

DAUB & ASSOCIATES, INC.



1985 ½ SOUTH BROADWAY
GRAND JUNCTION, CO 81507-9649
(970) 254-1224
FAX (970) 242-8438
email: gjdaub@daubandassociates.com
www.daubandassociates.com



NATURAL SODA

2010 Mine Plan Volume 1, Section 1.0 Preface and General Table of Content

Prepared for:
Natural Soda, Inc.
Piceance Creek Basin
Rio Blanco County, Colorado

Prepared by:
Daub & Associates, Inc.
Grand Junction, Colorado

SECTION 1.0 PREFACE

PREFACE

This Mining Plan Approval document is being submitted to the Bureau of Land Management (BLM), White River Field Office, Meeker, Colorado, in accordance with 43 CFR 3590. As recommended by the BLM, the format of the Mining Plan, Reclamation Plan, and supporting environmental information are in accordance with the guidelines (Mine Plan Requirements) received from the BLM for use in preparing such applications.

General Table of Content for the 2010 Mine Plan

Volume 1

Section 2.0 General Information

| | | |
|------|--|------|
| 2.1. | Operator Name..... | 2-1 |
| 2.2. | Lease Identification Numbers | 2-1 |
| 2.3. | Location of Operations | 2-1 |
| 2.4. | List of Federal, State and Local Permits Required for Operations..... | 2-5 |
| 2.5. | Identification of Contractors..... | 2-6 |
| 2.6. | Names, Addresses, and Telephone Numbers of Surface Owners | 2-7 |
| 2.7. | Status of Surface Use and Access Agreement from Public Rights-of-Ways to the Lease..... | 2-10 |
| 2.8. | Sodium Leases in the Vicinity..... | 2-10 |
| 2.9. | List of Agencies or Consultants Who Have Aided in the Preparation of the Mine Plan | 2-10 |

Section 3.0 General Site Conditions

| | | |
|--------|--|-----|
| 3.1. | Introduction..... | 3-1 |
| 3.2. | Previous Mining Reclamation Activities | 3-1 |
| 3.2.1. | Exploration Drilling | 3-1 |
| 3.2.2. | Bulk Sampling Program | 3-2 |
| 3.2.3. | Project Approval History | 3-5 |
| 3.2.4. | Commercial Operations | 3-5 |
| 3.3. | Cultural and Paleontological Resources..... | 3-6 |
| 3.3.1. | Cultural Resources | 3-8 |
| 3.3.2. | Paleontological Resources | 3-8 |
| 3.4. | Scenic or Natural Attractions | 3-8 |
| 3.5. | Existing and Proposed Post-Mining Land Use | 3-9 |
| 3.6. | Climate and Air Quality..... | 3-9 |

| | | |
|---------|---|-------|
| 3.6.1. | Regional Climatology | 3-9 |
| 3.6.2. | Regional Air Quality of the Piceance Basin..... | 3-15 |
| 3.7. | Toxic or Acid Wastes..... | 3-22 |
| 3.7.1. | Plant Wastes..... | 3-22 |
| 3.8. | Soils | 3-22 |
| 3.8.1. | Introduction | 3-22 |
| 3.8.2. | Soil Survey Procedures | 3-23 |
| 3.8.3. | Soil Sampling and Analysis..... | 3-26 |
| 3.8.4. | Soils of the Project and Lease Areas | 3-26 |
| 3.8.5. | Reclamation Characteristics | 3-38 |
| 3.9. | Vegetation | 3-40 |
| 3.9.1. | Introduction | 3-40 |
| 3.9.2. | Methods | 3-41 |
| 3.9.3. | Results and Discussion..... | 3-44 |
| 3.10. | Wildlife Information..... | 3-69 |
| 3.10.1. | Introduction | 3-69 |
| 3.10.2. | Methods | 3-70 |
| 3.10.3. | Results of Wildlife Studies | 3-75 |
| 3.10.4. | Threatened or Endangered Species | 3-92 |
| 3.10.5. | Seasonal Use..... | 3-92 |
| 3.10.6. | General Effects on Wildlife..... | 3-94 |
| 3.10.7. | Mitigation | 3-97 |
| 3.10.8. | Monitoring Plan | 3-101 |

List of Plates

Plate 3-1. Natural Soda, Inc. Lease Area and Soil Survey Map.....Map Pocket

Volume 2

Section 4.0 Geology

| | | |
|------|---|-------|
| 4.1. | INTRODUCTION | 4-1 |
| 4.2. | GEOLOGY OF PICEANCE CREEK BASIN | 4-7 |
| | 4.2.1. Introduction | 4-7 |
| | 4.2.2. Physiography | 4-8 |
| | 4.2.3. Stratigraphy..... | 4-11 |
| | 4.2.4. Structure..... | 4-25 |
| 4.3. | GEOLOGY OF NATURAL SODA LEASE | 4-30 |
| | 4.3.1. Introduction | 4-30 |
| | 4.3.2. Physiographic Setting | 4-32 |
| | 4.3.3. Surface Geology | 4-32 |
| | 4.3.4. Stratigraphy..... | 4-36 |
| | 4.3.5. Structural Geology | 4-80 |
| | 4.3.6. Important Nahcolite Horizons | 4-86 |
| | 4.3.7. Rock Quality Data | 4-111 |
| | 4.3.8. Stratigraphic Data for Rotary and Core Hole on Lease | 4-115 |
| | 4.3.9. Rock Quality Data Sheets | 4-143 |
| | 4.3.10. Geological Abbreviations | 4-146 |
| 4.4. | SUPPORTING DATA AND INFORMATION..... | 4-148 |
| | 4.4.1. References Cited | 4-148 |

List of Plates

| | |
|---|------------|
| Plate 4-1. MMC-IRI-5 Core Log | Map Pocket |
| Plate 4-2. North-South Stratigraphic Cross-Section..... | Map Pocket |
| Plate 4-3. East-West Stratigraphic Cross-Section..... | Map Pocket |
| Plate 4-4. MMC-IRI-1 RQD Log | Map Pocket |
| Plate 4-5. MMC-IRI-2 RQD Log | Map Pocket |
| Plate 4-6. MMC-IRI-3 RQD Log..... | Map Pocket |

Volume 3

Section 4.0 Geology

List of Plates

| | |
|--|------------|
| Plate 4-7. MMC-IRI-5 RQD Log..... | Map Pocket |
| Plate 4-8. MMC-IRI-9 RQD Log..... | Map Pocket |
| Plate 4-9. MMC-IRI-10 RQD Log..... | Map Pocket |
| Plate 4-10. MMC-IRI-11 RQD Log..... | Map Pocket |
| Plate 4-11. MMC-IRI-1 Lithologic Log..... | Map Pocket |
| Plate 4-12. MMC-IRI-2 Lithologic Log..... | Map Pocket |
| Plate 4-13. MMC-IRI-3 Lithologic and Fracture Log..... | Map Pocket |
| Plate 4-14. MMC-IRI-5 Lithologic Log..... | Map Pocket |
| Plate 4-15. MMC-PW-1 Lithologic and Fracture Log..... | Map Pocket |

Volume 4

Section 5.0 Hydrologic Conditions

| | | |
|--------|--|------|
| 5.1. | INTRODUCTION..... | 5-1 |
| 5.2. | SURFACE WATER | 5-1 |
| 5.2.1. | Regional Setting..... | 5-1 |
| 5.2.2. | Site Drainages | 5-3 |
| 5.2.3. | Diversions and Water Rights..... | 5-3 |
| 5.2.4. | Existing and Potential Regional Uses | 5-7 |
| 5.2.5. | Surface Water Quality..... | 5-15 |
| 5.3. | GROUNDWATER | 5-33 |
| 5.3.1. | Regional Setting..... | 5-33 |
| 5.3.2. | Aquifer Systems..... | 5-35 |
| 5.3.3. | Groundwater Quality | 5-47 |
| 5.4. | SUPPORTING DATA AND INFORMATION..... | 5-58 |
| 5.4.1. | References Cited | 5-58 |

Section 6.0 Mine Plan

| | | |
|--------|--|------|
| 6.1. | Introduction | 6-1 |
| 6.2. | Mine Plan Strategy | 6-4 |
| 6.3. | Resource Recovery and Production Rates | 6-5 |
| 6.3.1. | Sodium Bicarbonate Resources..... | 6-5 |
| 6.3.2. | Production Rates | 6-6 |
| 6.3.3. | Oil Shale Protection Lease Restriction..... | 6-6 |
| 6.4. | Mining Stratiform Nahcolite | 6-6 |
| 6.4.1. | General Process | 6-6 |
| 6.4.2. | Mining Interval..... | 6-7 |
| 6.4.3. | Groundwater | 6-11 |
| 6.4.4. | Operating Plan | 6-12 |

| | | |
|--------|--|------|
| 6.4.5. | Mining Methods..... | 6-12 |
| 6.4.6. | Mining Panels | 6-14 |
| 6.4.7. | Mining Procedures – Stratiform Saline Minerals | 6-16 |
| 6.4.8. | Drilling, Completion and Abandonment Details – Stratiform Saline Minerals | 6-18 |
| 6.5. | Process Monitoring | 6-25 |
| 6.6. | RD&D Plan – Deep Vertical Production Well (DVPW)..... | 6-27 |
| 6.6.1. | Introduction | 6-27 |
| 6.6.2. | Objectives | 6-28 |
| 6.6.3. | Pad Location and Mining Interval..... | 6-29 |
| 6.6.4. | Mining Procedure and Mined Interval Development | 6-32 |
| 6.6.5. | Mining Activity Monitoring | 6-35 |
| 6.6.6. | Well Abandonment and Pad Reclamation | 6-37 |
| 6.7. | Comprehensive Monitoring Plan..... | 6-38 |
| 6.8. | Affected Acreage | 6-39 |
| 6.9. | Rock Mechanics and Subsidence | 6-39 |
| 6.9.1. | Rock Mechanics..... | 6-39 |
| 6.9.2. | Boies Bed Mining Evaluation | 6-39 |
| 6.9.3. | Solution Mining Groundwater Effects..... | 6-39 |
| 6.9.4. | Surface Subsidence | 6-41 |
| 6.10. | Engineering Standards | 6-42 |

Section 7.0 Processing Facilities

| | | |
|--------|----------------------------------|-----|
| 7.1. | Introduction | 7-1 |
| 7.2. | Location | 7-1 |
| 7.3. | Plant Capacity..... | 7-3 |
| 7.4. | Phase 1 Construction Scope | 7-3 |
| 7.4.1. | Plant Facility..... | 7-3 |
| 7.4.2. | Utilities | 7-3 |
| 7.4.3. | Process Operations | 7-4 |
| 7.4.4. | Site Security (fencing) | 7-5 |

| | |
|--|------|
| 7.4.5. Wells | 7-5 |
| 7.5. Phase 1 Plant Facilities..... | 7-5 |
| 7.5.1. Buildings | 7-5 |
| 7.5.2. Process Control | 7-6 |
| 7.5.3. Site Fencing | 7-6 |
| 7.6. Utilities | 7-6 |
| 7.6.1. Electrical Power Distribution | 7-6 |
| 7.6.2. Fuel Storage and Distribution | 7-7 |
| 7.6.3. Communication..... | 7-7 |
| 7.6.4. Raw Water Supply and Storage..... | 7-7 |
| 7.6.5. Process Water Treatment and Storage..... | 7-8 |
| 7.6.6. Hot Water / Steam Generation and Distribution | 7-8 |
| 7.6.7. Cooling Water System | 7-8 |
| 7.6.8. Plant Air Systems..... | 7-9 |
| 7.6.9. Potable Water Supply | 7-9 |
| 7.6.10. Domestic Sewage Disposal System | 7-9 |
| 7.6.11. Fire Protection..... | 7-9 |
| 7.7. General Process Description | 7-10 |
| 7.7.1. Mining Operations..... | 7-10 |
| 7.7.2. Pregnant Liquor Storage..... | 7-12 |
| 7.7.3. Crystallization..... | 7-12 |
| 7.7.4. Dewatering..... | 7-12 |
| 7.7.5. Drying | 7-13 |
| 7.7.6. Storage | 7-13 |
| 7.7.7. Bagging Facility..... | 7-14 |
| 7.7.8. Loading Station..... | 7-14 |
| 7.7.9. Evaporation Pond | 7-14 |
| 7.7.10. Wash Water System | 7-15 |
| 7.8. General Processing Effects and Control Plans | 7-15 |
| 7.8.1. Air Pollutant Emissions | 7-15 |
| 7.8.2. Water Discharge | 7-15 |
| 7.9. Health and Safety | 7-16 |

| | | |
|---------|--|------|
| 7.9.1. | Objectives | 7-16 |
| 7.9.2. | Fire Prevention and Emergency Procedures | 7-17 |
| 7.9.3. | Safety..... | 7-18 |
| 7.9.4. | Potential Hazardous Gases | 7-20 |
| 7.10. | Phase 2 Mine Expansion | 7-21 |
| 7.10.1. | Introduction | 7-21 |
| 7.10.2. | Resource Evaluation..... | 7-21 |
| 7.10.3. | Facility Expansion | 7-24 |
| 7.10.4. | Processing Upgrades and Expansion | 7-24 |
| 7.10.5. | Air Pollutant Emissions (Phase 2)..... | 7-25 |

Section 8.0 Reclamation Plan

| | | |
|--------|--|------|
| 8.1. | Introduction..... | 8-1 |
| 8.2. | Post-Mining Land Use | 8-1 |
| 8.3. | General Reclamation Goals and Procedures | 8-2 |
| 8.4. | Site-Specific Reclamation Procedures | 8-2 |
| 8.4.1. | Construction and Well Field Reclamation | 8-2 |
| 8.4.2. | Regulatory Compliance..... | 8-6 |
| 8.4.3. | Well Field and Plant Decommissioning..... | 8-12 |
| 8.5. | Reclamation Schedule | 8-13 |
| 8.6. | Reclamation Monitoring..... | 8-14 |
| 8.7. | Surface and Ground Water Protection | 8-15 |
| 8.7.1. | Surface Water | 8-16 |
| 8.7.2. | Ground Water | 8-17 |
| 8.8. | Contingency Plans | 8-18 |