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NATURAL SODA

# 2014 Mine Plan Modification
# 500,000 Ton Per Year
# Volume 4, Section 7.0
# Processing Facilities

**Prepared for:**

## Natural Soda, Inc.
## Piceance Creek Basin
## Rio Blanco County, Colorado

**Prepared by:**

## Daub & Associates, Inc.
## Grand Junction, Colorado

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# SECTION 7 PROCESSING FACILITIES

## 7.1 Introduction

Natural Soda, Inc. (NSI) operates a sodium bicarbonate production facility on four Federal Sodium Lease tracts within the Piceance Basin in northwestern Colorado. Figure 2-1, illustrates locations of current area of operations, leases, wells and access roads. Sodium bicarbonate is produced by solution mining underground nahcolite deposits and then recovering the sodium bicarbonate in a surface processing and refining facility. The sodium bicarbonate produced is currently available in several grades, meeting ISO 9001-2008, ISO 22000, U.S. Pharmacopeia (USP), and other standards and certifications. National and international (export) food, industrial and specialty markets are currently supplied by NSI. Examples of the many uses of sodium bicarbonate produced by NSI include water treatment, animal feed, fire extinguishers, baking products, household cleaning and flue gas treatment for removal of sulfur and nitrogen oxides.

## 7.2 Location

The project site is located in Rio Blanco County, approximately 42 miles southwest of the town of Meeker, Colorado, at an elevation of 6,600 feet AMSL. Nearby small communities include Meeker, Rangely and Rifle. Grand Junction, the nearest major population center, is about 120 miles from the site. Paved roads provide access to the site.

## 7.3 Plant Capacity

The 1987 BLM Environmental Impact Statement (EIS) studied the environmental and socioeconomic effects of four potential plant capacities; no action at zero tons per year (tpy), 50,000 tpy, 125,000 tpy and 500,000 tpy of sodium bicarbonate. Over the long term, the plant was to be constructed and expanded in phases or modules with each module representing a production increase of 125,000 tpy. Phase I (125,000 tpy production capacity) construction was completed in January of 1991. The completion of Phase 2 plant expansion (250,000 tpy production capacity)

was in May, 2013. The Phase 3 expansion to 500,000 tpy is supported by expanding markets and world-wide demand; current and unique export opportunities exist.

## 7.4 Existing Facilities

The following is a general outline of existing facilities that are in place to support production of 250,000 tpy.

### 7.4.1 Plant Facility

The plant facility is designed and built to house:

- Process equipment
- Packaging, palletizer, warehouse, storage, load-out
- Services (maintenance, utilities, lab, etc.)
- Administration offices

### 7.4.2 Utilities

The following utilities are installed to support manufacturing.

- Two Electrical supply lines and associated distribution
- Natural gas supply line and distribution
- Telephone lines
- Two raw water wells, pipelines and storage
- Process water treatment and distribution
- Hot water heating and distribution
- Evaporative cooling water system
- Low pressure steam generation
- Plant and instrument air systems
- Domestic sewage system

### 7.4.3 Process Operations

Manufacturing process elements include the following:

- Brine storage and handling
- Cooling/Crystallization
- Dewatering, Drying, Screening
- Bulk Storage, Load-out
- Packaging and Warehousing Facility with Load-out Docks.
- Evaporation Pond (three-acre process pond and seven-acre waste pond, 10 acres total)

### 7.4.4 Site Security (fencing)

- Process area
- Evaporation pond
- Drill pads and topsoil stockpiles
- Reclaimed areas

### 7.4.5 Wells

- Water Supply
- Monitoring
- Production

## 7.5 Detail of Existing Facilities

### 7.5.1 Buildings

Administration, process, utilities, maintenance, bagging warehousing, bulk product storage silos and laboratory facilities are housed in a 47,000 square foot pre-engineered metal building. A bulk load-out scale-house and five product storage silos are located outside of the Main Plant Building. Small, pre-fabricated frame

outbuildings house water well electrical equipment, spare pumps and the fire water pump. The Bulk Feed and Industrial Product Storage building is a 100-foot diameter pre-engineered concrete and wood frame structure.

All permanent buildings and the tank farm areas are on concrete slabs. Floor drains and/or sumps collect any product spillage which is routed to an approximately seven acre waste pond for containment. Small quantities of stored hazardous materials, such as petroleum products, are contained within their own storage cabinets.

### 7.5.2 Process Control

The mining, processing, and utilities operations utilize a computer based Distributed Control System (DCS). The system interfaces with field instruments to manage all closed loop control, monitoring and alarming of process variables. In addition, the system provides trend and reporting capabilities for both control and accounting purposes.

Process monitoring and control is managed from a central control room. Each of six operator stations is capable of performing all necessary interfacing between the control system and the operator(s). The operator interface includes complex, trending systems, analog and discrete monitoring, and alarm systems, set-point adjustment of control loops, as well as the capability to start and stop motors. System printers are utilized for generated reports and for alarm documentation.

### 7.5.3 Site Fencing

An eight-foot high woven wire fence has been constructed around the approximately ten-acre evaporation pond to limit animal access. In addition, the pond has been covered with a net to protect and keep birds out of the pond. A four-strand barbed wire fence (conforming to BLM Type D Specifications) was constructed around the plant facilities and the topsoil embankment. Fencing is also be maintained around monitor well locations, top soil storage piles, and reclaimed areas.

## 7.6 Utilities

The following subsections provide detail for the various utility and process elements that support current operations.

### 7.6.1 Electrical Power Distribution

For redundancy, two White River Electric Association (WREA) power lines supply electricity to the NSI plant. The Right-of-Ways (ROW) are secured and will be maintained by White River Electric Association.

### 7.6.2 Fuel Storage and Distribution

NSI owns an on-lease natural gas distribution line which is supplied by Questar Pipeline. This natural gas distribution line supplies the on-site equipment which requires natural gas. The natural gas is supplied by a 4-inch line approximately 2.5 miles in length. A BLM ROW was issued to NSI for this line. High pressure natural gas is reduced to 40 pounds per square inch gauge (psig) for in-plant distribution. Gas is distributed to the boilers, flash dryers and building heaters direct fired equipment.

A diesel storage tank is located in the fire-suppression pump house. The diesel fuels the fire-suppression water pump. Above ground bulk gas and diesel tanks with secondary containment are located on site for company vehicles and heavy equipment.

### 7.6.3 Communication

Telephone lines were installed from Mile Marker 7 on Rio Blanco County Road (C.R.) 24 (Ryan Gulch Road), along Yellow Creek Jeep Trail (C.R. 83) to the original NSI access road and onto the mine site. The Right-of-Way is assigned to NSI. Portable 2-way radios are also utilized for communications within and around the operating facilities. Communication is augmented for outlying areas by a 50W repeater located at the plant. Radio and 50W repeater use are licensed with the U.S. Federal Communications Commission (FCC).

### 7.6.4 Raw Water Supply and Storage

Raw water for mining and process operations is supplied from wells 90-1 and WSW-2 located south of the plant site. A buried six-inch pipeline is installed from the well to a 100,000 gallon tank, which serves as a raw water storage section (70,000 gallons) and dedicated fire-suppression water storage section (30,000 gallons). Electric power supply was constructed to the well site. In 2014, NSI will drill two new water supply wells (WSW-3 & WSW-4). The 90-1 well will be retired and converted to an A-Groove ground water monitor well. Additional back up and supplemental water supply wells WSW-5 and WSW-6 are being sited to ensure an adequate supply of raw water to the plant for the expansion to a 500,000 tpy operation.

### 7.6.5 Process Water Treatment and Storage

Water used directly in the mining, crystallization and surface cooling operations is treated to remove hardness. The raw water is filtered and softened in a water softener unit to remove calcium and magnesium ions. The softener includes a common brine tank to regenerate the resin beds. Softener regeneration wastes drain to the waste water pond. To minimize the water load on the waste water pond, plant water balance is monitored and managed so that waste volume is minimized. The softened water is stored in a 72,000 gallon carbon steel tank located in the process tank farm. A 100 gpm process water pump distributes process water to the plant users.

### 7.6.6 Hot Water / Steam Generation and Distribution

Low pressure steam boilers provide process heating. Principle uses include the heating of barren liquor and wash water.

Curbs and floor drains are provided around the heaters and pumps to contain any spills. Floor drains are routed to the waste pond.

### 7.6.7 Cooling Water System

An evaporative cooling tower and distribution system is in service for process cooling requirements. The principal use is to cool the fourth stage crystallizers for both crystallizer trains.

The cooling tower services both crystallizer trains and cools about 2,400 gpm of cooling water with a design inlet of approximately 90°F. A system is provided to chemically treat the cooling water to prevent scaling and bacteria growth in the cooling water system. The cooling water blowdown system drains to the waste pond.

### 7.6.8 Plant Air Systems

Plant and instrument air is supplied by screw compressors furnishing dried, oil free air at 125 psig output.

The instrument air loop includes an air dryer and is distributed at 100 psig. In addition to meeting the instrument requirements, the dried instrument air system serves the dust collectors with bag cleaning air. Plant air serves the maintenance shops and plant utility stations.

### 7.6.9 Potable Water Supply

Bottled drinking water is supplied from off-site. Softened process water is supplied to showers, toilets, sinks, safety showers and other service applications. Plumbing for these systems is such that a potable water treatment system can be added at a later date.

### 7.6.10 Domestic Sewage Disposal System

The criteria for design of the sewage disposal system were based on Colorado Department of Public Health and Environment (CDPHE) Guidelines. A total of up to 50 personnel (office/plant) are expected to be employed. A Rio Blanco County permit was obtained for the sewage disposal system.

### 7.6.11 Fire Protection

The fire protection system consists of a diesel powered water pump and an underground piping system with fire hydrants and hose houses. The building is equipped with fire extinguishers as required by fire code. The bottom ⅓ (30,000 gallons) of the raw water storage tank is reserved for fire protection.

A jockey pump is installed to maintain pressure on the fire loop. The fire-suppression loop consists of a buried eight-inch HDPE pipe (FM approved) with fire hydrants spacing at 250 feet. Fire hose boxes are installed near three of the fire hydrants. A sprinkler system provides fire protection for the bagging warehouse area where wood and paper products are stored.

## 7.7 General Process Description

### 7.7.1 Mining Operations

Mining operations deliver a saturated solution of sodium bicarbonate in water (pregnant liquor) at temperatures ranging up to 250°F. Figure 7-1 illustrates a generalized process flow. Production rates can be controlled by varying brine temperature and/or flow rate, and process cooling.

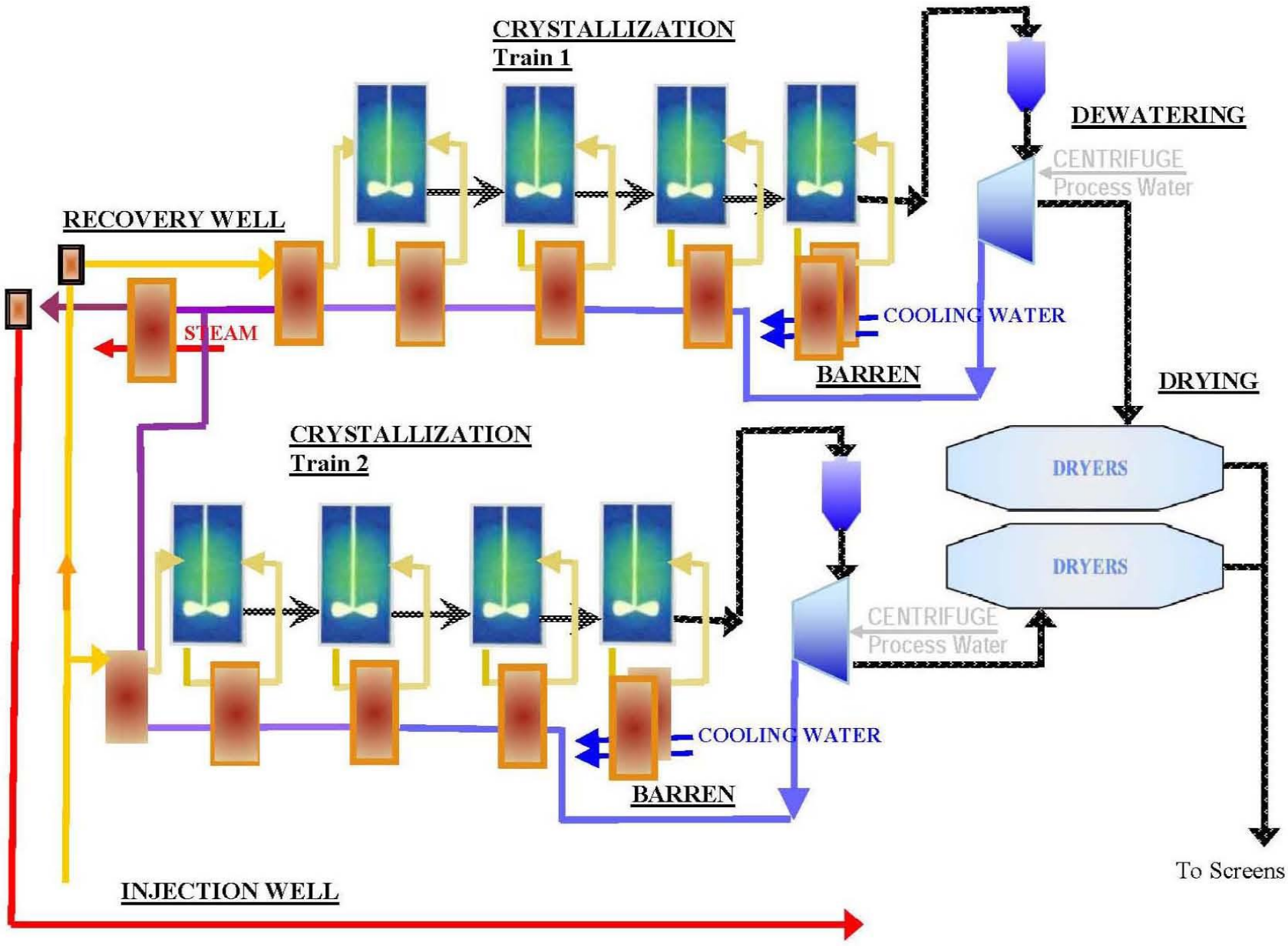
Surface operations return preheated barren liquor for reinjection. The solution mining operation is the net consumer of water as saturated solution fills the cavity created by the dissolution of nahcolite. This increment of water will be added in the process operations with process pond recycle or treated well water.

For a production rate of 250,000 tpy, the water makeup rate for the mine is estimated at 30,442 lbs/hr or 60.8 gallons per minute (gpm). This is to make up for cavity growth only and assumes no other mine or system losses. Makeup rate is linear with production rate, that is, a production rate of 500,000 tpy would assume a makeup rate of 121.6 gpm or 60,884 lbs/hr. Additional water make-up is required at the plant for process operations including evaporation in the cooling towers, product drying, utilities, and drilling needs. Extrapolating current water usage to the Phase 3 500,000 tpy manufacturing scenario yields an estimated total average water usage of 352 gpm. The cooling tower water usage is dependent upon heat load to the

plant and ambient conditions, but the towers create potentially the largest water demand. For existing 250,000 ton per year production rates, the tower usage ranges as high as 70 gpm, and would potentially double for the 500,000 tpy manufacturing scenario.

Flow meters, temperature and pressure sensing devices are provided on the injection (barren liquor) lines and the recovery (pregnant liquor) lines. A final flow meter is located in the pregnant liquor stream at the plant. These devices provide information for control of the operation and for accounting purposes. Piezometric head transmitters are installed downhole in Dissolution Surface and B-Groove monitoring wells in solution mining areas. Real time readings from these wells are transmitted to the central control room to assist operations in ensuring a balance is maintained on the production well-sets

# NATURAL SODA PROCESS FLOW



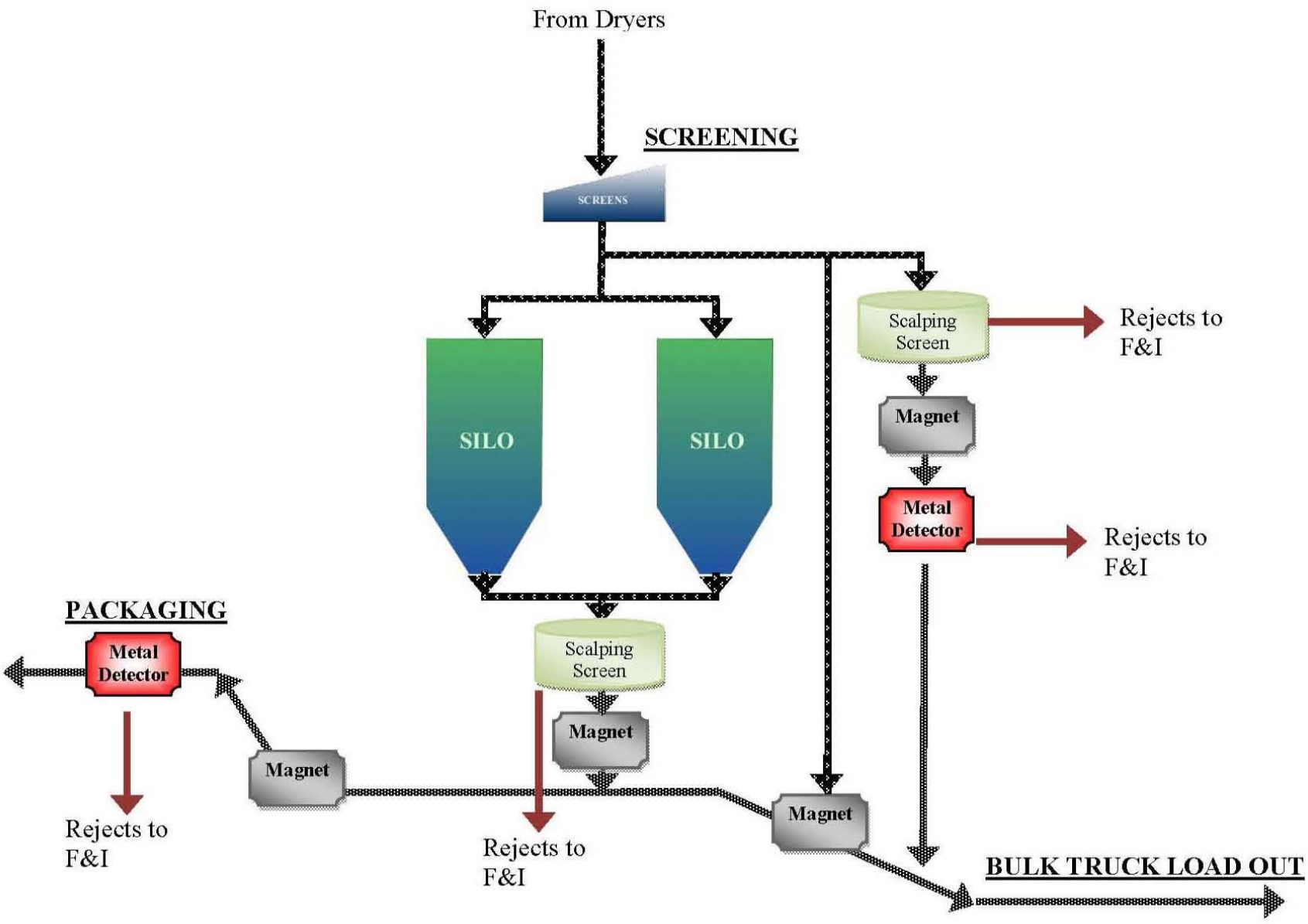




**Figure 7-1. Generalized Process Flow Diagram**

### 7.7.2 Pregnant Liquor Storage

Saturated brine from the operating well-pairs is pumped to two 42,000 gallon storage tanks at the plant site. The storage tank is insulated for energy conservation and to prevent cooling and premature crystallization of bicarbonate.

### 7.7.3 Crystallization

Sodium bicarbonate is produced by cooling the pregnant liquor in two independent crystallizer circuits (trains). Train 1 was constructed in 1991, and Train 2 was constructed in 2013. Cooling and crystallization for each train is accomplished in a series of four crystallizers. The crystallizers, in Train 1, are cylindrical draft-tube vessels with mechanical agitators. Train 2 crystallizers are cone bottom draft tube vessels, and also have mechanical agitation.

The crystallizer feed streams are cooled using external plate and frame type heat exchangers. Feeds to Crystallizers Nos. 1, 2, and 3 for each train are cooled by counter current flow of the barren liquor. Crystallizer No. 4 feed is cooled with cooling tower water. Barren liquor from both trains is stored in a 36,000 gallon barren liquor tank. This tank is covered and insulated for energy conservation. Barren liquor from this tank is pumped through an external tube and shell heat exchanger, where it is heated, utilizing low pressure steam from the fire tube boiler. Hot barren liquor is pumped to mining operations for reinjection. A food grade additive is utilized at low concentration (less than 20 ppm) in the crystallizer circuit to promote improved crystal habit.

### 7.7.4 Dewatering

The total sodium bicarbonate production from the two crystallizer trains is pumped as slurry to two sets of six-inch hydro-cyclones for thickening. The underflow from these Hydro-cyclones is fed to the centrifuges to dewater further before the product is fed to the product dryers. Filtrate from the dewatering operation is channeled through two banks of four-inch hydro-cyclones for final product capture. The solids captured at this stage are recycled back to the No.1 Crystallizers in each train. The clarified effluent from this stage is pumped back through the crystallizer heat

exchangers as barren liquor to cool the first three crystallizers in each train. This stream is collected in the barren liquor tank for reinjection. Anti-foamant is utilized in the barren liquor stream to control foaming.

### 7.7.5 Drying

Wet cake from the dewatering operation is dried in natural gas, direct-fired flash dryers. The wet cake is first mixed with recycled dry product to enhance flow and handling characteristics. The mixing also minimizes caking and plugging problems in the dryer feed system. Dry product is recovered by means of cyclones and bag-houses. Bag-house fines are recombined with the main product stream.

### 7.7.6 Storage

Product from the cyclone is transferred to the dome storage building, direct to silos or to the screening operation. The dome storage building has a nominal capacity of 3800 tons of finished feed and industrial grade bulk product. The screening operation provides capability to classify the product by size and product use. Two air classifiers are utilized to separate granular and powder products, and further differentiate the powder products prior to conveyance to screens. Differentiated products are transported from screens by screw conveyors to any of the nine bins (seven-240 ton, one-50 ton and one-120 ton capacity) or to the storage dome. Product from the bins is conveyed by screw conveyors and elevators through a scalping screen and magnets to the bagging facilities or bulk load-out. Scales on the conveyance streams (to dome storage and to the screening operation) are included for production accounting.

A reclaim conveyor is constructed in the floor of the dome storage building for loading out product. A front end loader may be used to feed the reclaim conveyor. Dust collection equipment is included on the conveyor transfer points and in the dome storage building.

### 7.7.7 Bagging Facility

The bagging facility has three packers for production of 50 lb. or 25Kg bags. The packers are rated at 16 tons/hour combined. A palletizer rated at 32 tons/hour, is utilized to palletize and stretch-wrap bags for shipment by truck. Additionally, the product can be packaged in "super sacks" of generally one ton capacity. Packaged products are stored in a 700 ton capacity warehouse prior to shipment.

### 7.7.8 Loading Station

Product is shipped from the site in bulk transport trucks or bagged and shipped by tractor/van units. Loading from the bulk storage building is done by mechanical conveyors. The 110-foot truck scale is included in the loading station for control of operations and final accounting. Bagged product is stored in the bagging warehouse and loaded by forklift. Dust collection systems are provided for the conveyors and the truck load-out area.

### 7.7.9 Evaporation Pond

An evaporation pond has been provided for containment of process water and disposal of waste streams. The pond consists of two compartments of approximate three and seven acres. The smaller compartment is provided to contain plant spills or excess process solution overflow. The solutions collected in this compartment will be pumped back (150 gpm submersible pump) to the plant for recycling. The larger compartment contains utility waste streams such as cooling tower blow down, boiler blow down, and water softener regeneration purge. In the past, drainage from the glycol heater containment was directed to this pond, but these heaters were replaced by boilers in 2002. In unusual circumstances, the waste water compartment may accommodate overflow from the process compartment. The pond has a double liner with a leak detection system. The primary liner (top) is made of 60 mil high density polyethylene (HDPE). The secondary liner is made of 40 mil HDPE. Drainage netting was used between the two liners to assist flow of potential leakage from the primary liner to a sump between the liners, where the leakage will be recycled. This design limits potential leakage through the 40 mil

liner. The lined earthen dike separating the two compartments is three feet lower than the perimeter dike of the pond. The pond is a maximum depth of ten feet, not including three feet for freeboard. An increase in sodium bicarbonate production could potentially result in more wash-down and process water. A pondage increase of seven acres may be necessary to accommodate the increase in sodium bicarbonate production. In addition, this would allow for more flexibility when emptying a pond for maintenance and clean-out.

### 7.7.10 Wash Water System

A wash water tank, heater and distribution system was provided to permit washing liquor and slurry handling equipment, and for general area cleanup. The wash water system uses process water for makeup.

## 7.8 General Processing Effects and Control Plans

### 7.8.1 Air Pollutant Emissions

The sodium bicarbonate production capacity following Phase 1 construction was 125,000 tpy; Phase 2 construction increased plant production capacity to 250,000 tpy. Total emissions from NSI operation throughout Phase 1 and Phase 2 have remained under 100 tpy. Therefore, NSI has been classified by the CDPHE as a minor emitter.

NSI remains committed to using best management practices (BMP) and best available technology (BAT) to keep emissions as low as practical. The Phase 3 plant expansion will increase sodium bicarbonate production to 500,000 tpy. Prior to the Phase 3 plant expansion, NSI will conduct stack testing to better quantify current emissions. Research concerning new technologies, especially as it relates to emissions reduction, is ongoing. Refer to the Phase 3 Mine Expansion subsection for post-expansion emission commentary.

### 7.8.2 Water Discharge

The nahcolite solution mine has been designed as a zero discharge facility in regard to wastewater. Water produced during drilling is conveyed via truck to a retention

pond and no discharge is anticipated. NSI files annual stormwater reports pursuant to Permit No. COR 34-0751. Detailed information can be found in the NSI Stormwater Management Plan submitted to the DRMS in 2012.

Disturbed areas associated with access roads, well field and plant site are reclaimed as soon as practical following construction. Erosion control measures, such as contour furrowing and water bars, are utilized to minimize erosion until such time that a vegetative cover is established.

The product handling and load-out areas have been paved with asphalt or concrete. They are sloped to prevent precipitation runoff from these areas. Since a potential exists for precipitation falling on these areas to become enriched with sodium bicarbonate, this water is directed to containment structures and subsequently removed to the evaporation ponds for disposal. Surface runoff is regulated by the NSI Storm Water Discharge Permit.

## 7.9 Health and Safety

### 7.9.1 Objectives

The overall objective of the NSI Health and Safety Plan is to reduce injuries and illnesses to the minimum level practicable for employees, contractors and the on-site public. This is accomplished in part through the following means:

- Safe design of facilities and equipment.
- Engineering controls and equipment hazard isolation
- Administrative controls and safe operating procedures.
- Use of personal protective equipment (PPE).
- Training programs.
- Hazard awareness, recognition and mitigation
- Compliance with all applicable laws and regulations (OSHA),
- Natural Soda safe work practices and regulations

- Regular monitoring of all on-site activities by trained personnel to ascertain effectiveness of the plan and recommend any necessary changes.

Specific manuals, training programs, and safe work practices are developed and updated as the project proceeds.

### 7.9.2 Fire Prevention and Emergency Procedures

Although the product at the NSI nahcolite solution plant is not a flammable hazard, fire remains a serious consideration for all employees. Fire prevention consists of controlling the supply of flammable and combustible materials, as well as any possible sources of ignition.

a. The dry terrain surrounding the nahcolite plant is a potential source of combustion and caution must be used in extinguishing smoking materials at the plant and for travel to and around the site. Smoking materials should be disposed of in appropriate containers.

b. Oil, flammable liquids and grease shall be kept in containers provided for that purpose. The containers must be labeled (NFPA Code) as to their contents.

c. Fire extinguishers are strategically located throughout the plant and office building for accessibility and rapid response to a fire. Clear access to fire extinguishers will be maintained. Portable, dry chemical general purpose extinguishers are utilized and work for most types of fire. This is the most common extinguisher throughout the plant site. At a minimum, these fire extinguishers are checked annually for condition and charge. Surrounding the plant are fire hydrants. Water extinguishment works well for most solid flammable fuels, such as structure fires, and for cooling structures during brush fires, but should not be used on an electrical fire. Electronics-sensitive extinguishers are located in instrumentation and electrical areas. Sodium bicarbonate is commercially used as a fire-extinguishing media and is readily available at the plant in bulk quantities and will be used as needed.

The first concern during a fire is the safety of the employees and others on site. If a fire starts there are at least two options, depending on the size of a fire:

a. The fire may be controlled with a fire extinguisher, bulk sodium bicarbonate, or if necessary, the fire hydrant system.

b. If the fire is too large to control with hand-held fire extinguishers or the fire pump system is inadequate, the employees and any other persons will leave the area and initiate a fire response team immediately from Meeker. Information regarding the facility name, the location of the fire, and the type of fire will need to be provided to the first responders. If necessary, locate and evacuate all other persons from potentially dangerous situations. Evacuated personnel are to gather at the muster location in the parking lot at the front of the plant.

### 7.9.3 Safety

- The health and safety of all employees, contractors and visitors is the responsibility everyone---NSI, each employee and contractor alike. The goal is the safe production of nahcolite; safety is an integral part of every job.
- Safety will not be subordinated to demands for production, cost savings, product quality, schedules, convenience or expediency.
- Every employee has the responsibility to perform their job in a safe manner, to ensure their own safety and the safety of their co-workers and contractors.
- It is the policy of Natural Soda, Inc. to maintain safe working conditions. Work places shall be free of recognized safety hazards. NSI will comply fully with all state and federal laws and regulations pertaining with the safety and health of its employees. All employees will receive necessary safety training regarding procedures and regulations.
- Employees will be held accountable for the safe performance of their duties, and will be measured on their accomplishments in controlling accidents and losses. Disregard for safety can be grounds for disciplinary action up to and including termination of employment.

- NSI recognizes its responsibility to manage activities in a manner that assures a safe and healthy operation. NSI will continue in its endeavors to develop better methods to attain the safest and healthiest environment possible.
- Conditions may be particularly hazardous for those who are not familiar with the equipment and operating procedures at the plant site. The safety program is intended to ensure that all personnel are aware of hazardous conditions to which they may be exposed, exclude unauthorized personnel from undue hazards, and protect authorized personnel that must enter hazardous areas.
- Exclusion of unauthorized personnel is accomplished by signs, physical barriers, and security practices. Warning signs are posted in hazardous areas; and when potential for accidents is greatest, physical barriers such as solid enclosures or fences will be used. The process area and hazardous areas, such as evaporation ponds, are fenced. Security practices include measures taken by employees to assure that hazardous areas remain inaccessible to the public.
- Contractors, inspectors, and other visitors that must access hazardous areas will be given proper safety equipment and instruction. In all cases, such visitors will be accompanied by a NSI employee.
- Contractors, inspectors, and other visitors are given a safety induction, which includes written verification that expectations of safe practices and awareness of common hazards are reviewed prior to being allowed access to the plant.

### 7.9.4 Potential Hazardous Gases

Under unusual circumstances, three (3) gases may be encountered during operations at the nahcolite solution plant: Carbon Monoxide (CO), Methane ($CH_4$) and Hydrogen Sulfide ($H_2S$).

Carbon monoxide (CO) would be present in the event of a fire. It is colorless, odorless and tasteless. Like hydrogen sulfide, carbon monoxide is highly toxic. It is classified as a chemical asphyxiant.

Methane ($CH_4$) would be the most common of the flammable gases encountered on site. Methane pockets exist underground in the Piceance Creek Basin per historical geologic records. Ventilation in the plant is such that an accumulation of methane would not occur. Well drilling into an underground methane pocket could produce an ignition if the range of oxygen (5 - 15% volume) is such to form the flammable, explosive mixture. Methane reduces the oxygen concentration when mixed with air, thus acting as an asphyxiant. Methane induced flames can produce carbon monoxide.

Hydrogen sulfide ($H_2S$) potential is indicated by historical records in the Piceance Basin. Because of this potential, NSI monitors for $H_2S$ as part of its confined space entry procedure. Monitoring of oxygen, hydrogen sulfide, methane and other explosive gases is done on a regular basis, and before and during any operations in which gases may be encountered at the nahcolite solution plant or at the well sites.

## 7.10 Phase 3 Mine Expansion

### 7.10.1 Introduction

The original design plan allowed for a phased or modular approach to expansion and increased production. The existing 250,000 tpy facility scope, construction and operational elements are described in sections 7.4 through 7.8. Most existing elements will be unaffected by the planned expansion to 500,000 tpy capacity which will located on independent siting near the existing facilities. The new facilities will be designed conceptually to be similar to existing facilities. Figure 7-2 and Figure 7-3 indicate the general layout of the existing processing plant and plant expansion. This proposed location may be moved further to the east, so that all facilities are contiguous and the overall surface disturbance is reduced. However, civil work for this alternative may be economically unfeasible. Surveys and soil studies are planned to determine the best location for the new facilities. In general, the expansion will add a new line(s) for the production of USP grade product in response to the current unique export opportunity. The NSI plant expansion will increase overall production capability to 500,000 tpy. The planned expansion is expected to be completed no later than 2016.

### 7.10.2 Resource Evaluation

Resource evaluation of in-place nahcolite and facies definition of the Boies Bed supports NSI expansion plans. Current and future mining operations will focus on the Boies Bed, a resource of stratiform nahcolite containing more than 80 million tons of sodium bicarbonate within the NSI sodium lease boundaries. Beyond 2014, nahcolite solution mining within the Boies Bed is anticipated to occur in the southern portion of Section 25 and 26, and western portions of Section 26 and eastern portion of Section 27 (Figure 7-4, CONFIDENTIAL). In addition to solution mining stratiform nahcolite found in the Boies bed, NSI is enhancing resource recovery by understanding the resource extent including but not limited to the following: nahcolite/halite facies relationships, the truncation area, the transition area and potential recovery methods of thinly bedded, and disseminated nahcolite located below the R-5 Zone in the lower part of the Saline Zone.

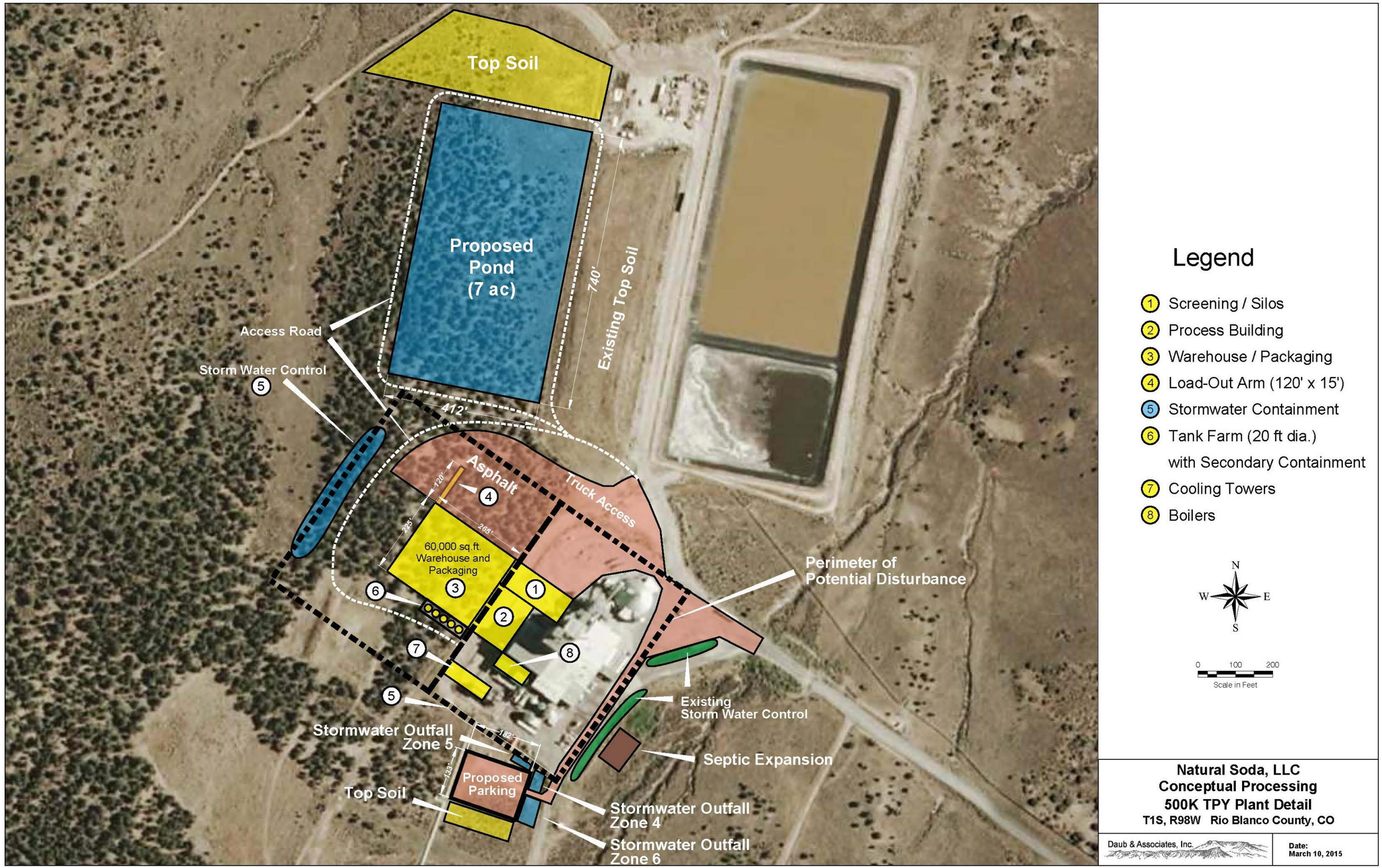



**Figure 7-2. Conceptual Processing Plant Detail Map**

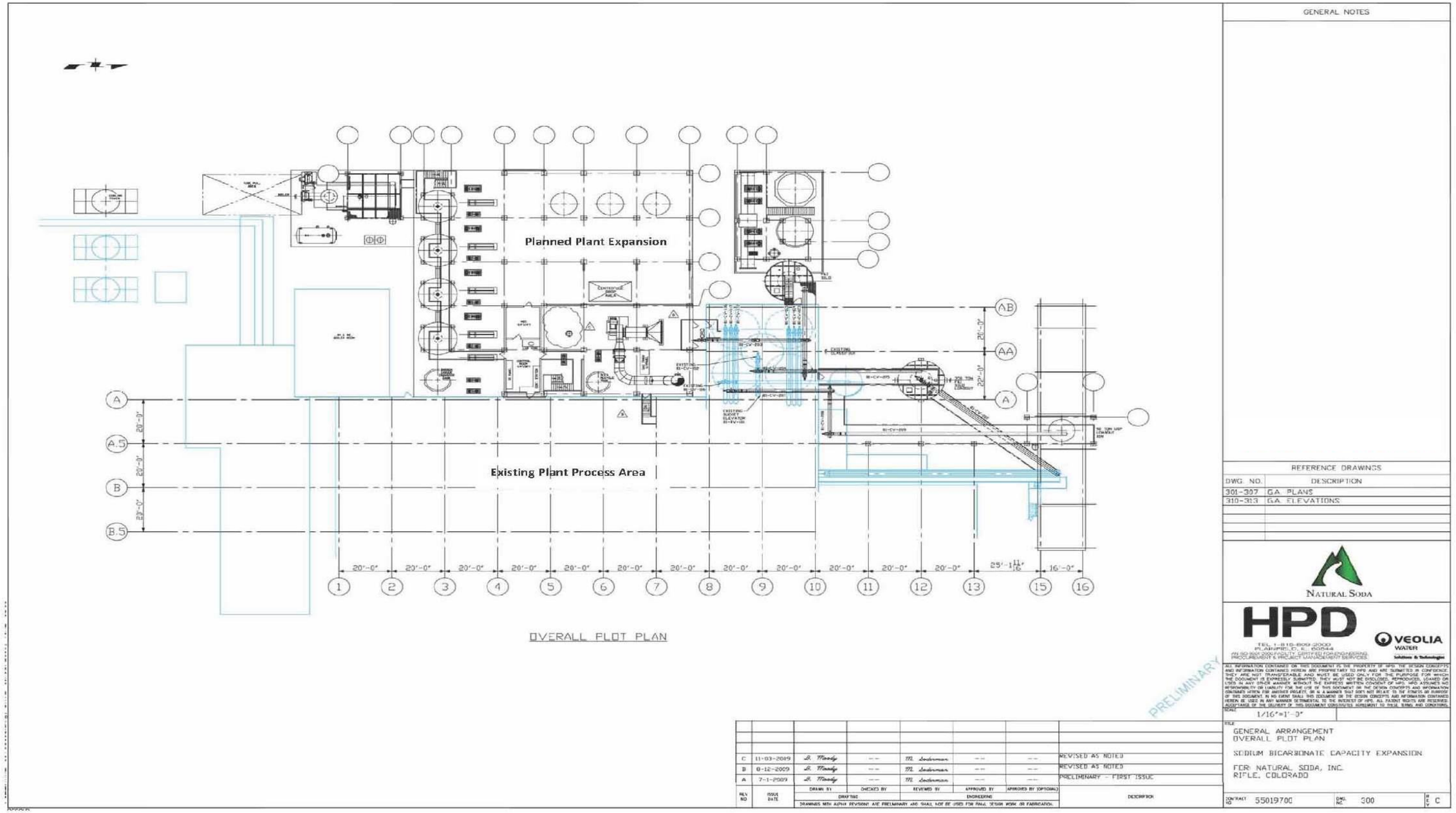



**Figure 7-3. Phase 2 Plant Drawing**

CONFIDENTIAL

**Figure 7-4. Upper Boies Bed Saline Facies Map (CONFIDENTIAL)**

### 7.10.3 Facility Expansion

The planned plant expansion, housing the new production line(s), will include a new process building. The size of the process building addition will be approximately 150 by 115 feet for a plant footprint increase of approximately 17,000 square feet (Figure 7-2). The post expansion tank farm area will add five 20-foot diameter tanks. Upgraded warehousing and packaging facilities will be contained in a 265 by 225 feet building (60,000 square feet) contiguous with the planned processing facility. The increased packaging, storage and warehousing is required to allow the production of a broader range of size grades specific for export markets. The new dry handling, screening and storage will occupy an area of approximately 190 feet by 80 feet (15,000 square feet), and is planned to be adjacent to the warehouse and processing facilities. Upgraded product storage will be achieved with 9 new 250 ton capacity USP product silos and a 250 ton capacity industrial/feed product silo. One new cooling tower and three boilers will be installed adjacent to the existing plant on existing disturbance. Plant expansion will nominally double the current disturbance associated with existing manufacturing facilities.

### 7.10.4 Processing Upgrades and Expansion

Much of the plant expansion will focus on the construction of an additional production line. This new processing line will assume the production of and increase the production capacity of NSI's USP and higher grade products. Processing upgrades and expansion include:

- Add a 4 stage crystallizer system with heat exchangers and associated equipment.
- Add three pusher centrifuges with associated hydrocyclones.
- Construct an additional 60MMBtu/hr, counter-flow cooling tower.
- Two new air compressors will be added to support bag-house, instrumentation and packaging requirements.
- Add two flash dryers with associated equipment.

- Add a new screening facility and associated equipment.
- Addition of three new 75,000 lb/hr gas-fired steam boilers with associated equipment. New boilers will have state-of-art (BAT) emission controls. One of these new boilers will be utilized as a backup for the entire processing facilities.
- Add two new brine storage tanks, raw water, process water and wash water tanks to be contained in a new tank farm.
- Construct ten additional storage / load-out silos for USP and industrial/animal feed products.
- Construct new packaging and warehousing facilities.
- Add new central control room with DCS (Distributed Control System) linked to all process control instrumentation.
- New process building will include new administrative offices and maintenance facilities.

### 7.10.5 Air Pollutant Emissions (Phase 3)

Air pollution emission sources include: a natural gas-fired boiler, flash dryers, air classifier bag-houses, and dust collectors. Recognized fugitive dust sources include: vehicle traffic, product conveyance, well drilling equipment and windblown dust from non-vegetated disturbed land areas.

The access road will be paved, to limit vehicle dust emissions. Disturbed areas are stabilized as soon as possible. Processing facilities utilize baghouses, filters and dust collectors to limit emissions. Natural gas is burned in a low $NO_x$, low pressure steam boiler to heat brine pumped to the well-field utilizing BAT. The boiler emission reduction is possible through the use of a low-$NO_x$ burner and flue gas recirculation (FGR). Air Pollution Emission Notices (APEN) submitted by NSI will be approved by the CDPHE prior to startup. Natural Soda Inc. will continue to operate within the emission levels as approved by the CDPHE.

| Source Name | Permit Number | Requested Production (tpy) | Requested NG (scf) | Requested Annual Permitted Emissions (TPY) Through ~2021 (@ 500K TPY Production) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TSP (PM) | $PM_{10}$ | $PM_{2.5}$ | SOx | NOx | VOC | CO |
| **Nahcolite Mining** | 86RB140-2F | 500,000 | NA | 30.195 | 9.051 | 1.38 | NA | NA | NA | NA |
| **Boiler, Main, Low Nox** | 10RB1572 | NA | 715,991,111 | 3.06 | 3.06 | 3.06 | 0.68 | 14.23 | 2.26 | 14.72 |
| **New Boiler(s)** | tbd | NA | 715,991,111 | 3.06 | 3.06 | 3.06 | 0.68 | 14.23 | 2.26 | 14.72 |
| **New Boiler(s)** | tbd | NA | 715,991,111 | 3.06 | 3.06 | 3.06 | 0.68 | 14.23 | 2.26 | 14.72 |
| **New Boiler(s)** | tbd | NA | 715,991,111 | 3.06 | 3.06 | 3.06 | 0.68 | 14.23 | 2.26 | 14.72 |
| **Flash Dryer, Niro** | 10RB1573 | 165,000 | 82,000,000 | 1.878 | 1.878 | 1.878 | 0.025 | 4.1 | 0.226 | 3.444 |
| **Flash Dryers, Raymond (2)** | 86RB140-9 | 165,000 | 113,556,000 | 1.622 | 1.622 | 1.622 | 0.034 | 5.678 | 0.312 | 4.769 |
| **New Flash Dryer(s)** | tbd | 330,000 | 227,112,000 | 3.756 | 3.756 | 3.756 | 0.068 | 11.356 | 0.624 | 9.538 |
| **Air Classifier, SD-20** | 98RB0843 | 150,000 | NA | 0.924 | 0.924 | 0.924 | NA | NA | NA | NA |
| | **Projected Annual Total Natural Gas :** | | 3,286,632,444 | | | | | | | |
| * Requested Annual Permitted Emission Totals per Emission Type, TPY: | | | | 50.615 | 29.471 | 21.8 | 2.847 | 78.054 | 10.202 | 76.631 |

**Table 7-1. Requested Permitted Annual Emissions**

## 7.11 Environmental Protection Plan

An Environmental Protection Plan (EPP) was submitted to Colorado DRMS as part of Designated Mining Operation (DMO) Exhibit U (2012). It was written in accordance with the DRMS Hard Rock, Metal and Designated Mining Operation Rules and Regulations. Those regulations state:

> "The Environmental Protection Plan shall describe how the Operator/Applicant will assure compliance with the provisions of the Act and Rules in order to protect all areas that have the potential to be affected by designated chemicals, toxic or acid-forming materials or acid mine drainage, or that will be or have the potential to be affected by uranium mining."

Designated chemicals are defined by the DRMS as:

> ". . . toxic or acidic chemicals used within the permit area in extractive metallurgical processing . . ."

NSI does not use any designated chemicals or acid-forming materials. The NSI in-situ nahcolite mining operation does not cause any acid mine drainage. NSI is not a uranium mining (in-situ leach mining) operation. NSI solution mines in situ nahcolite, which is naturally occurring sodium bicarbonate (baking soda) with a hot water solution. The Chemical Abstracts Service (CAS) number for sodium bicarbonate is 144-55-8. Detailed EPP information, including environmental protection measures required by U. S. Government Agencies, can be found in the DRMS DMO Exhibit U document. NSI will continue to use BAT and BMP to limit and minimize the effects of mining operations to the environment during their expansion to a 500,000 tpy production.