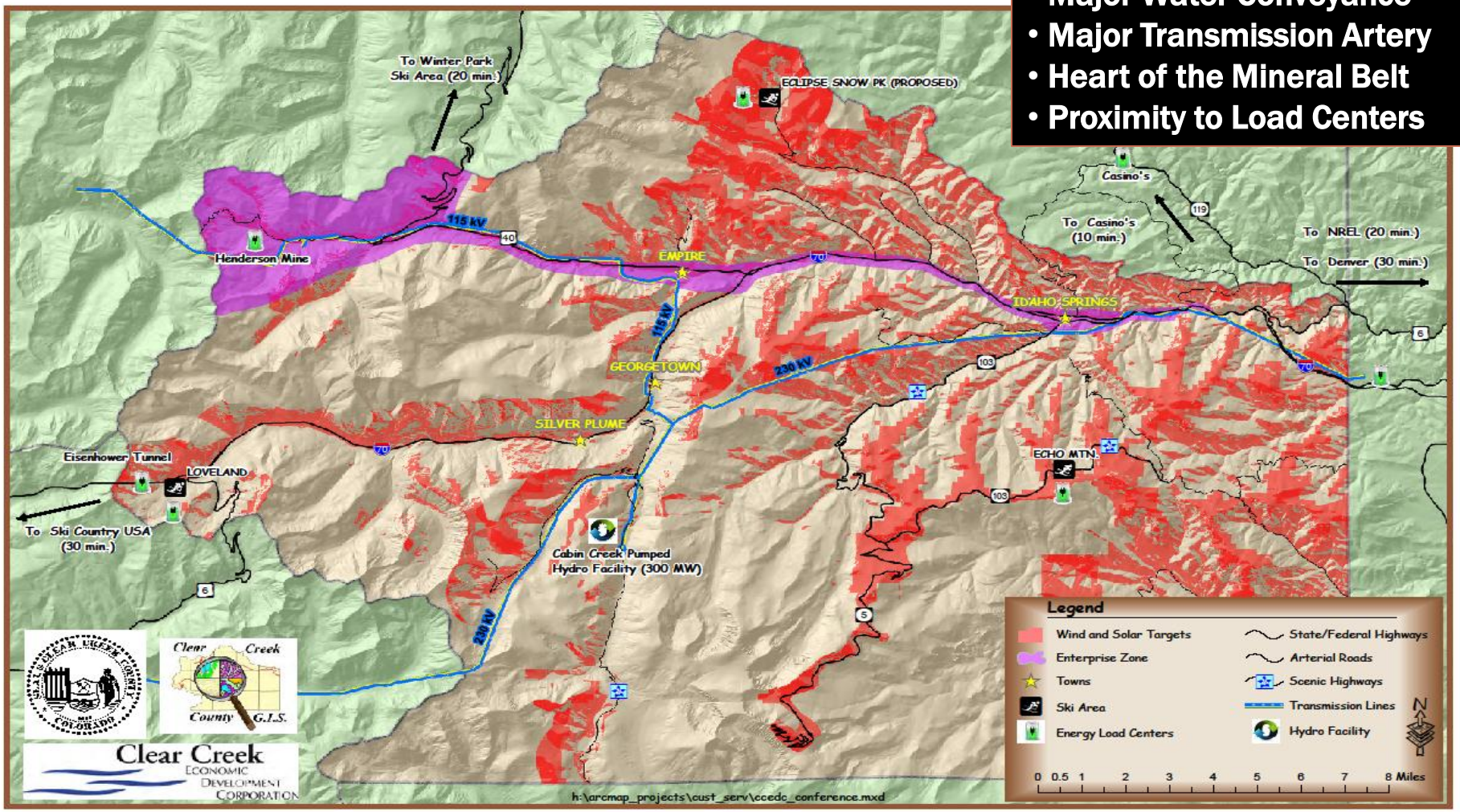
Exploring Watershed Sustainability

Broadening our focus from cleaner water through mine remediation by adding seven additional market areas to our portfolio:

1. Orphan Mine Remediation
2. Natural Resource Management
3. Water/Wastewater Management
4. Preservation/Promotion of Historical Mine Sites
5. Alternative Energy/Transportation
6. Waste Stream Reduction
7. Subsurface Rights and Uses
8. Outreach/Education

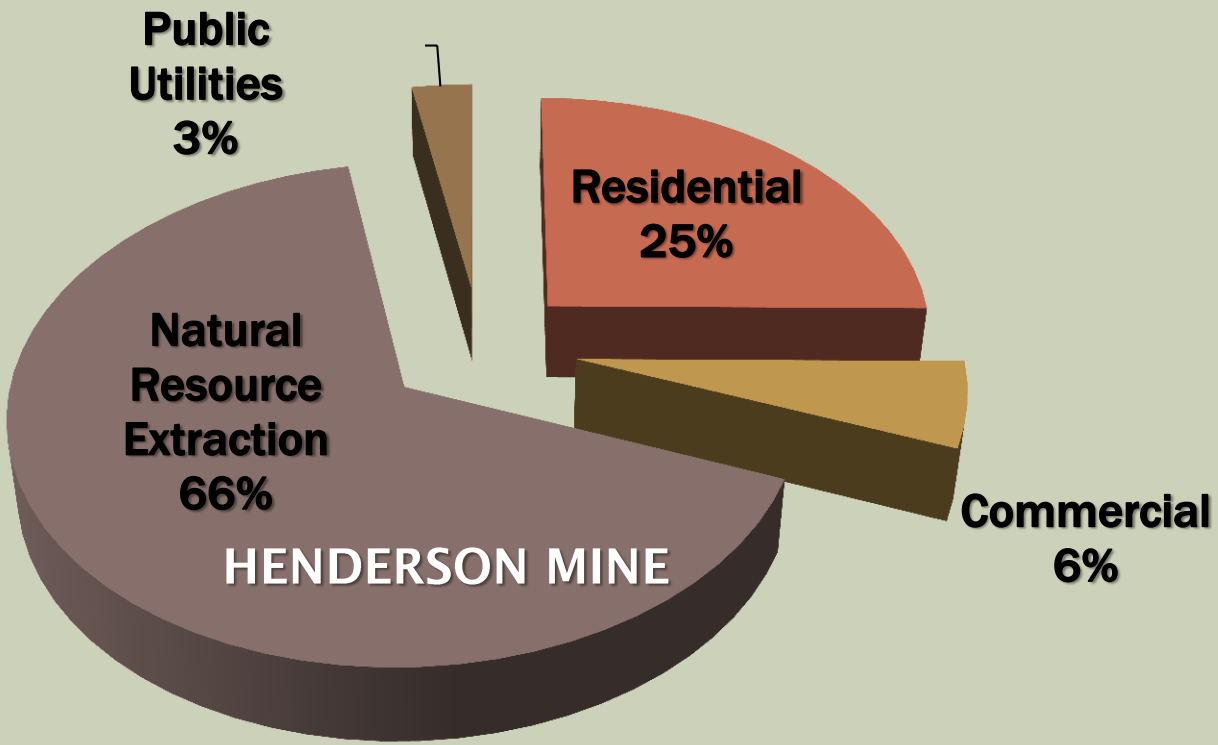
LOCATION, LOCATION, LOCATION!

- Major Transportation Artery
- Major Water Conveyance
- Major Transmission Artery
- Heart of the Mineral Belt
- Proximity to Load Centers



CLEAR CREEK COUNTY "NEW ENERGY ECONOMY"

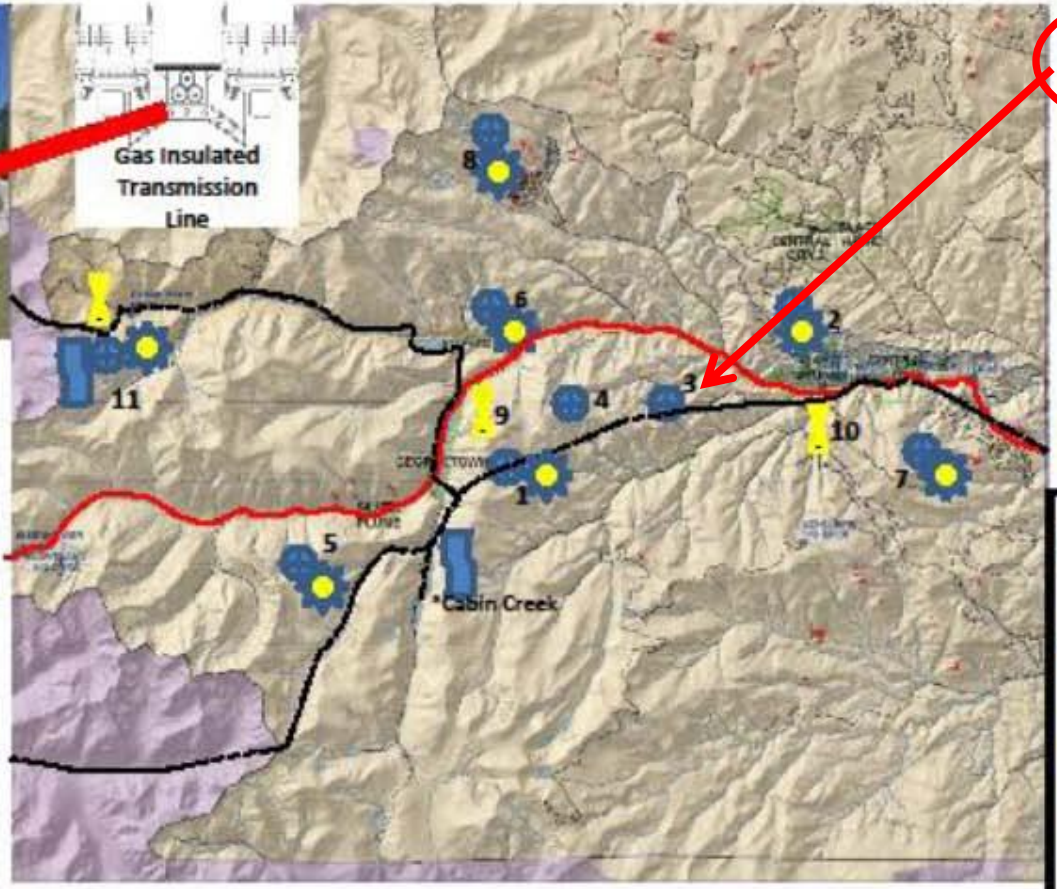
Assessed Valuation (2010) $525,220,630



Underground natural resource supply is finite.

Clear Creek County should diversify their economy in preparation for the potential decommission of Henderson Mine.

Road To Clear Creek County's RE Goal
1000MW by 2018



ADVANCED GUIDEWAY POWER REQUIREMENTS:

Assuming 44 trains are operating on the guideway between DIA and Eagle County Airport, the nominal load is:

204,170 kW or 205 MW

(4,640 kw x 44 trains = 204,170 kW)

Source: Urban MagLev Technology Development Program, Colorado MagLev Project, Final Report, June 2004, Federal Transit Administration

Brightfield Target Areas

1. Highland Park/ Capital Prize Mine
   3500 Suitable Acres
2. Gilson Gulch Orphanage
   [illegible] Suitable Acres
3. Lamartine Mine/ Trail Creek Ridge
   2350 Suitable Acres
4. [illegible]
   1200 Suitable Acres
5. Leavenworth
   2500 Suitable Acres
6. North Empire Creek
   1600 Suitable Acres
7. Hidden Wilderness
   800 Suitable Acres
8. Alice/St. Mary's
9. Shadows Ranch
10. Idaho Springs
11. Henderson Mine

Wind

Solar

Geothermal

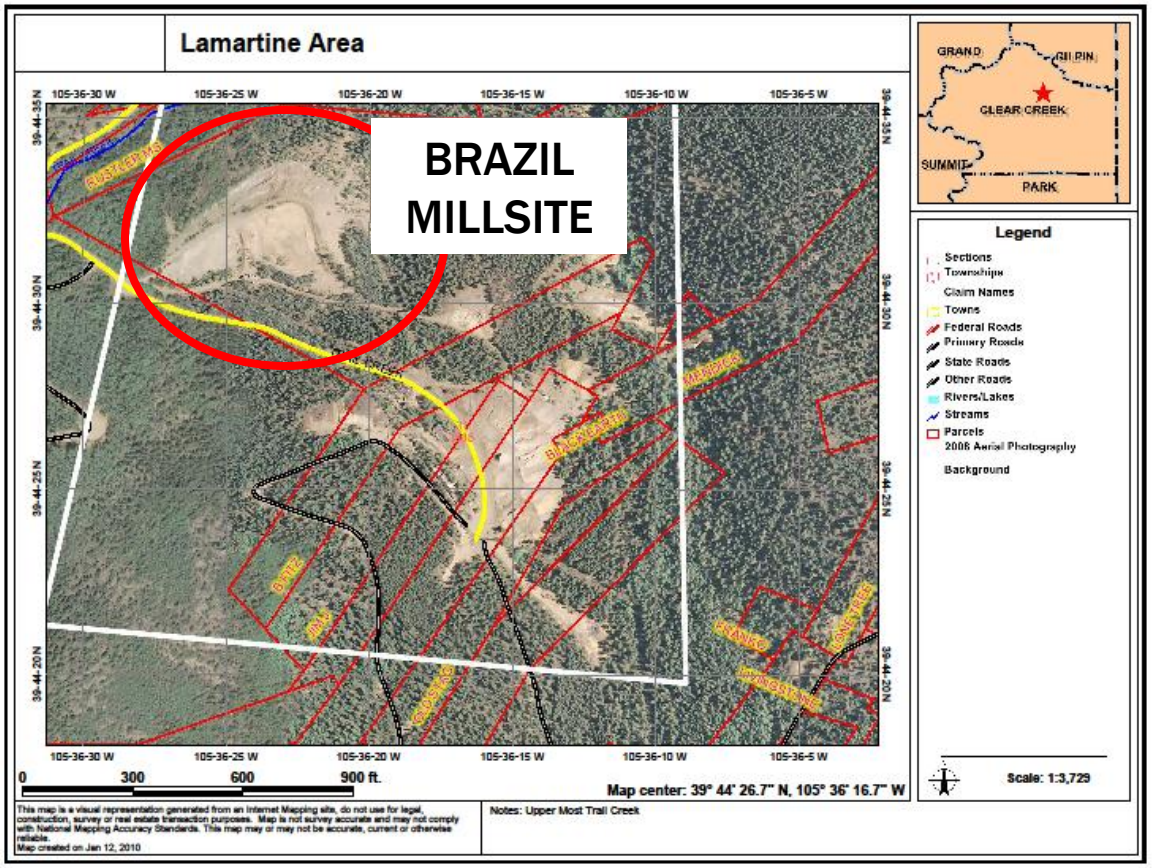
Pumped Hydro

I-70

Transmission

BRAZIL MILLSITE AERIAL

- Elevation 9,600 feet
- Trail Creek area was a very productive mining center through the Late 1800s to mid 1900s.
- Trail Creek is a steep mountain stream with an average channel gradient of 11 percent.



BRAZIL MILLSITE BEFORE RECLAMATION

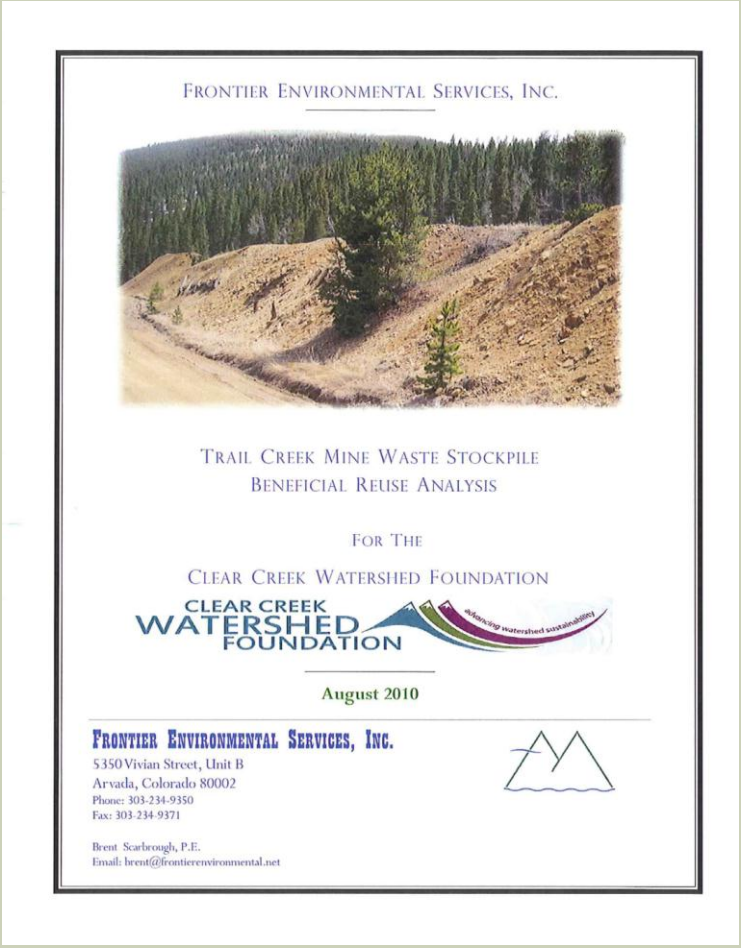
In June 2011 this was the Brazil Millsite as it stood as a Brownfield.

BRAZIL MILLSITE AFTER RECLAMATION

This is the Brazil Millsite 3 months later as a Greenfield.

What would it look as a Brightfield and how much energy could this Brightfield produce?

ENVIRONMENTAL OPPORTUNITY



FRONTIER ENVIRONMENTAL SERVICES, INC.

TRAIL CREEK MINE WASTE STOCKPILE
BENEFICIAL REUSE ANALYSIS

FOR THE

CLEAR CREEK WATERSHED FOUNDATION

CLEAR CREEK WATERSHED FOUNDATION

August 2010

FRONTIER ENVIRONMENTAL SERVICES, INC.
5350 Vivian Street, Unit B
Arvada, Colorado 80002
Phone: 303-234-9350
Fax: 303-234-9371

Brent Scarbrough, P.E.
Email: brent@frontierenvironmental.net

RESULTS/CONCLUSIONS

- Engineering and chemical analysis of mine waste piles as a resource instead of a liability.
- Reusing waste for productive purposes such as general site fill, foundation pads, and soil cement base.
- Added benefit of removing waste piles that negatively affect waterways.

HOW MIGHT CLEAR CREEK COUNTY MAKE HIGHEST AND BEST USE OF A BROWNFIELD PROPERTY AS A RENEWABLE ENERGY SOURCE?

CSM Department of Engineering: Senior Design Course

- Two semesters of design education and application
- Provides a basis on engineering design and project planning
- Provides professional experience
- Site characterized by CSM students from the Environmental Science & Engineering Department working under the direction of Professors Jonathan Sharp and Tom Wildeman, who supervised reclamation design recommendations

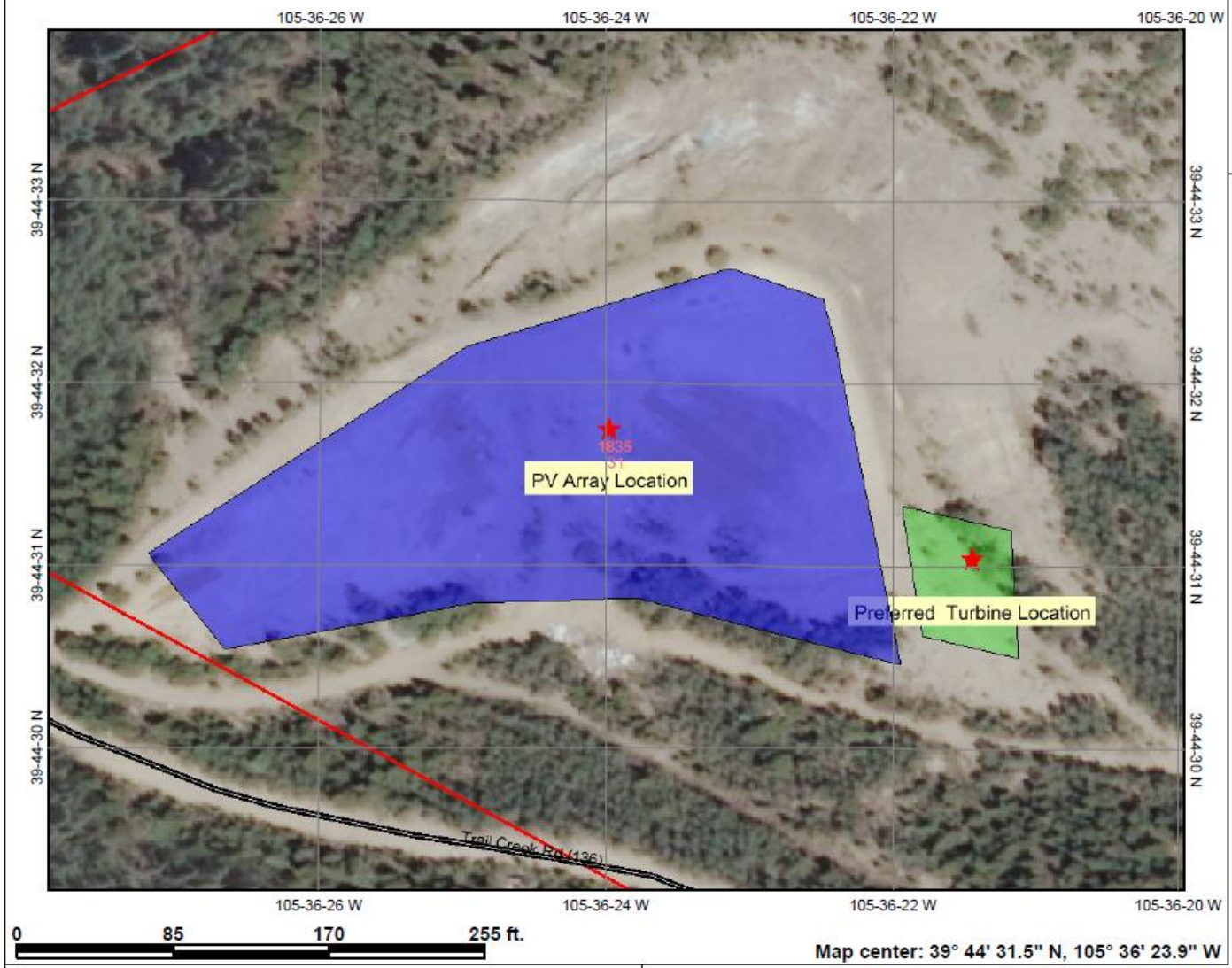
CSM CAPSTONE PROGRAM

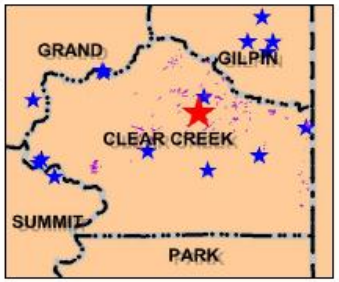
TEAM:

Jeff Babbit
Electrical
Matt Beach
Electrical
David Branath
Mechanical
Paul Franklin
Environmental
Jeannette Hartman
Environmental
Megan Shirley
Environmental

COLORADO SCHOOL OF MINES
EARTH • ENERGY • ENVIRONMENT

Conceptual Design





Legend

- 2010 Tax Sale
- Weather Stations
- Sections
- Townships
- Claim Names
- Towns
- Federal Roads
- State Roads
- Primary Roads
- Other Roads
- Rivers/Lakes
- Streams
- Parcels
- 2010 Aerial Photography
- Background

0 85 170 255 ft.

Scale: 1:1,017

Map center: 39° 44' 31.5" N, 105° 36' 23.9" W

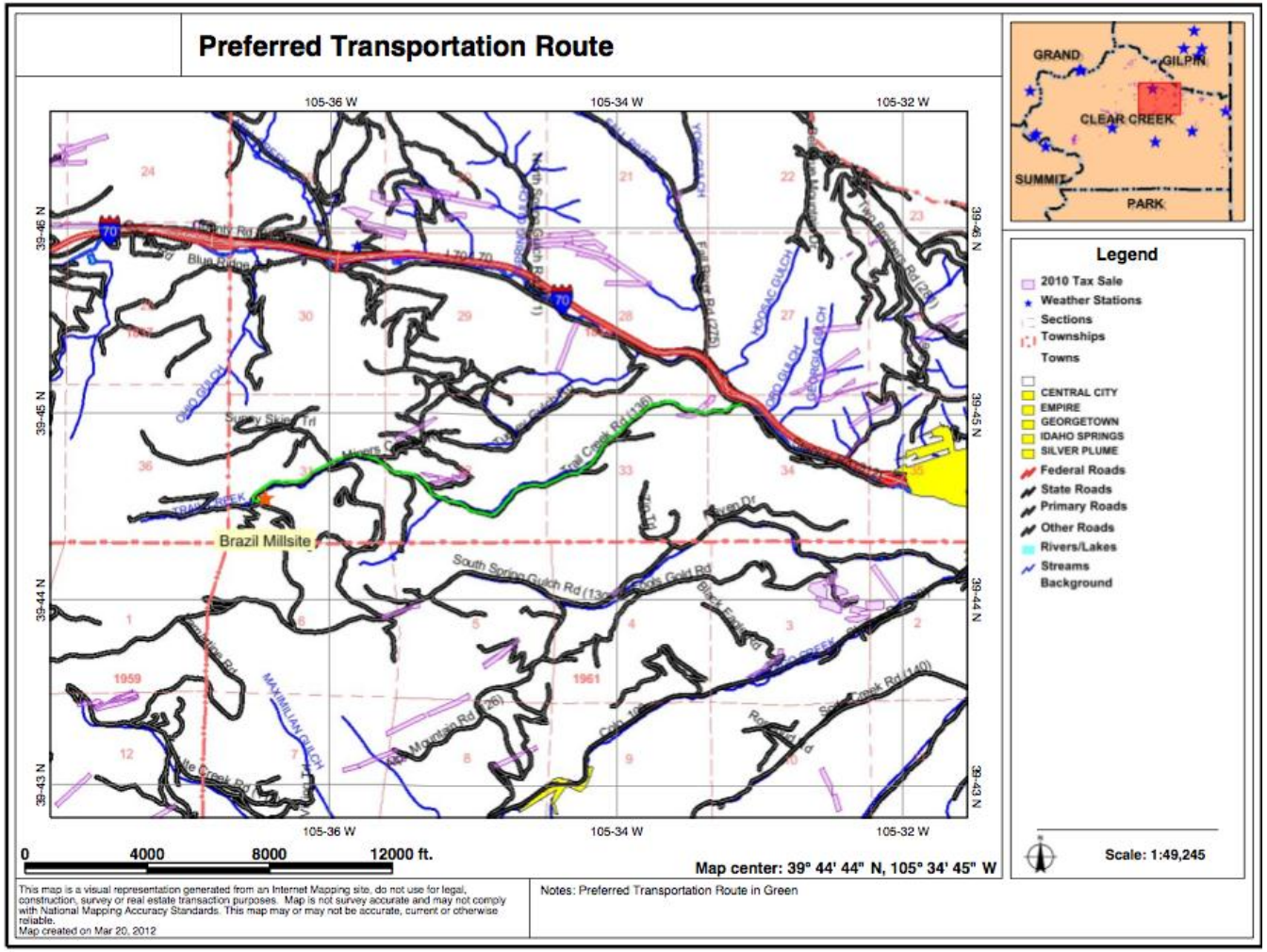
Map created on Mar 22, 2012

PROJECTED TIMELINE

Permit & Decision Period	**4 months (120 days) - 7 months (196 days)**
Turbine Construction Phase	1 Month (30 days)
Solar Construction Phase	3 weeks (21 days)

LOCAL CAPACITY

Considerations



SERVICE DELIVERY SYSTEMS

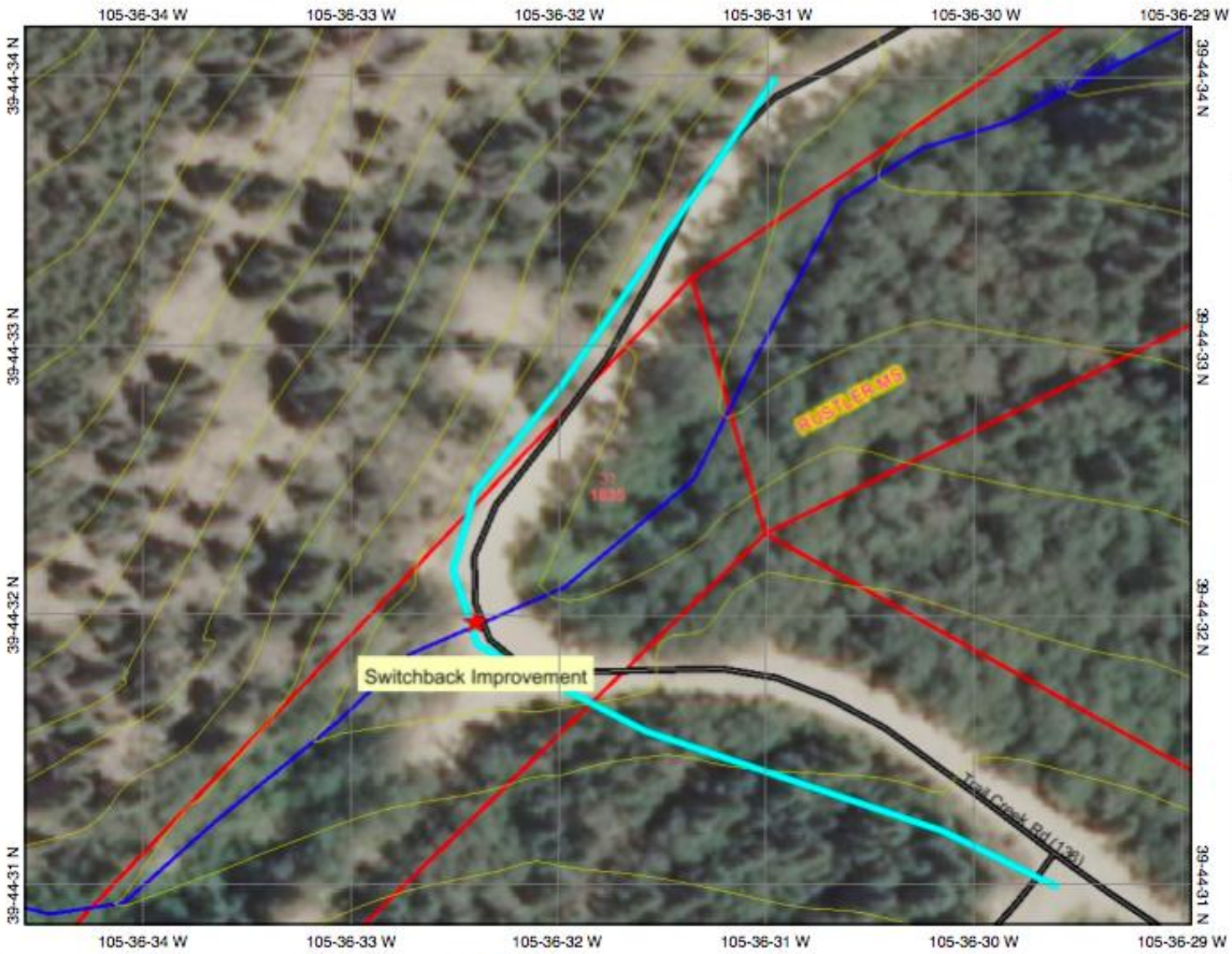
Road Capacity

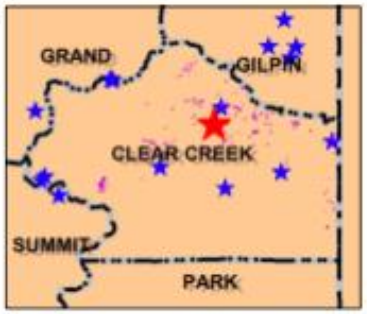
Access

Emergency Services

Site Security

Switchback Improvement





Legend

- 2010 Tax Sale
- Weather Stations
- Contours (10ft)
- Sections
- Townships
- Claim Names
- Towns
- Federal Roads
- State Roads
- Primary Roads
- Other Roads
- Rivers/Lakes
- Streams
- Parcels
- 2010 Aerial Photography
- Background

0 60 120 180 ft.

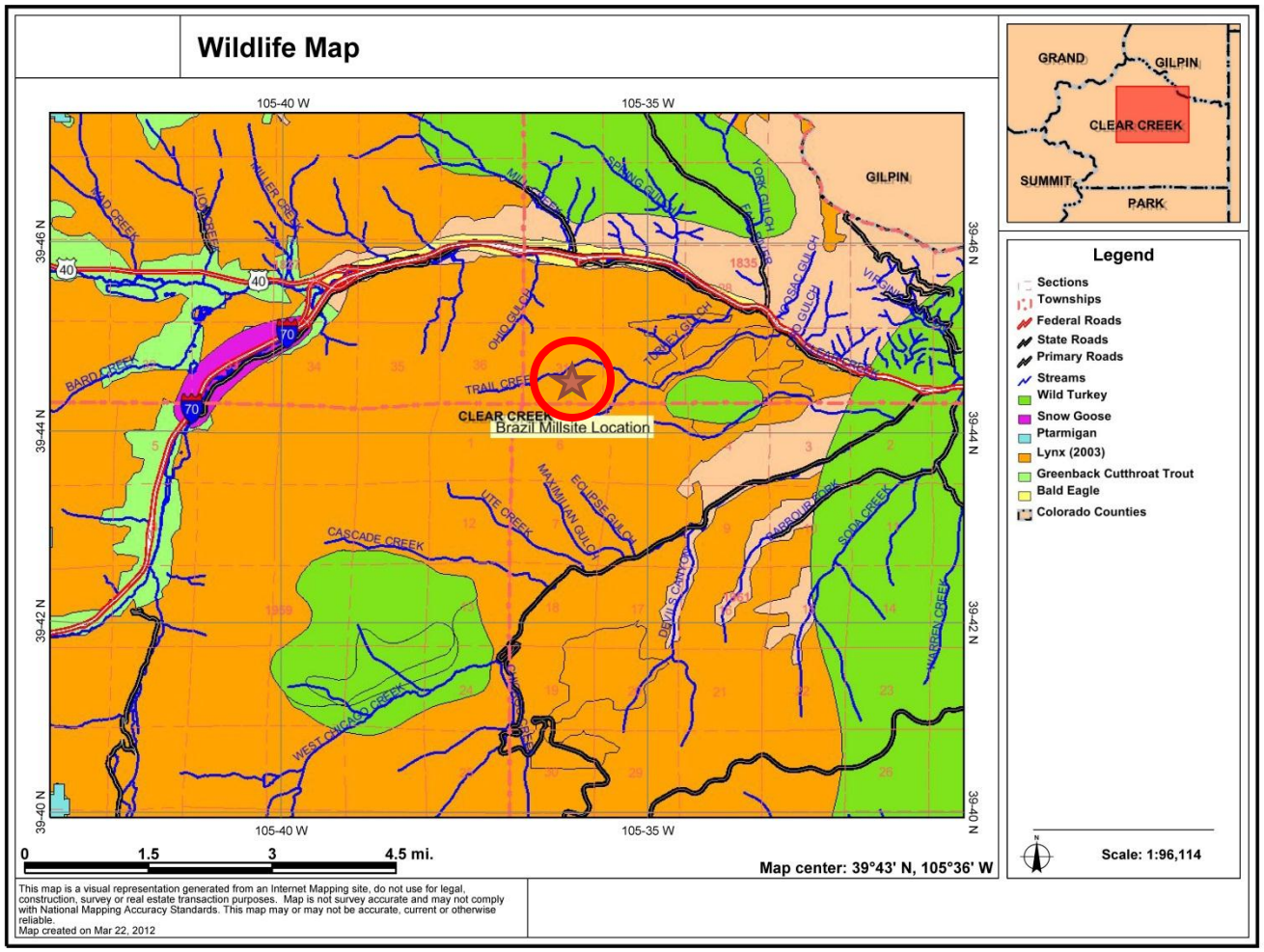
Map center: 39° 44' 32.51" N, 105° 36' 31.76" W

Scale: 1:719

Map created on Mar 20, 2012

ENVIRONMENTAL ANALYSIS

Considerations



CONCLUSION: STUDIES TO BE CONDUCTED

Remediation met all the environmental considerations.

Development consideration examined all 1041 Matters of State Interest requirements and found adequate data to support permit submittal.

TECHNICAL FEASIBILITY

Considerations

CLEAR CREEK POWER

TECHNICAL SUITABILITY

Alstom Eco 110 Wind Turbine:

- 3 MW power output
- 100m rotor diameter
- IEC IIA Classification for this altitude

Suntech Vd Solar Panels:

- 280 W per module
- 14.4% efficiencies
- Strong wind and snow loading capabilities

FINANCIAL FEASIBILITY

Considerations

RETScreen Energy Model - Power project

☑ Show alternative units

Proposed case power system — **Incremental initial costs**

Base load power system

Technology		Wind turbine			
Analysis type		◉ Method 1 ○ Method 2 ○ Method 3			
Wind turbine #1					
Power capacity	kW	3,000.0			See product database
Manufacturer		Alstom			
Model		Eco 110	1 unit(s)		
Capacity factor	%	40.0%			
Electricity exported to grid	MWh	10,512			

Intermediate load power system

Technology		Photovoltaic			
Photovoltaic #2					
Power capacity	kW	200.00			See product database
Manufacturer		Suntech			
Model		STP280 - 24/Vd	1 unit(s)		
Capacity factor	%	19.7%			
Electricity exported to grid	MWh	345			
Electricity export rate	$/MWh	45.00	$/kWh	0.000	
			$/kWh	0.045	
Select base load power system		Power system #1	Wind turbine #1		

Proposed case system summary	Fuel type	Fuel consumption - unit	Fuel consumption	Capacity (kW)	Energy delivered (MWh)
Power					
Base load	Wind			3,000	0
Intermediate load	Solar			200	0
Electricity exported to grid					10,857
			Total	**3,200**	**10,857**

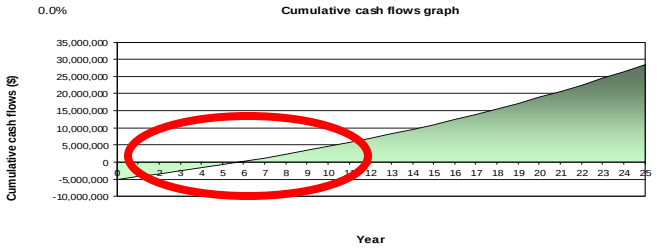
☑ **Emission Analysis**

Base case electricity system (Baseline) Country - region	Fuel type	GHG emission factor (excl. T&D) tCO2/MWh	T&D losses %	GHG emission factor tCO2/MWh
United States of America	All types	0.544	6.0%	0.578
Electricity exported to grid	MWh	10,857	T&D losses	8.0%

GHG emission					
Base case	tCO2	6,278.7			
Proposed case	tCO2	502.3			
Gross annual GHG emission reduction	tCO2	5,776.4			
GHG credits transaction fee	%	2.0%			
Net annual GHG emission reduction	tCO2	5,660.8	is equivalent to	2,432,307	Litres of gasoline not consumed
GHG reduction income					
GHG reduction credit rate	$/tCO2	0.00			

Financial Analysis

Financial parameters			
Inflation rate	%	4.2%	
Project life	yr	25	
Debt ratio	%	0%	
Initial costs			
Power system	$	0	0.0%
Other	$	5,500,000	100.0%
Total initial costs	$	5,500,000	100.0%
Incentives and grants	$	620,000	0.0%
Annual costs and debt payments			
O&M (savings) costs	$	50,000	
Fuel cost - proposed case	$	0	
Warranty and Insurance Costs	$	30,000	
Total annual costs	$	80,000	
Annual savings and income			
Fuel cost - base case	$	0	
Electricity export income	$	488,571	
Federal Tax Credits	$	343,264	
Total annual savings and income	$	831,835	
Financial viability			
Pre-tax IRR - assets	%	19.8%	
Simple payback	yr	6.5	
Equity payback	yr	5.6	



WIND & SOLAR PREFERRED ALTERNATIVE

Environmentally the installation of wind and solar combined is best

- **utilizes land to its highest & best use**

If merged with other projects proposed in the area the financial model would improve

- **economy of scale**

FINAL DELIVERABLE

The final document is formatted to conform with the County's **1041 Matters of State Interest** regulations permit requirements to demonstrate technical, financial, and environmental feasibility.

- The process is reasonable
- The data is readily available

FOR MORE INFORMATION

ED RAPP, President
DIANE KIELTY,
Project Development Coordinator
www.clearcreekwater.org
303-567-2699
2060 Miner Street
Idaho Springs, CO 80452

COLORADO SCHOOL OF MINES
TEAM ADVANCED ENGINEERING
ASSOCIATES
http://engineering.mines.edu/research/senior-design/?pid=60
303-273-3650
1600 Maple Street
Golden, CO 80401