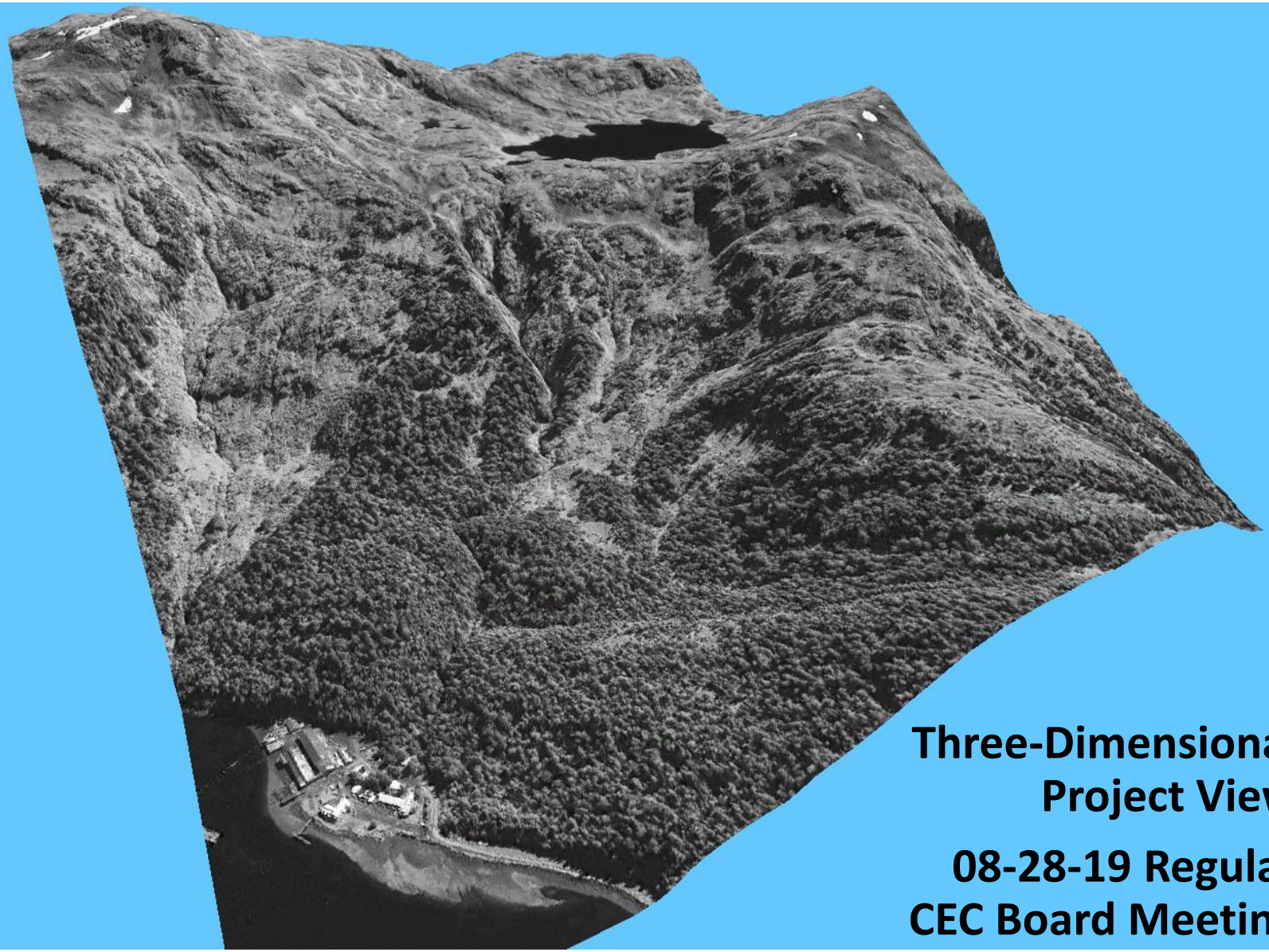
Crater Lake Water and Power Project Update



Three-Dimensional Project View

08-28-19 Regular CEC Board Meeting

Strategic Plan/Need: Ten-Year Goal (2025)

90% of the electricity for Cordova will be provided with renewable energy by 2025

Reduce diesel use to under 300,000 gallons by 2025

Crater Lake is Likely CEC's Best Opportunity to Meet this Goal

Crater Lake Costs as of 12/13 Inception

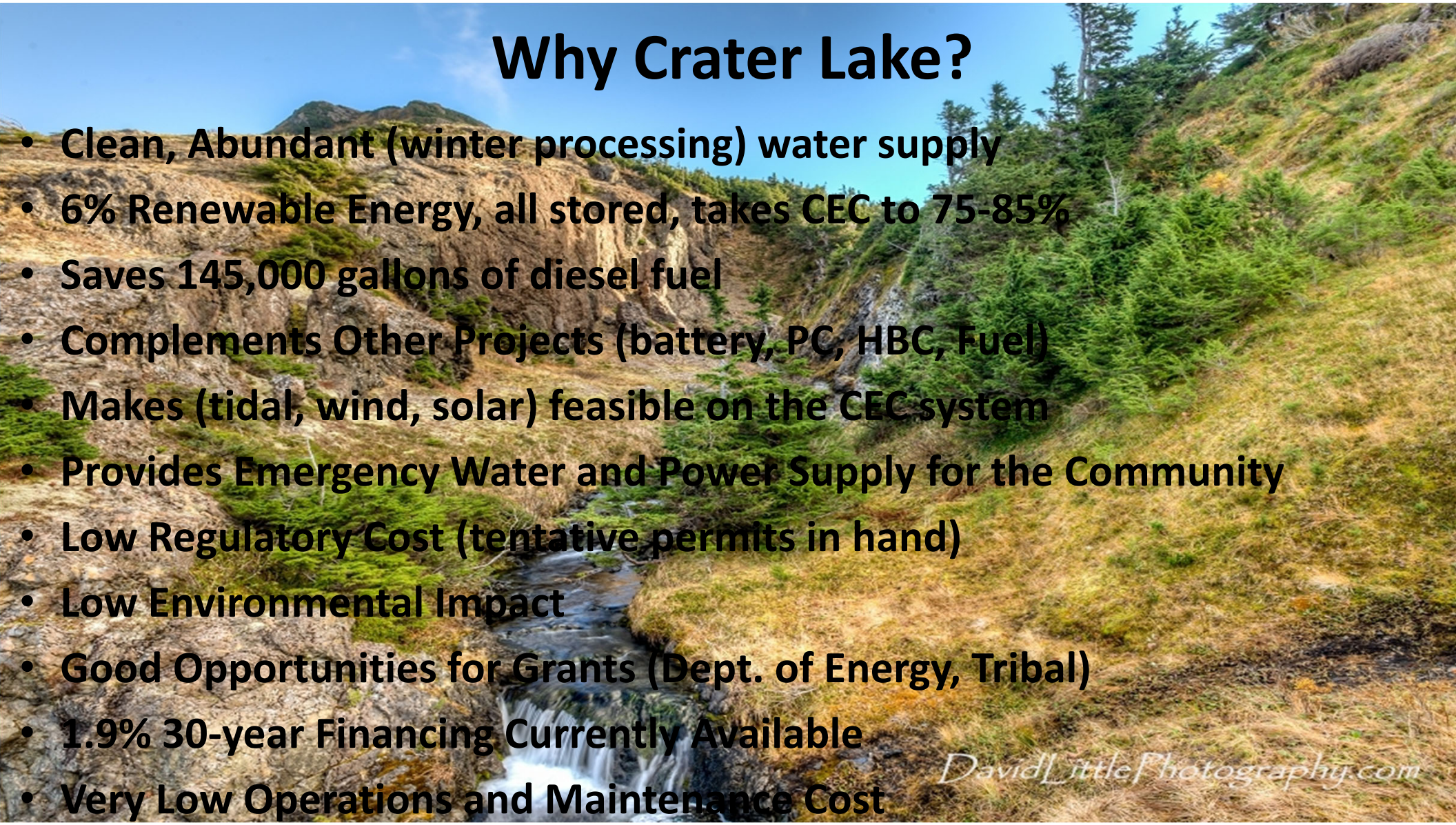
- $660,000 by CEC
- $50,000 by City of Cordova (feasibility)
- $100,000 by Dept. of Energy (Geotech)

- **Total: $810,000**

CEC Fuel Costs as of 12/13 CL Inception

- 2014 – $ 2,021,000
- 2015 – $ 1,392,000
- 2016 – $ 888,800
- 2017 – $ 1,511,000
- 2018 – $ 1,486,000
- 2019 – $ 743,000

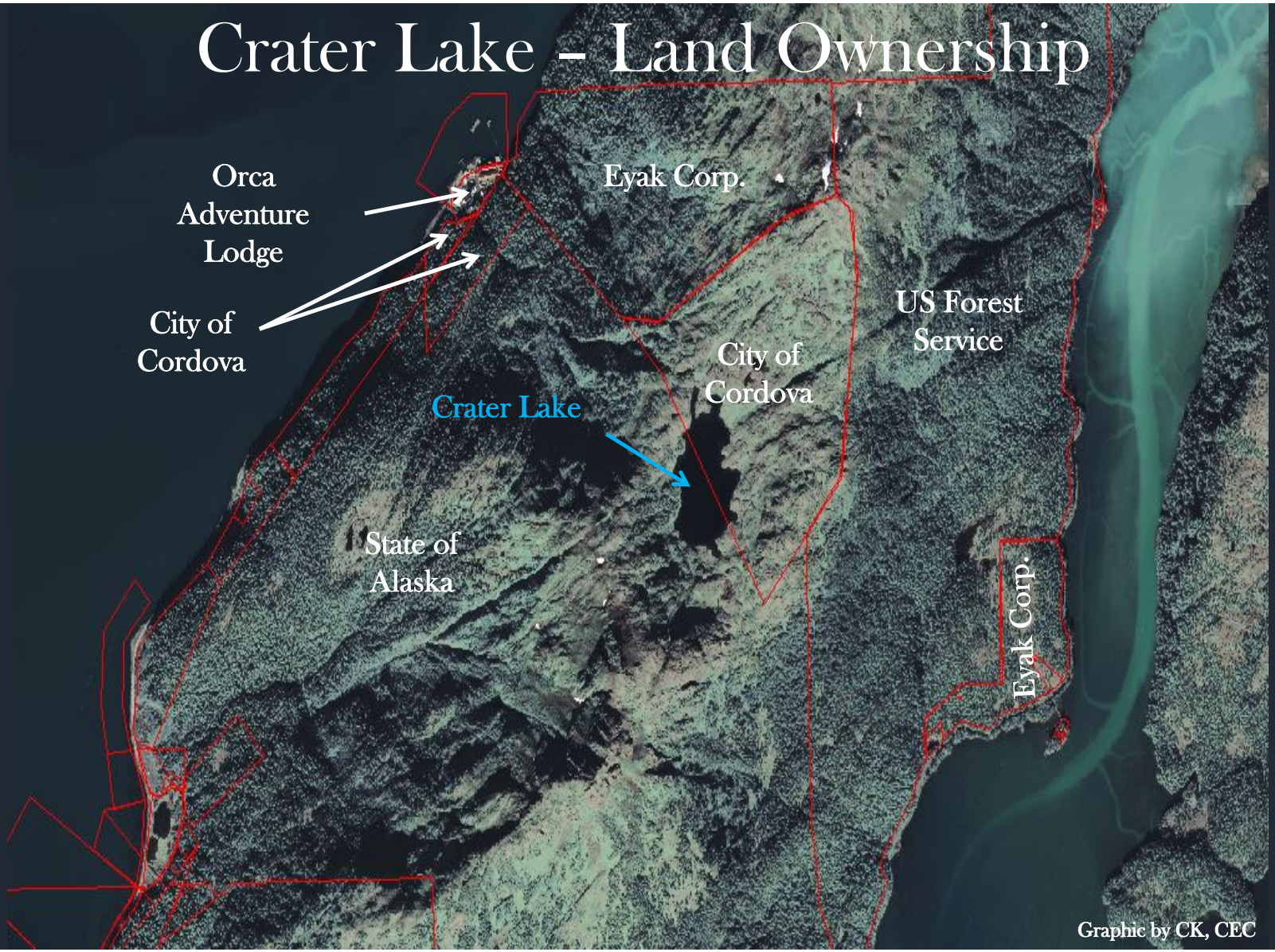
- **TOTAL: $ 8,041,000**


Why Crater Lake?
• Clean, Abundant (winter processing) water supply
• 6% Renewable Energy, all stored, takes CEC to 75-85%
• Saves 145,000 gallons of diesel fuel
• Complements Other Projects (battery, PC, HBC, Fuel)
• Makes (tidal, wind, solar) feasible on the CEC system
• Provides Emergency Water and Power Supply for the Community
• Low Regulatory Cost (tentative permits in hand)
• Low Environmental Impact
• Good Opportunities for Grants (Dept. of Energy, Tribal)
• 1.9% 30-year Financing Currently Available
• Very Low Operations and Maintenance Cost
DavidLittlePhotography.com

Why Not Crater Lake?

- Stakeholder / Community Perceptions and Objections
- Marginal Feasibility Without Financial Partners
- High Up-Front Capital Cost (commitment / organizational will)

Crater Lake Physical Characteristics (Outflow)


Crater Lake – Land Ownership
Orca Adventure Lodge
City of Cordova
Eyak Corp.
US Forest Service
City of Cordova
Crater Lake
State of Alaska
Eyak Corp.
Graphic by CK, CEC


Existing Crater Creek Water Intake El. 200


Deep Trench Approaching the Outflow

Blue Lake Project, Sitka, Alaska


Example: Chester Lake
Dam on Annette Island

2015-16 Feasibility Study

Cordova Electric Cooperative

CEC, Your Member Owned Cooperative

CITY OF CORDOVA

INCORPORATED 1909

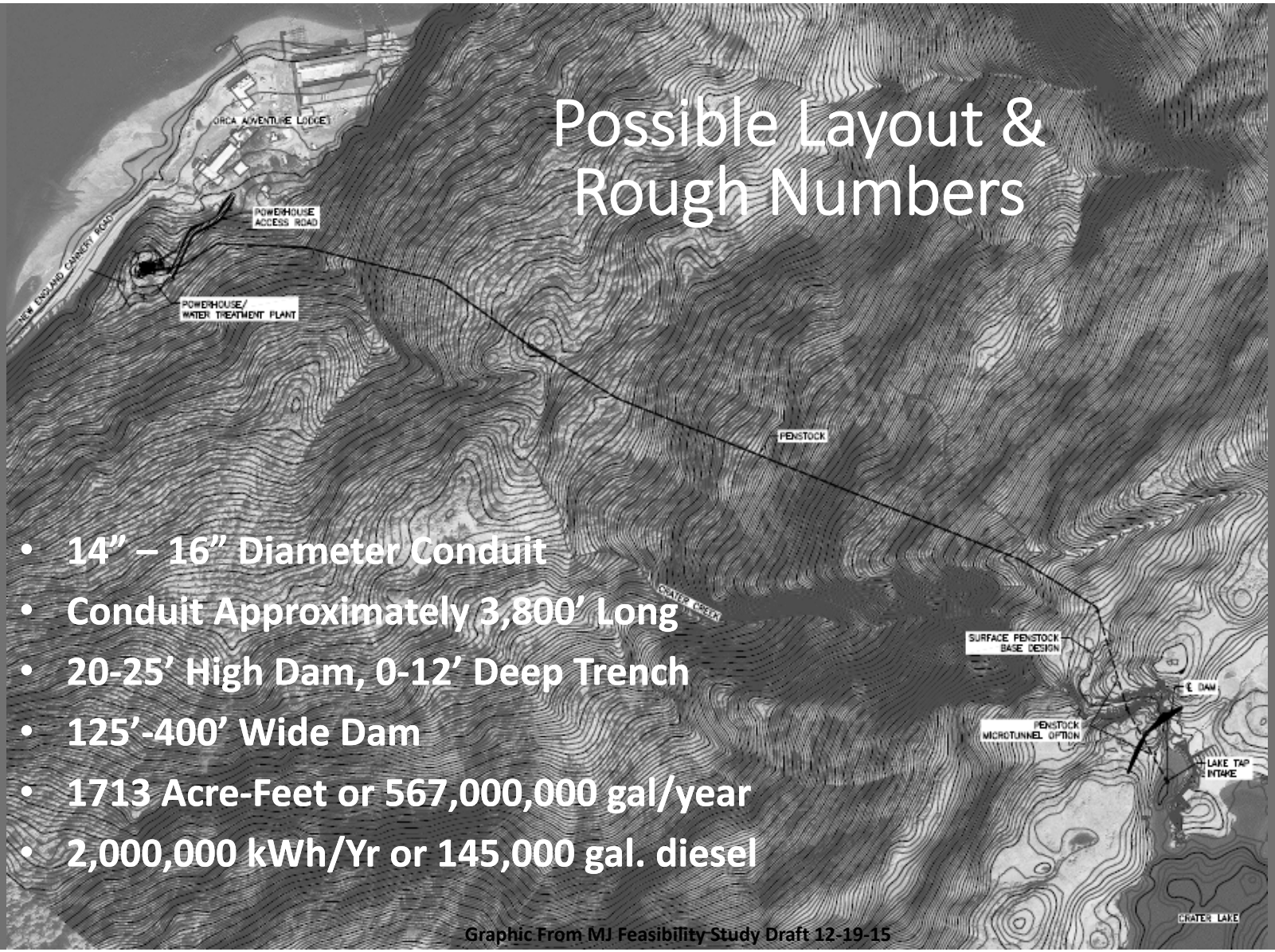
Crater Lake Water and Power Project Feasibility Study

Feasibility/Conceptual Design Report

McMILLEN JACOBS ASSOCIATES

January 20, 2016

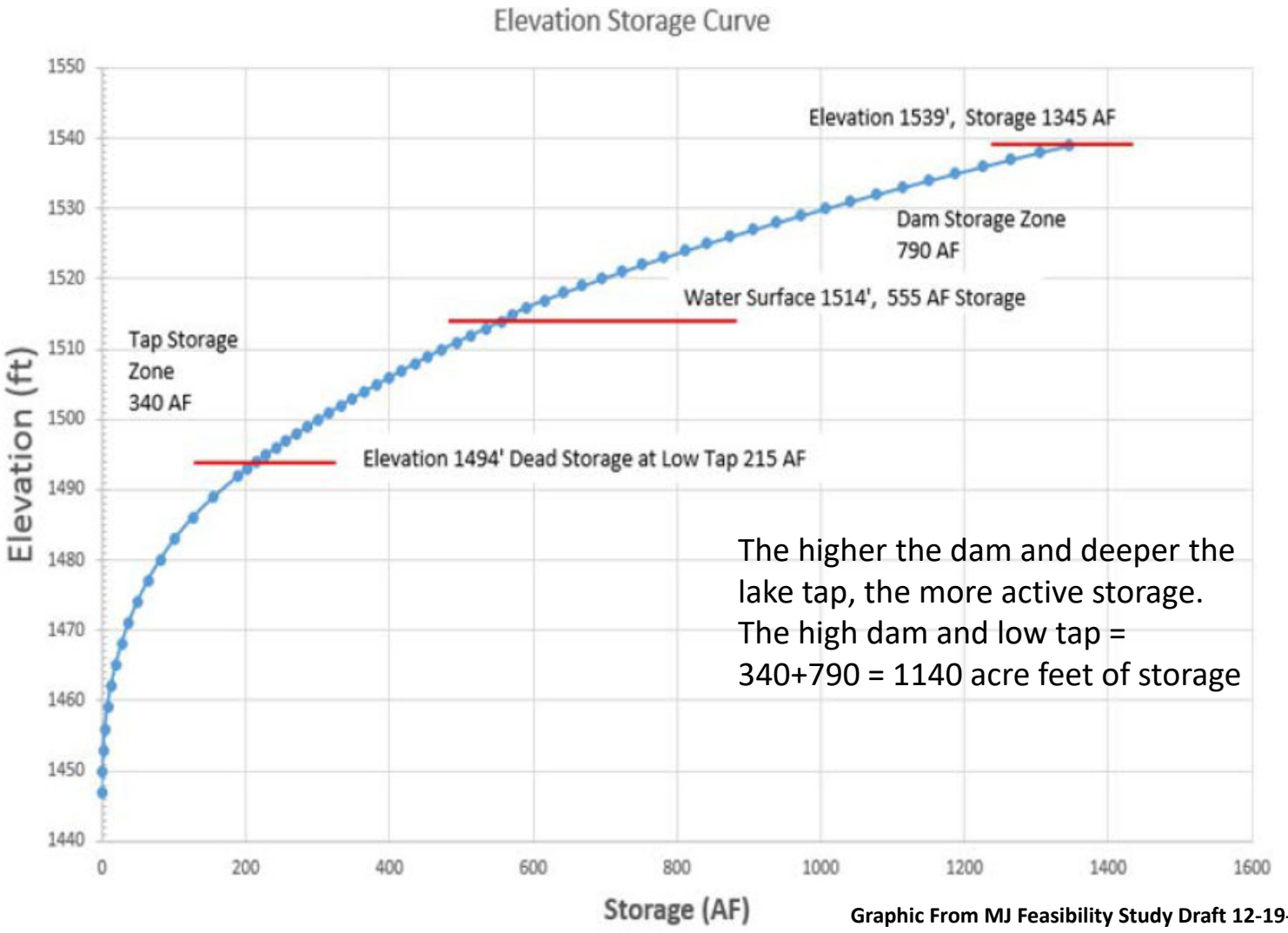
Possible Layout & Rough Numbers



- 14” – 16” Diameter Conduit
- Conduit Approximately 3,800’ Long
- 20-25’ High Dam, 0-12’ Deep Trench
- 125’-400’ Wide Dam
- 1713 Acre-Feet or 567,000,000 gal/year
- 2,000,000 kWh/Yr or 145,000 gal. diesel

Graphic From MJ Feasibility Study Draft 12-19-15

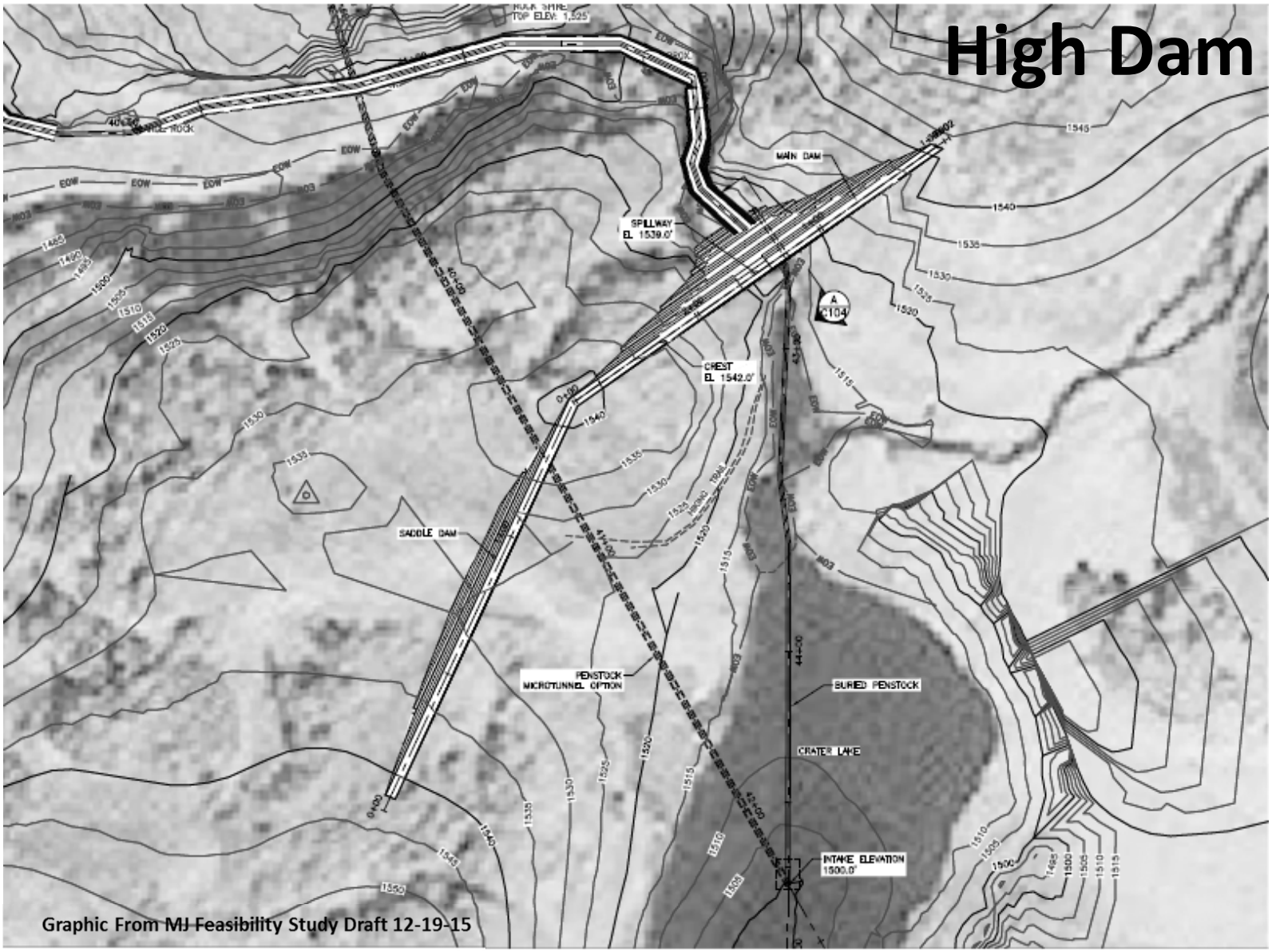
Potential Storage Curves



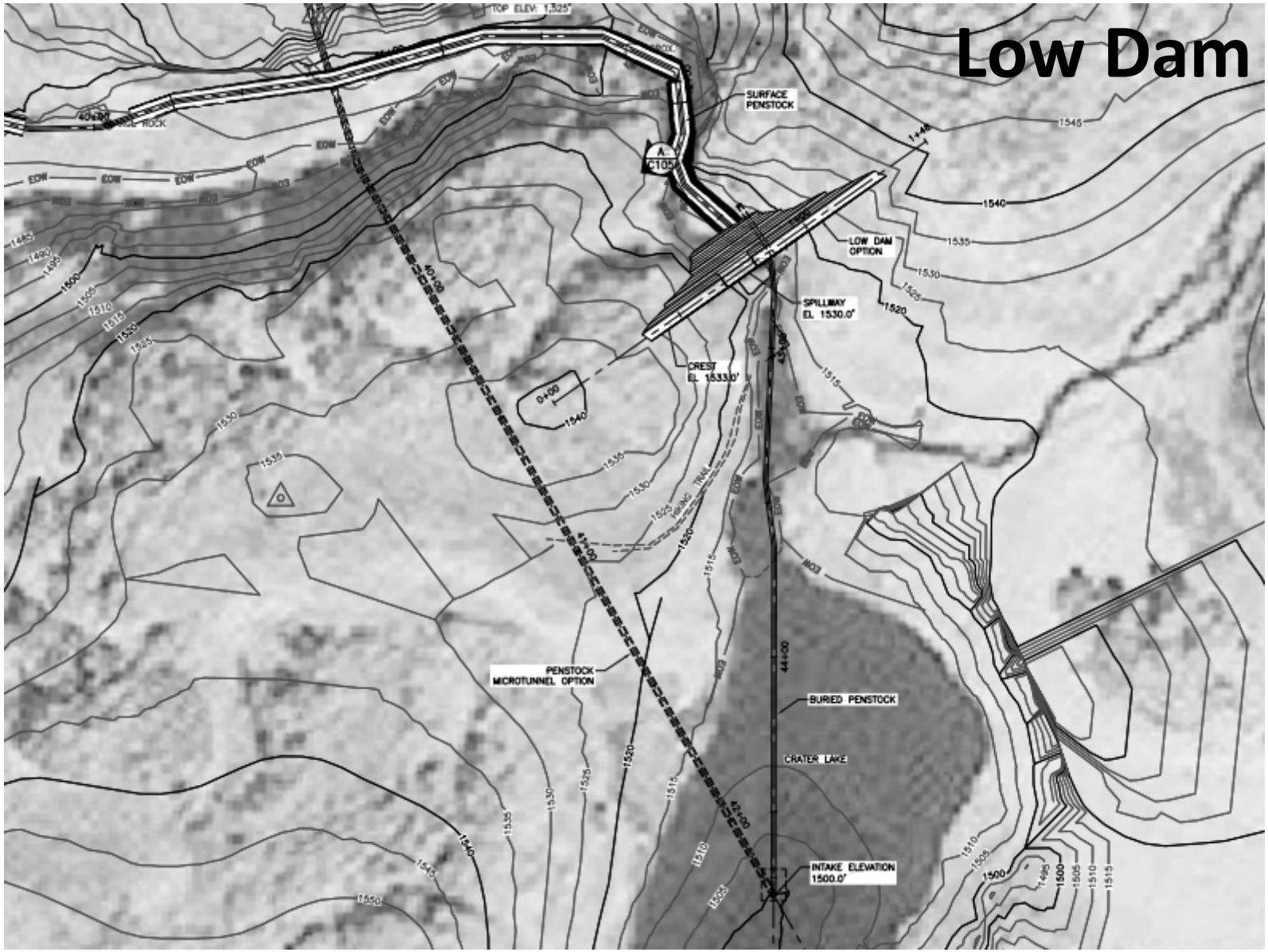
The higher the dam and deeper the lake tap, the more active storage. The high dam and low tap = 340+790 = 1140 acre feet of storage

Graphic From MJ Feasibility Study Draft 12-19-15

High Dam



Graphic From MJ Feasibility Study Draft 12-19-15


Low Dam
TOP ELEV: 1,525'
SURFACE PENSTOCK
LOW DAM OPTION
SPILLWAY EL 1530.0'
CREST EL 1533.0'
PENSTOCK MICROTUNNEL OPTION
BURIED PENSTOCK
CRATER LAKE
INTAKE ELEVATION 1500.0'

Community Water Records

Table 5-1. City of Cordova Historical Avg Water Usage from Crater Creek and Total from all Sources

Month	Crater Creek Hist. Avg Water Use* (2000-2014) (MG)	Crater Creek Hist. Avg Water Use* (2000-2014) (cfs)	Crater Creek Hist. Avg Water Use* (2010-2014) (cfs)	Total (All Sources). Hist. Avg Water Use (2000-2014) (MG)	Total (All Sources). Hist. Avg Water Use 2000-2014) (cfs)	Total (All Sources). Hist. Avg Water Use (2010-2014) (cfs)
January	11.4	0.57	0.66	29.5	1.47	1.99
February	10.9	0.60	0.70	29.2	1.61	2.15
March	9.18	0.46	0.38	35.1	1.75	2.25
April	12.2	0.63	0.74	37.7	1.94	2.71
May	18.0	0.90	1.02	42.6	2.12	2.74
June	20.8	1.07	1.14	51.3	2.56	3.30
July	24.6	1.23	1.66	77.6	3.87	6.06
August	22.3	1.11	1.55	78.9	3.93	4.79
September	12.6	0.65	0.71	43.5	2.24	2.52
October	12.3	0.61	0.58	31.3	1.56	1.78
November	11.5	0.59	0.58	28.8	1.48	1.73
December	11.7	0.58	0.62	30.7	1.53	1.90
Avg. Annual Production			**204 MG** (625 acre-ft)			**612 MG** (1880 acre-ft)
Max. Annual Production			**245 MG** (2014)			**636 MG** (2014)

Crater Lake Resource 200-2015

Water Year	Annual Precipitation (in)	Annual Yield (AF)	Adj. Factor (Dim)
Summary			
AVG	138.6	1713	0.95
Max	175.4	2167	1.04
Min	104.5	1291	0.83

Project Estimate – Benefit/Cost

Cost Estimate

Cordova Elec. - Crater Lake - Cost Estimate

Project: Crater Lake Hydroelectric Project
Location: Cordova, AK
Nameplate Capacity (kW): 825
Date: 2-Dec-15

Item #	Description	Base Project Amount	Option 1 - Micro Tunnel Amount (Delta from Base Project)	Option 2 - Lower Dam Amount (Delta from Base Project)
Direct Construction Cost				
1	General Requirements (15%)	$1,543,000	$228,000	-$347,000
2	Mobilization (5%)	$515,000	$76,000	-$116,000
3	Powerhouse Access Road	$82,000	$0	$0
4	Dam	$3,595,250	$0	-$2,309,975
5	Micro Tunnel	$0	$2,295,100	$0
6	Penstock	$3,069,400	-$777,996	$0
7	Intake - Lake Tap Inlet and Trash Rack	$70,000	$0	$0
8	Powerhouse/Treatment Plant	$3,014,600	$0	$0
11	Switch Yard	$250,000	$0	$0
12	Return Water to Crater Creek - Tail Race	$50,000	$0	$0
13	Intertie - Electrical Transmission Line	$75,000	$0	$0
14	Intertie - Treated Water Transmission Line	$80,000	$0	$0
	Subtotal	**$12,344,250**	**$1,821,104**	**-$2,772,975**
	Total Direct Construction Price	**$12,344,250**	**$14,165,354**	**$9,571,275**
Markups & Overhead				
	Taxes 0.00%	$0	$0	$0
	Equipment Markup 0.00%	$0	$0	$0
	GC Overhead and Profit 15.00%	$1,851,638	$2,124,803	$1,435,691
	Construction Bonds 1.00%	$141,959	$141,654	$95,713
	Total - Overhead (all included in unit prices on first page)	**$1,993,596**	**$2,266,457**	**$1,531,404**
Direct Cost Contingency				
	*Overall Project Contingency (Excludes Turbine/Gen. Costs): 0.00%	$0	$0	$0
	Total - Contingency	**$0**	**$0**	**$0**
	Median Direct Construction Cost	**$14,337,846**	**$16,431,811**	**$11,102,679**
	Total Direct Construction Cost Range (-30% to +50%)	**$10,036,492 to $21,506,770**	**$11,502,267 to $24,647,716**	**$7,771,875 to $16,654,019**
Planning, Permitting, & Engineering				
	Planning 5.00%	$617,212.50	$708,267.70	$478,563.75
	Permitting & Environmental 5.00%	$617,212.50	$708,267.70	$478,563.75
	Geotechnical	$500,000.00	$500,000.00	$500,000.00
	Engineering 10.00%	$1,234,425.00	$1,416,535.40	$957,127.50
	Total Planning, Permitting, & Engineering Cost	**$2,968,850.00**	**$3,333,070.80**	**$2,414,255.00**
	Median CAP EXP Cost	$17,306,696	$19,764,881	$13,516,934
	Opinion of Probable CAP EP Cost Range (-30%/+50%)	$12,114,687 to $25,960,045	$13,835,417 to $29,647,322	$9,461,854 to $20,275,401
	$ per KW - Direction Construction Costs + Overhead	**$12,165.45 to $26,069**	**$13,942.14 to $29,876.02**	**$9,420.45 to $20,186.69**
	Total $ per KW - Incl. Indirect	**$14,684.47 to $31,467**	**$16,770.20 to $35,936.15**	**$11,468.91 to $24,576.24**

$12,114,000 - - - $17,307,000 - - - $25,960,000

Graphic From MJ Feasibility Study Draft 12-19-15

Cost/Benefit Assumptions

CASE NAME:	Modified AEA
Assumptions:	
General Inflation	0.0%
Discount Rate	3.0%
Fish Tax Escalator	0.0%
CEC Project Share	52%
CEC Fuel Efficiency, kWh/gal.	14.5
CEC Load Growth	0.0%
Both CEC & COC:	
% Financed	100%
Interest Rate	3.0%
Term of Note, Yrs.	30

Figure 10-1. Case 1 Assumptions

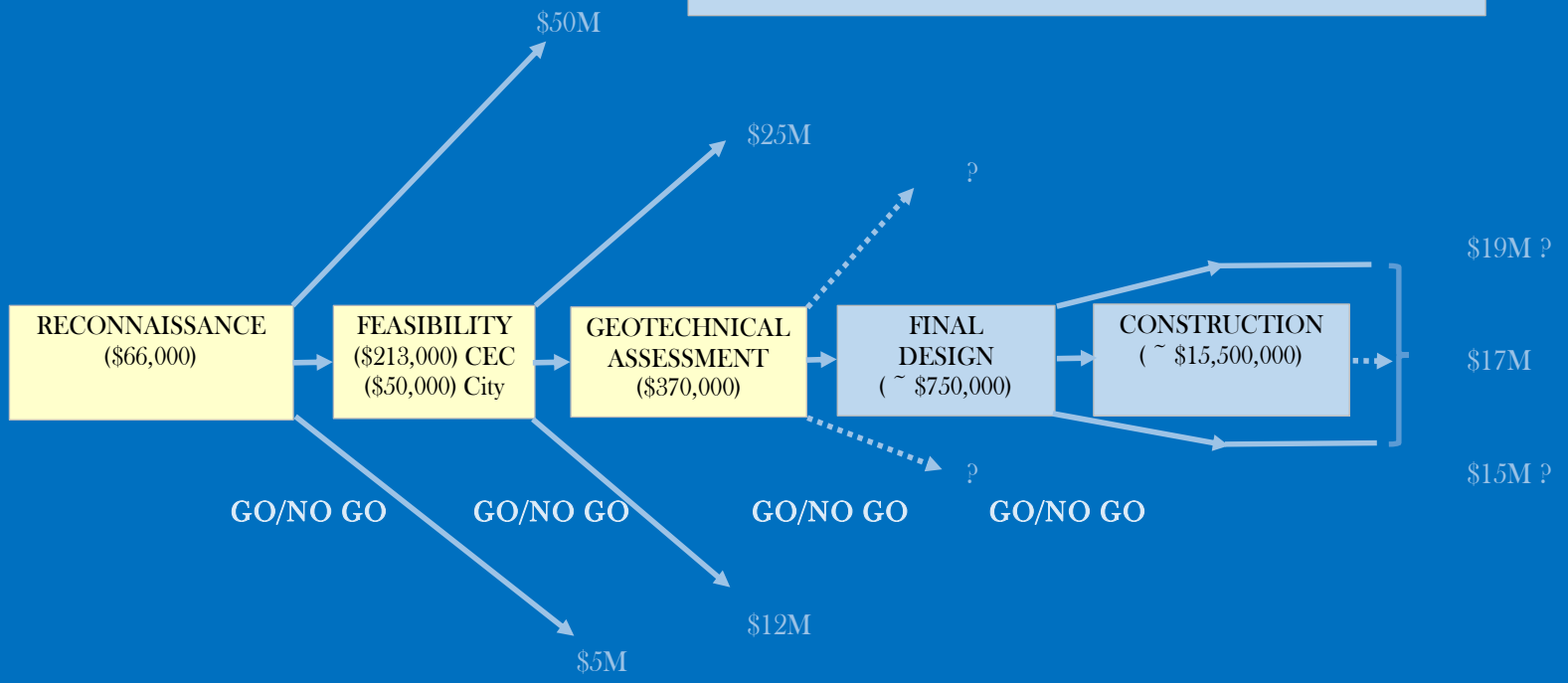
Cost/Benefit Results

Crater Lake Preliminary Economic Feasibility - CEC and COC ($000)

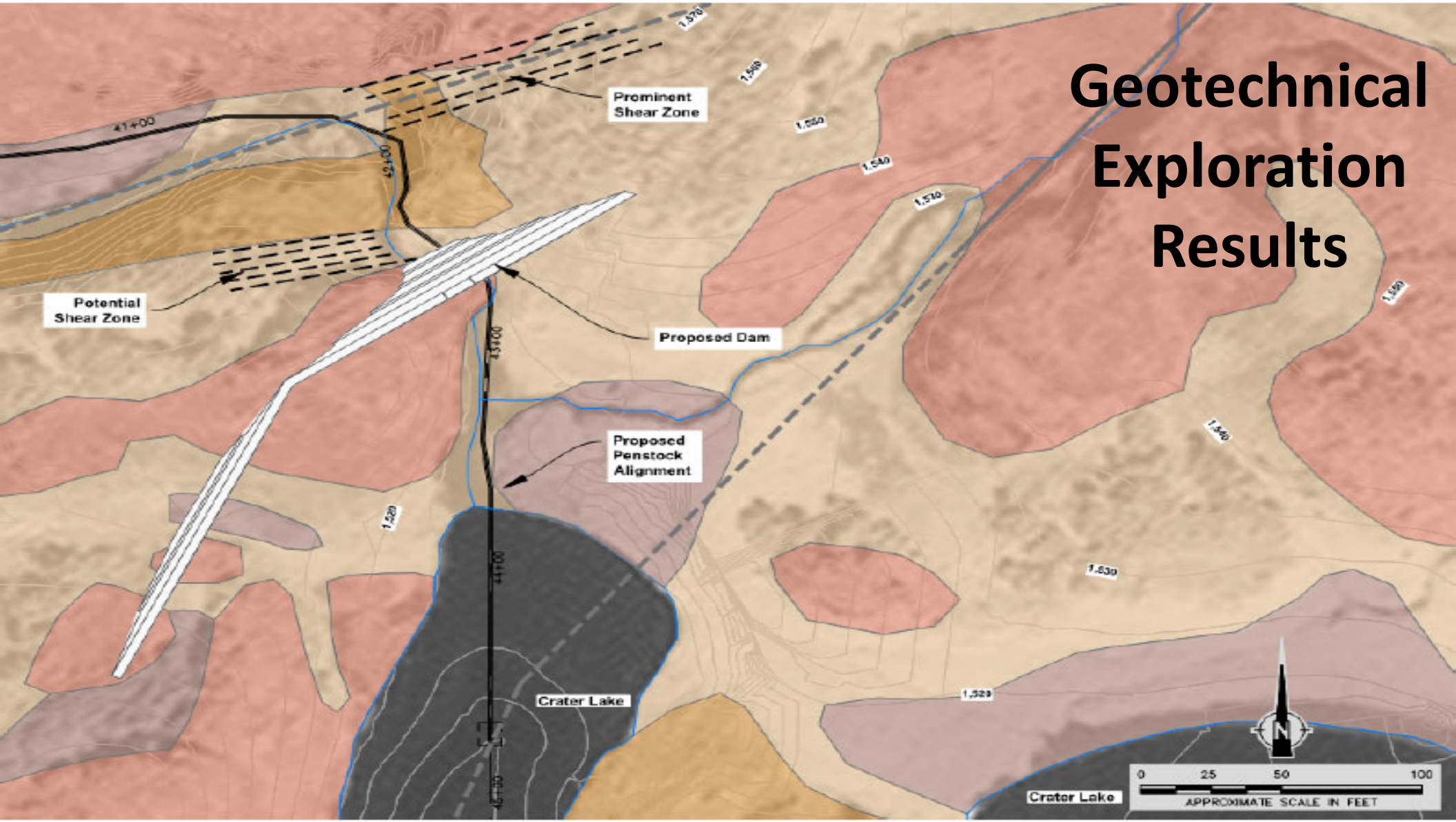
Modified AEA

Crater Lake	CEC NPV Benefit $	CEC NPV Cost $	CEC B/C Ratio	COC NPV Benefit $	COC NPV Cost $	COC B/C Ratio
Base Project	15,353	11,315	**1.36**	8,629	10,445	**0.83**
Option 1	15,353	12,910	**1.19**	8,629	11,917	**0.72**
Option 2	15,353	8,837	**1.74**	8,629	8,158	**1.06**

Tollgates Governance Process



Geotechnical Exploration Results



Summary of Geotechnical Findings

Based on the geologic mapping, explorations, in-situ testing, and laboratory testing presented in the GDR, the following key geotechnical parameters and findings have been obtained:

- Confirmed the suitability of foundation rock at the proposed Crater Lake Dam and Saddle Dam sites;
- Identified areas within the foundation that may require foundation treatment in accordance with standard concrete dam construction practices;
- Identified the presence of shear zones within the proposed reservoir and downslope of the proposed dam (Figure ES-4);
- Identified the need for a grouted cutoff curtain at the upstream heal of the proposed dam;
- Established a likely range of rock strength and conditions in the dam area;
- Established the presence of relatively shallow bedrock along the penstock alignment that could be used for foundation support or anchor bond zones;
- Identified geologic hazards along the penstock alignment to avoid unstable soils; and
- Confirmed most initial geotechnical assumptions made for the project.

Geotechnical Findings for Overall Project Picture

Feasibility Study	Conclusions
Geotechnical and Geohazards Analysis	Determined that no fatal flaw geotechnical or geologic hazards were identified that would present significant risk of the project feasibility
Baseline Hydrology Study	Crater Lake hydrology is sufficient to support a storage/hydro Project and represents both a water supply and renewable energy resource that could provide significant benefit to Cordova.
Water Supply System Evaluation and Penstock Sizing	Cordova water system could benefit substantially from the additional, high quality water available through a storage resource. The existing water distribution pipeline can support this additional water.
Operations Modeling	The preliminary operations model showed multiple options for combined water/power supply and may offset as much as 25% of current diesel generation.
Initial Project Design Criteria and Conceptual Civil Design	The Project could employ conventional design and construction methods to develop a combined hydroelectric and water supply Project.
Permitting Evaluation and Strategy	No fatal flaws were identified in permitting. Cordova administers public lands and private land agreements could be negotiated. Permit requirements should be addressed early in the Project development cycle.
Constructability Review, Cost Estimate and Schedule	The Project is constructible with conventional and helicopter-based methods. Cost estimates range from $12M to $26M, with a median cost of $17.2M for the base Project. Advanced design effort will narrow the cost range through development of site-specific design details
Cost/Benefit	The Project shows promise with an estimated cost/benefit ratio for CEC of 1.36 (AEA method) and 1.27 (inflation adjusted). The Project shows both negative and positive outcomes for Cordova, depending on assumptions, with an estimated ratio of 0.83 (AEA method) and 1.09 (inflation adjusted).

Questions?