APPENDIX A

WATER BALANCE EVALUATION

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A probabilistic water balance has been developed for the purpose of sizing the evaporation ponds for the Piñon Ridge Project. The water balance evaluation was conducted assuming that the evaporation ponds will be constructed in phases, with Phase 1 accommodating a milling rate of 500 tons per day (tpd), and Phase 2 allowing for an ultimate milling capacity of 1,000 tpd.

MODEL DEVELOPMENT

For the purpose of sizing the evaporation ponds, the following water balance components were considered: (1) the amount of raffinate water entering the pond system from the mill (CH2M Hill, 2008); (2) water entering the system through meteoric precipitation; and (3) the amount of water released to the atmosphere through evaporation. Precipitation values are likely to exhibit largest variations, and were therefore treated as stochastic inputs (i.e., probabilistic), while the other parameters were treated as deterministic variables. Water balance calculations were performed using the computer program *Goldsim*™.

The water balance model was based on the following equation:

$$\Delta S = (Q + P) - (E + E_{SP})$$

where:

ΔS	=	change in stored solution volume
Q	=	raffinate inflow from the mill
P	=	precipitation collected within the evaporation pond footprint
E	=	evaporation loss from the pond surface
E_{SP}	=	water loss due to enhanced evaporation

AVAILABLE DATA

Water balance assumptions and sources of input data are summarized in Table A-1. The evaluation of climate data conducted by Golder for nearby weather stations indicates that the Uravan weather station is likely to provide reasonable precipitation estimates (See Appendix A-1). The average monthly precipitation values for the Uravan weather station are summarized in Table A-2.

The Hargreaves (1985) method was used to estimate monthly evaporation values at the Piñon Ridge site, using the available climate data from the Uravan weather station (i.e., precipitation, air temperature, etc.). The calculated evaporation values were scaled by a factor of 0.7 to represent lake evaporation. Monthly evaporation values used for the water balance calculations are summarized in Table A-2. The extreme climate data used for water balance modeling to simulate average, dry, and wet climatic conditions are summarized in Table A-3.

Based on design-level process water balance information provided by CH2M Hill (2008), the design process water inflow (raffinate from the mill) to the evaporation ponds was predicted to range from 63 gallons per minute (gpm) for 500 tons per day (tpd) milling operations, up to 126 gpm for 1,000 tpd milling operation.

DEVELOPMENT OF STOCHASTIC PRECIPITATION PARAMETERS

In order to develop stochastic precipitation input for the *Goldsim* model, continuous probability distributions were calibrated against the available monthly precipitation data from the Uravan weather station. The Weibull distribution was selected due to its flexibility to represent a wide range of values. The distribution is truncated at its lower end and has a long tail to the upper end, making it well-suited to modeling extreme positive values, such as precipitation events with longer return periods. Separate Weibull distributions were fitted to non-zero precipitation records collected for each month. A moment estimation method was used to determine distribution parameters resulting in fitting coefficients summarized in Table A-4. Minimum monthly precipitation was set to 0.1 inches per month for all *Goldsim* simulations.

MODEL VALIDATION

To verify the adopted probability distributions, a precipitation model was constructed in *Goldsim*™ and allowed to run for a 1-year period using Monte-Carlo sampling with 1,000 realizations. *Goldsim* results are compared against recorded values for the Uravan weather station in Figures A-2 to A-13 for the months of January through December, respectively, with annual totals in Figure A-14. *Goldsim* results show favorable agreement between the measured and calculated extreme values on both monthly and annual basis.

ENHANCED EVAPORATION

Enhanced evaporation values were evaluated from the estimated monthly vapor pressure deficit (e_{sat}-e_{air}) where:

e_{sat} = saturated vapor pressure (kPa)
e_{air} = actual vapor pressure (kPa)

Both saturated and actual vapor pressures were calculated based on the quarterly values for relative humidities for Grand Junction reported by Schroeder et al. (1994), and monthly temperature records for Uravan as summarized in Table A-5.

Enhanced evaporation losses summarized in Table A-5 were calculated using the methodology proposed by Ortega et al. (2000), who proposed the following equation for sprinkling irrigation losses:

$$Evap_Losses = 7.63 * (e_{sat} - e_{air})^{0.5} + 1.62 * W$$

where W is the wind speed in meters per second (m/s), and e_{sat} and e_{air} were defined above. Assuming negligible evaporation losses caused by wind drift, as the sprinklers will be placed internal to the ponds such that drift is not a concern from a regulatory standpoint, the wind speed influence was neglected for the enhanced evaporation calculations. Total sprinkler output was evaluated by assuming installation of low impact sprinklers with a nominal outflow of 2 gallons per minute (gpm) per sprinkler head. The adopted sprinkler influence diameter was 30 feet. It was assumed that the sprinklers are uniformly spaced along the evaporation pond perimeters, with the distance between two adjacent sprinklers equal to the influence diameter. *Note that to prevent irrigation beyond the outer edge of the ponds, no sprinklers were installed within 100 feet from the evaporation pond boundaries.*

WATER BALANCE RESULTS

Preliminary Estimates

In order to provide initial estimates for the evaporation pond sizing calculation, the following general expression may be used:

$$RequiredEvapArea(L^2) = \frac{ProcessWaterInflows(L^3/T) - EnhancedEvaporation(L^3/T)}{Evaporation(L/T) - Precipitation(L/T)(1 - EnhEvapCoef.)}.,$$

Enhanced evaporation losses were calculated assuming a sprinkler application rate of 1,000 gpm for the raffinate inflow of 63 gpm, and a sprinkler application rate of 2,000 gpm for the raffinate inflow of 126 gpm. For these preliminary calculations, the average annual enhanced evaporation loss of 7.4 percent was applied assuming that the sprinklers were activated 33 percent of the time (i.e., 8 hours per day).

For the annual precipitation values presented in Table A-3, preliminary estimates for the pond evaporation areas are summarized in Table A-6. Table A-6 indicates the need of increasing pond sizes to provide contingency for precipitation events of larger magnitude. Probabilistic analyses were conducted to provide estimates which consider variations in the climate during the milling period.

Probabilistic Estimates

The evaporation pond areas were evaluated at different stages of the facility development assuming a maximum time of operation of 40 years. *Goldsim* calculations were based on the stochastic monthly precipitation records generated by using Weibull's distribution parameters presented in Table A-4, and illustrated in Figures A-2 through A-13. The acceptable probability of unscheduled shutdown was selected based on the 1 in 1000 year reoccurrence interval, or a 0.001 probability in any given year. The probability of the unscheduled shutdown occurring once during the 40-year operation period can be calculated as follows:

$$Cumulative\ probability = 1 - (1 - p)^n,$$

where

p = annual probability of occurence
n = number of years to evaluate

Thus, the allowable probability of exceedence for the entire 40 year period is approximately 4 percent. The calculated evaporative area was considered adequate if greater than 96 percent (100% minus 4%) of the simulations did not trigger an unscheduled shutdown during the entire 40 year simulation. A Monte-Carlo simulation with 1,000 realizations was used to evaluate the probability of exceeding the evaporation pond storage capacity (i.e. probability of unscheduled shut down) after 5, 10, 20 and 40 years of operation. For the 1-year simulation, the evaporative area was considered adequate if 99.9 percent of simulations did not trigger an unscheduled shutdown. Due to relatively high target probabilities in Monte Carlo simulations for 1- and 2-year periods, these simulations required a larger number of realizations. Results from the probabilistic analyses are summarized in Tables A-7 and A-8 and Figures A-15 through A-18.

SUMMARY

The stochastic water balance model for a continuous raffinate inflow of 126 gpm corresponding to 1000 tpd operations indicates that the evaporation pond area of approximately 83 acres is required for the operating period of 40 years with the probability of emergency shut-down below four percent. For the raffinate inflow of 63 gpm based on the design milling capacity of 500 tpd, the required evaporation pond area reduces to 45.5 acres, also assuming approximately four percent chance of emergency shutdown during 40 years of milling operations. It should be noted that a potential reduction in evaporation pond size due to pumping water to the tailings cells for dust control has not been considered, as this flow rate is assumed to be negligible.

For the above analyses, a reduction in evaporation of 30 percent was assumed based on the difference between calculated and actual shallow lake or pond evaporation. The evaporation ponds are expected to be protected from water fowl using ultraviolet (UV) stabilized knotted

polyethylene netting. As the netting may influence the wind speed and radiation exposure, the proposed evaporation rates should be verified in-situ, and possibly revised upon initial construction of the evaporation ponds for the 500 tpd milling rate. The influence of netting and the presence of total dissolved solids (TDS) in the process flow to the evaporation ponds are both likely to affect pond evaporation. Thus, the need to provide field evaporation measurements during the early years of milling operations is warranted to assist in refining the design of the evaporation ponds and allow modifications to operations as warranted, which may include construction of an additional cell (or cells) if milling continues at the 500 tpd rate for the entire mine life. Further, field evaporation measurements will assist in refining expansion design of the evaporation ponds for an increase in the milling capacity (i.e., to 1,000 tpd or more).

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TABLE A-1

WATER BALANCE MODEL ASSUMPTIONS

Property	Value	Source	Comment/Assumptions
Number of evaporation ponds	Varies	Calculated variable	Calculated from water balance requirements
Dimensions for a single evaporation pond	300 ft x 600 ft	See Figure A-1	Pond constructed with a 3H:1V upper portion over the vertical distance of 5 ft for containment purposes.
Sprinkler outflow	2 gpm	Rain Bird and Senninger specifications	Assume low impact sprinkler to minimize wind drift
Sprinkler diameter of influence	30 ft	Rain Bird and Senninger specifications	Use diameter of influence to determine required distance between adjacent sprinklers
Raffinate inflow	63 or 126 gpm	CH2M Hill (2008)	Design flow of 63 gpm corresponds to a milling rate of 500 tpd. Design flow of 126 gpm corresponds to a potential expansion milling rate of 1000 tpd.
Climate data	Varies	See Appendix A-1	Use climate date for Uravan
Annual Pan Evaporation	55 to 60 inches	wrcc.dri.edu/climmaps/panevap.gif	Use pan factor of 0.7 to estimate lake (pond) evaporation
Enhanced evaporation loss	Varies	Ortega et al. (2000)	Neglect wind influence in calculations

Notes:

1. Tailings and evaporation pond stream analysis for project design provided by CH2M Hill (2008).

TABLE A-2

MONTHLY PRECIPITATION AND EVAPORATION VALUES

Month	Average* Precipitation (inches)	Minimum* Precipitation (inches)	Maximum* Precipitation (inches)	Calculated Lake Evaporation (inches)
January	0.88	0	3.19	0.8
February	0.76	0	2.05	1.2
March	1.03	0	3.43	2.2
April	1.01	0.03	2.68	3.3
May	0.94	0	2.85	4.8
June	0.48	0	1.65	5.8
July	1.19	0.09	3.54	6.3
August	1.36	0.18	3.32	5.4
September	1.5	0.06	4.78	3.8
October	1.51	0	5.89	2.5
November	1.05	0	2.39	1.2
December	0.88	0.03	3.55	0.7

* Precipitation values obtained for Uravan weather station from 1961 to 2007

TABLE A-3

EXTREME ANNUAL PRECIPITATION AND AVERAGE EVAPORATION VALUES

Average* Precipitation (inch)	Min.* Precipitation (inch)	Max.* Precipitation (inch)	Estimated Lake Evaporation (inch)
12.5	7.13	21.4	38.0

* Precipitation values obtained for Uravan weather station from 1961 to 2007

TABLE A-4

WEIBULL DISTRIBUTION PARAMETERS

Month	Slope Parameter (-)	Mean Minus Minimum* (inch/month)
January	1.49	0.78
February	1.35	0.71
March	1.27	0.97
April	1.32	0.93
May	1.13	0.89
June	0.98	0.44
July	1.57	1.09
August	1.51	1.28
September	1.28	1.39
October	1.25	1.46
November	1.75	0.98
December	1.48	0.76

*****Minimum monthly precipitation was set to 0.1 inches per month for all *Goldsim* simulations.

TABLE A-5

CALCULATED ENHANCED EVAPORATION LOSSES

Month	Min. Temperature T_{min} (^oF)	Max. Temperature T_{max} (^oF)	Avg. Temperature T_{avg} (^oF)	Relative Humidity (%)	e_{sat} (kPa)	e_{air} (kPa)	Evaporation Losses (no wind) (%)
January	15.6	42.7	29.2	60	0.62	0.37	3.8
February	22.4	49.9	36.3	60	0.82	0.49	4.4
March	29.2	58.7	43.9	60	1.12	0.67	5.1
April	35.7	67.6	51.7	36	1.51	0.54	7.5
May	44.5	78.6	61.5	36	2.17	0.78	9.0
June	52.4	89.5	70.9	36	3.04	1.09	10.6
July	59.4	95.5	77.4	36	3.72	1.34	11.8
August	58.2	92.2	75.2	36	3.41	1.23	11.3
September	48.3	83.5	65.8	36	2.53	0.91	9.7
October	36.9	71.4	54.2	57	1.68	0.96	6.5
November	26.5	54.7	40.6	57	0.97	0.56	4.9
December	17.8	43.4	30.6	57	0.65	0.37	4.0

TABLE A-6

PRELIMINARY EVAPORATION POND AREA ESTIMATES

Climatic Condition	Annual Precipitation (inch)	Pond Area for Raffinate Inflow of 63 gpm (acre)	Pond Area for Raffinate Inflow of 126 gpm (acre)
Dry Conditions	7.13	26	55
Average Conditions	12.5	32	69
Wet Conditions	21.4	54	117

TABLE A-7

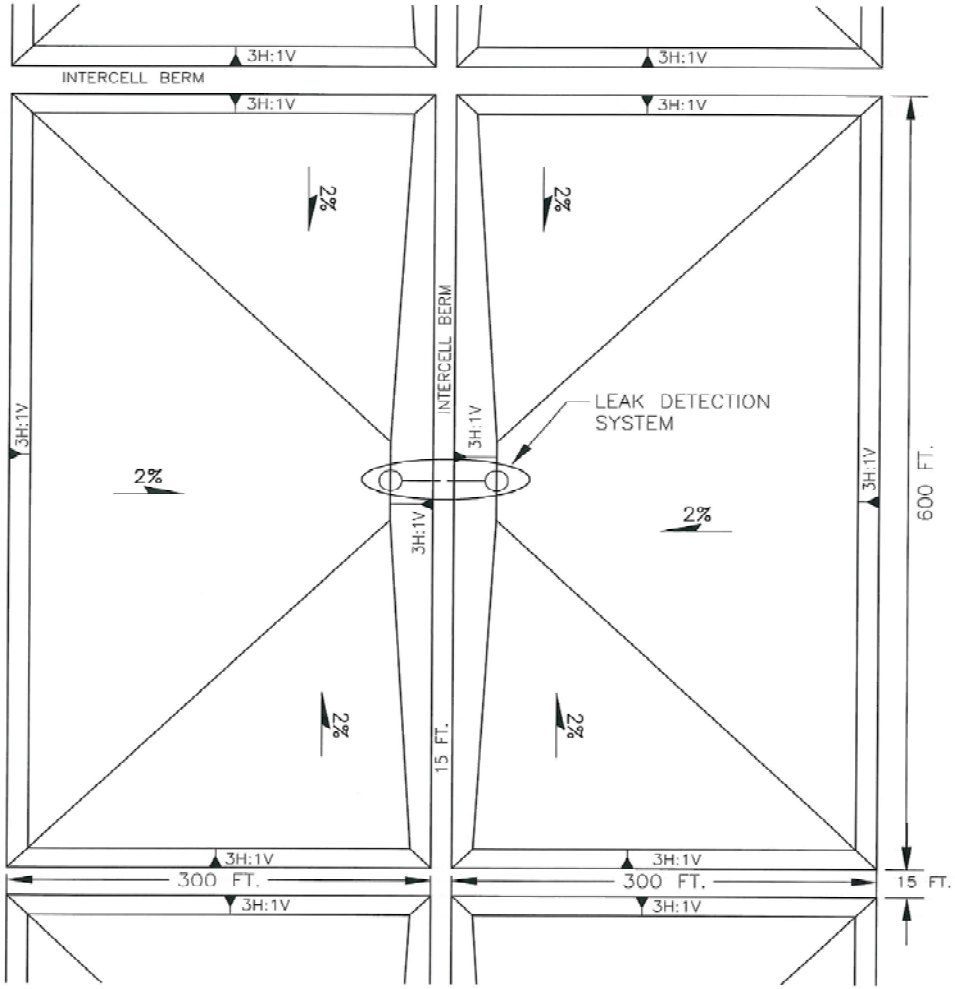
PROBABILISTIC EVAPORATION POND AREAS FOR RAFFINATE INFLOW OF 63 GPM

Design Storm	Pond Areas at Different Times of Operation (t=1, 2, 5, 10, 20 and 40 yrs) (acres)					
	1 yr	2 yr	5 yr	10 yr	20 yr	40 yr
1/1000 yrs	16.5	24.8	37.2	41.3	45.5	45.5

TABLE A-8

PROBABILISTIC EVAPORATION POND AREAS FOR RAFFINATE INFLOW OF 126 GPM

Design Storm	Pond Areas at Different Times of Operation (t=1, 2, 5, 10, 20 and 40 yrs) (acres)					
	1 yr	2 yr	5 yr	10 yr	20 yr	40 yr
1/1000 yrs	33.1	49.6	70.2	78.5	82.6	82.6



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TYPICAL EVAPORATION POND CELL LAYOUT

CLIENT/PROJECT

ENERGY FUELS RESOURCES CORPORATION
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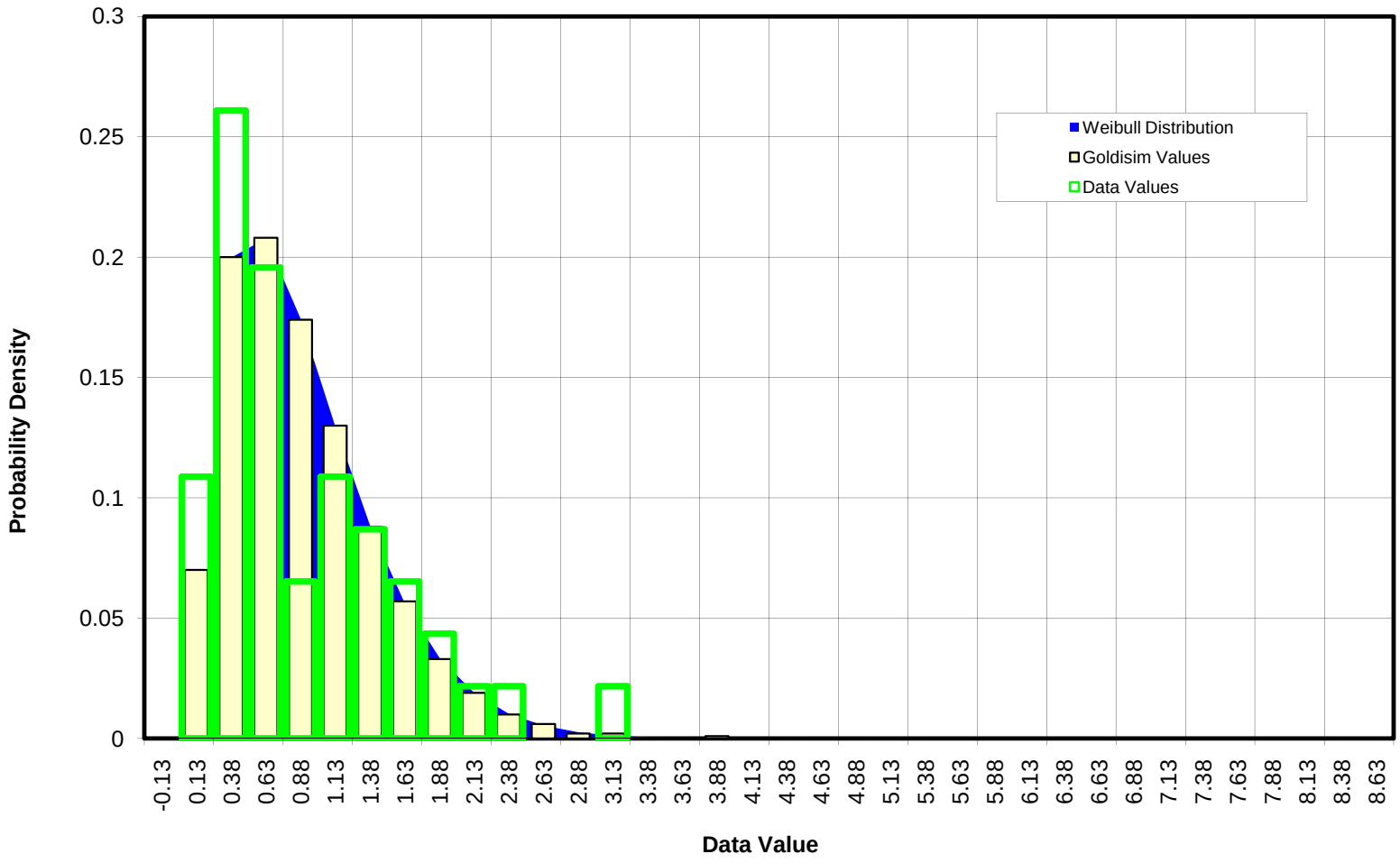

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URAVAN DATA
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CLIENT/PROJECT

ENERGY FUELS RESOURCES CORPORATION
PIÑON RIDGE PROJECT

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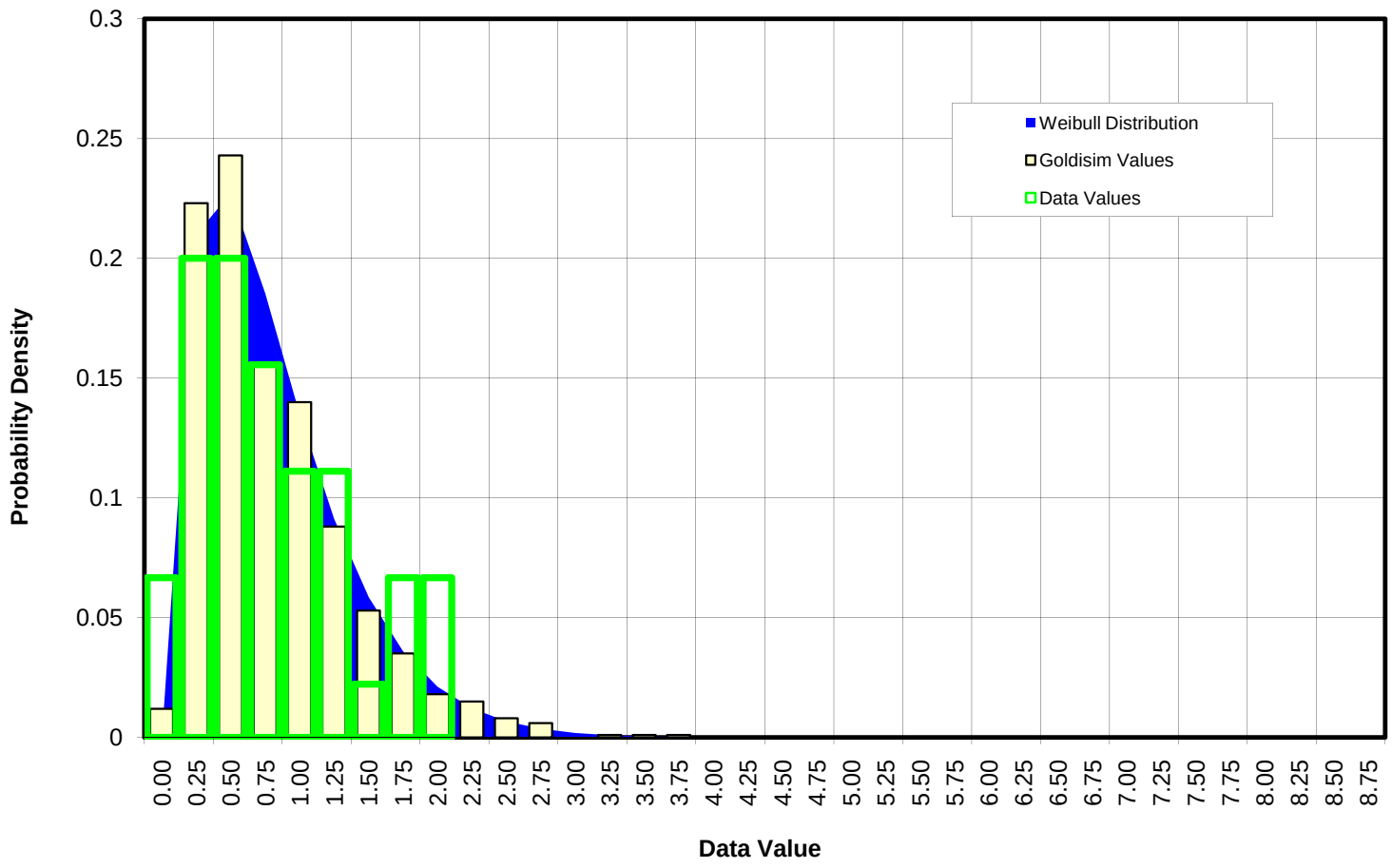

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URAVAN DATA
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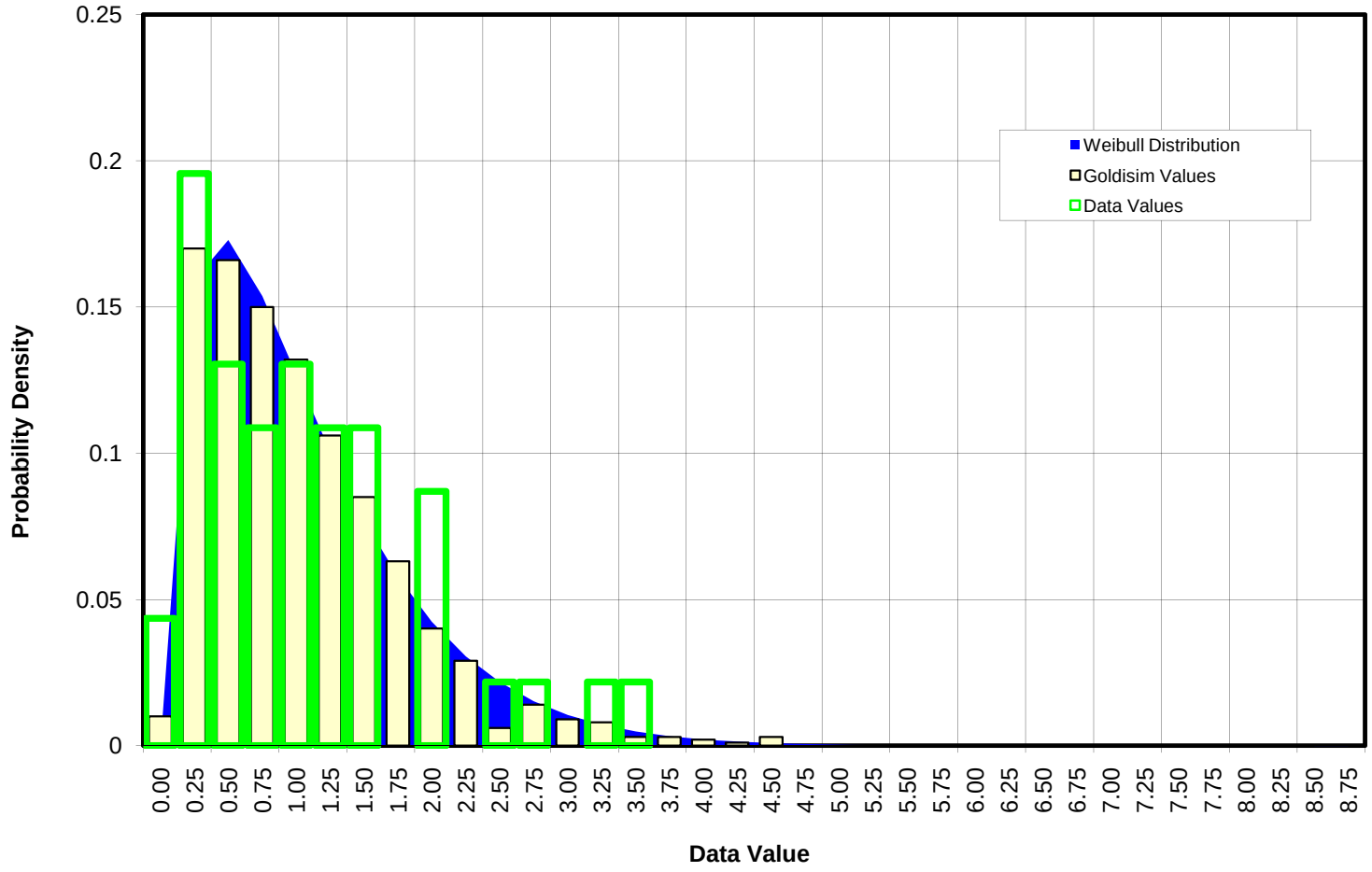

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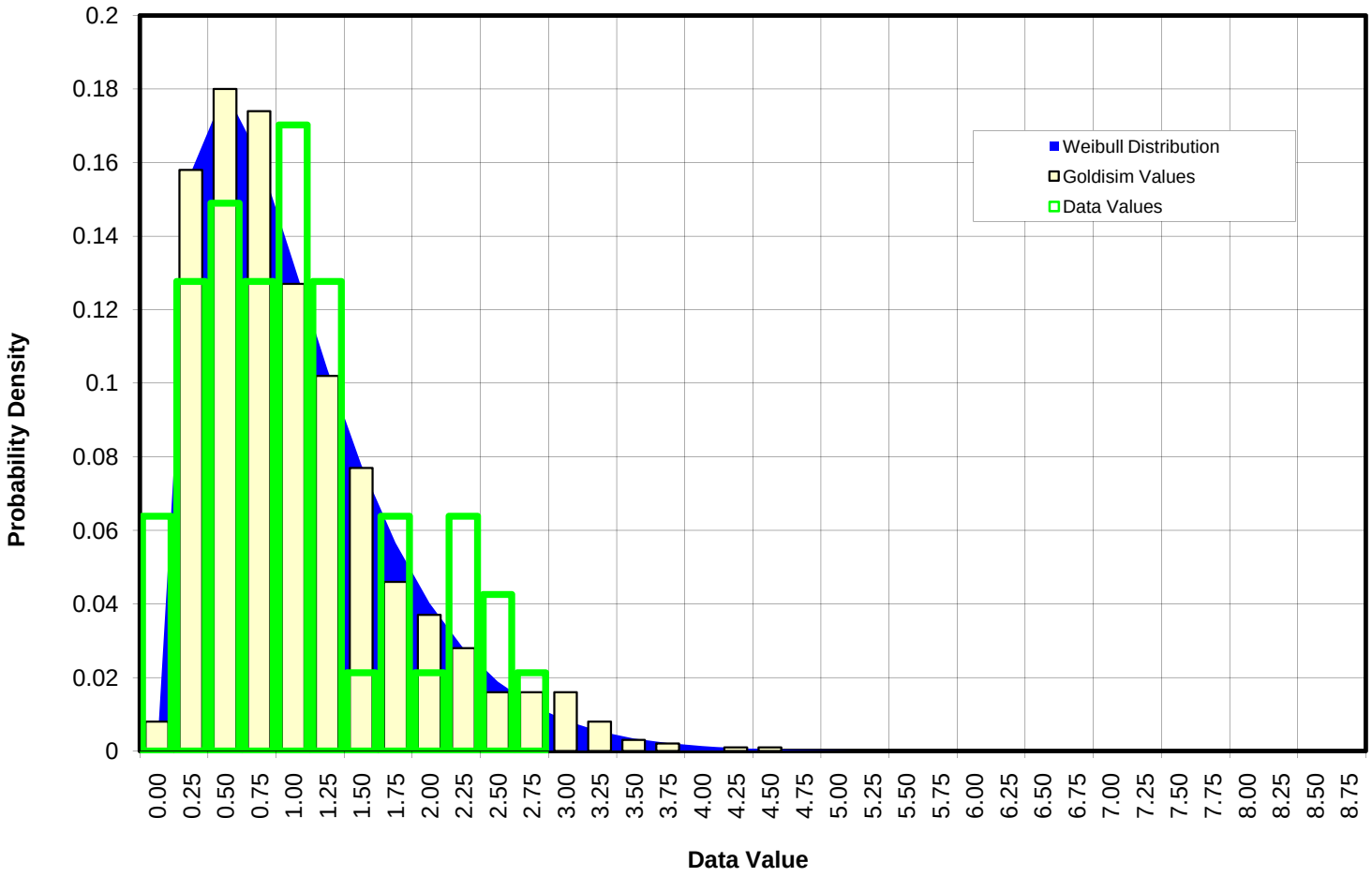

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CLIENT/PROJECT

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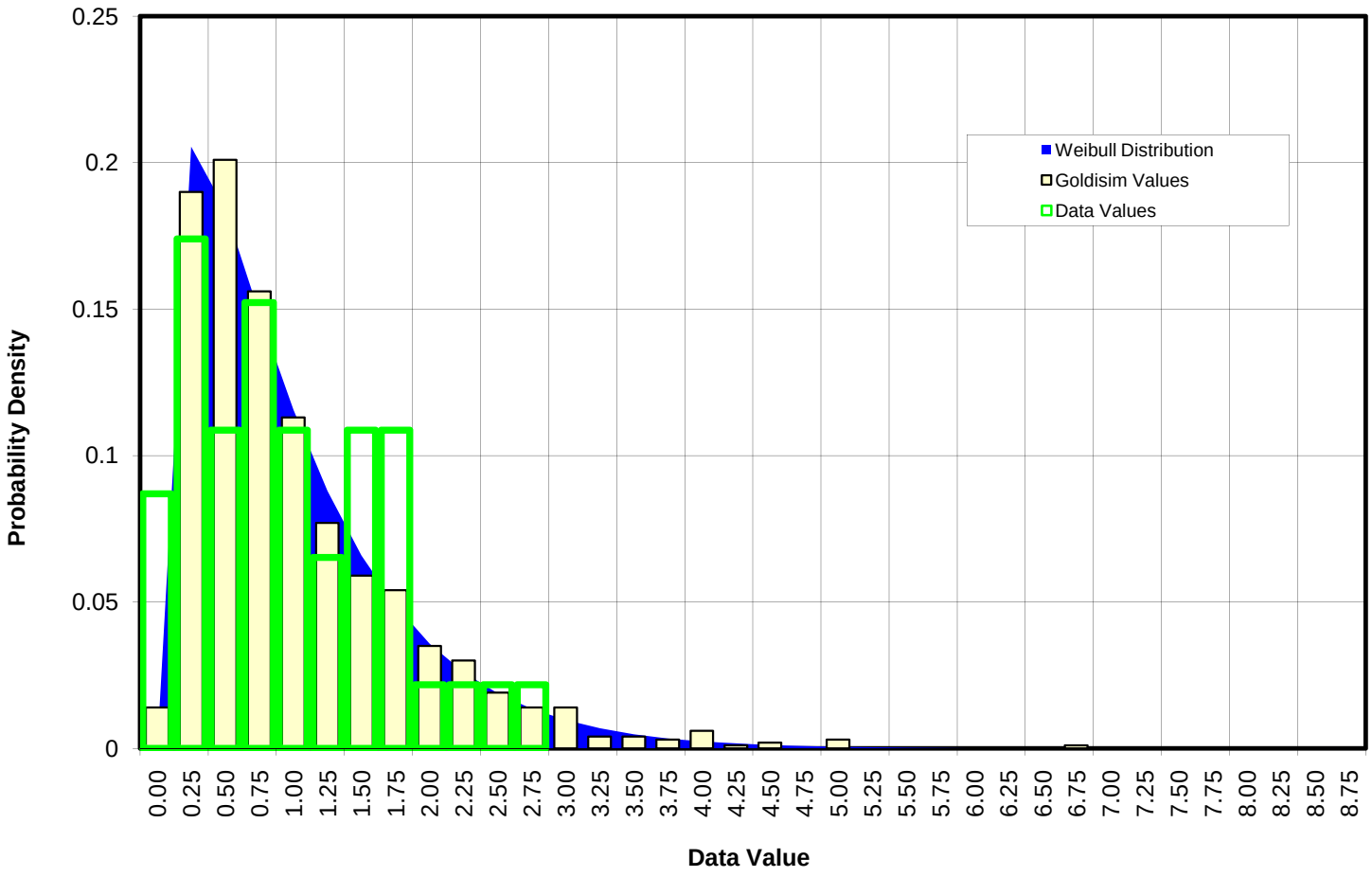

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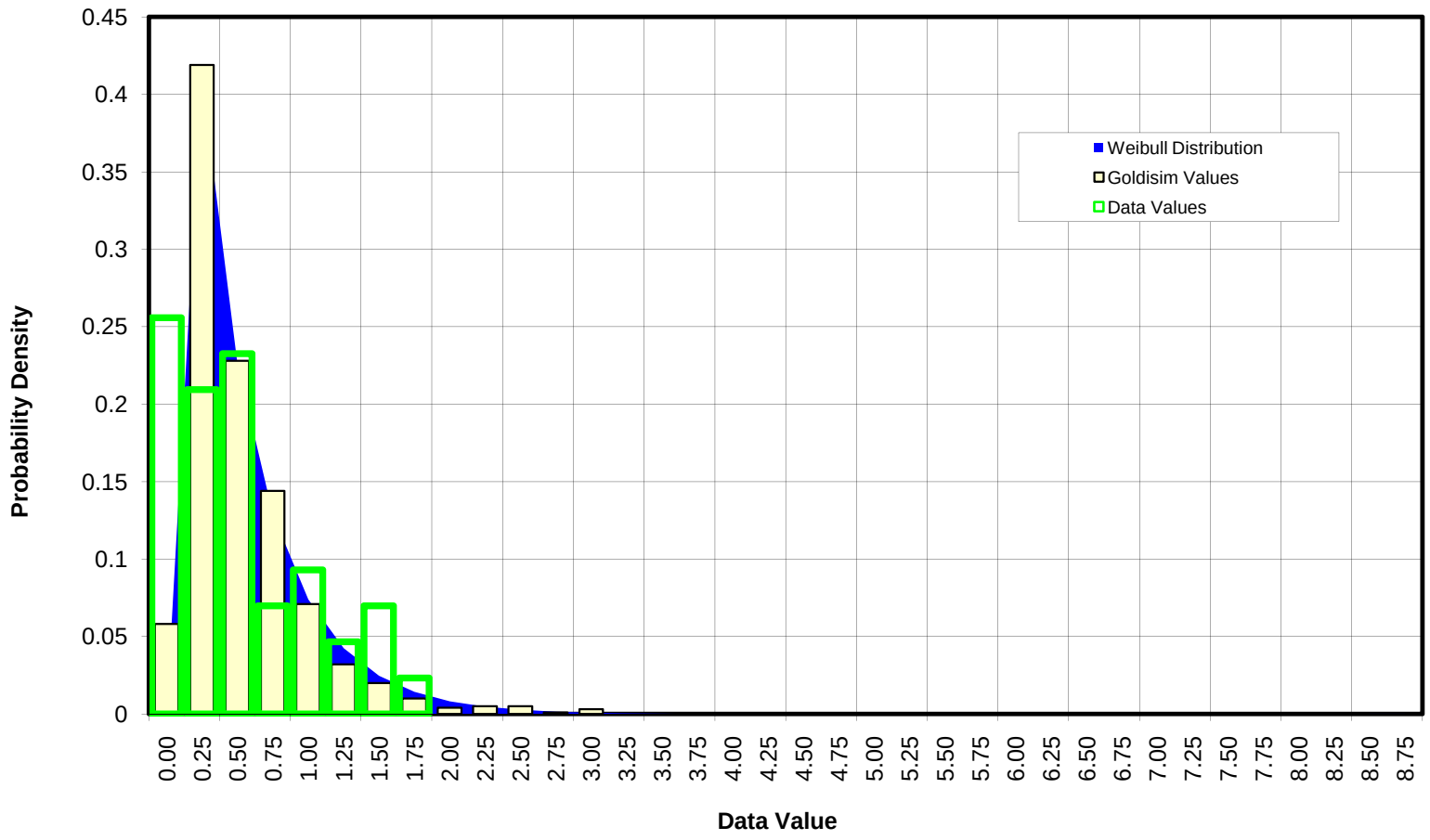

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CLIENT/PROJECT

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PIÑON RIDGE PROJECT

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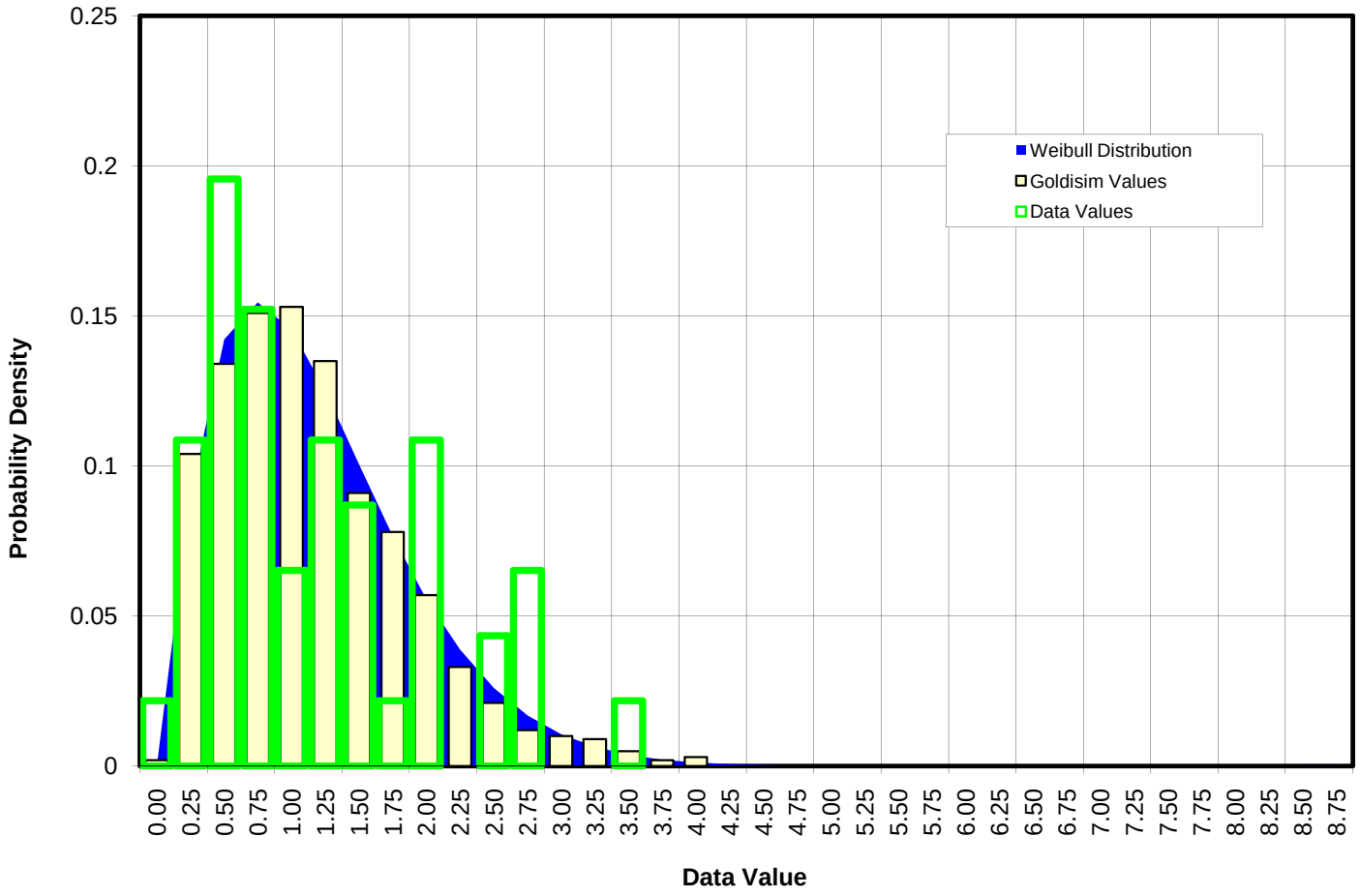

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PIÑON RIDGE PROJECT

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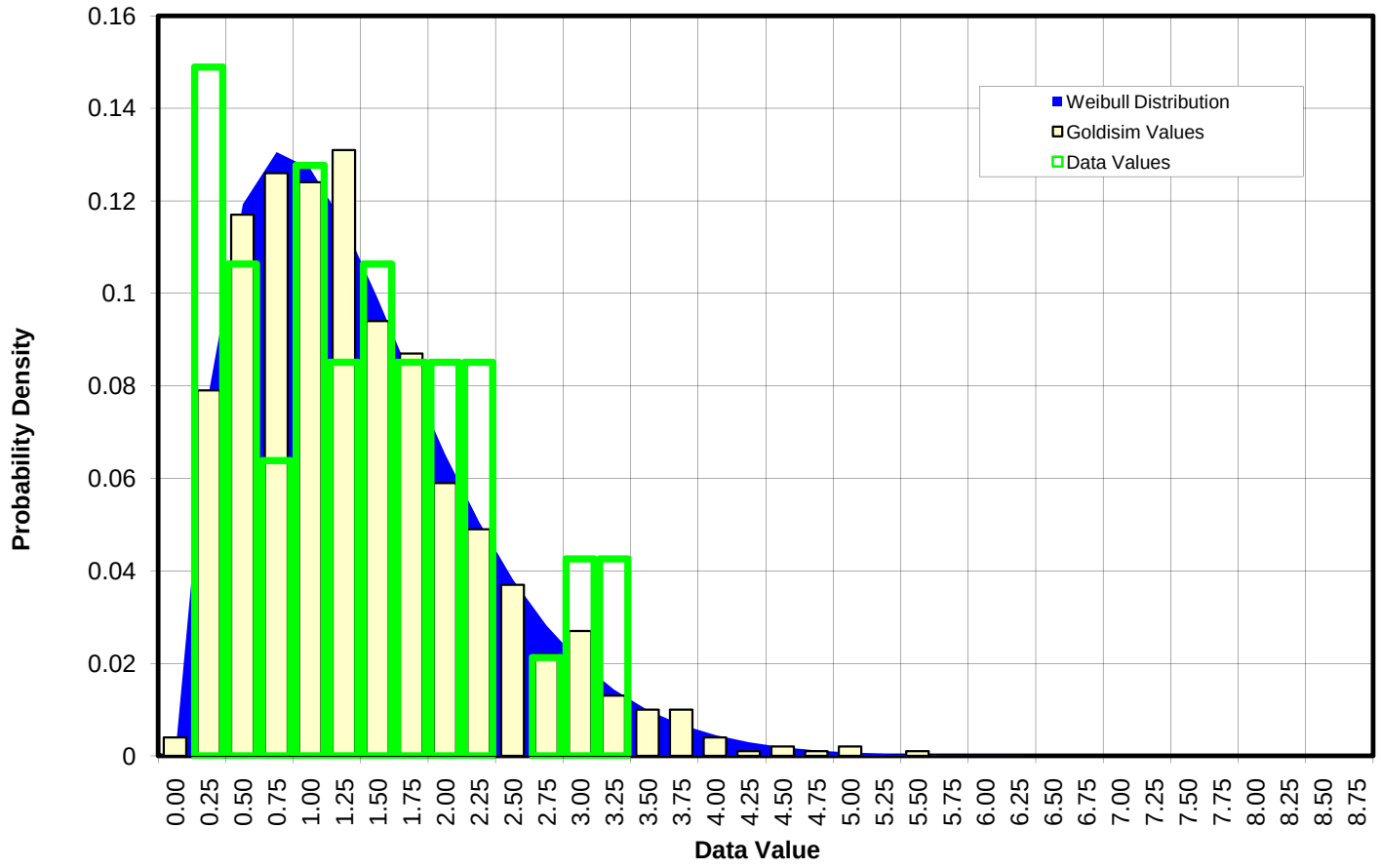

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URAVAN DATA
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CLIENT/PROJECT

ENERGY FUELS RESOURCES CORP.
PIÑON RIDGE PROJECT

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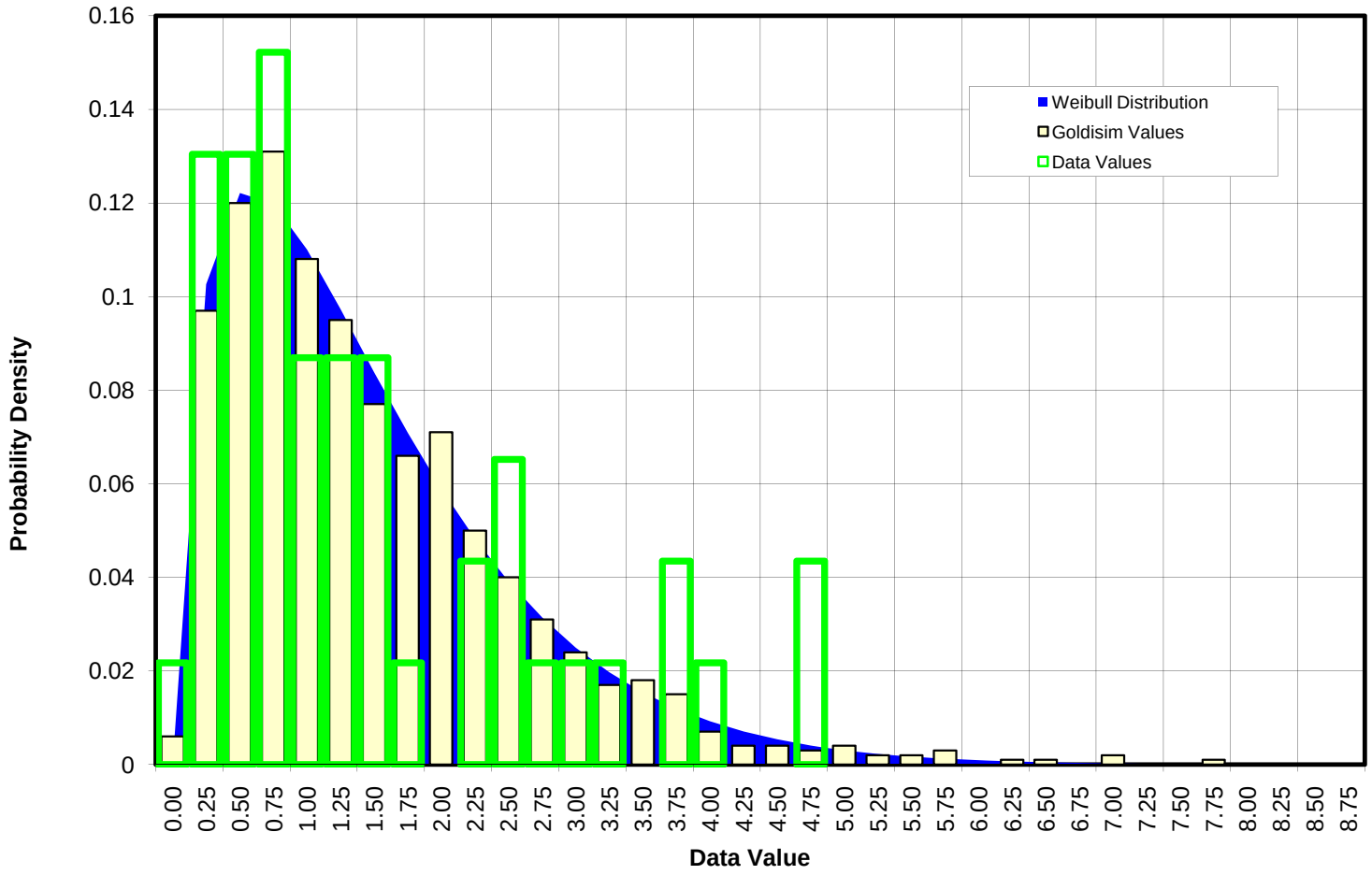

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URAVAN DATA
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CLIENT/PROJECT

ENERGY FUELS RESOURCES CORP.
PIÑON RIDGE PROJECT

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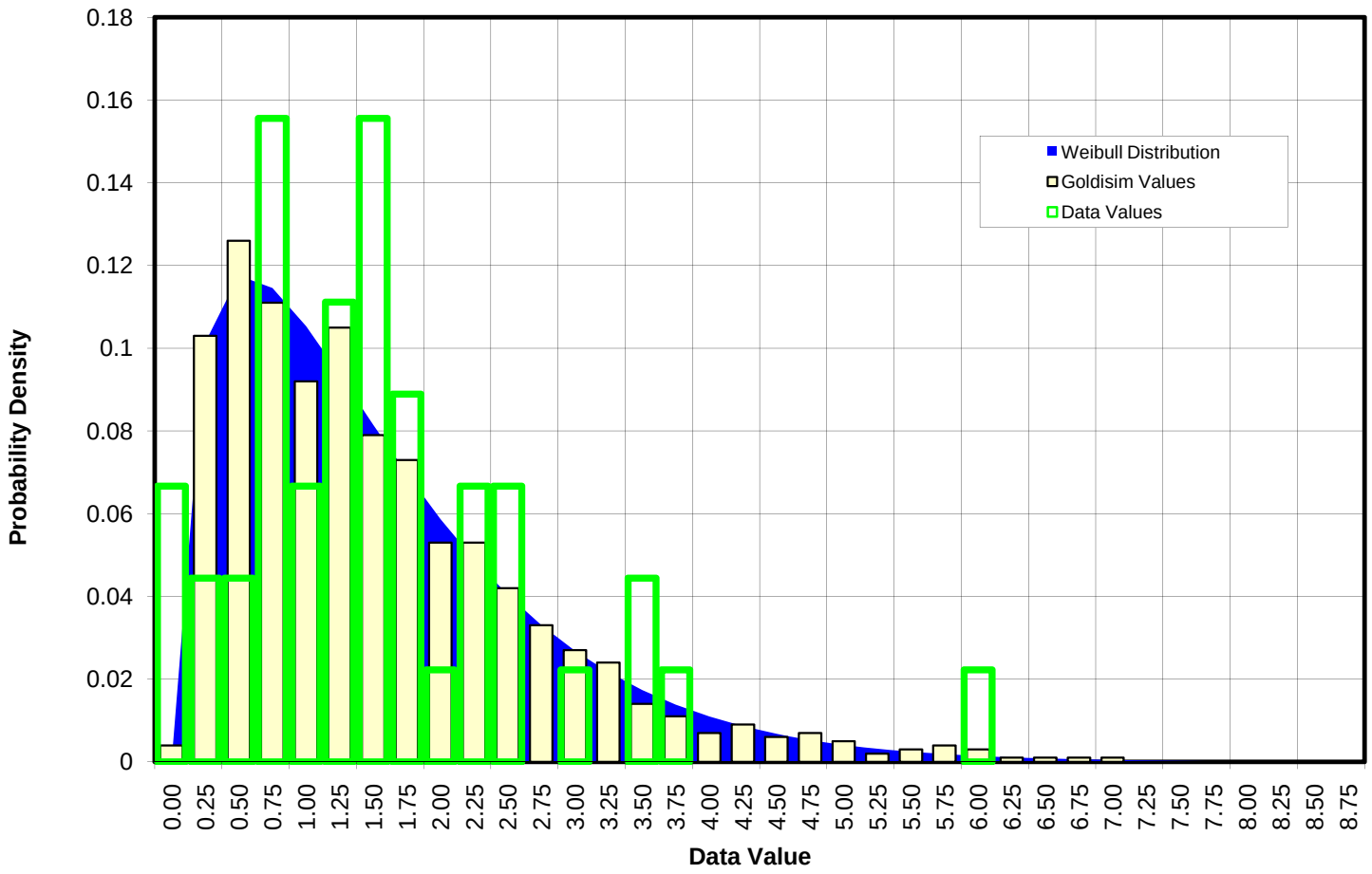

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URAVAN DATA
GOLDSIM RESULTS AND WEIBULL DISTRIBUTION FOR OCTOBER

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ENERGY FUELS RESOURCES CORP.
PIÑON RIDGE PROJECT

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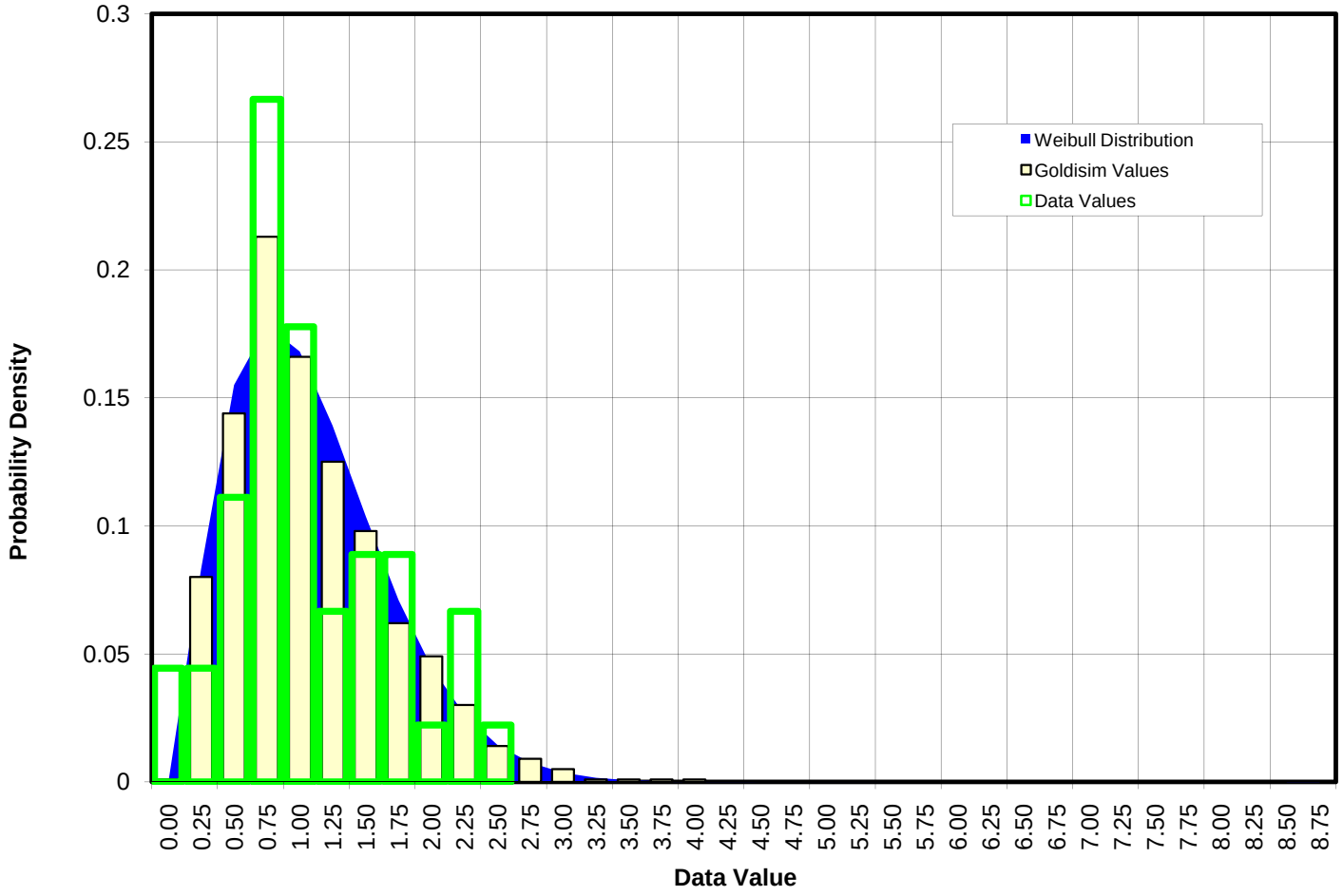

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URAVAN DATA
GOLDSIM RESULTS AND WEIBULL DISTRIBUTION FOR NOVEMBER

CLIENT/PROJECT
ENERGY FUELS RESOURCES CORP.
PIÑON RIDGE PROJECT

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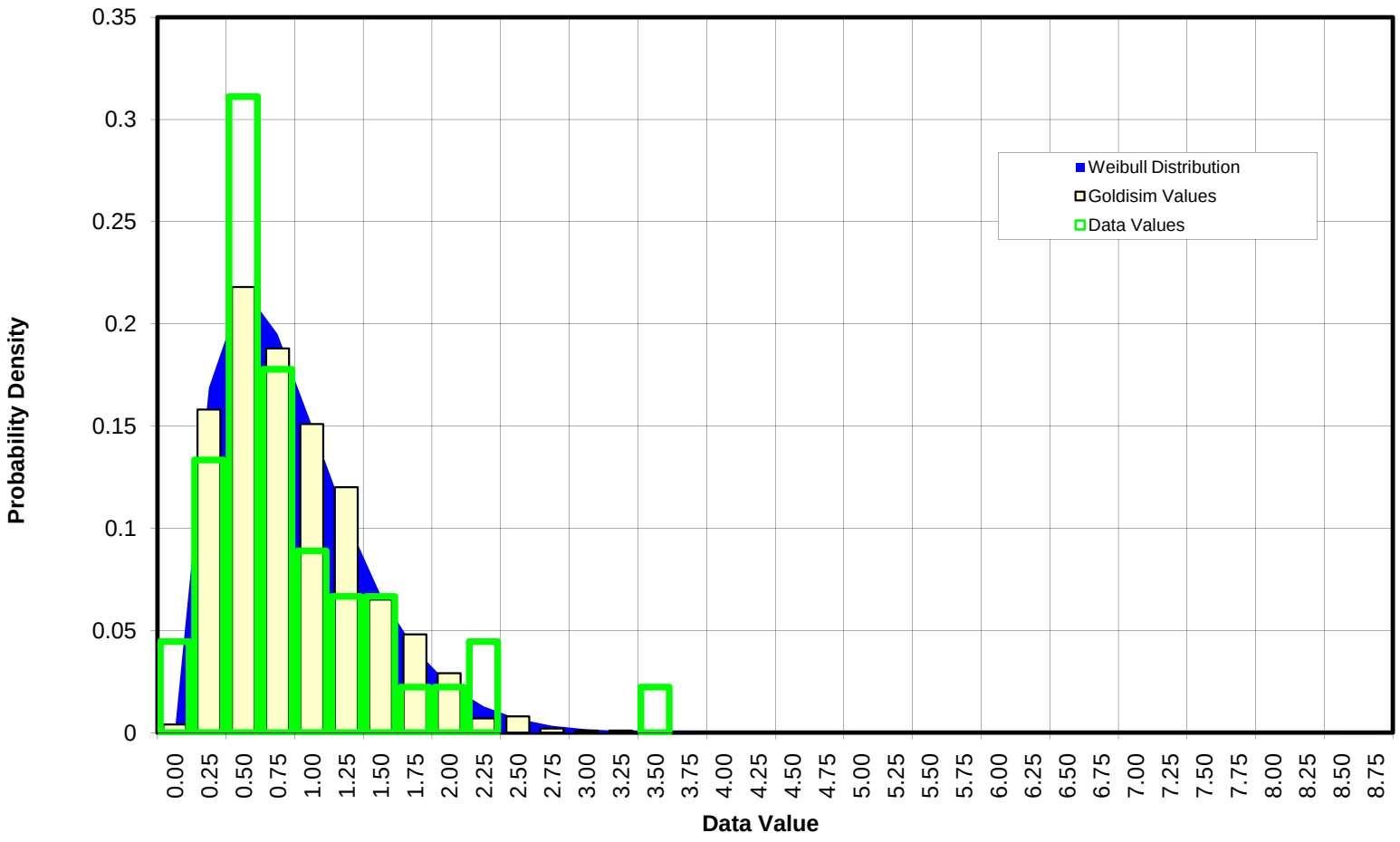

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URAVAN DATA
GOLDSIM RESULTS AND WEIBULL DISTRIBUTION FOR DECEMBER

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ENERGY FUELS RESOURCES CORP.
PIÑON RIDGE PROJECT

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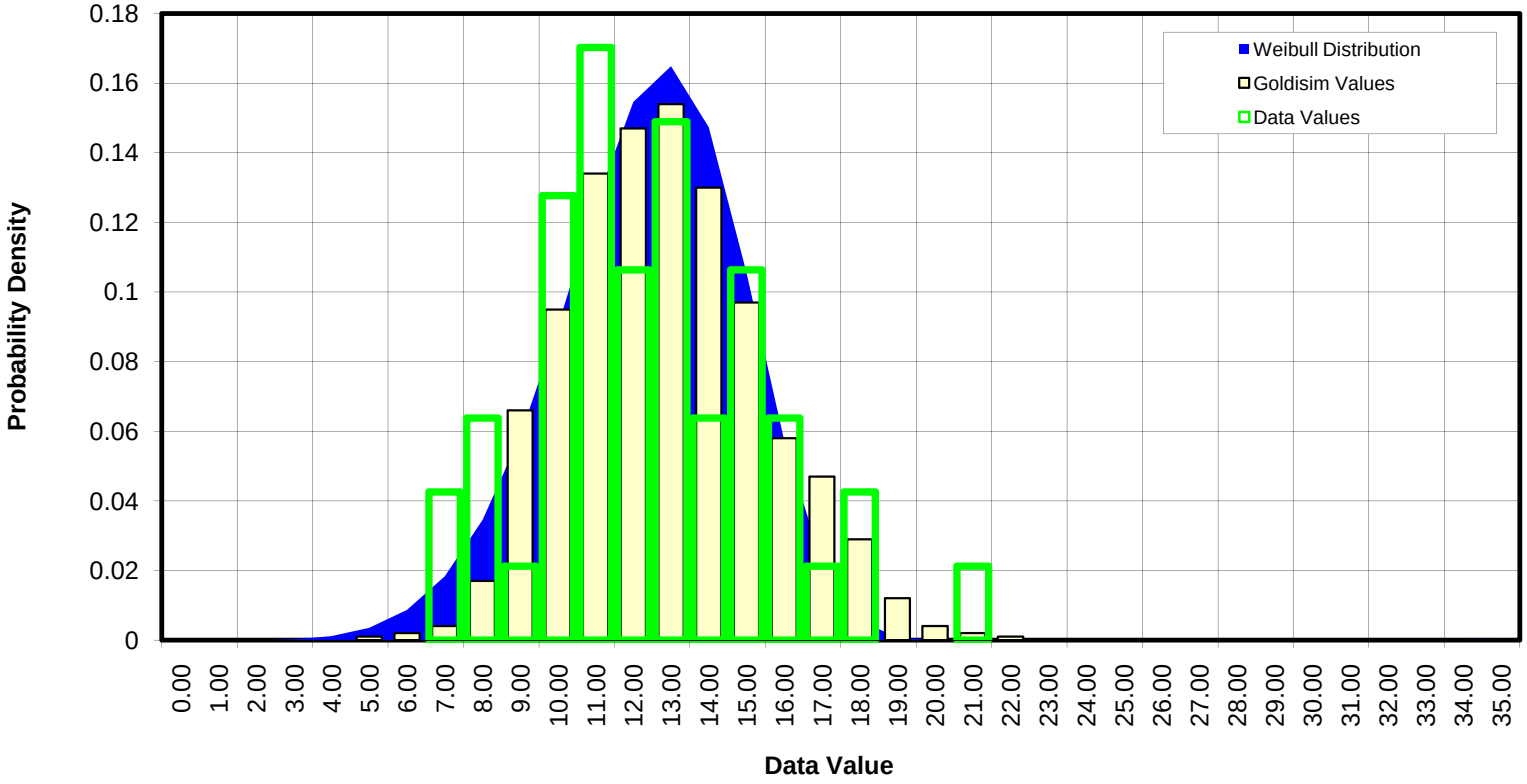
Annual Data Histograms with Weibull Distribution Fit to Uravan Historical Precipitation Data



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TITLE: **URAVAN DATA**
GOLDSIM RESULTS AND WEIBULL DISTRIBUTION FOR ANNUAL PRECIPITATION

CLIENT/PROJECT: **ENERGY FUELS RESOURCES CORP.**
PIÑON RIDGE PROJECT

DRAWN	GG	DATE	Oct-08	JOB NO.	073-81694
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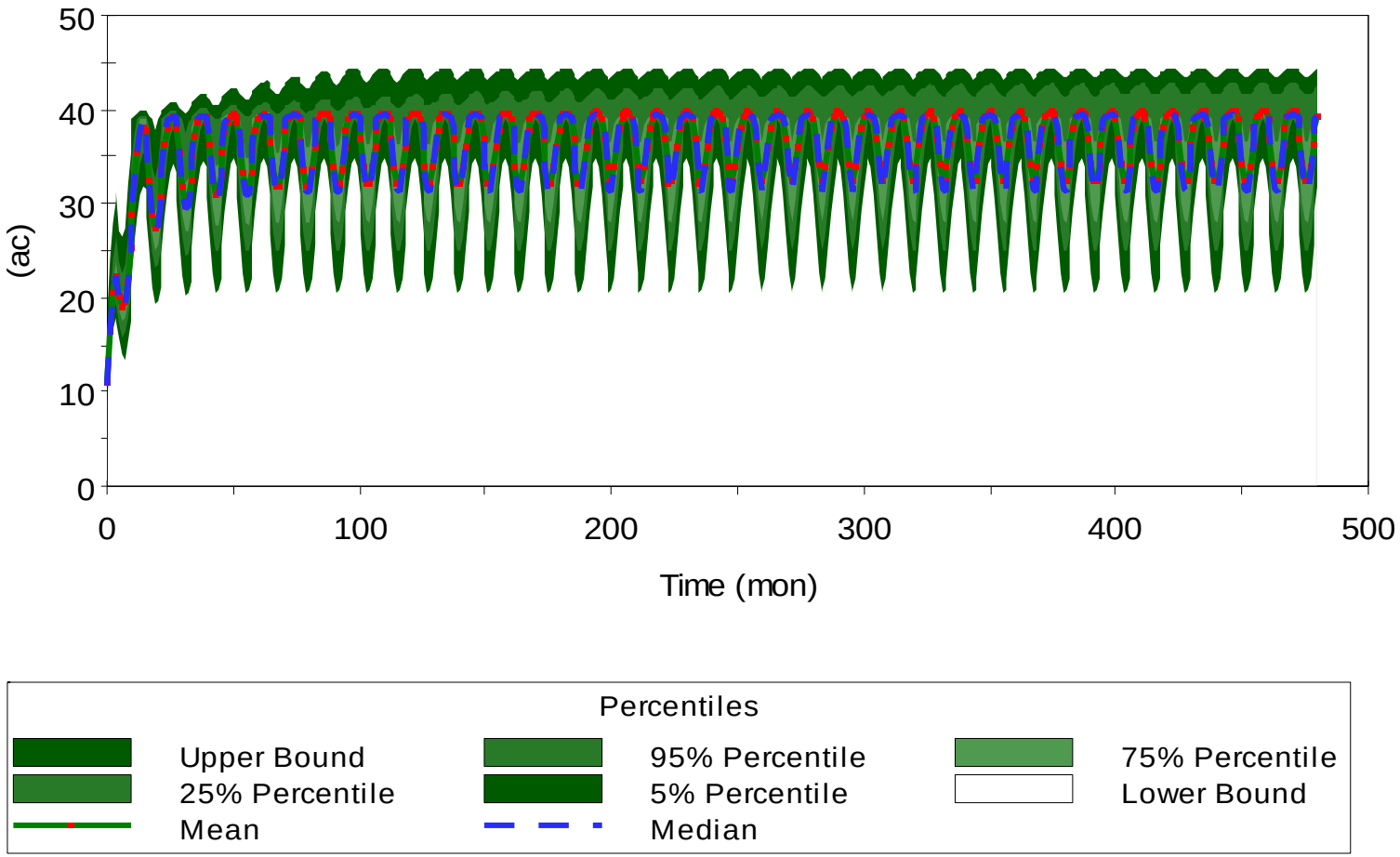

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Denver, Colorado

TITLE

EVAPORATION POND AREA FOR 63 GPM INFLOW

CLIENT/PROJECT

ENERGY FUELS RESOURCES CORPORATION
PIÑON RIDGE PROJECT

DRAWN	GG	DATE	Oct-08	JOB NO.	073-81694
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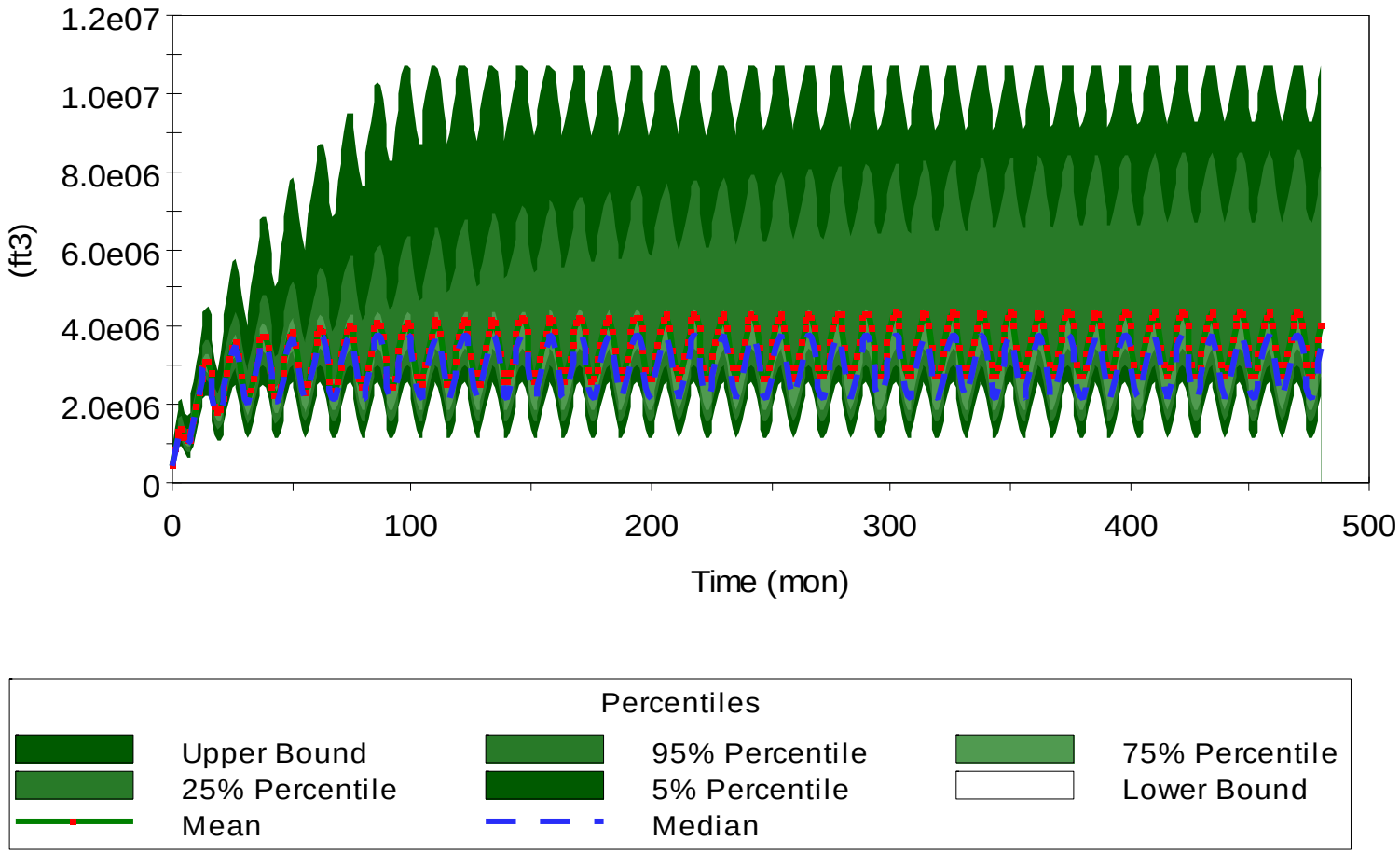

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Denver, Colorado

TITLE

EVAPORATION POND VOLUME FOR 63 GPM INFLOW

CLIENT/PROJECT

ENERGY FUELS RESOURCES CORPORATION
PIÑON RIDGE PROJECT

DRAWN	GG	DATE	Oct-08	JOB NO.	073-81694
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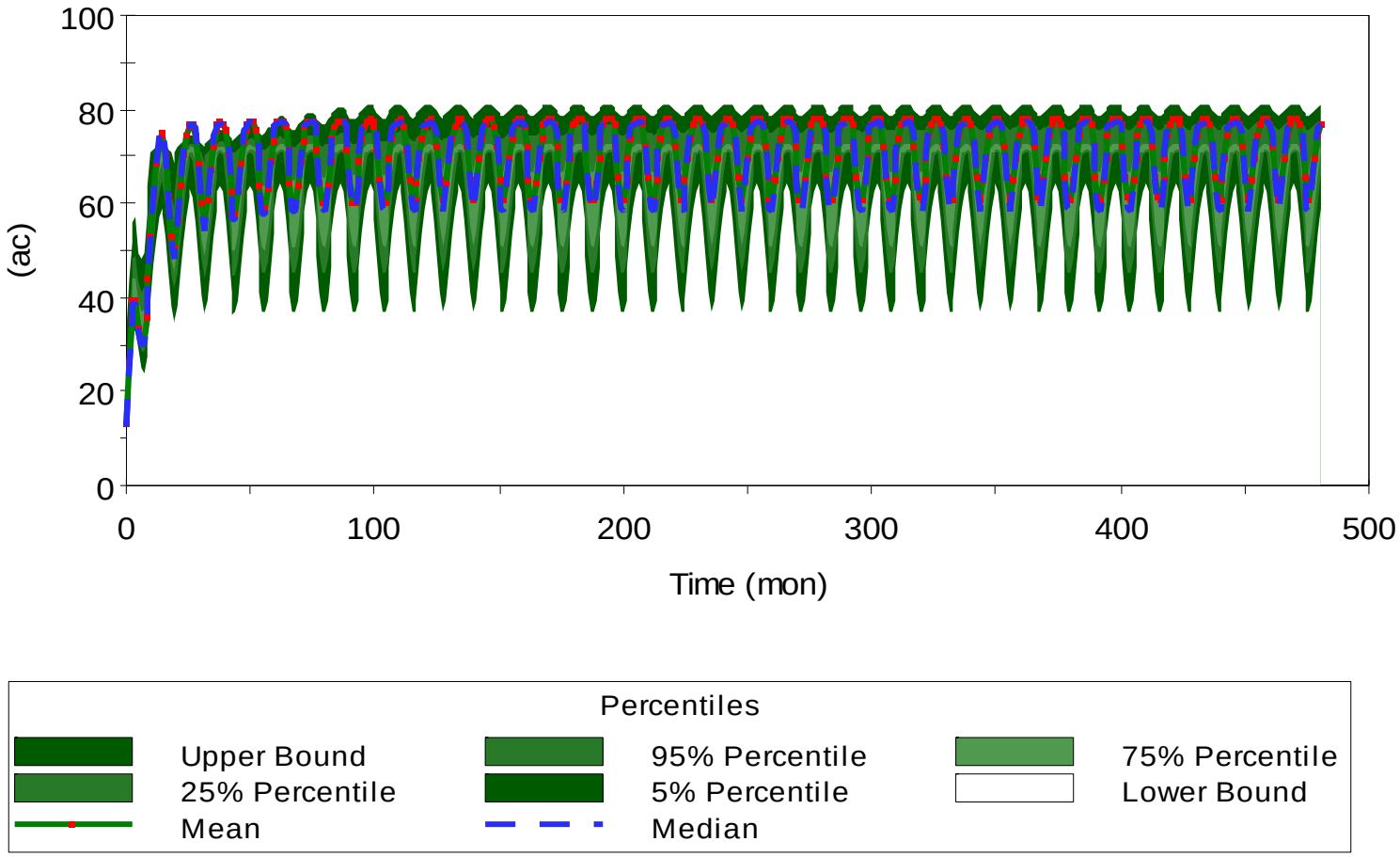

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TITLE

EVAPORATION POND AREA FOR 126 GPM INFLOW

CLIENT/PROJECT

ENERGY FUELS RESOURCES CORPORATION
PIÑON RIDGE PROJECT

DRAWN	GG	DATE	Oct-08	JOB NO.	073-81694
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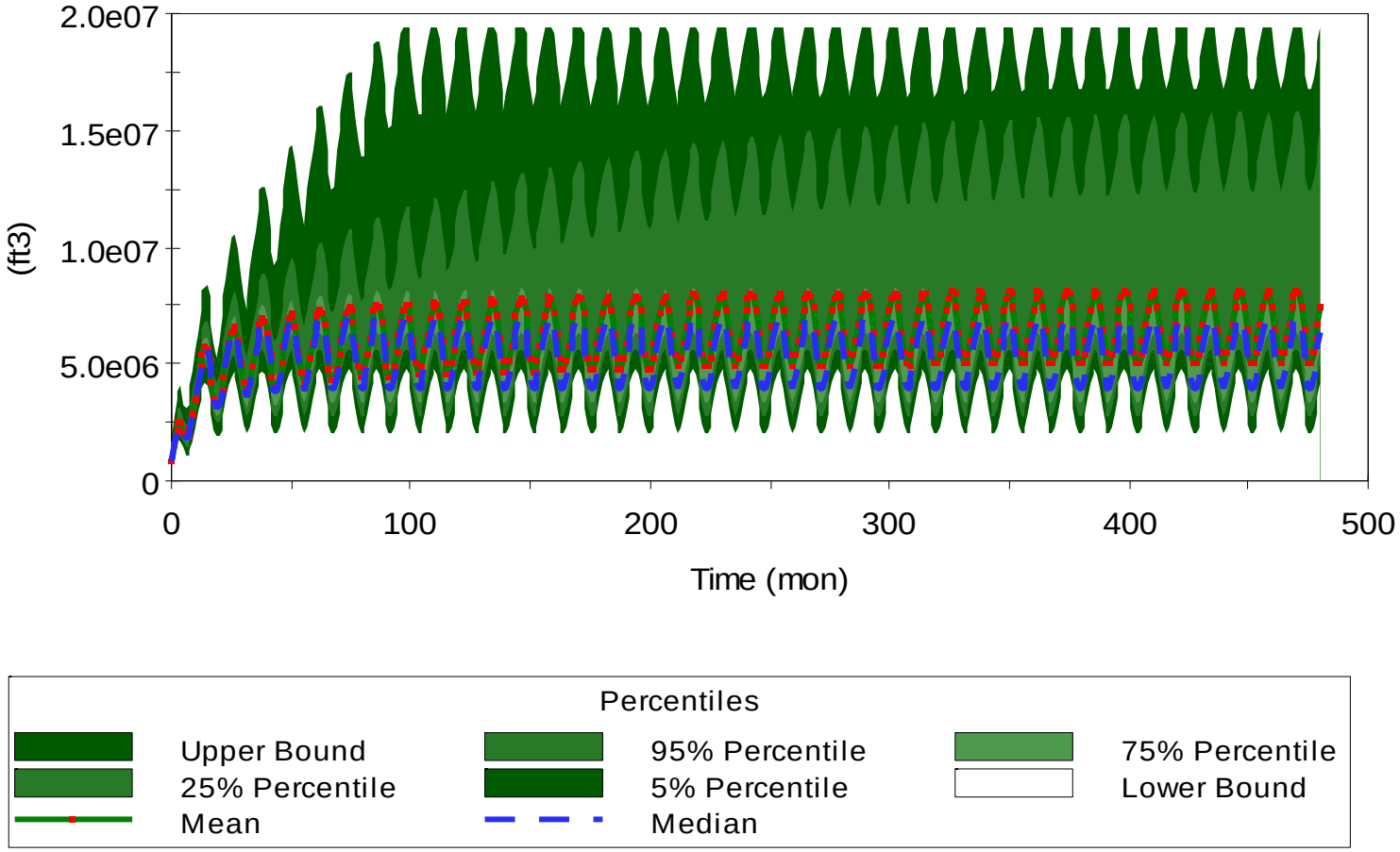

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TITLE

EVAPORATION POND VOLUME FOR 126 GPM INFLOW

CLIENT/PROJECT

ENERGY FUELS RESOURCES CORPORATION
PIÑON RIDGE PROJECT

DRAWN	GG	DATE	Oct-08	JOB NO.	073-81694
CHECKED	DPH	SCALE	AS SHOWN	DWG. NO.	NA
REVIEWED	KFM	FILE NO.	EvapPondWatBal-Figures.xls	FIGURE NO.	A-18

APPENDIX A-1

CLIMATE DATA ANALYSIS

OBJECTIVE:

Evaluate the available weather data for the Piñon Ridge site and select a data set to be used in the design of facilities for the project.

GIVEN:

- Daily weather data obtained from the Western Regional Climate Center from the following locations:
  - Uravan
  - Nucla
  - Grand Junction
  - Montrose

ANALYSIS:

Site-Specific Data

Piñon Ridge site is located at 38°15' latitude, 108°45' longitude, elevation 5,480 feet. The site rests in the middle of a narrow valley near Monogram Mesa (see Figure A-1-1). Due to the limitations of obtaining site specific weather data, nearby weather stations are used to estimate or approximate the climatic conditions for the Piñon Ridge site.

Regional Data

The weather data from the following weather stations are considered due to proximity to the investigated site, and the available data inventory:

- *Uravan* (NCDC No. 058560)
- *Nucla* (NCDC No. 053807)
- *Grand Junction* (NCDC No. 053488)
- *Grand Junction 6 ESE* (NCDC No. 053489)
- *Montrose 1* (NCDC No. 055717)
- *Montrose 2* (NCDC No. 055722)

Data for above sites were obtained from the Western Regional Climate Center. The locations of the nearby weather stations and the Piñon Ridge site are illustrated in Figure A-1-2. In the following section, a brief description is presented for each weather station.

Uravan

Uravan is located at 38°22' latitude 108°45' longitude, elevation 5,010 feet, about 8.5 miles North of the Piñon Ridge site. The difference in elevation between the sites is 470 feet. This weather station provides the following daily weather data between the years of 1960 to 2007:

- Precipitation
- Air temperature
- Snow cover

The average total annual precipitation is equal to 12.6 inches. The months of September and October are generally the wettest months of the year. The maximum total annual precipitation of 21.4 in was recorded in 1965. The driest year was 1989 with a total annual rainfall equal to 7.3 inches. The average annual temperature is equal to 53.1 °F, and the average total annual snowfall is equal to 9.4 inches. The maximum snowfall was recorded during 1978-1979 with a total 40.4 in. Table A-1-1 shows the average monthly and annual data for this weather station.

Nucla

Nucla is located at 38°13' latitude 108°33' longitude, elevation 5,860 feet, about 11 miles East of the Piñon Ridge site. The difference in elevation between the sites is 380 feet. This weather station provides the following daily weather data for the years 1999 to 2007:

- Air temperature
- Solar radiation
- Wind velocity
- Relative humidity
- Precipitation

The average annual temperature at the Nucla site is 53 °F. The solar radiation has been increasing during the period of record (i.e., 1999 to 2007) from 746 langleys (ly) in 1999 to 827 ly in 2007. The maximum solar radiation was collected during June 2007 at 828 ly. The average relative humidity (RH) for this site is equal to 42%, where the driest season corresponds to summer time (RH =31 %) . The average total annual precipitation for this location is 9.3 inches. The wettest month is September with an average accumulated precipitation of 1.8 inches. The driest month corresponds to January with 0.3 inches of precipitation. The wettest year correspond to 2006 with a total accumulated precipitation equal to 10.4 inches. Table A-1-2 shows the average monthly and annual data for this weather station.

Grand Junction Airport

Grand Junction Airport is located at 39° 8' latitude 108°32' longitude, elevation 4,840 feet, about 62 miles North of the Piñon Ridge site. The difference in elevation between the sites is 640 feet. This weather station provides the following daily weather data for the years 1900 to 2007:

- Air temperature
- Precipitation
- Snow cover
- PAN evaporation
- Relative humidity
- Cloud cover
- Wind velocity

PAN evaporation data is available only for years 1948 to 1960 for this location, with an average total annual PAN evaporation equal to 82.4 inches. The annual average relative humidity is equal to 53.1%. An annual average of 22 inches of snowfall was recorded at Grand Junction airport, with a maximum snowfall of 6.3 inches recorded in December of 1998. The wettest year was in 1957 with 15.7 in of total precipitation. Grand Junction airport average annual precipitation is 8.8 in. The average cloud cover is 6%. The average annual data for Grand Junction are summarized in Table A-1-3.

Grand Junction 6ESE

Grand Junction 6ESE weather station is located at 39° 2' latitude 108°27' longitude, and elevation of 4,760 feet. The weather station is located 7.8 miles south of the Grand Junction Airport weather station. This weather station complements the data provided by the Grand Junction airport weather station. The Grand Junction 6ESE weather station provides the following daily weather data for the years 1962 to 2007:

- Air temperature
- Precipitation
- PAN evaporation
- Snow cover

The total average annual PAN evaporation is equal to 57.9 inches. The average annual precipitation is equal to 8.9 inches. The wettest year was in 1957 with 16 inches of total precipitation. The average annual snowfall for this station is 12.3 inches with a maximum snow fall recorded in December of 1978. Table A-1-4 shows the average annual data for this weather station.

Montrose

Two weather stations are used to obtain climate data for this location: one located at 38°28' latitude 107°52' longitude, elevation 5,786 feet and the second located at 38°29' latitude 107°52' longitude, elevation 5,785 feet. The first weather station provides data from 1905 to 1982; the second weather station provides data from 1895 to 2007. Montrose is located 50 miles southeast from the Piñon Ridge site. These weather stations provide the following daily weather data:

- Air temperature
- Precipitation
- Snow cover
- Average monthly PAN evaporation

The average total annual snowfall recorded at this location is 25.9 inches. With a maximum snowfall of 72 inches recorded in 1918. Montrose records show that the average annual precipitation is 9.6 in. The maximum precipitation was in 1941 with 17 inches of rainfall. The annual average PAN evaporation is 55.8 inches. Table A-1-5 shows the average monthly annual data for this weather station.

Data Analysis

Precipitation Data

Figure A-1-3 shows a comparison in total annual precipitation for years 1999 through 2007. Note that the Uravan weather station exhibits higher average annual precipitation than the rest of the sites. Table 1 compares the accumulated precipitation from 1999 to 2007 for all sites. Uravan weather station, which is the closest station to the Piñon Ridge site, provides the maximum precipitation. Also, historical data shows that the Uravan weather station provides the most critical rainfall event (year 1965). For reference purposes, Figure A-1-4 presents the annual precipitation as a function of station elevation for all regional stations considered in this report. Note that there is no clear correlation between elevation and precipitation for the considered weather stations. Figure A-1-5 shows the monthly precipitation for the driest and wettest years for the Uravan weather station. A comparison of monthly precipitation between Uravan and Grand Junction airport weather stations for the years 1965 (wettest year) and 1989 (driest year), show that these sites present different precipitation events (Figure A-1-6 and Figure A-1-7).

Table 1. General statistics for selected weather stations.

	Elevation (ft)	Difference in Elevation (ft)[1]	Distance to Piñon Ridge (miles)	Accumulated Precipitation (in) from 1999-2007	Average Max. Temp (°F)	Average Min. Temp (°F)
Uravan	5010	-470	8.5	100	69	37
Nucla	5860	380	11	74	68	39
Grand Junction	4840	-640	62	81	67	41
Montrose	5786	306	49.5	87	63	35

[1]Compared to Piñon Ridge site, EL. 5,480 ft

Temperature Data

A comparison between different weather stations is shown is Figure A-1-8. Correlation between elevation and temperature is shown in Figure A-1-9. A summary of temperature data is presented in Table 1.

Evaporation/Evapotranspiration data

Due to the limitation of weather data, the potential evapotranspiration (PET) for the Uravan weather station was calculated using the Hargreaves (1985) method as discussed by Allen et al. (1998). The estimated PET was then scaled by a factor of 0.7, to meet the average annual evaporation from shallow lakes for the Piñon Ridge site (Figure A-1-10). Figure A-1-11 shows a comparison between PAN evaporation and analytical PET estimates for different sites. Table 2 summarizes the scaled monthly PET for the Uravan weather station.

Table 2. Scaled Average monthly PET evaporation for the Uravan weather station

	Avg. PET (in)
January	0.8
February	1.2
March	2.2
April	3.2
May	4.6
June	5.5
July	5.9
August	5.0
September	3.7
October	2.5
November	1.2
December	0.7
Total Annual	35.8

Wind data

Table A-1-6 shows the maximum annual wind speed for various years for the Grand Junction airport and Nucla weather stations. The maximum wind speed was recorded in Grand Junction weather station at 23.4 miles per hour (mph) in the year 2007. The average wind speed for this weather station is 7.8 mph. The prevalent wind direction is ESE for Grand Junction, SE for Montrose and E for the Nucla station.

CONCLUSIONS:

A review of available climate records for nearby weather stations indicates that Uravan weather station is likely to represent conservative precipitation estimates for the Piñon Ridge site.

REFERENCES:

Western Regional Climate Center online data source: http://www.raws.dri.edu/cgi-bin/rawMAIN.pl?coCNUC

Kleinfelder (2007). "Climatological Report, Piñon Ridge Mill Site Montrose County, Colorado." Kleinfelder project no. 83088

Allen, R. G., Pereira, L. S., Raes, D., and Smith, M. (1998). "Crop evapotranspiration - Guidelines for computing crop water requirements." Irrigation and drainage paper 56, FAO, Rome.

TABLES

TABLE A-1-1. Uravan weather station data

Period of record : 11/17/1960 to 6/30/2007

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	42.7	49.9	58.7	67.6	78.6	89.4	95.4	92.2	83.5	71.4	54.7	43.4	69
Average Min. Temperature (F)	15.6	22.4	29.2	35.7	44.5	52.4	59.3	58.1	48.3	36.9	26.5	17.8	37.2
Average Total Precipitation (in.)	0.88	0.76	1.03	1.01	0.94	0.48	1.2	1.35	1.5	1.51	1.05	0.88	12.6
Average Total SnowFall (in.)	3.8	0.8	0.5	0.2	0	0	0	0	0	0.1	0.6	3.5	9.4

TABLE A-1-2. Nucla weather station data

Period of Record : 1/ 1/1999 to 12/31/2007

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	44.8	48.5	57.4	65.3	76.5	87.3	93.5	88.4	79.8	67.7	54.2	43.3	67.4
Average Min. Temperature (F)	19.7	23.2	29.6	37.1	45.3	53.7	60.6	58.0	18.6	38.3	26.9	18.6	38.4
Average Total Precipitation (in.)	0.3	0.5	0.6	0.8	0.5	0.4	0.8	1.1	1.8	1.5	0.4	0.5	9.3

TABLE A-1-3. Grand Junction weather station data

Period of Record : 1/ 1/1900 to 12/31/2007

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	36.7	44.7	55.1	65.2	75.6	86.9	92.8	89.4	80.5	67.3	51.2	38.9	65.5
Average Min. Temperature (F)	16.0	23.3	31.2	39.3	4826.0	54.2	64.1	62.0	53.0	41.1	28.3	18.7	40.4
Average Total Precipitation (in.)	0.6	0.6	0.8	0.8	0.8	0.4	0.6	1.0	1.0	0.9	0.7	0.6	8.8
Average Total SnowFall (in.)	6.1	4.0	3.2	0.9	0.1	0.0	0.0	0.0	0.0	0.4	2.5	4.9	22.0

TABLE A-1-4. Grand Junction 6ESE weather station data

Period of Record : 3/26/1962 to 6/30/2007

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	38.6	46.3	56.6	65.6	75.9	86.8	92.7	89.7	80.7	67.8	51.9	40.4	66.1
Average Min. Temperature (F)	17.5	23.9	32.3	39.5	48.4	57.2	63.5	61.3	52.4	40.8	29.2	19.7	40.5
Average Total Precipitation (in.)	0.48	0.45	0.87	0.84	0.94	0.5	0.75	0.83	0.97	0.98	0.76	0.55	8.93
Average Total SnowFall (in.)	3.4	1.8	1.6	0.3	0.1	0	0	0	0	0.3	1.4	3.5	12.3

TABLE A-1-5. Montrose weather station data

Period of Record : 1/ 1/1895 to 6/30/2007

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	38	43.9	52.9	62.4	72.4	83.1	88.6	85.7	77.9	65.7	50.3	39.3	63.3
Average Min. Temperature (F)	13.7	19.7	26.6	34	42.1	49.7	55.6	53.9	45.6	35	23.9	15.3	34.6
Average Total Precipitation (in.)	0.57	0.48	0.7	0.86	0.88	0.53	0.86	1.26	1.1	1.04	0.66	0.62	9.56
Average Total SnowFall (in.)	6.5	4.3	3.5	1.8	0.1	0	0	0	0	0.6	2.7	6.4	25.9

TABLE A-1-6. Maximum annual wind speed

	Grand Junction Airport	Nucla
year	wind speed (mph)	
1984	16.3	-
1985	18.3	-
1986	22.0	-
1987	14.8	-
1988	18.6	-
1989	17.3	-
1990	17.8	-
1991	18.1	-
1992	17.1	-
1993	17.2	-
1994	19.4	-
1995	16.8	-
1996	17.7	-
1997	18.1	-
1998	18.0	16.4
1999	17.1	18.2
2000	18.8	18.6
2001	19.7	14.6
2002	21.2	17.2
2003	19.8	16.8
2004	19.9	14.3
2005	18.0	14.0
2006	21.9	14.8
2007	23.4	15.1
Maximum W(mph)	**23.4**	**18.6**

FIGURES

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TITLE

SITE VIEW PIÑON RIDGE

CLIENT/PROJECT

ENERGY FUELS RESOURCES CORPORATION
PIÑON RIDGE PROJECT

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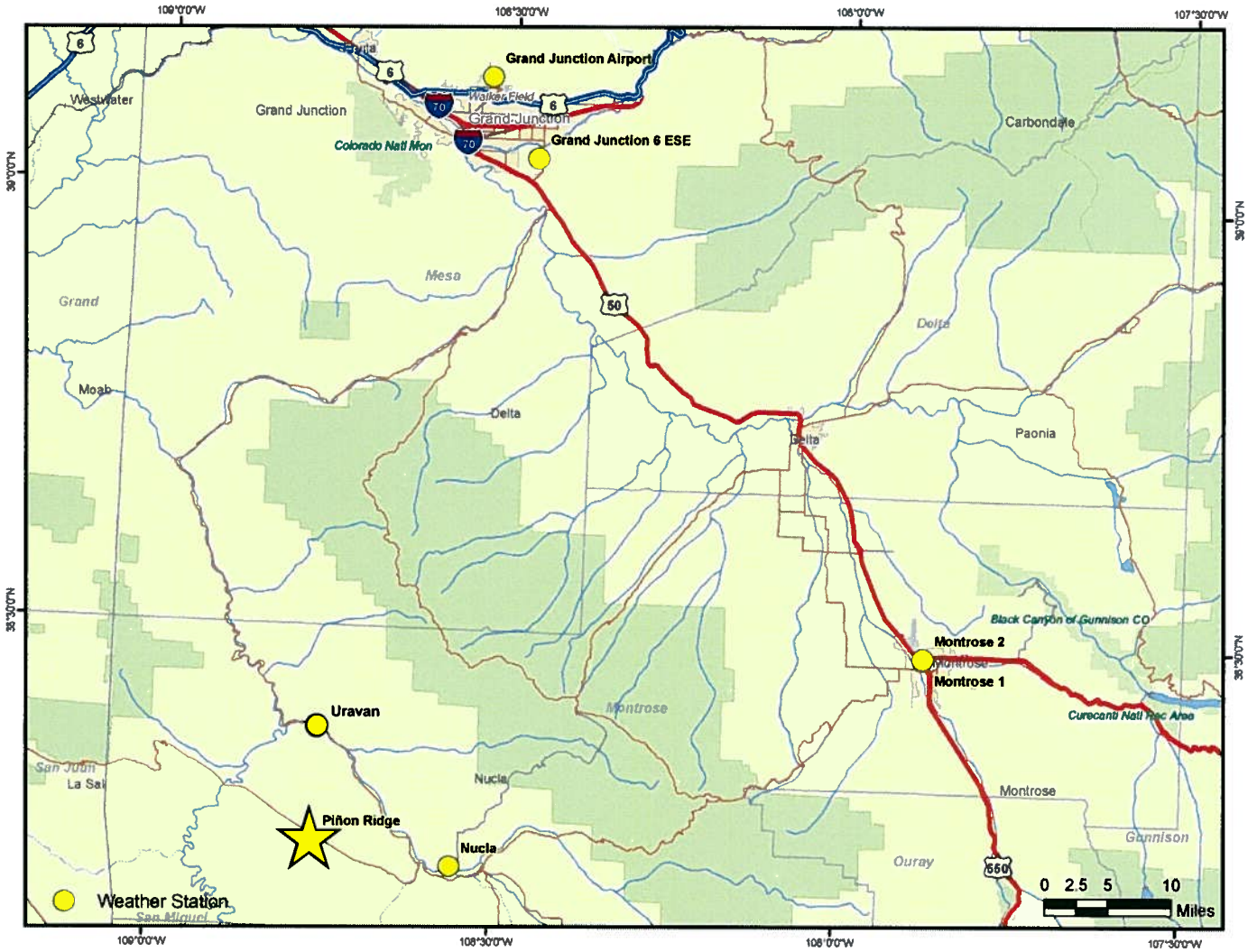

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TITLE

WEATHER STATION LOCATIONS

CLIENT/PROJECT

ENERGY FUELS RESOURCES CORPORATION
PIÑON RIDGE PROJECT

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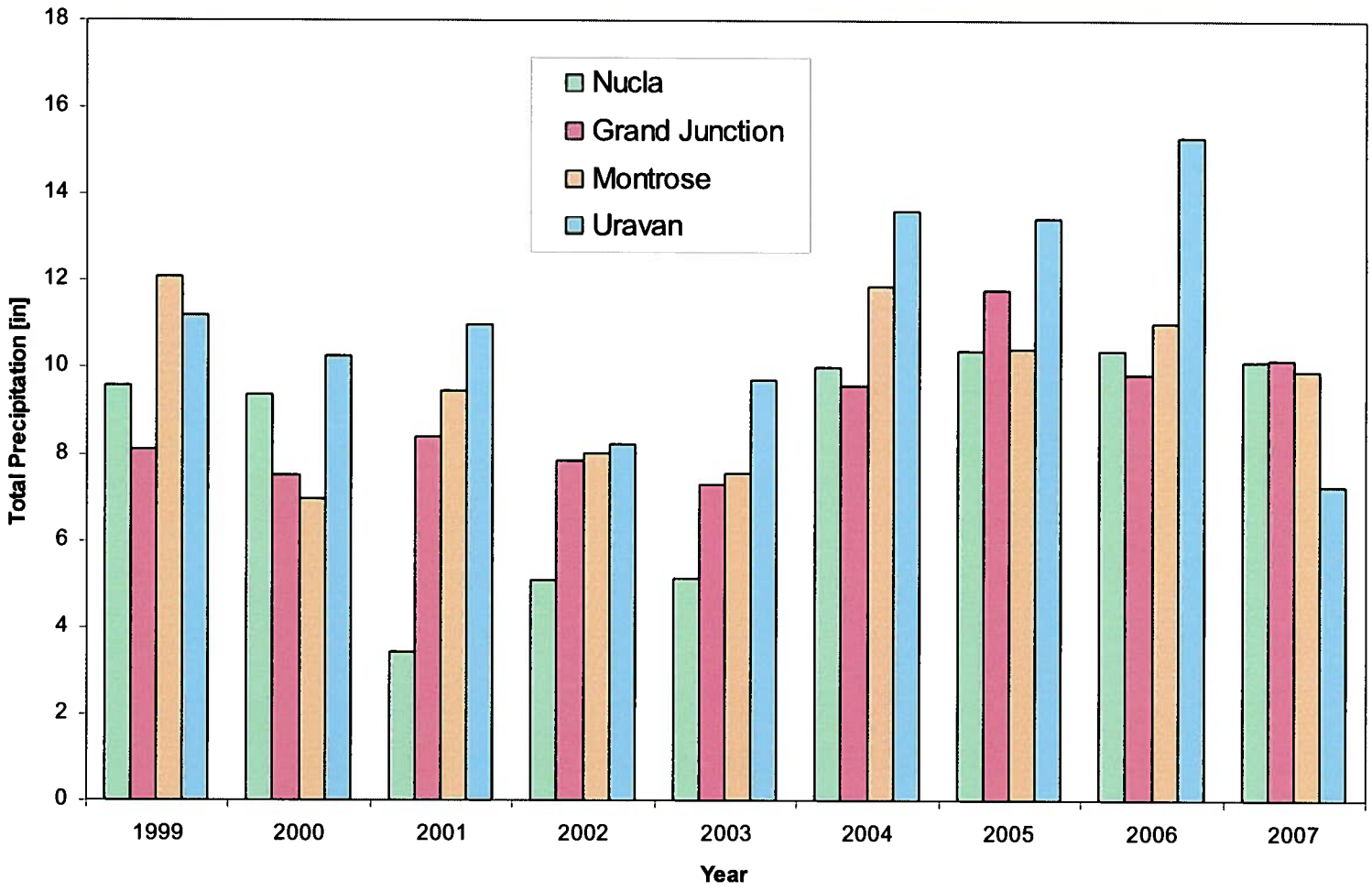

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TITLE

TOTAL ANNUAL PRECIPITATION

CLIENT/PROJECT

ENERGY FUELS RESOURCES CORPORATION
PIÑON RIDGE PROJECT

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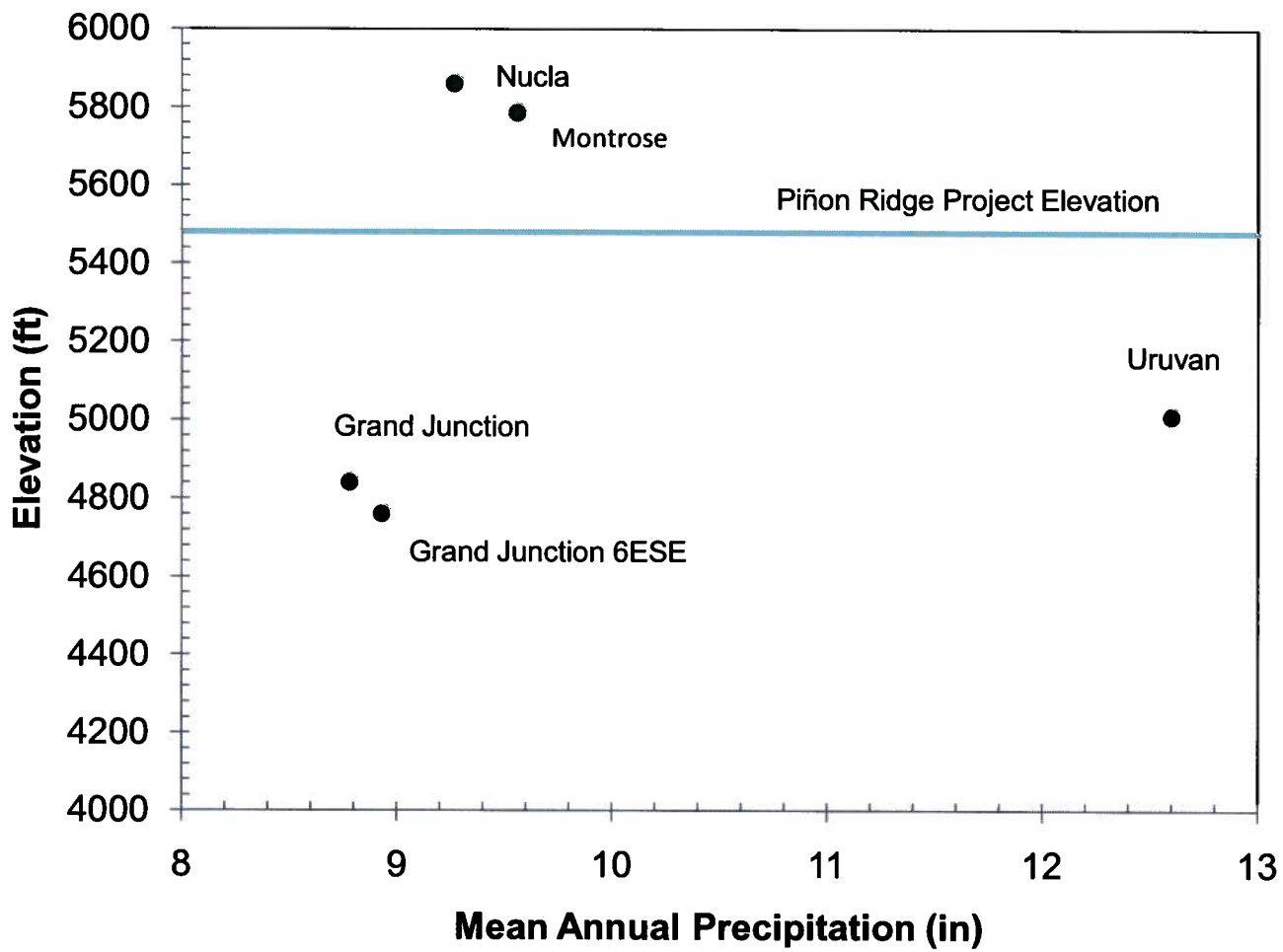

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Denver, Colorado

TITLE

VARIATION IN ANNUAL PRECIPITATION vs. ELEVATION FOR REGIONAL METEOROLOGICLA STATIONS

CLIENT/PROJECT

ENERGY FUELS RESOURCES CORPORATION
PIÑON RIDGE PROJECT

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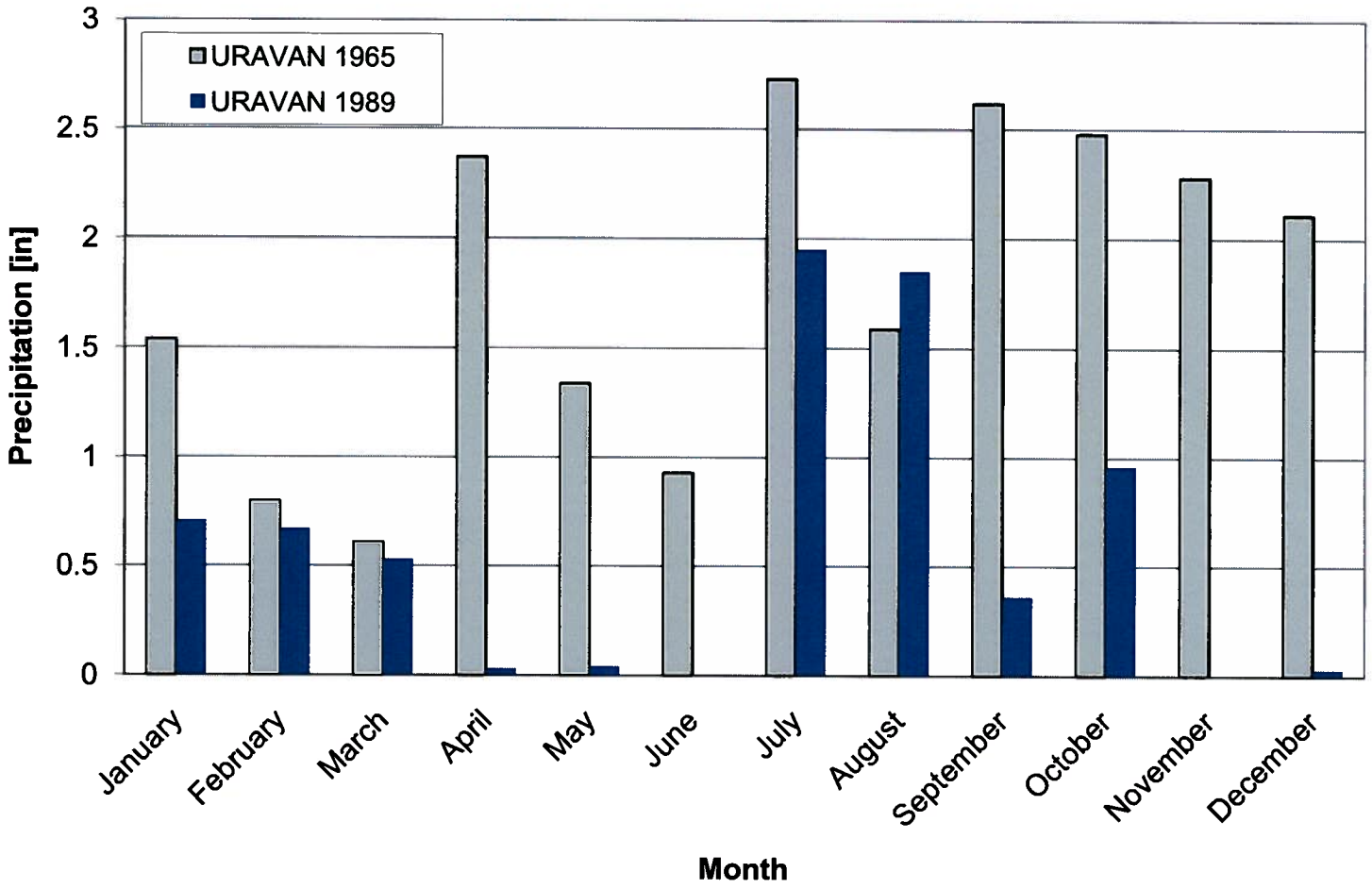

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TITLE
MONTLY PRECIPITATION FOR DRIEST AND WETTEST YEAR FOR URAVAN SITE

CLIENT/PROJECT
ENERGY FUELS RESOURCES CORPORATION
PIÑON RIDGE PROJECT

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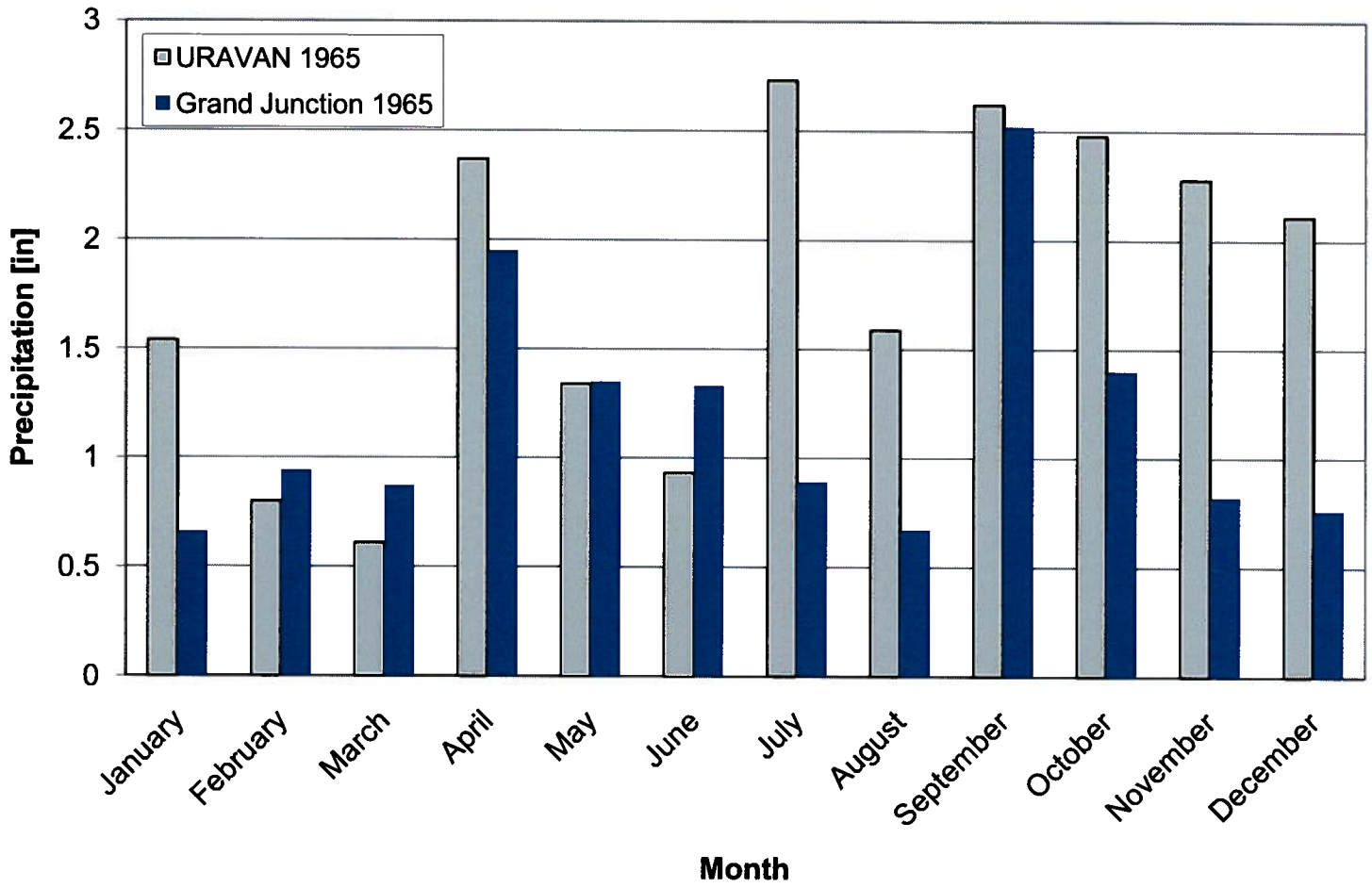

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TITLE
ANNUAL PRECIPITATION URAVAN AND GRAND JUNCTION FOR YEAR 1965

CLIENT/PROJECT
ENERGY FUELS RESOURCES CORPORATION
PIÑON RIDGE PROJECT

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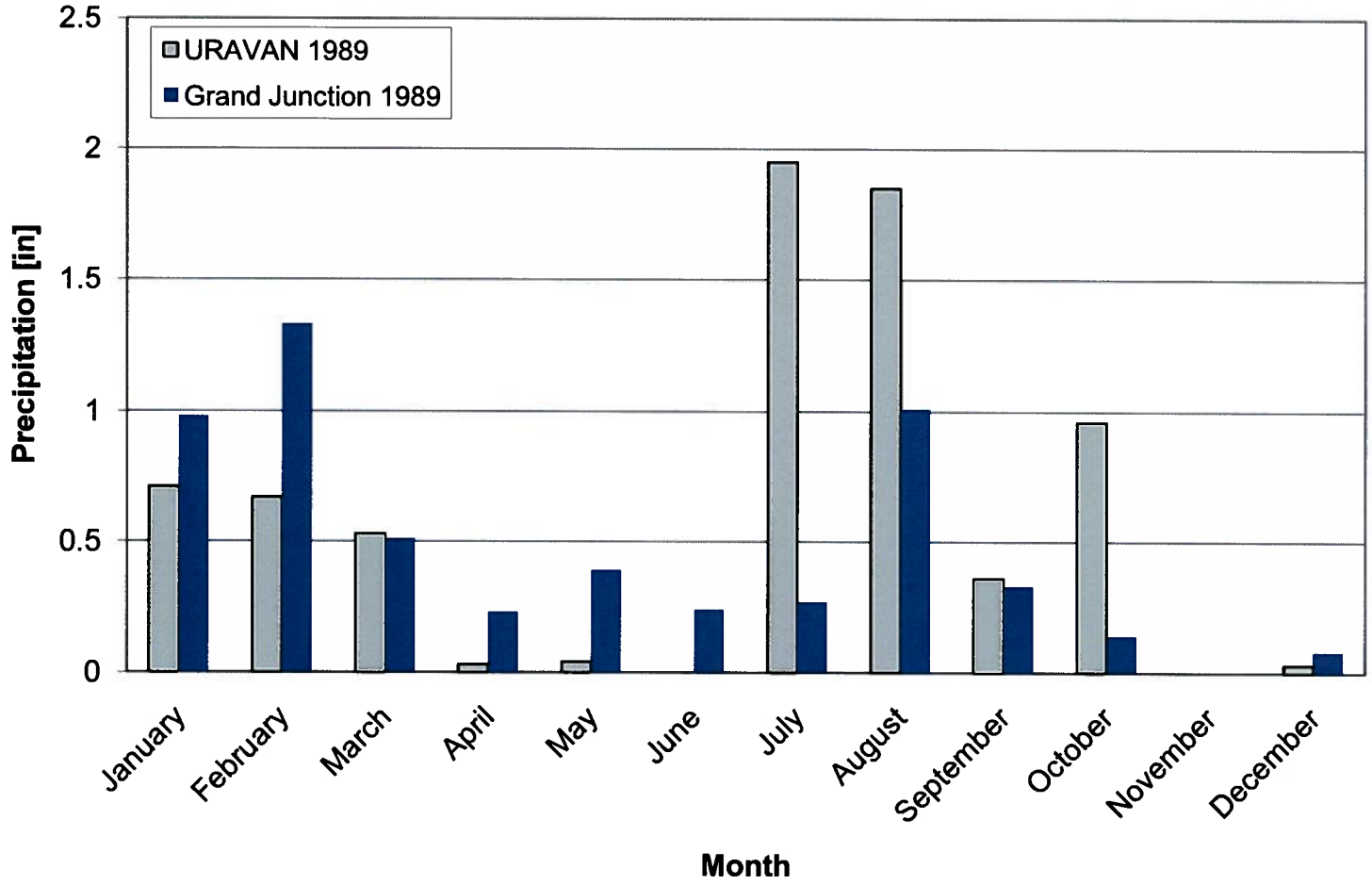

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TITLE

MONTHLY MAXIMUM TEMPERATURE FOR URAVAN AND GRAND JUNCTION

CLIENT/PROJECT

ENERGY FUELS RESOURCES CORPORATION
PIÑON RIDGE PROJECT

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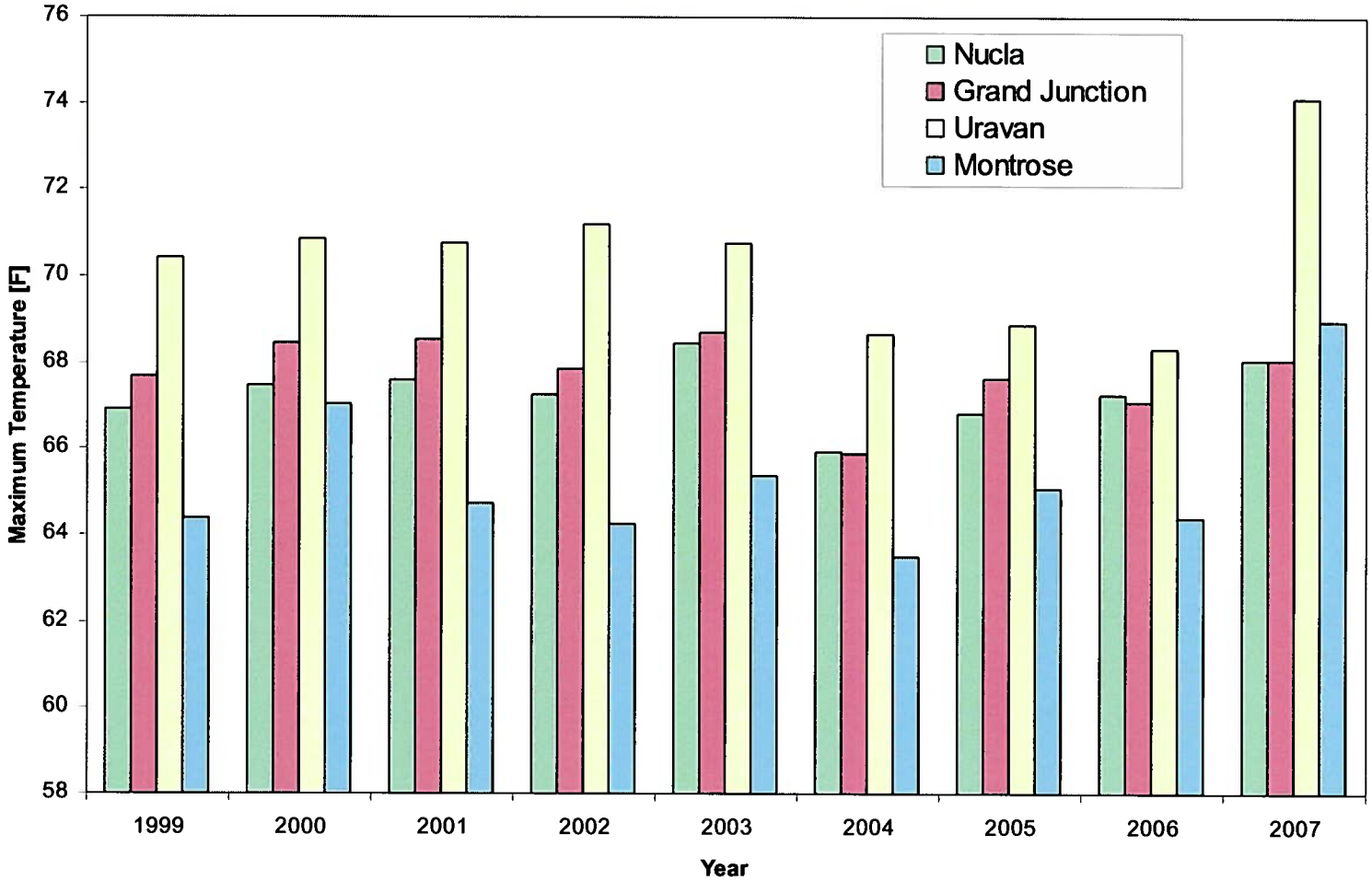

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TITLE
ANNUAL MAXIMUM TEMPERATURE

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PIÑON RIDGE PROJECT

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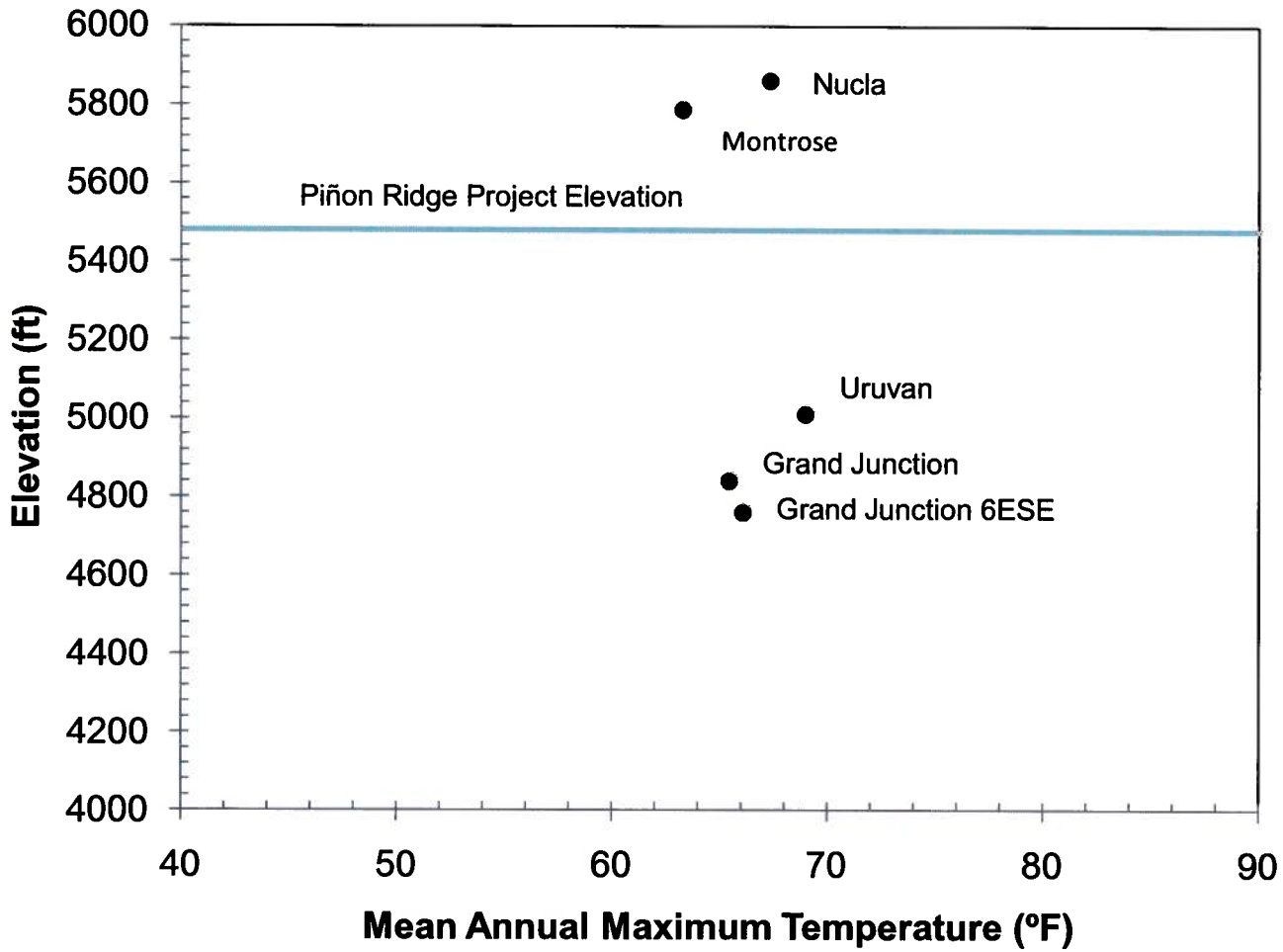

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TITLE
VARIATION IN ANNUAL MAX. TEMPERATURE vs. ELEVATION FOR REGIONAL METEOROLOGICAL STATIONS

CLIENT/PROJECT
ENERGY FUELS RESOURCES CORPORATION
PIÑON RIDGE PROJECT

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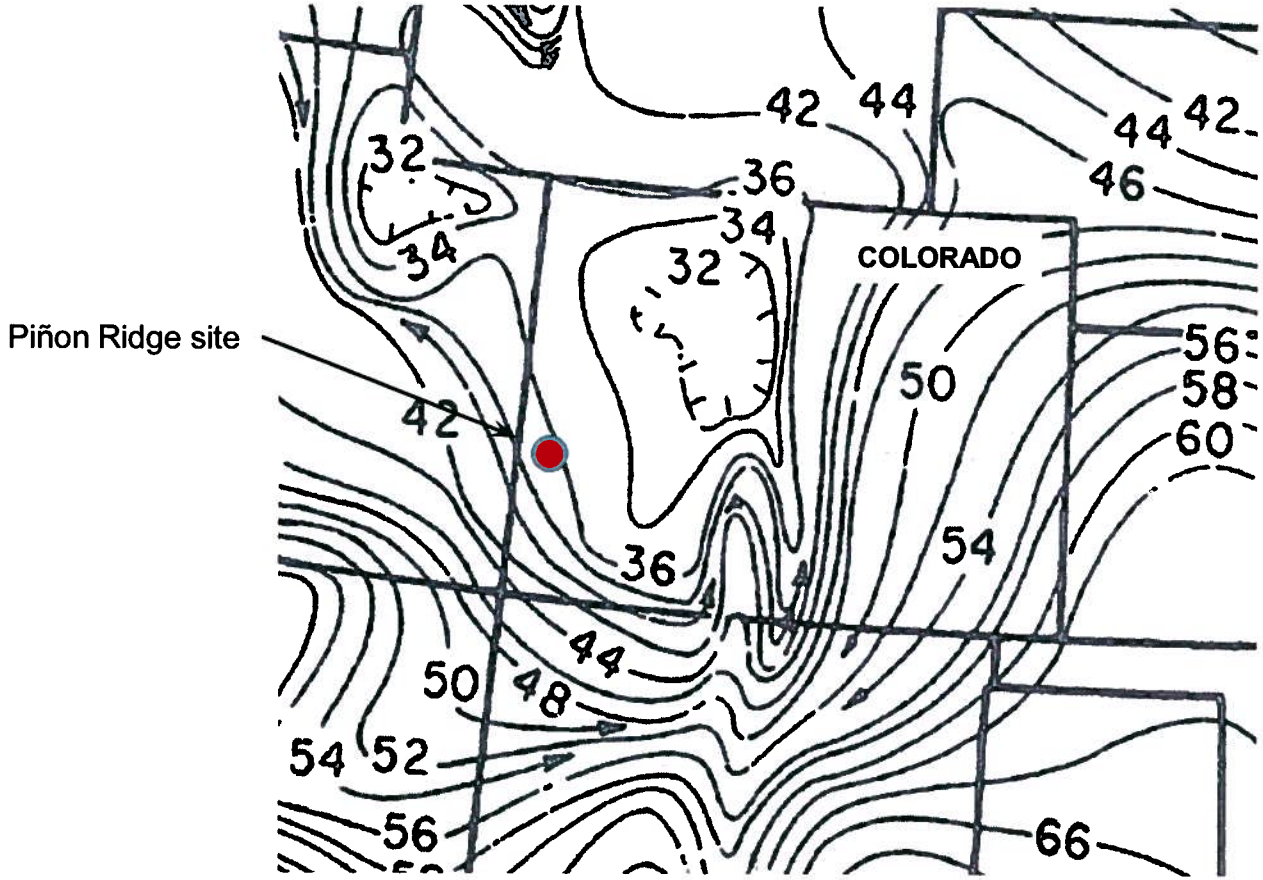

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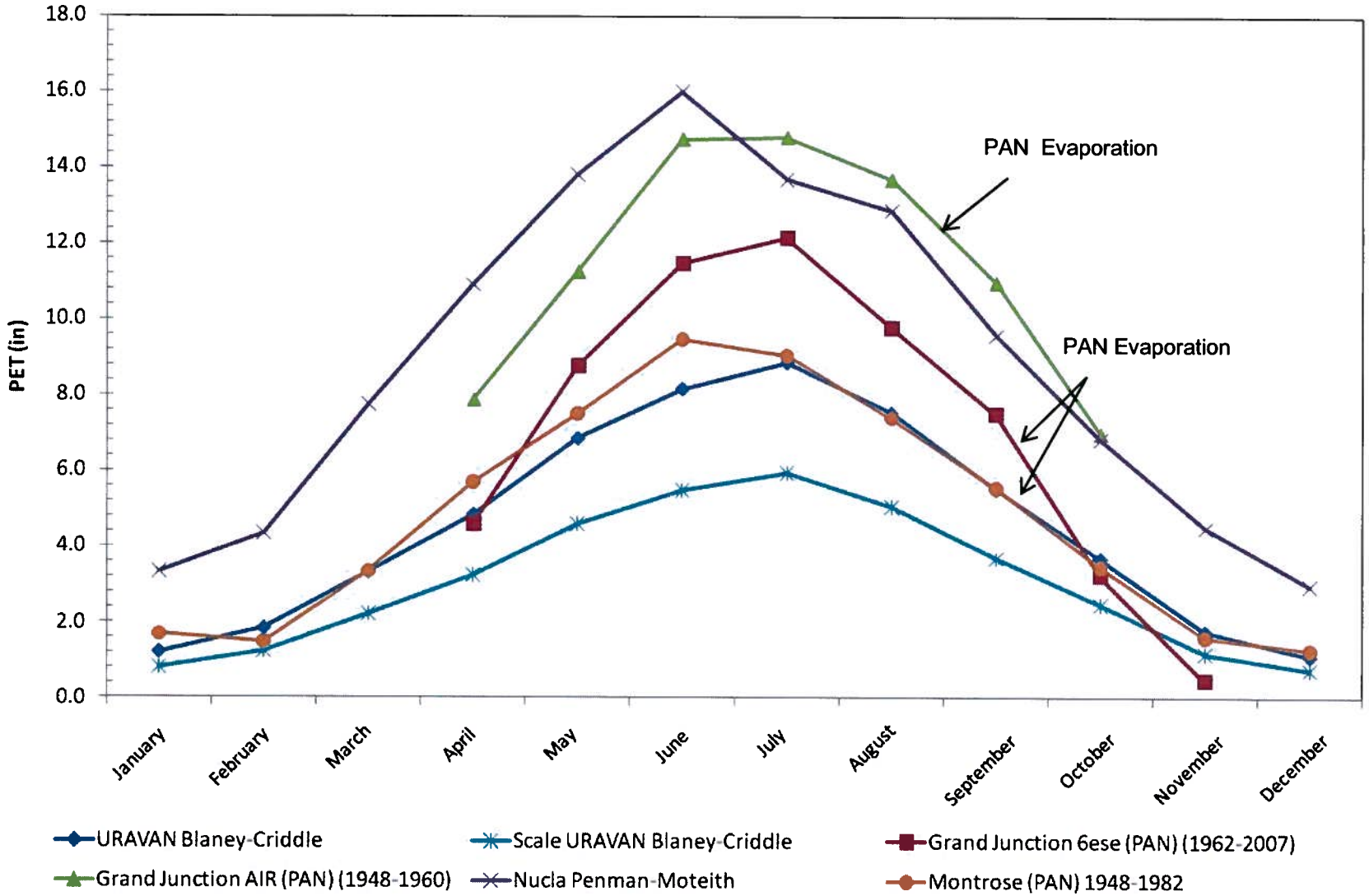
TITLE

AVERAGE ANNUAL EVAPORATION (INCHES) FROM SHALLOW LAKES

CLIENT/PROJECT

ENERGY FUELS RESOURCES CORPORATION
PIÑON RIDGE PROJECT

DRAWN	EF	DATE	1/16/2008	JOB NO.	073-81694
CHECKED	GG	SCALE	N.T.S	DWG. NO.	N/A
REVIEWED	KFM	FILE NO.	figures-weather.ppt	FIGURE NO.	A-1-10



Golder Associates
Denver, Colorado

TITLE
MONTHLY EVAPOTRANSPIRATION

CLIENT/PROJECT
ENERGY FUELS RESOURCES CORPORATION
PIÑON RIDGE PROJECT

DRAWN	EF	DATE	1/16/2008	JOB NO.	073-81694
CHECKED	GG	SCALE	N.T.S	DWG. NO.	N/A
REVIEWED	KFM	FILE NO.	figures-weather.ppt	FIGURE NO.	A-1-11