



MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON KNUDSEN COMPANY

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WM Record File

WM Project

48

Docket No.

PDR

LPDR

Distribution:

T Johnson

M Haisfield

(Return to WM, 623-SS)

Sollenberger

4005-DUR-L-01-00547-00

26 November 1985

Mr. Ted L. Johnson
U.S. Nuclear Regulatory Commission
Mail Stop 623-SS
Washington, D.C. 20555

Subject: UMTRA PROJECT - DUR
Preliminary Riprap Testing Results

Dear Mr. Johnson: Ted

Attached please find the data you requested during our recent meeting in Albuquerque regarding the riprap testing program. Please note that this information is preliminary and we have not as yet received results of petrographic examinations or freeze/thaw testing for the Lemon Dam Quarry samples.

The data include:

- o Telecon notes and comments by Lambert and Associates on the various sites.
- o Lime Creek test results.
- o Lemon Dam Quarry test results.
- o Pueblo Coal (sandstone overburden) test results.
- o Limestone (Shalona Quarry) test results.
- o Sandstone (Bodo Canyon) test results.
- o Xerox copies of photographs taken at Lime Creek, Lemon Dam Quarry and Shalona Quarry.
- o A map indicating locations of riprap sources.

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PDR WASTE
WM-48 PDR

Mr. Ted L. Johnson
Page 2

4005-DUR-L-01-00547-00
26 November 1985

At this time we think the Lemon Dam Quarry material will prove to be suitable. However, we will be interested in hearing about the status of studies being made by the NRC regarding methodology for selection of lesser quality rock for erosion protection.

Very truly yours,



T. R. Wathen, P.E.
Engineering & Design Manager

TRW:FJF:kfb

Attachment: As stated above.

cc: J. G. Oldham
G. Parker
R. Junge
J. D'Antonio

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

DAILY FIELD REPORT

PROJECT NUMBER D85103GE

DATE Thursday, 8/22/85

PROJECT NAME Rip-Rap

TECHNICIAN Brown

PROJECT LOCATION Durango, CO

WEATHER CONDITIONS Clear/hot

CLIENT Morrison-Knudsen

WORK REQUESTED Set up and
locate

CONTRACTOR Morrison-Knudsen

FOREMAN Fred Feliz

MK P.O. #3050-521-9239, Item #2

WORK PERFORMED BY LAMBERT AND ASSOCIATES REPRESENTATIVE (AND REMARKS)

I spoke with Mr. Feliz of the San Francisco office of Morrison-Knudsen today. Items discussed involved job-scope, job set up, suggestions for possible locations, and personel contacts. Other phone calls were made today concerning site access, and possible new site locations.

RECEIVED - MKE

NOV 18 1985

UMTRA-S.F.

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

DAILY FIELD REPORT

PROJECT NUMBER M85103GE

DATE Thursday, 8/22/85

PROJECT NAME Morrison & Knudsen Rip Rap

TECHNICIAN Trautner

PROJECT LOCATION Durango, CO

WEATHER CONDITIONS N/A

CLIENT Morrison-Knudsen

WORK REQUESTED Quarry
reconnaissance

CONTRACTOR Morrison-Knudsen

FOREMAN

P. O. #3050-521-9239 (Item 2)

WORK PERFORMED BY LAMBERT AND ASSOCIATES REPRESENTATIVE (AND REMARKS)

Several telephone conversations were conducted today with Morrison-Knudsen personnel and also local individuals with a knowledge of local quarries in the Durango vicinity.

Mr. Fred Feliz of Morrison-Knudsen requested some preliminary reconnaissance with regard to the Rip Rap quarry locations. Mr. Larry Curtis was contacted concerning the quarry that was used for the construction of the Electra Lake and he indicated that the Colorado Ute Electric Association should be contacted for additional and more in depth information on the quarry at Electra Lake. The telephone was not answered at the Colorado Ute office and therefore to this date no additional information has been generated concerning the Electra Lake Quarry. Further reconnaissance will be conducted concerning this and other quarries in the area. Mr. Ed Bennett, La Plata County Engineer, was also contacted by telephone. Mr. Bennett provided me with some information of individuals to contact concerning possible quarry location, the most promising of which appears to be the Purgatory Development north of Durango, Colorado. The other possibilities mentioned by Mr. Bennett are being pursued at this time.

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

DAILY FIELD REPORT

PROJECT NUMBER M85103GE

DATE Friday, 8/23/85

PROJECT NAME Morrison-Knudsen Rip Rap

TECHNICIAN Brown

PROJECT LOCATION Durango, CO

WEATHER CONDITIONS Clear/hot

CLIENT Morrison-Knudsen

WORK REQUESTED Job scope,
quarry sites

CONTRACTOR Morrison-Knudsen

FOREMAN

P. O. #3050-521-9239 (Item 2)

WORK PERFORMED BY LAMBERT AND ASSOCIATES REPRESENTATIVE (AND REMARKS)

I spoke with Mr. Fred Feliz by telephone at the San Francisco office today. Further job scope was discussed along with possible quarry site locations. Further phone calls were made in regards to access into the Horse Gulch Quarry and possible other site locations.

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

DAILY FIELD REPORT

PROJECT NUMBER M85103GE

DATE Monday, 9/9/85

PROJECT NAME Morrison-Knudsen Rip Rap

TECHNICIAN Brown

PROJECT LOCATION Durango, CO

WEATHER CONDITIONS

CLIENT Morrison-Knudsen

WORK REQUESTED

CONTRACTOR

P. O. #3050-521-9239
Item #2

FOREMAN

WORK PERFORMED BY LAMBERT AND ASSOCIATES REPRESENTATIVE (AND REMARKS)

Completed test results of magnesium sulfate soundness test of sample #4 with red inclusions. I reported test results by telephone to Mr. Ed Tom of Morrison-Knudsen in San Francisco. Due to the small remainder of the sample, Mr. Tom said to hold from any further testing of sample #4. Mr. Tom said to begin testing sample #2 and to obtain samples from the Lime Creek proposed site. We were also asked to visually observe the proposed Horse Gulch site.

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

DAILY FIELD REPORT

PROJECT NUMBER M85103GE

DATE Tuesday, 9/10/85

PROJECT NAME Morrison-Knudsen Rip Rap

TECHNICIAN Trautner

PROJECT LOCATION Durango, CO

WEATHER CONDITIONS Sunny/cool

CLIENT Morrison-Knudsen

WORK REQUESTED Sampling

CONTRACTOR

P.O. #3050-521-9239 FOREMAN
Item #2

WORK PERFORMED BY LAMBERT AND ASSOCIATES REPRESENTATIVE (AND REMARKS)

Samples of the proposed rip-rap material were retrieved today. The samples were taken adjacent to the Lime Creek campground from talus slopes as indicated on a topographic map provided by Morrison-Knudsen. The talus consists of gneiss and amphibolite from the Twilight Gneiss unit with the Amphibolite possibly originating from the Precambrian Amphibolite complex. Today's samples were retrieved from the talus located on the eastern flanks of Potato Mountain. Potato Mountain is an erosional remnant (a "rouche moutonnée") from Pleistocene Epoch glaciation. The mountain consists entirely of Twilight Gneiss with some intrusive features from the Precambrian Amphibolite Complex.

The samples were returned to our Durango Laboratory for testing as specified in Item 2 of the Morrison-Knudsen purchase order number #3050-521-9239. Laboratory test results will be available upon test completion. Mr. Lanny Brown accompanied me during the field work today.

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

DAILY FIELD REPORT

PROJECT NUMBER M85103GE

DATE Monday, 9/16/85

PROJECT NAME Morrison-Knudsen Rip Rap

TECHNICIAN Brown

PROJECT LOCATION Durango, CO

WEATHER CONDITIONS Clear/warm

CLIENT Morrison-Knudsen

WORK REQUESTED Visual observations

CONTRACTOR

FOREMAN

P.O. #3050-521-9239

Item #2

WORK PERFORMED BY LAMBERT AND ASSOCIATES REPRESENTATIVE (AND REMARKS)

I spoke with Mr. Fred Feliz of Morrison-Knudsen's San Francisco office today. Previous test results were relayed and discussed. After the telephone conversation Dave Trautner and myself went to Pueblo Coal Company to acquire clearance on their property to get access to the Horse Gulch Quarry.

The Horse Gulch material appeared similar to that encountered for sample #2 from Bodo Canyon. Mr. Feliz asked that the material from Horse Gulch be visually observed and not yet sampled. Mr. Feliz discussed the possibility of using a larger quantity and size of less competent material. In speaking with Mr. Hendricks of Pueblo Coal Company, Mr. Hendricks said he had access to a very large quantity of rock previously shot. I told Mr. Feliz this information.

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

DAILY FIELD REPORT

PROJECT NUMBER	M85103GE	DATE	Tuesday, 9/17/85
PROJECT NAME	Morrison-Knudsen Rip Rap	TECHNICIAN	Brown
PROJECT LOCATION	Durango, CO	WEATHER CONDITIONS	Clear/mild
CLIENT	Morrison-Knudsen	WORK REQUESTED	Phone conversation and scheduling
CONTRACTOR		FOREMAN	
	P.O. #3050-521-9239		
	Item #2		

WORK PERFORMED BY LAMBERT AND ASSOCIATES REPRESENTATIVE (AND REMARKS)

I spoke with Mr. Feliz of Morrison-Knudsen today by telephone concerning a possible Rip Rap source from Pueblo Coal Inc. Mr. Feliz said to sample from this source and begin testing. Scheduling with Pueblo Coal was arranged for Wednesday, 9/18/85 for me to meet Mr. Jim Hendricks of Pueblo Coal on site.

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

DAILY FIELD REPORT

PROJECT NUMBER M85103GE

DATE Wednesday, 9/18/85

PROJECT NAME Morrison-Knudsen Rip Rap

TECHNICIAN Brown

PROJECT LOCATION Durango, CO

WEATHER CONDITIONS Rain

CLIENT Morrison-Knudsen

WORK REQUESTED Consult and
sample shot rock

CONTRACTOR

FOREMAN

P.O. #3050-521-9239
Item #2

WORK PERFORMED BY LAMBERT AND ASSOCIATES REPRESENTATIVE (AND REMARKS)

met with representatives of Pueblo Coal Inc. at the Carbon Junction Mine site in Durango. I visually observed the mining operations and discussed information about the rock. The rock is a picture cliffs sandstone. Samples were retrieved for our laboratory testing purposes. Some past testing data from other sources on this material was sent by Lambert & Associates from Pueblo Coal to Mr. Fred Feliz of Morrison-Knudsen in San Francisco.

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

DAILY FIELD REPORT

PROJECT NUMBER M85103GE

DATE Thursday, 9/19/85

PROJECT NAME Morrison-Knudsen Rip Rap

TECHNICIAN Brown

PROJECT LOCATION Durango, CO

WEATHER CONDITIONS

CLIENT Morrison-Knudsen

WORK REQUESTED Phone
consultation

CONTRACTOR

FOREMAN
P.O. #3050-521-9239
Item #2

WORK PERFORMED BY LAMBERT AND ASSOCIATES REPRESENTATIVE (AND REMARKS)

I spoke with Mr. Fred Feliz of Morrison-Knudsen's San Francisco office today. We discussed the samples retrieved from Pueblo Coal Inc. in Durango. Mr. Feliz said to run the full spectrum of testing on this material. We also discussed the size of the material to be tested for the specific gravity and absorption tests. It was decided to use 3/4". Mr. Feliz said for now not to run the freeze/thaw tests.

Mr. Feliz also said to go ahead with the petrographic examinations on the samples obtained from Lime Creek and Pueblo Coal Inc.

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

DAILY FIELD REPORT

PROJECT NUMBER M85103GE

DATE Monday, 9/23/85

PROJECT NAME Morrison-Knudsen Rip Rap

TECHNICIAN Brown

PROJECT LOCATION Durango, CO

WEATHER CONDITIONS

CLIENT Morrison-Knudsen

WORK REQUESTED Information
up-date

CONTRACTOR

FOREMAN

P.O. #3050-521-9239 ITEM 2

WORK PERFORMED BY LAMBERT AND ASSOCIATES REPRESENTATIVE (AND REMARKS)

I spoke with Mr. Feliz of Morrison-Knudsen's San Francisco office today by telephone. Test data was verbally relayed to Mr. Feliz concerning magnesium sulphate test results from the Lime Creek sample and L. A. abrasion test results from the Pueblo Coal Inc. sample. Mr. Feliz requested that a specific gravity test and absorption test on both of the above mentioned samples be performed. The magnesium sulfate soundness test on the Pueblo Coal Inc. sample will begin today.

Additional telephone calls were made locally in an attempt to gather additional information about possible quarry sites for Rip Rap.

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

DAILY FIELD REPORT

PROJECT NUMBER M85103GE

DATE Monday, 10/7/85

PROJECT NAME Morrison-Knudsen Rip Rap

TECHNICIAN Brown

PROJECT LOCATION Durango, CO

WEATHER CONDITIONS

CLIENT Morrison-Knudsen

WORK REQUESTED Rip Rap
investigation

CONTRACTOR

FOREMAN

P.O. #3050-521-9239 ITEM 2

WORK PERFORMED BY LAMBERT AND ASSOCIATES REPRESENTATIVE (AND REMARKS)

I spoke with Mr. Fred Feliz of Morrison-Knudsen's San Francisco office today after I picked up additional data on the Lemon Dam Quarry from the Bureau of Reclamation. Mr. Feliz gave the go ahead to sample the material from Lemon Dam Quarry and begin laboratory testing.

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

DAILY FIELD REPORT

PROJECT NUMBER M85103GE

DATE Tuesday, 10/8/85

PROJECT NAME Rip Rap

TECHNICIAN Brown

PROJECT LOCATION Durango, CO

WEATHER CONDITIONS Rain/cloudy

CLIENT Morrison-Knudsen

WORK REQUESTED Sampling

CONTRACTOR

FOREMAN

WORK PERFORMED BY LAMBERT AND ASSOCIATES REPRESENTATIVE (AND REMARKS)

Dave Trautner of Lambert & Associates and myself went to the Lemon Quarry site today. Samples of the existing rock were taken for laboratory testing purposes as requested by Mr. Fred Feliz of Morrison-Knudsen. Please refer to Dave Trautners field report for site details.

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

DAILY FIELD REPORT

PROJECT NUMBER M85103GE

DATE Tuesday, 10/8/85

PROJECT NAME Rip Rap

TECHNICIAN Trautner

PROJECT LOCATION Durango, CO

WEATHER CONDITIONS Rainy

CLIENT Morrison-Knudsen

WORK REQUESTED Sampling and
observations

CONTRACTOR

FOREMAN

P.O. #3050-521-9239 Item 2

WORK PERFORMED BY LAMBERT AND ASSOCIATES REPRESENTATIVE (AND REMARKS)

Samples of proposed Rip Rap material were retrieved from the Lemon Dam Quarry today.

The material sampled was a poorly sorted sandstone which shows evidence of metamorphism. Some foliation associated with the metamorphism was observed and relict bedding is predominant. Some chloritization was observed, therefore the material may be considered as a low-grade metamorphosed sandstone. The mineralogic content of the material varies, in areas where quartz is the predominant constituent mineral the unit may be considered as quartzite.

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

DAILY FIELD REPORT

PROJECT NUMBER M85103GE

DATE Friday, 10/18/85

PROJECT NAME Rip Rap

TECHNICIAN Brown

PROJECT LOCATION Durango, CO

WEATHER CONDITIONS

CLIENT Morrison-Knudsen

WORK REQUESTED Data discussion
and proposals

CONTRACTOR

FOREMAN

P.O. #3050-521-9239 Item 2

WORK PERFORMED BY LAMBERT AND ASSOCIATES REPRESENTATIVE (AND REMARKS)

I spoke with Mr. Fred Feliz of Morrison-Knudsen's San Francisco office today. Various test data was relayed and discussed concerning the Lemon Quarry site, also a request to submit a proposal for mapping the hillside of the mill tailings piles was relayed and discussed by Mr. Feliz. I began assembling information to submit this proposal.

Later in the day I called Mr. Feliz and discussed the scope of our services for the mapping. The proposed fee for Lambert and Associates was \$500.00. Mr. Feliz said he would get back with me next week.

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

P.O. #3050-521-9239
Item 2

TEST RESULTS

PROJECT Morrison-Knudsen PROJECT NO. M85103GE DATE 9/26/85
LOCATION Durango, CO REPORT NO. TIME
SOURCE Rip Rap SAMPLE NO. 1137 ENGINEERING TECHNICIAN Brown

SPECIFIC GRAVITY AND ABSORPTION

Sample Description: Lime Creek Gneiss

Bulk Specific Gravity: 2.63

Bulk Specific Gravity: 2.64
(Saturated-surface-dry basis)

Apparent Specific Gravity: 2.66

Absorption: 0.38%

Lime Creek

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

P. O. #3050-521-9239, Item 2

TEST RESULTS

PROJECT	<u>Morrison-Knudsen</u>	PROJECT NO.	<u>D85103GE</u>	DATE	<u>9/12/85</u>
LOCATION	<u>Durango, CO</u>	REPORT NO.	<u> </u>	TIME	<u> </u>
SOURCE	<u>Rip Rap</u>	SAMPLE NO.	<u> </u>	ENGINEERING TECHNICIAN	<u>Brown</u>

LOS ANGELES ABRASION TEST RESULTS

Sample: Lime Creek Gneiss

100 Revolutions: 4.5% loss

500 Revolutions: 21.4% loss

MAGNESIUM SULFATE SOUNDNESS

<u>SIEVE SIZE</u>	<u>INITIAL NO. OF PARTICLES</u>	<u>TOTAL NUMBER OF PARTICLES AFTER TEST RETAINED</u>	<u>WEIGHT BEFORE TEST (GRAMS)</u>	<u>DESIGNATED SIEVE AFTER TEST</u>	<u>WEIGHT RETAINED AFTER TEST (GRAMS)</u>	<u>WEIGHT LOSS</u>	<u>PERCENT LOSS</u>	<u>ORIGINAL GRADING OF SAMPLE % RETAINED</u>	<u>WEIGHTED PERCENT % LOSS</u>
-2½"+2"	12	12	3109.4	1 1/4	3109.1	.30	0.01	50.7	0.01
-2"+1½"	16	16	2006.0	1 1/4	2005.2	.80	0.04	32.7	0.01
-1½"+1"	21	21	1020.8	5/8	1018.8	2.0	0.20	16.6	0.03
		Total	6136.2						

Sample: Lime Creek Gneiss

Lab# - D1131

Date: 9/16/85 to 9/21/85

5 cycles, 16 hours cycles

P.O. #3050-521-9239
ITEM #2

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

P.O. #3050-521-9239

Item 2

TEST RESULTS

PROJECT	<u>Morrison-Knudsen</u>	PROJECT NO.	<u>M85103GE</u>	DATE	<u>10/15/85</u>
LOCATION	<u>Durango, CO</u>	REPORT NO.	<u> </u>	TIME	<u> </u>
SOURCE	<u>Rip Rap</u>	SAMPLE NO.	<u>D1160</u>	ENGINEERING TECHNICIAN	<u>George</u>

SPECIFIC GRAVITY AND ABSORPTION

Sample Description: Lemon Dam Quarry
Metamorphosed Sandstone and Quartzite

Bulk Specific Gravity: 2.55

Bulk Specific Gravity: 2.58
(Saturated-surface-dry basis)

Apparent Specific Gravity: 2.62

Absorption: 1.09

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

P.O. #3050-521-9239

Item 2

TEST RESULTS

PROJECT Morrison-Knudsen PROJECT NO. M85103GE DATE
LOCATION Durango, CO REPORT NO. TIME
SOURCE Rip Rap SAMPLE NO. D1154 ENGINEERING TECHNICIAN George

LOS ANGELES ABRASION TEST RESULTS

Sample: Lemon Dam Quarry

100 Revolutions: 8.1% loss

500 Revolutions: 29.7% loss

MAGNESIUM SULFATE SOUNDNESS

M85103GE

<u>SIEVE SIZE</u>	<u>INITIAL NO. OF PARTICLES</u>	<u>TOTAL NUMBER OF PARTICLES AFTER TEST RETAINED</u>	<u>WEIGHT BEFORE TEST (GRAMS)</u>	<u>DESIGNATED SIEVE AFTER TEST</u>	<u>WEIGHT RETAINED AFTER TEST (GRAMS)</u>	<u>WEIGHT LOSS</u>	<u>PERCENT LOSS</u>	<u>ORIGINAL GRADING OF SAMPLE % RETAINED</u>	<u>WEIGHTED PERCENT % LOSS</u>
-2 1/2"+2"	12	12	2880.8	1 1/2"	2864.8	16.0	0.6	49.2	0.30
-2"+1 1/2"	16	16	1962.7	1 1/2"	1948.6	14.1	0.7	33.5	0.23
-1 1/2"+1"	21	21	1015.6	5/8"	1007.7	7.9	0.8	17.3	0.14
		Total	5859.1						

Sample: Lemon Dam Quarry

Lab#: D1155

Date: 10/14/85

P.O. #3050-521-9239

ITEM #2

5 cycles -16 hour cycles

Begin 10/14/85, end 10/19/85

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING
P.O. #3050-521-9239
Item 2

TEST RESULTS

PROJECT	<u>Morrison-Knudsen</u>	PROJECT NO.	<u>M85103GE</u>	DATE	<u> </u>
LOCATION	<u>Durango, CO</u>	REPORT NO.	<u> </u>	TIME	<u> </u>
SOURCE	<u>Rip Rav</u>	SAMPLE NO.	<u>D113</u>	ENGINEERING TECHNICIAN	<u>Brown</u>

SPECIFIC GRAVITY AND ABSORPTION

Sample Description: Pueblo Coal Sandstone, grey

Bulk Specific Gravity: 2.41

Bulk Specific Gravity: 2.50
(Saturated-surface-dry basis)

Apparent Specific Gravity: 2.64

Absorption: 3.48

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

P. O. #3050-521-9239, Item #2

TEST RESULTS

PROJECT Morrison-Knudsen PROJECT NO. D85103GE DATE 9/19/85
LOCATION Durango, CO REPORT NO. TIME
SOURCE Rio Rap SAMPLE NO. 1136 ENGINEERING TECHNICIAN Brown

LOS ANGELES ABRASION TEST RESULTS

Sample: Sandstone. grey - Pueblo Coal Stripmine Stie

100 Revolutions: 12.7% loss

500 Revolutions: 47.9% loss

MAGNESIUM SULFATE SOUNDNESS

<u>SIEVE SIZE</u>	<u>INITIAL NO. OF PARTICLES</u>	<u>TOTAL NUMBER OF PARTICLES AFTER TEST RETAINED</u>	<u>WEIGHT BEFORE TEST (GRAMS)</u>	<u>DESIGNATED SIEVE AFTER TEST</u>	<u>WEIGHT RETAINED AFTER TEST (GRAMS)</u>	<u>WEIGHT LOSS</u>	<u>PERCENT LOSS</u>	<u>ORIGINAL GRADING OF SAMPLE % RETAINED</u>	<u>WEIGHTED PERCENT % LOSS</u>
-2½"+2"	15	15	3261.2	1½"	2883.8	377.4	11.6	51.9	6.02
-2"+1½"	18	16	2003.6	1½"	1451.1	552.5	27.6	31.9	8.80
-1½"+1"	27	29	<u>1019.3</u>	5/8"	761.2	258.1	25.3	16.2	4.10
		Total	6284.1						

Sample: Pueblo Coal - Grey sandstone

Lab#: D1138

Date: 9/23/85

P.O. #3050-521-9239
ITEM #2

5 - 12 hour cycles
began 9/23/85, ended 9/28/85

LIMESTONE
(SHALONA QUARRY)

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

P. O. #3050-521-9239, Item #2

TEST RESULTS

PROJECT Morrison-Knudsen PROJECT NO. D35103GE DATE 9/9/85
LOCATION Durango, CO REPORT NO. TIME
SOURCE Rip Rap SAMPLE NO. 4A ENGINEERING TECHNICIAN Brown

LOS ANGELES ABRASION TEST RESULTS

Sample: Limestone breccia with red inclusions

100 Revolutions: 7.3% loss

500 Revolutions: 32% loss

MAGNESIUM SULFATE SOUNDNESS

<u>SIEVE SIZE</u>	<u>INITIAL NO. OF PARTICLES</u>	<u>TOTAL NUMBER OF PARTICLES AFTER TEST RETAINED</u>	<u>WEIGHT BEFORE TEST (GRAMS)</u>	<u>DESIGNATED SIEVE AFTER TEST</u>	<u>WEIGHT RETAINED AFTER LOSS (GRAMS)</u>	<u>WEIGHT LOSS</u>	<u>PERCENT LOSS</u>	<u>WEIGHTED PERCENT (%) LOSS</u>
-2 $\frac{1}{2}$ " + 2"	10	11	3148.0	1 1/4"	3083.8	64.2	2.0	1.10
-2" + 1 $\frac{1}{2}$ "	12	12	1519.7	1 1/4"	1502.7	17.0	1.1	0.29
-1' " + 1"	21	21	<u>1013.5</u>	5/8"	1009.5	4.0	.4	0.07
		Total	5681.2					

Limestone w/red inclusions

Lab#-D1121

Sample #4

P. O. #3050-521-9239

Item #2

16 hours cycles

5 cycles

Begin 9/4/85, end 9/8/85

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

P. O. #3050-521-9239, Item #2

TEST RESULTS

PROJECT Morrison-Knudsen PROJECT NO. D850103GE DATE 9/9/85
LOCATION Durango, CO REPORT NO. TIME
SOURCE Rip Rap SAMPLE NO. 4B ENGINEERING TECHNICIAN Brown

LOS ANGELES ABRASION TEST RESULTS

Sample: Grey Limestone

100 Revolutions: 7.6% loss

500 Revolutions: 32% loss

Lambert and Associates

CONSULTING GEOTECHNICAL ENGINEERS AND MATERIAL TESTING

P. O. #3050-521-9239, Item 2

TEST RESULTS

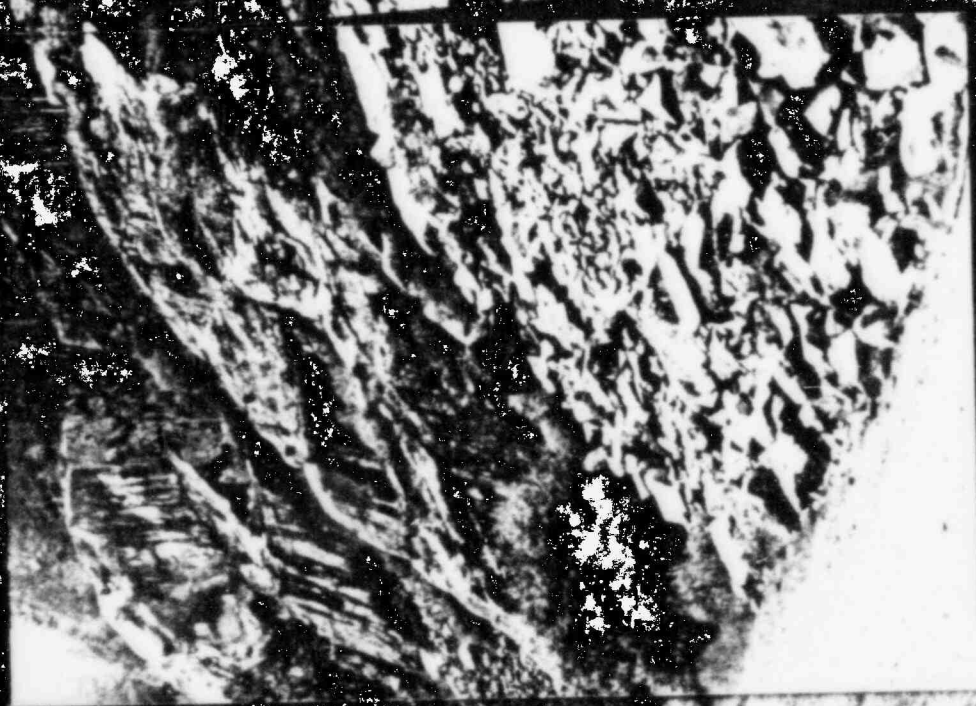
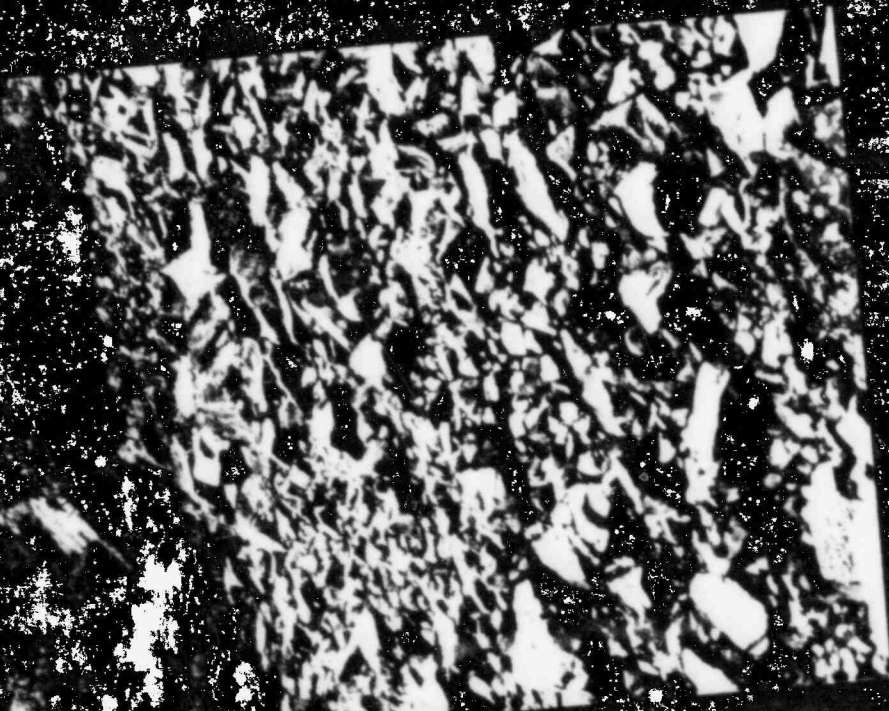
PROJECT Morrison-Knudsen PROJECT NO. D85103GE DATE 9/12/85
LOCATION Durango, CO REPORT NO. TIME
SOURCE Rio Rap SAMPLE NO 1130 ENGINEERING TECHNICIAN Brown

LOS ANGELES ABRASION TEST RESULTS

Sample: #2: grey sandstone - Bodo Canyon

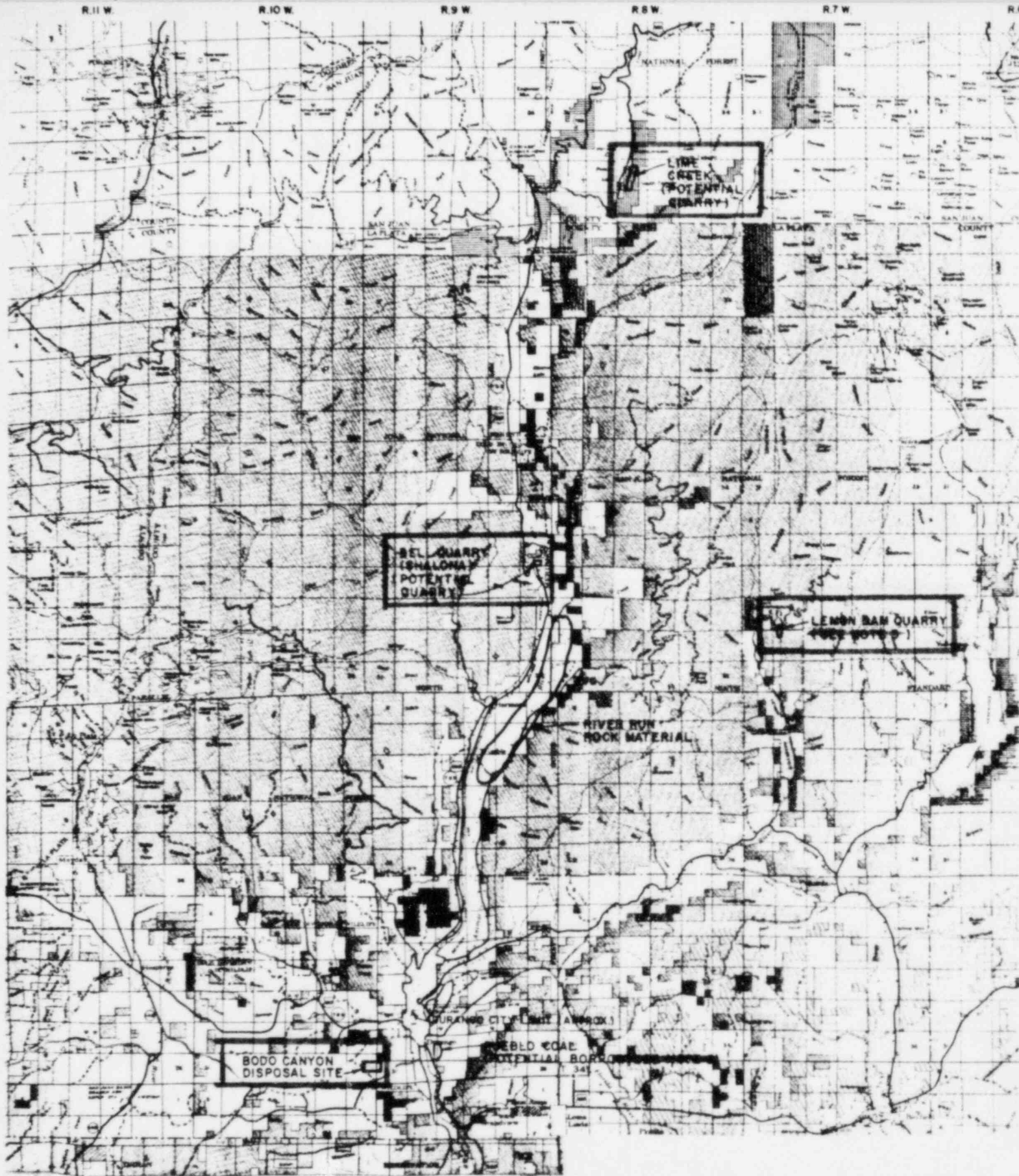
100 Revolutions: 15.8% loss

500 Revolutions: 57.2% loss



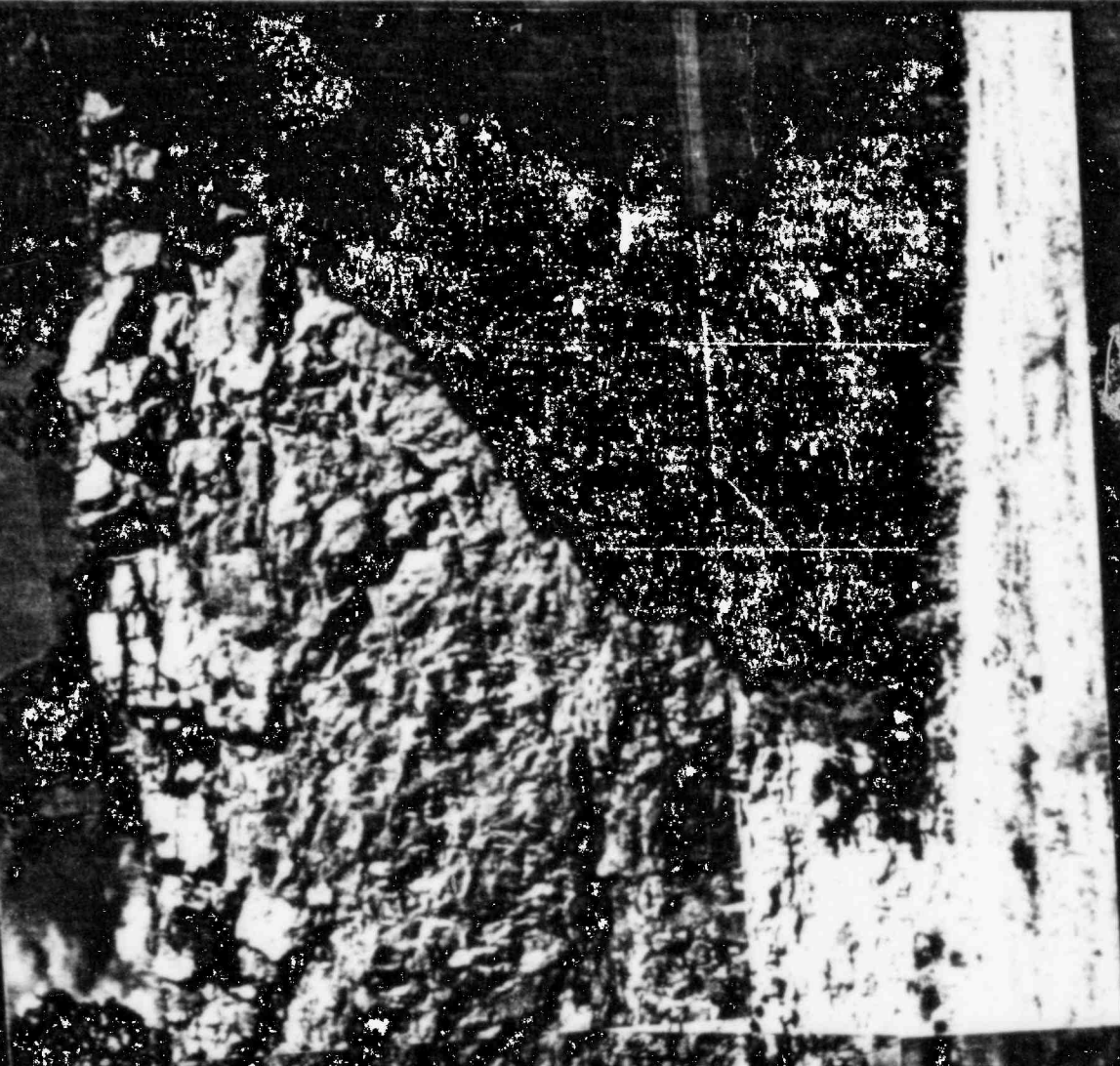
LIME CREEK
AREA





0 1 2 3 4 5 6 7 8 9 10 MILES
GRAPHIC SCALE

UMTRA PROJECT
DURANGO SITE
POTENTIAL RIPRAP
SOURCES



SHALONA QUARRY
LEROY ENGLISH
PROPERTY

Above: Panorama
of existing Lemon
Dam Riprap Source
pit.

10-9-85

Left: Blasted face
of typical large
block @ Lemon Dam
Riprap Source.

10-9-85

