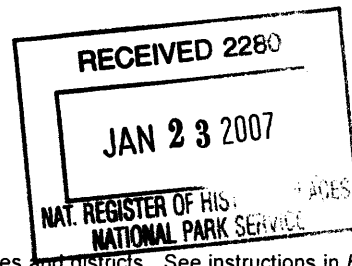


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United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form



This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in *How to Complete the National Register of Historic Places Registration Form* (National Register Bulletin 16A). Complete each item by marking "x" in the appropriate box or by entering the information requested. If any item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. Place additional entries and narrative items on continuation sheets (NPS Form 10-900a). Use a typewriter, word processor, or computer, to complete all items.

1. Name of Property

Historic name San Juan Lime Company/ Cowell's

Other names/site number Lime Kiln

2. Location

street & number 1567 West Side Road N not for publication

city or town Friday Harbor X vicinity

State Washington code WA county San Juan code 055 zip code 98250

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1986, as amended, I hereby certify that this X nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property X meets does not meet the National Register criteria. I recommend that this property be considered significant nationally statewide X locally. (See continuation sheet for additional comments.)

Alfred M.
Signature of certifying official/Title

12-20-06
Date

WASHINGTON STATE HISTORIC PRESERVATION OFFICE
State or Federal agency and bureau

In my opinion, the property meets does not meet the National Register criteria. (See continuation sheet for additional comments.)

Signature of certifying official/Title

Date

State or Federal agency and bureau

4. National Park Service Certification

I, hereby, certify that this property is:

- ☒ entered in the National Register.
 See continuation sheet
- ☐ determined eligible for the
 National Register.
 See continuation sheet
- ☐ determined not eligible for the
 National Register.
- ☐ removed from the
 National Register.
- ☐ other (explain:) _____

Signature of the Keeper

Date of Action

for
Donna K. Martin Seibert 3/6/07

5. Classification

Ownership of Property

(Check as many boxes as apply)

☐ private
☒ public-local
☒ public-State
☐ public-Federal

Category of Property

(Check only one box)

☐ building(s)
☒ district
☐ site
☐ structure
☐ object

Number of Resources within Property

(Do not incl. previously listed resources in the count.)

Contributing	Non-Contributing	
		buildings
16		sites
3		structures
		objects
19		Total

Name of related multiple property listing:

(Enter "N/A" if property is not part of a multiple property listing.)

N/A

Number of contributing resources previously listed in the National Register

None

6. Functions or Use

Historic Functions

(Enter categories from instructions)

Extractive Facility

Processing Site

Single Dwelling

Institutional Housing

Agricultural Outbuilding

Current Functions

(Enter categories from instructions)

Vacant/Not in Use

Outdoor Recreation

7. Description

Architectural Classification

(Enter categories from instructions)

Other: Industrial

Other: Utilitarian

Materials

(Enter categories from instructions)

foundation STONE: Limestone

walls STONE: Limestone, Sandstone

roof WOOD: Shingles

other

Narrative Description

(Describe the historic and current condition of the property.)

SEE CONTINUATION SHEET

8. Statement of Significance**Applicable National Register Criteria**

(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing.)

- ☒ **A** Property is associated with events that have made a significant contribution to the broad patterns of our history.
- ☐ **B** Property is associated with the lives of persons significant in our past.
- ☐ **C** Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
- ☒ **D** Property has yielded, or is likely to yield, information important in prehistory or history.

Criteria Considerations

(Mark "x" in all the boxes that apply.)

Property is:

- ☐ **A** owned by a religious institution or used for religious purposes.
- ☐ **B** removed from its original location.
- ☐ **C** a birthplace or grave.
- ☐ **D** a cemetery.
- ☒ **E** a reconstructed building, object, or structure.
- ☐ **F** a commemorative property.
- ☐ **G** less than 50 years old or achieving significance within the past 50 years.

Areas of Significance

(Enter categories from instructions)

INDUSTRY

ARCHAEOLOGY: Historic - Non-Aboriginal

Period of Significance

1860 -1935

Significant Dates

1860 – San Juan Lime Company

1886 – Cowell's

Significant Person

(Complete if Criterion B is marked above)

Cultural Affiliation**Architect/Builder****Narrative Statement of Significance**

(Explain the significance of the property.)

SEE CONTINUATION SHEET

9. Major Bibliographical References**Bibliography**

(Cite the books, articles, and other sources used in preparing this form.)

SEE CONTINUATION SHEET

Previous documentation on file (NPS):

- ☐ preliminary determination of individual listing (36 CFR 67) has been requested
- ☐ previously listed in the National Register
- ☐ previously determined eligible by the National Register
- ☐ designated a National Historic Landmark
- ☐ # _____
- ☐ recorded by Historic American Engineering
- ☐ Record# _____

Primary location of additional data:

- ☐ State Historic Preservation Office
- ☐ Other State agency
- ☐ Federal agency
- ☐ Local government
- ☐ University
- ☐ Other

Name of repository:

10. Geographical Data**Acreage of Property** 40.8 acres**UTM References**

(Place additional UTM References on a continuation sheet.)

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Verbal Boundary Description

(Describe the boundaries of the property.)

See continuation sheet.

Boundary Justification

(Explain why the boundaries were selected.)

See continuation sheet.

11. Form Prepared By

name/title Boyd C. Pratt and Nancy Larsen
organization Mulno Cove Research & Design date 8-28-2006
street & number 2551 Cattle Point Road telephone 360-378-7172
city or town Friday Harbor state WA zip code 98250

Additional Documentation

Submit the following items with the completed form:

Continuation Sheets**Maps**A **USGS map** (7.5 or 15 minute series) indicating the property's location.A **Sketch map** for historic districts and properties having large acreage or numerous resources.**Photographs**Representative **black and white photographs** of the property.**Additional items**

(Check with the SHPO or FPO for any additional items.)

Property Owner (Complete this item at the request of the SHPO or FPO.)

name San Juan County Land Bank & Washington State Parks
street & number 350 Court Street No. 6 telephone 360-378-4402
city or town Friday Harbor state WA zip code 98250

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SAN JUAN LIME COMPANY/COWELL'S
SAN JUAN COUNTY, WASHINGTON

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Narrative Description:

Located on the west side of San Juan Island in San Juan County, Washington, the nominated property, named after the companies that operated there—San Juan Lime Company and Cowell's—features remnants of the structures and sites that once served to quarry, process, pack, and ship limestone and lime product. These include three standing structures—two kilns and a water heater—and sixteen sites. The latter include remains of a boarding/cook house, barn, stable, cooperage, blacksmith shop, office, housing, wharf, warehouses, and other structures. Quarries and a system of roads and trackage that transported the supply of limestone to the processing areas also remain from the period of significance.

Setting

The San Juan Islands rise out of the waters of North Puget Sound, midway between the northwestern coast of Washington and southern Vancouver Island, British Columbia. The archipelago's location at the confluence of three important waterways—the Strait of Juan de Fuca, Haro Strait, and Rosario Strait—enticed the region's early settlers, who discovered the islands were blessed with a combination of geographical features ideal for the development of the limestone industry: accessible limestone deposits and abundant timber. A large ledge of high-quality limestone stretched across the northwestern corner of Orcas Island to culminate in a large deposit on the north end of San Juan Island, with smaller deposits located along its west side. The islands' dry climate and rocky soil produced an unusually hard Douglas fir, sufficient to produce a fire hot enough to burn or transform lime into a useable product. The smaller islands were covered with virgin stands of this timber, which was cut into cordwood and hauled by scow to kilns scattered along the shoreline of both San Juan and Orcas Islands. (See Map for location of San Juan County lime quarries and kilns.)

The nominated site consists of 41 acres of steep slope located along the dramatic western coastline of San Juan Island, overlooking Haro Strait. The upper terrain is mostly open, either exposed rock or grassy, although some areas have stands of trees—madrona (*Arbutus menziesii*), Douglas fir (*Pseudotsuga menziesii*), and big leaf maple (*Acer macrophyllum*)—as well as bushes, shrubs, and blackberry vines.

There are two points of access to the site from the sea: a small gravelly beach to the north and an inlet to the south. Land access was originally by means of a road that ran along the west side of the island from San Juan Valley and Kanaka Bay to the south, through the site, and on to Smallpox Bay, two miles to the north, and Mitchell Bay beyond. Current access is by means of trails on the Lime Kiln Point State Park to the south or road tracks off West Side Road to the east.

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The limestone deposits that supported the operations on the site consisted of three large, lens-like beds as well as smaller pods, which extended from sea level to over 320 feet in elevation. The first quarries to be mined were concentrated in several bench-like areas around 200-260 feet above sea level, with the processing, storage, shipping, and living areas located on the slopes below that.

An overall system of gravitational flow from upslope to downslope dictated the design and arrangement of the structures on the site. After being quarried, the stone chunks were loaded by hand onto carts on temporary railroad tracks and transported via log trestles to the top of the kilns (at about 60 feet above sea level), which were built into the hillside. The kilns were heated through fire doors midway down on the sides, and then the burnt lime was removed from the bottom and packed in barrels. The cooperage, warehouse(s), and wharf were all located near the water's edge or on the cliffs immediately proximate thereto. Supporting structures, such as the boarding house, barn, stable, office, and connecting roadbeds, were located in the middle level, close to the processing areas.

The operations at the nominated property covered a span of 97 years. Lime was processed in the kilns from 1860—1935, a period of 75 years, with limestone continuing to be quarried until 1957. Once the kilns were closed and the quarries emptied, this section of the island remained open and undeveloped for many years. Considered a "rock pile" by many old timers, and not conducive to farming, it became a place for hunting, camping, beachcombing, picnics, and a respite or playground for farm families. In more recent times, the nominated site has continued to be a favorite place for exploration and hiking. In 1997 the San Juan County Land Bank purchased the majority of the nominated site, along with Deadman's Bay and a stretch of open cliff side extending south along the shore from Lime Kiln.

The nominated site has not only been preserved for open space and recreational use, but also the remains of an important part of the island's history. Remnants of the once flourishing lime industry are still visible, the most prominent of which are the two kilns, one located in the San Juan County Land Bank's Limekiln Preserve, the other within Lime Kiln Point State Park. The nominated historic site comprises portions of two separate properties: San Juan County Land Bank's Limekiln Preserve and Lime Kiln Point State Park.

Extant Features

Because many of the remnants of the original structures associated with the lime quarrying and processing operations on the site are not standing, but are clearly identifiable, the term "feature" is used for any extant remains—either a standing structure or simply an assemblage of artifacts on the surface of the ground that constitute a distinguishable archaeological site.

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The following descriptions of the extant contributing features at Lime Kiln list the common name followed by the feature number as established in the Northwest Archaeological Associates heritage resources survey (Boswell and Hudson 2001) and in the resurvey of the site conducted by Boyd C. Pratt and Nancy Larsen in May 2005. In each case, a description of the extant remains is followed by a conjectural description of construction, design, use, and structural history.

Boarding House (Feature 1). The boarding house, roughly 33'-0" by 36'-0", sits upon a hillside that slopes down to the water from east to west. It consisted of two parts: a one-story, shed-roofed section to its north and a two-story, gable-roofed section to the south. The shed-roofed section contained three rooms: a 12'-0" by 14'-0" (presumed) kitchen to the northeast, and two rooms of unknown use—a 9'-6" by 12'-0" space in the north central area and a 11'-6" by 19'-6" space in the northwest overlapping into the second story section. The ground floor of the second story section consisted of a 19'-6" by 24'-0" (presumed) dining hall to the southeast and a 19'-6" by 11'-6" room of unknown use to the southwest. The second story contained three rooms of approximately 11-12' by 19-6" each; presumably these were all used as a dormitory or sleeping quarters. The building was designed and constructed in a vernacular manner, using materials and systems common to the period. These included wood shake roofs, wood balloon framing with shiplap siding, and simple windows and doors.

Because of its deteriorated condition, which posed a serious danger to visitors to the site, in 2005 the standing walls of the boarding house were induced to collapse upon themselves, and the resulting ruin fenced off. An historic structures report, including archival-quality photographs and measured drawings, was completed prior to this demolition (Pratt 2004).

Water Heater (Feature 2). This is a small, concrete and firebrick structure that measures 2'-3" wide by 4'-4" long and 4' high. It is located about 27'-0" south of the boarding house. The central core of the structure is a metal barrel set on its side, surrounded by the concrete and firebrick. (One of the firebricks was identified as TROY IDAHO/N^o 1 Wedge [Gurcke 1987].) An open space beneath the barrel contains evidence of ashes and cinders, indicating that it was used as a firebox for heating water in the barrel. Two threaded pipes protrude from structure: one near the middle of the top and the other on the south side.

Because of its proximity to the Boarding House (Feature 1), it is conjectured that this served as a water heater for the kitchen in that structure.

North Kiln (Feature 3). This structure consists of a tall masonry shaft built into the hillside at the relative center of the site. It is constructed of an inner lining of two courses of firebrick around a flattened oval that measures approximately 6'-0" by 8'-0". This firing chamber is contained within squared outer walls of rough limestone and rubble fill (including, in some cases, chunks of burnt firebrick from old linings) in

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between. Approximate dimensions of the masonry shaft are 18'-0" high on the upslope side and 30'-0" on the down slope, 18'-0" wide (on the lime-removal side) and 20'-0" deep (on the firebox sides). A wooden superstructure, rising another 9'-0" above the top of the stone shaft, was used as the hopper for the unburnt limestone. This structure was held together by 6"x8" vertical wood columns that were mortised into at least the top 9' of the corners of the masonry shaft. Large (6"x8") timber frame beams, set at 5'-6" intervals, as well as 1½"-diameter tie rods were used to encase the structure. Sandstone, quarried from Sucia Island, was used in key places such as the arches over the bottom removal area as well as quoins of the shaft. The fireboxes, pairs of which were located on the north and south side of the kiln, consisted of hinged steel doors covering 18" wide by 24" high arched, firebrick-lined openings. Open-brickwork grates on the bottom let the ashes fall into cinder boxes below, for easy removal.

Extending south from the southwest corner of the kiln is a 25-foot stone wall in two sections: a 7'-0" high, 14'-0" long portion that resembles the walls of the shaft, and, to the south of that, a 6'-0" high, 26'-0" long portion that is dry-laid masonry. In the latter wall there is a 7'-0" wide opening 26' from the kiln; it appears to have allowed material to pass from the road above down the slope, possibly all the way to the wharf.

Log Cribbing (Feature 4). On the uphill slope above the two kilns is some log cribbing. This consists of 6-10"- diameter logs that appear to have been stacked against large 12" posts and held together with iron spikes and rods, in order to act as a retaining wall for a staging platform. Some of the logs are saddle-notched. There are also some 6"x12" wooden beams. The structure extends about 25'-0" along the slope from north to south, and about 10'-0" down slope. Artifacts nearby consist of worked logs and sections of railroad track.

Historic photographs suggest that this structure may have been a staging area for the carts on tracks that were then shuttled to the trestles leading to the hoppers of the kilns.

Barn/Stable (Feature 5). The remains of the barn/stable consist of a stone foundation with scattered wooden posts, beams, and joists. The stone foundation, which was built into the slope, measures 61'-0" by 32'-6". On the east side it projects only 1'-1" from the ground, and on the northwest corner it measures 1'-5" high. On the west side it is most exposed and stands 13'-6" from the ground at the southwest corner. The 28"-thick masonry walls are random rubble limestone set with lime mortar. The top foot of the wall is only 20" thick, forming an 8"-wide ledge on the inside; this upper part is of a different masonry style, both in regard to mortar and scoring of the joints. The ledge has remnants of a wooden sill plate.

Located on the south end of the west wall is a 2'-11" wide by 4'-2" tall opening, supported by wooden lintel, to what appears as a partial basement, apparently confined to the southwest corner of the structure.

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Inside, 10 feet or so from the north-south walls, there are 10"-diameter logs set as posts every 7-8'; these supported 8"x8" girders with 4"x5" joists at 2'0" o.c. The floorboards appear to have been 2"x10". In addition, there are remains of some squared timber frame posts and beams.

Historic photographs indicate a tall, gable-roofed wooden structure with a monitor on top at this location. The presence of both timber frame and regular balloon frame wood elements indicate two different structural systems for this building; possibly the upper barn structure was timber frame.

Powder House or Office (Feature 6). To the southeast and uphill of the roadbed to the south of the Barn/Stable (Feature 5) are the remains of a small structure. It consists of a 5'-long mortared random limestone rubble foundation, and a scattering of 1"x6" milled lumber and 1"x7" hewn timber. Historic photographs indicate a small, gable-roofed log structure near this location. Because of its isolated siting, it is conjectured that it could have been either a storage shed for explosives—located away from other structures in the case of accidental ignition—or an early office structure.

Stable or Powder House (Feature 7). To the east of the Barn/Stable (Feature 5) are the remains of a small structure that might have been the powder house. It consists of a 14'-0" long foundation of random limestone rubble set with lime mortar that averages about 3-4' in height. On top of this is a 2"x8" wood sill with 2"x6" joists laid horizontally at 2'-0" o.c. On top of these were 1"x material, possibly 6" wide. There are also the remains of 2"x4" joist roof with wooden shakes scattered down slope (to the west).

Historic photographs indicate a shed-roofed structure with doorways on the west side in this location. Because of its proximity to the barn/stable, this structure could have been an additional stable, or a storage shed for explosives—again, located away from other structures in the case of accidental ignition.

Cooperage and/or Warehouse (Feature 8). This feature consists of an approximately 26'-0" by 65'-0" foundation constructed of 2'-0" thick random limestone rubble set in lime mortar. This foundation is either underground or non-existent on the east (up hill) side, but on the west side it varies from 3'-9" at the north corner to 3'-11" at the south corner.

Historic photographs indicate a long, gable-roofed board-and-batten structure on this site, consisting of a taller (perhaps two story) elevation on southern two thirds and a shorter (perhaps one story) section in the north third. Barrels on top of the roof ridges, which possibly served as stove chimneys, suggest that this was a cooperage, because that was a customary signature of coopers.

Shed (Feature 9). Down slope (west) of the North Kiln (Feature 3) are the remains of a timber structure. An extensive scattering of logs and sawn wood timbers—presumably the remains of shed—are strewn

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across the area. These include 8-16" diameter logs, approximately 8"x12" hewn timbers, and various dimensional sawn lumber. Both square-cut and wire nails are in evidence. There is a 3'-0" high, 13'-0" long standing structure on the north side of the debris, consisting of two log uprights and a log beam.

This was probably the shed-roofed structure, shown in several of the historic photographs, that covered the lime removal area at the base of the North Kiln.

Pot Kiln (Feature 10). Feature 10 is situated on a terrace above the small cove lying below the two kilns. The site consists of the remains of a rock and mortar foundation wall and a pit or depression with a slightly raised "lip." There are several sections of the rock and mortar foundation remaining; the largest and most intact is on the west side of the northern edge of the structure, and consists of a 12'-0" long segment that varies in height from 9'-0" on its exposed section on the west to 4'-0" on the east. Varying in width from 24-30", the wall consists of limestone laid with what appears to be a lime mortar in a random rubble pattern, and is built directly upon the bedrock of the cliff embankment. There are several other foundation segments consisting of random rubble piles scattered along the exposed western edge of the site for approximately 36'-0". In the northwest corner of this generally level site formed by the foundation is a 12'-0" diameter, 4'-0" deep depression or pit, set back 9'-0" from the western and 8'-0" from northern edge of the outer foundation wall. Around the rim of this depression is an approximately 12" high, 4' wide berm consisting of stones and dirt. The depression is currently filled with trash, including what appear to be the remains of a kiln funnel or sluice made of sheet metal.

The depression suggests that it may have been a pot kiln used for processing lime, but it could also be just a collapsed basement. However, it is not clear what the structure of Feature 10 was used for.

Rock Debris with Timbers (Feature 11). To the south of the North Kiln's shed (Feature 9) and west of its south rock wall is a scattering of debris and wooden timbers. It is distinguished by the smaller size of rock (around 3" or less in diameter) as well as some log cribbing.

This may be the remains of the extensive structures located above the wharf structures, as seen in historic photographs.

Stone Foundation (Feature 12). To the east, or uphill, side of the cooperage and/or warehouse are the remains of a dry-laid, random rubble retaining wall or foundation. The maximum height of this wall is 5'-4", which decreases to the south.

The function of this structure, which appears in several of the historic photographs, is not known.

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Ramp and Roadbed (Feature 13). To the south of the Barn/Stable (Feature 5) are some remains of log cribbing that project from the crushed rock roadbed toward the Barn/Stable. This cribbing, with logs of about 12" in diameter, extends along the west side of the roadway, which runs about 60 feet to the south, towards the North Kiln (Feature 3). There are also loose, 8"x8" timbers scattered on the slope to the west of the roadbed.

These remains seem to correspond to a wooden ramp that led from the road to the barn, as indicated in historic photographs. Historic photographs also indicate that this roadway was not only built into the upslope (east) side but also supported by some sort of cribbing on the down slope (west) side.

Tailings (Feature 14). Below the North Kiln (Feature 3) is a major area of tailings, or remains of discarded burnt limestone. Feature 14 begins to the west of where the Shed (Feature 9) was on the North Kiln and extends all the way down to the high tide mark at the water's edge. Discarded burnt limestone and lime were also used below the foundations of several of the buildings, such as the nearby Boarding House (Feature 1), where it was used in order to create a level platform for the structure.

Wharf Area (Feature 15). Little remains of what appear to have been an extensive wharf and storage complex in the ravine below the kilns and Feature 10. There are several iron rings driven into or cemented onto the rocks near the water. There are also several concrete pads that probably served as the foundation of approximately 10" square or round pilings for the wharfs and supporting structures for the buildings. Several round pilings can still be seen embedded in the ground in the tidal area.

Historic photographs indicate an extensive complex of wharfage and buildings at this site. The wharf extended a least 40-50' out from the shore, and consisted of a loading area with a crane hoist as well as storage or processing sheds. Nearby on the shore were several other buildings, the use of which has not been determined. According to old time islanders, a large storm in the 1920s washed out the wharf.

South Kiln (Feature 16). This structure, referred to by old-timers as the "Little Kiln," consists of a tall masonry shaft built into the hillside on the southern edge of the site. It was constructed of an inner lining of two courses of firebrick around a flattened oval that measures approximately 5'-8" by 8'-5". This firing chamber is contained in squared outer walls of rough limestone and (presumed) rubble fill in between. Approximate dimensions of the masonry shaft are 18'-0" high on the upslope side and 32'-6" on the down slope, 16'-2½" wide (on the lime-removal side) and 15'-9" deep (on the firebox sides). Large (6"x8") timber frame beams, as well as 1½"- diameter tie rods, were used to encase the structure. Sandstone, quarried from nearby Sucia Island, was used in key places such as the arches over the bottom removal area as well as quoins of the shaft. The fireboxes, pairs of which are spaced 2'-3" apart, were located on the north and south sides of the kiln, and consisted of hinged steel doors covering 1'-6" wide by 2'-0" high

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arched firebrick-lined openings. Open-brickwork grates on the bottom let the ashes fall into 1'-10"-high cinder boxes below, for easy removal.

This structure, located on Lime Kiln Point State Park, was restored in 1999 by Washington State Parks. Historic photographs as well as physical evidence, upon which the restoration was based, indicate that the original wooden bracing system was of a different configuration and design than the North Kiln (Feature 3). It is possible that the original builders used this timber framework as an enclosure for a 'slip-form' masonry system, with the masons mortaring and setting stone against boards held in place by the frame.

Tailings (Feature 17). Below the South Kiln (Feature 16) is a major area of tailings, or remains of discarded burnt limestone. It extends southwest to the water's edge, and is several feet thick in places, as indicated by a section cut through by erosion that reveals pieces of wood and melted firebrick.

Coghlan House (Feature 18). All that remains of the house that Cowell's superintendent from 1891 to 1925, Cornelius Coghlan, and his family lived in is an extensive patch of *Vinca* and scattered archaeological remains. These include a frame set of steps (possibly used to access an outhouse further down the slope) and a retaining wall constructed of randomly-laid limestone.

Historic photographs indicate that the house was a large, two-story structure with a gable roof. According to local sources it was burned by arson in late 1920s or early 1930s.

Quarries (Feature 19). The limestone deposits at the nominated site consist of three large, irregular, lenticular beds ranging from 800-1,500 feet in length and 50-300 feet in width, as well as 11 smaller (less than 100 feet in length and 50 feet in width) pods. Although these deposits extend from sea level to over 320 feet in altitude, the worked quarries are concentrated in bench-like areas around 200-320 feet above sea level. They consist of large, amphitheater-like spaces where the limestone has been quarried from the surrounding stone walls. Massive piles of both sprie and tailings form talus-like slopes at the base of these cliff walls and down slope of the level bench areas. There are also some artifacts scattered in these areas, such as worked logs and sections of railroad track.

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Statement of Significance:

San Juan Lime Company/Cowell's contains evidence of the lime rock, the structures, and the technology involved in the quarrying, processing, packing, and shipping of lime products during the period of significance, 1860-1935. Remnants consist of three standing structures—two kilns and a water heater—and sixteen sites, which include remains of a boarding/cook house, barn, stable, cooperage, blacksmith shop, office, housing, wharf, warehouses, and other structures. Quarries and a system of roads and trackage that transported the supply of limestone to the processing areas also remain from the period of significance. Beginning in 1860, the San Juan Lime Company conducted operations at the site until 1886, when Henry Cowell purchased it. Always referred to simply as "Cowell's" thereafter, the site operated until 1957, although 1935 marks the end of the lime burning and therefore the period of significance.

During most of this period, San Juan County was the principal lime-producing county in the state of Washington. The islands were ideal for the manufacture and transport of lime; the largest deposits of high-quality limestone were located right on the shoreline with good harbors and deep water, and protection from the prevailing winds. The final product—barrels full of processed lime—did not have far to travel from the kilns. They were shunted downhill to warehouses built on or close to wharves that accommodated the fleets of ships, both sail and steam, that regularly transported lime and other freight to Puget Sound, West Coast, and Pacific Rim markets. These remains provide vivid examples of lime-processing technology at the close of the 19th century. In addition, they help to illustrate life and work in a company town, furnishing significant historic and archaeological examples of industrial architecture and engineering.

The nominated site and its historic remains is one of two significant remaining examples of the limestone industry in San Juan County. San Juan Lime Company/Cowell's, as well as Roche Harbor, provides one of the few surviving examples of the production of a resource essential to the growth and economic development of not just Washington State and the Pacific Northwest but the entire West Coast. Thus, it is significant at the local level for its association with broad patterns of events.

San Juan Lime Company/Cowell's has yielded, and is likely to yield, information important in the history of the lime production process and the early settlement of the San Juan Islands. The property's potential as an industrial archaeological site is evident from the many surface as well as possible subsurface remains relating to the lime production process. In particular, specific investigation of several of the features should shed light on their design and function. For example, excavation at Feature 10 may yield information as to whether the site was a pot kiln or a basement; further documentation of Feature 5 could determine the wooden superstructure of the barn/stable; and both surface and subsurface examination of the debris at Feature 9, may establish the extent and construction of the North Kiln shed. Furthermore, a more thorough

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surface survey of the whole property, supplemented by test excavations, might reveal more information about other, non-extant structures.

This narrative begins with the history of the San Juan Islands, and the San Juan Lime Company in particular. The development of the West Coast lime industry is then described, with emphasis on Henry Cowell's dominance of the lime trade, including his long-standing feud with John S. McMillin that culminated in a bitter lawsuit. The history of the site concludes with a portrait of daily operations under the management of Cornelius Coghlan and a brief look at the Cowell family's legacy. In order to portray the value and significance of lime and its role in the history of the West, the narrative continues with a section on the nature and uses of limestone and lime. This begins with a brief description of the geological features of lime and its common uses. There follows a description of various ways to extract and process lime. The section concludes with an explanation of evolution of its manufacturing as the demands for lime as mortar and cement changed.

THE HISTORY OF SAN JUAN LIME COMPANY/COWELL'S

Early History of the San Juan Islands

There was once a strong Native American presence in the San Juan Islands. Among the Coast Salish people, the Lummi maintained seasonal fishing camps in the islands as well as a few permanent settlements at the north end of San Juan Island. A favorable climate and an abundant food supply—salmon, shellfish, waterfowl, deer, and plentiful native fruit, berries, and other plants, like camas—provided the island's earliest inhabitants with life's basic necessities.

Spanish explorers made several voyages to the Pacific Northwest and to Puget Sound between 1774 and the early 1790s. They charted and named many waterways and islands in the San Juan archipelago. The British also made their way into the region during the 1790s with an expedition led by Captain George Vancouver. British and American traders soon followed, with the powerful Hudson's Bay Company establishing fur trading centers and markets. The British began to expand their territory as well as their commercial ventures throughout the early 1800s, especially after the War of 1812. Americans started to trickle into the Pacific Northwest, and it wasn't long before Britain and the United States disagreed on the boundaries of the territory each had declared as their own. In June, 1846, the two governments signed a treaty to establish a boundary line between the United States and Canada at the 49th parallel. The San Juan Islands were caught in an unusual predicament as they are situated between Vancouver Island and the American mainland: the demarcation or boundary line between the two countries was not clearly specified in the treaty. Because there are three channels running through this chain of islands, it was long unclear as

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to which country could claim ownership of the archipelago.

The Hudson's Bay Company established first a salmon-processing station in 1851 and two years later a sheep farm on San Juan Island. During the late 1850s, American prospectors began to flock into the region, most on their way to the Fraser River to seek their fortunes in gold processing. Miners making their way north from Victoria and Port Townsend frequently stopped in the islands, with many preferring to "squat" instead of venturing into the unknown. Other miners returned from the gold fields to claim land in the islands' favorable location. British residents in the island eventually clashed with these American squatters, and what ensued was a joint occupation of the islands from 1859 to 1872, when the long-standing boundary dispute was turned over to Kaiser Wilhelm of Germany for arbitration. Wilhelm decided in favor of the United States, awarding the ownership of the island to the American government in that same year.

San Juan Lime Company

In 1860, the U.S. Boundary Commission made the first official discovery of limestone as a potentially valuable resource in the San Juan Islands, particularly the deposits near the site. The Boundary Survey reported finding large deposits of limestone on San Juan Island itself:

It is to be found on the southern end, in the vicinity of the Hudson's Bay Company's station. On the western shore, near the base of Mount San Juan, immense masses raised up into perpendicular walls are seen at several localities, covering an area of many acres. The northeastern corner of the island is composed of an extensive ledge of the same material... Testing by acid and burning, it proved to be of a superior quality. It exists in sufficient quantities not only for lime, but might be profitably quarried for building stone. The value of these discoveries can better be appreciated from the fact that up to the time of the discovery of limestone on this island it was not known to exist at any point on Puget Sound, within United States territory, and for building purposes it was necessary to procure all the lime used, from California or Vancouver's Island (Geographical Memoir in Senate Executive Document No.29, Serial #1316, Vol. 1:137).

In 1860, Lyman Cutlar and E.C. Gillette, doing business under the name San Juan Lime Company, together with Frank Newsome began actively mining and processing limestone at the site. After the first winter of operation, Gillette sold his interest to Augustin Hibbard. At that point, both Cutlar and Newsome seem to disappear from the scene, and Hibbard became the main operator.

In 1868, Hibbard mortgaged the land to Catherine McCurdy of Port Townsend, in order to raise

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\$1,500 for operations. A year later, on March 9, he formed a partnership (still known as San Juan Lime Company) with Nicholas C. Bailey, Charles Huntington, and Charles Watts (Chart 1).

Three months later, Watts murdered Hibbard. He died intestate, and the court appointed an executor, Charles Bartlett, to settle the estate. There were three heirs, all from New England: Harriet Truesdale, Ashley Hibbard, and Sophia A. Maskey (Hibbard Probate).

Sophia's husband, Thomas Maskey, came west with her to represent the heirs and manage the lime kiln operations. Maskey and court-appointed appraisers prepared inventories of the property, and the heirs petitioned for distribution of the estate in April of 1871. However, Thomas Maskey died before that could occur. Despite the effort of the heirs to prevent it, the court eventually ordered the sale of the property to cover numerous debts and the mortgage with Catherine McCurdy (including the promissory note and accumulated interest).

The property was sold in 1873 to Catherine McCurdy herself for \$1,500, thus both paying off her own mortgage and obtaining full title to the land and improvements in the process. She turned it over to her son, James McCurdy, to operate with former San Juan Lime Company partner N.C. Bailey (Huntington appears to have been out of the picture at this point). The two men soon secured a contract to supply lime for the new territorial prison at Steilacoom; within a few years, they had expanded production to 20,000 barrels per year.

Documents pertaining to the settlement of the Hibbard estate and subsequent surveys indicate that several structures were constructed within the first decade of operation: a draw kiln "capable of burning 70 barrels per day"; a lime shed; a cooperage; a blacksmith shop; a stable; a boarding house with cooking, dining, sleeping, storage, and live-in parlor and bedroom facilities; several log structures for workers; and a wharf. There was also a kitchen garden to the north of the boarding house.

In order to ship the lime to Puget Sound ports, the company bought or leased the schooner *Ontario*; unfortunately, it sank along with its full cargo of lime when it came loose from the company wharf during a storm in March, 1875. Other means of shipping must have been found; by November, the sloop *Magnolia* was reported as having arrived at Port Townsend with 50 barrels of lime from San Juan Island.

Earlier in that same year, N.C. Bailey had died, leaving his half of the company and property to his wife, Jane, and their two children (Bailey Probate). Within a few years, Jane married James McCurdy, which

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united their ownership of the San Juan Lime Company.

Although the boundary dispute between the United States and Great Britain was settled in 1872, the San Juan Islands were not officially surveyed until several years later, and the site itself not platted until November 29, 1875.

On June 17, 1879, James McCurdy applied for a 152-acre homestead to the north of the original kiln site (Lot 4 and the SE $\frac{1}{4}$ of SE $\frac{1}{4}$ of Section 14 and the W $\frac{1}{2}$ of SW $\frac{1}{4}$ of Section 13). Then, on August 6 of the same year, he applied under the Timber and Stone Act of 1878 for land relinquished by Jane Bailey, and subsequently returned a half interest to her in December 1880, as his wife. McCurdy applied to establish a post office—called “Lime Kiln”—in March of 1879, and served as postmaster until 1886.

Because of the relatively isolated nature of early settlement on the west side of San Juan Island, the post office and the store at the San Juan Lime Company offered a source of communication and supplies for settlers in an area ranging from Bailer Hill and False Bay to the south to Garrison Bay to the north. Mitchell Bay homesteader Samuel Gross recorded in his account book many invoices for goods purchased at the store, often in trade for barrel hoops made from local sapling and vine materials. Local settlers such as William H. Higgins used to cut cordwood and prepare barrel hoops for the kiln operations (Samuel Gross Account Book; McDonald 1990:91).

The *Washington Standard*, an early territorial newspaper that reported periodically on the San Juan Islands, noted on June 16, 1877 that the San Juan Lime Company was producing 70 barrels and burning four cords of wood daily. With 15-20 men employed, the company expenses ran about \$1,200 per month. Two years later, on March 28th, while noting that the kiln had been shut down for repairs, the newspaper reported that some 20,000 barrels were produced annually, and projected 30,000 in 1880.

A comparison of the 1870 and 1880 censuses gives a general sense of the overall operations at the site. According to the Special Manufacture Census of 1870, the San Juan Lime Company produced \$26,000 worth of lime—13,000 barrels at \$2 a barrel—and employed 18 men for 6 months of a year for a total payroll of \$11,000. These 18 employees included 1 lime maker, 2 coopers, 2 carpenters, 4 quarrymen, 1 chopper, 3 laborers, and 2 cooks. Among the various ethnic groups working there—most of whom were American or Canadian—two groups stand out: the quarrymen were all from Cornwall (typical of western mining operations), and both cooks were Chinese.

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By the time of the 1880 census, the kilns were producing only \$18,000 of lime, and paid \$6,000 to the 21 employees who worked there 9 months of the year. The typical work day was 10 hours, 9 in the winter; a day's wage for an "average day laborer" was \$.75, but a "skilled mechanic" could earn as much as \$3.50. (Although the census enumerated McCurdy and his family, as well as a [Chinese] cook, carpenter, cooper, and woodcutter, it is not clear who else made up the 21 workers claimed.)

Most of the product during this period went to regional cities and towns—Victoria, 14 miles across the Haro Strait on the southern tip of Vancouver Island, and Puget Sound ports such as Port Townsend, Seattle, and Tacoma. According to an 1878 newspaper article, of the 8,000 barrels produced by August of that year, two-thirds had been shipped to Tacoma and thence to Portland via railroad, while another 1,000 had been sent to British Columbia and other parts of the Sound (Daily Pacific Tribune 8/5/1878).

During the early 1880s, McCurdy's operation (Chart 2) began to slip, and production dropped to 7,000 barrels per year. The McLaghan Brothers, who were producing lime at Eureka, north of Friday Harbor on the east coast of San Juan Island, provided strong competition. In November 1883, McCurdy obtained a \$6,000 promissory note, secured by the San Juan Lime Company property and improvements, from Corbitt and MacLeay of Portland, who later sold the mortgage to the Tacoma Lime Company. In November of the following year, McCurdy signed a second mortgage with his mother, for \$2,500. However, in the same year, 1884, two companies—the Mattulah Manufacturing Company of California and the Puyallup Manufacturing Company—sued (and were, as a result, paid) for reimbursement for supplies. McCurdy had also made promissory notes to Israel Katz, a local entrepreneur, in 1884 and then again in 1886, when Katz sued for payment. McCurdy's mother sold her latest promissory note and mortgage to John S. McMillin, who also held the Tacoma Lime Company mortgage. McMillin, who had purchased and established the lime operations on the north end of the island under the auspices of the Tacoma and Roche Harbor Lime Company, then leased the property from James and Jane McCurdy for three years, beginning in September 1886.

One month later, the McCurdys sold their property to Henry Cowell of San Francisco. Cowell in turn sold a half interest to his California partner Lloyd Tevis. Cowell refused to pay the mortgages on the property, forcing foreclosure by the Tacoma and Roche Harbor Lime Company; he turned around and picked up the property at the subsequent bankruptcy sale. McMillin then filed suit against Cowell, Tevis, Lee Ingram, and Richard and Robert Scurr—the latter three hired to work the quarries at that time—claiming that they were depleting the resources on land leased to McMillin. In this, the first of several legal battles between McMillin and Cowell, the judge eventually found for the defendants and dismissed the case.

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Henry Cowell & the West Coast Lime Industry

In 1886, the lime plant formerly owned by the McCurdys came under the ownership of the Henry Cowell Lime & Cement Company of California, and remained so for the next 71 years. It was known on the island simply as "Cowell's." Although the plant was just one in a vast network of lime-processing sites owned and operated by the company—the foremost of which was located in Santa Cruz, California—it represented Henry Cowell's sole means of establishing his business empire in Puget Sound.

Henry Cowell (1819-1903) made his way from Wrentham Massachusetts to San Francisco with his brother John at the height of the California Gold Rush, just in time to make a fortune from a drayage and storage business. While Henry Cowell was establishing himself in San Francisco, two young arrivistes, Albion Jordan and Issac Davis, were beginning to thrive as lime manufacturers in Santa Cruz, some 80 miles south. In 1865 Cowell entered the business by buying out Jordan for \$100,000. The company was renamed Davis & Cowell, and Henry left San Francisco with his family in tow to live at his newly acquired ranch and lime works in Santa Cruz.

By 1888, when Henry Cowell acquired Isaac Davis' half of the business for \$400,000 following Davis's death, he was the sole owner of the largest lime manufacturing enterprise in California and indeed along the West Coast. He is even reported to have established a cement trade with Belgium. Excerpts from an article about the lime industry in Santa Cruz County (The Daily Surf, January 31, 1889) shed light on Henry Cowell's business plans and his intention to expand his business ventures into the northwest.

It is now announced by Henry Cowell, the surviving partner of the firm of Davis & Cowell, that it is their intention to suspend operation here in the spring for an indefinite period.

When the Santa Cruz kilns close down they [the Cowell Lime & Cement Company] will increase their businesses in Washington Territory, the intention being to ship in bulk by vessel to San Francisco from their kilns in the Territory.

It is not known when Henry Cowell first arrived in Tacoma to set up business. Although Cowell was not named in the 1885 Polk City Directory of Tacoma listing for the Tacoma Lime Company, by all accounts he was a major investor. As the dominant player in the West Coast lime industry, he was dubbed the California "Lime King and millionaire" in many territorial news accounts. Henry Cowell, the lime magnate, may have assumed that he could easily acquire the rich deposits of limestone located in Puget Sound. There is much evidence to suggest that he had every intention of adding quarries to his empire, in particular the large ledge of limestone at Roche Harbor on the north end of San Juan Island, and there are a

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number of reasons for his strategy to expand his business by acquiring large quantities of limestone in places where the rock could be more efficiently mined, processed, and transported than the at quarries he owned in California. First and foremost: San Francisco was in the midst of a building boom, with wood frame buildings being replaced by masonry and there was a shortage of lime for mortar. It was Cowell's strategy to move into the Puget Sound not only to acquire more limestone but to corner the West Coast market at a time when there was great demand for lime.

A series of devastating fires in San Francisco had leveled vast parts of the city, resulting in a clamor for masonry construction. During the ensuing building boom the demand for lime outstripped available supplies. A building boom also occurred farther north. During the 1880s, the population of the Pacific Northwest also swelled, by a phenomenal 165%, primarily in four urban areas: Portland, Seattle, Tacoma, and Spokane. Seattle's population jumped from 3,553 to nearly 43,000 between 1880 and 1889 (Ficken and LeWarne 1988: xvii). By 1910, one-third of the entire population of Oregon, Washington, and Idaho lived in these four cities. As had been the case earlier in San Francisco, devastating fires in Seattle, Ellensburg, and Spokane in 1889 brought about changes in attitude about safety, resulting in new construction techniques. Brick buildings with lime mortar were erected in place of the wood structures leveled by fire, their walls made of solid brick, two and three feet thick, with fire-resistant lime mortar to hold them together. Thus there was an enormous demand for lime as mortar in the Pacific Northwest as well as along the entire West Coast.

By the close of the 19th Century, the West Coast lime industry was dominated by two archrivals who were in competition to meet this demand: Henry Cowell, now a millionaire, and an upstart, John S. McMillin (1855-1936) of Roche Harbor, Washington. Cowell's acquisitiveness was unparalleled; he had bought up lime deposits from as far south as San Luis Obispo in California to as far north as Texada Island in British Columbia. It was Cowell's practice to eliminate competition by buying out smaller companies, amassing his holdings, and fixing rates and market prices. He sought to control not only the production of lime, but also its transportation and marketing. In short, once he bought out his competition, Henry Cowell was in the enviable position of naming the price of the commodity.

Cowell was almost 70 and a legend in California when John McMillin ventured west in 1882 to Washington Territory. A young, brash, and opportunistic attorney from Indiana, McMillin intended to ride the waves of the Pacific Northwest economic boom. After settling in Tacoma, he was attracted to a familiar resource: limestone. In Indiana the lime industry had already proven to be lucrative, and McMillin was quick to get in on the beginnings of a new Northwest industry in the Puyallup Valley. He was not much older than 30 when he joined the Tacoma Lime Company, which operated a quarry on land leased

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from the Northern Pacific Railroad. (As noted previously, Henry Cowell was probably a principal investor in the same company.)

According to many local sources, relations between the two men were cordial in the beginning. It was only after McMillin's skillful maneuvers to wrest control of the Roche Harbor lime works—leaving Henry Cowell with only minority shares of the Tacoma & Roche Harbor Lime Company—that the two men engaged in a long and bitter rivalry. A number of Pacific Northwest historians, Lucile McDonald foremost among them, have stated that John S. McMillin was sent as a representative of the Tacoma Lime Company to investigate the lime deposits and operations at Roche Harbor. Others have indicated that McMillin, after seeing an incredible opportunity at Roche Harbor, asked Cowell for a loan of \$25,000 to buy the property and lime works outright. But Cowell, after learning of the richness of the lime deposits there, claimed that McMillin had been on his retainer to purchase the property. Allegedly, in response to this, McMillin refused Cowell's funds and sought financing independently from Tacoma investors.

Lawsuit

Many years later Judge C. H. Hanford, of the U. S. Circuit Court, had to wind his way through a myriad of claims and counter claims about the origins of the feud between Cowell and McMillin and the beginnings of the Roche Harbor & Tacoma Lime Company. The acrimonious lawsuit initiated by Ernest (E.V.) Cowell in 1906 gives a full and colorful portrait of the lime industry on the West Coast and also provides a glimpse of the men and the way they conducted business in that era as well as general market conditions. The role the Cowells played in the West Coast lime trade is likewise portrayed.

By the time of the lawsuit, Henry Cowell had died, at age 84, having been shot by D. Leigh Ingalsbe in San Francisco in March of 1903. The Henry Cowell Lime & Cement Company was the beneficiary of Cowell's vast fortune. His surviving children held joint or equal ownership of the company and Ernest succeeded his father as director.

Ernest Cowell filed suit three years after his father's death, perhaps as an act of retribution. Whatever his motives, revenge or retaliation, the lawsuit stands out as a clever attempt to influence or direct the future of the West Coast lime industry. Ernest Cowell made a shrewd calculation and used the lawsuit to foil McMillin in the future market for lime: Portland cement. He petitioned the court for the restitution of stock or shares and property that were "fraudulently obtained." He also requested and received a restraining order that prevented the anticipated sale of all property and business of the corporation and, additionally, enjoined McMillin from disposing of his stock.

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After sorting through the "great mass of evidence submitted," Judge Hanford dismissed the suit and found John S. McMillin to be innocent of all of Cowell's charges, in particular that of fraud, saying that Ernest Cowell "reveals himself in the attitude of a would-be destroyer of a business competitor through the instrumentality of judicial process." He agreed with McMillin's assertion that the Cowells, while minority stockholders, were also "hostile competitors of the Tacoma & Roche Harbor Lime Company." Moreover, Hanford decided, *if* Cowell had received additional stock amounting to a clear majority, he would have been in the "position to dominate the corporation and the effect" would have been able to "promote a monopoly of the lime business on the Pacific Coast."

Hanford's ruling echoes an observation made by Carlos Schwantes: "A common feature in American business history has been for competing local companies to fail or be merged into large-scale, often monopolistic, enterprises." (Schwantes 1989: 151) "Ambition to become a monopolist," Hanford wrote, "being manifestly the motive which actuates the complainant in the prosecution of this suit, a court of equity will not permit its process to be thus abused."

Business Practices of the Era

Before anti-trust legislation was enacted, lime manufacturers were more often than not in collusion. This was simply common business practice for those engaged in the lime and cement industry as well as other industries such as the timber and railroad companies. Manufacturers set fixed prices for the commodity itself, the minimum required lot size for purchase, and freight or shipping charges. They specified the number of representatives or dealers each manufacturer was allowed; they agreed on provisions for discounts or rebates, and how to handle used shipping containers. For example, in an effort to control the lime trade, McMillin drafted a proposed contract for all lime manufacturers in the State of Washington in July of 1900. Under the terms of the agreement, producers would sell lime for no less than \$1.25 per barrel. This price was reserved for dealers or agents who bought in lots of 100 barrels or more, with the exception of dealers in Whatcom and Snohomish counties, where the minimum lot size was 50 barrels. McMillin's proposal went on to include a different price—\$1.50 per barrel f.o.b. wharf at kilns—for dealers not described in the contract. No rebates or discounts were to be allowed, nor would any manufacturer be allowed to purchase any empty second-hand barrels.

John S. McMillin frequently claimed that Henry Cowell "depressed" markets by cutting prices. However, it appears that it was McMillin himself who favored this maneuver. George Willey, general dealer in lime and cement, was another of several Pacific Northwest agents or distributors who handled lime for the Cowells and McMillin as well as for other manufacturers. He made it clear during the protracted lawsuit that the "Cowells were always the last to reduce the price of lime." Their prices were generally higher than

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Roche Harbor's because, he said, they did not produce a "large amount of lime." He gave a picture of market conditions and transportation issues following the Panic of 1893, a near decade when a "general depression prevailed in this section of the country," and wages and salaries were "extremely low." At the time, when construction in Puget Sound was at such a low ebb that only large public buildings were being erected, bids were called for furnishing lime for the construction of one of the state's university buildings. Willey claimed that McMillin secured the contract by underbidding, going below the "established price for the sale of lime prevailing in Puget Sound." By slashing prices McMillin began what lime traders dubbed the "Lime War," a four-year period following the Panic of 1893, when the price of lime was anything but "uniform."

Alpheus Byers, owner of Island Lime Company, located near Deer Harbor on Orcas Island, encapsulated this four-year instability when he noted: "In 1891 the retail price of lime in the City of Seattle and in Western Washington generally was \$1.60 per barrel, and the price f. o. b. wharf at kiln was \$1.25 per barrel." By 1904, when Island Lime Company ceased operation, the price had dropped to less than a dollar per barrel.

Demand for Portland cement

In 1900, the demand for lime as mortar began to decline. There was a clamor for safer, more stable buildings, and urgent demands for new construction techniques. Portland cement was beginning to replace lime mortar and brick construction. The 1906 Earthquake in San Francisco and its devastating fires hastened this shift in the lime industry.

The Cowell Lime & Cement Company suffered the huge loss of their ten-story office building and their lime and cement warehouses as a result of the quake; nonetheless, the company was well positioned to prosper during the rebuilding of San Francisco. Ernest assumed the role of the family's emissary, investigating potential sites for manufacturing Portland cement.

John McMillin was also developing ambitious plans for manufacturing Portland cement at Roche Harbor, seeking capital and partners from Canada and the East Coast. McMillin and R.P. Butchart, a prominent lime and cement producer in Victoria, British Columbia, developed both a social and business relationship. On behalf of a number of prospective business partners from Eastern Canada, Butchart began negotiations with McMillin for the purpose of purchasing his stock in the Tacoma & Roche Harbor Lime Company. Butchart, McMillin, and the eastern investors, one of whom was J.E. Murphy of Toronto, had come to an agreement on the terms of the sale; their intention was to develop a large Portland cement manufacturing plant with the capacity of some 5,000 barrels a day. In addition to acquiring McMillin's stock, the

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consortium sought to buy out all remaining stockholders. They were blocked by Ernest Cowell, who refused to dispose of stock held by the Cowells.

After Ernest refused to part with the 309 shares still belonging to the Cowells, Butchart and his associates scuttled their plans. They declined to purchase McMillin's stock, effectively leaving him without the capital and wherewithal to modernize and build a facility for manufacturing Portland cement. In June of 1908, Judge C. H. Hanford issued his decree, dismissing Cowell's complaint and exonerating McMillin. During the course of the lawsuit McMillin had been enjoined from selling, transferring, or entering into any agreement to sell or transfer the property itself, its assets and business, or the capital stock or shares in the Tacoma & Roche Harbor Lime Company, a further blow to his plans to modernize and become a player in the burgeoning and lucrative cement industry.

Cowell's on San Juan Island

The feud between Henry Cowell and John McMillin served as a backdrop to daily operations at Cowell's on San Juan Island. That Henry Cowell took possession of the San Juan Lime Company under convoluted circumstances is without question. It is probable that he sought revenge for losing control of Roche Harbor by moving quickly to take possession of the McCurdy operation just at the time McMillin himself was entering into a purchase agreement with the owner.

When the Cowells assumed ownership of the San Juan Lime Company operations, Ernest Cowell said, there was an "old" kiln on the site that was not capable of producing a large quantity of lime. A new kiln with a capacity of 100 barrels a day had just been completed. The old kiln was shut down for repairs, and the new kiln was the sole means of firing the lime rock for the next year. Sometime in 1891 the old kiln was back in operation. The total output of the two kilns was "only 225 barrels when used up to the limit of their capacity" (Affidavit of Ernest Cowell, Case #1413, US Circuit Court. Seattle: NARA). In addition to the two kilns, the plant on San Juan Island included a cooperage where the barrels used for shipping "San Juan Diamond Lime" (as it was soon called) were manufactured, with staves and hoops purchased "in the market" and shipped to the island. The cost of producing the barrels ranged from 23 cents to 26 cents each.

Although the site wasn't wildly profitable for the Cowells, especially in comparison to the company's other holdings and to Roche Harbor, it was nonetheless important to the economic and social life of San Juan Island. What distinguishes the lime operation at Cowell's from 1891—1925 is the oversight and management of one of the Henry Cowell's former employees from Santa Cruz: Cornelius "Cornie" Coghlan, who arrived on San Juan Island in 1891 to run the operation for the Cowells.

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Cornelius Coghlan was at the helm of Cowell's for 34 years until his death on September 11, 1925. The affable Irishman was born in 1851 in County Cork, Ireland, immigrating to California in 1874. After a short stint at the Cowell's Santa Cruz lime works, Coghlan worked in various Northern California locales, marrying Catherine Zimmerman in 1883. For a number of years he held the job as postmaster in Clarkesville, an El Dorado County mining area. After a severe fire wiped out his general store and post office, Coghlan, as his obituary in the *Friday Harbor Journal* read, "entered into partnership with E.V. Cowell of San Francisco and came to San Juan Island in 1891 as manager of the lime plant just acquired by Henry Cowell of Santa Cruz." As the paper also noted, Coghlan was active in community affairs, especially in the parish duties and activities at St. Francis Catholic Church. He was, the paper said, "an athlete of unusual ability." He held the championship of the "100-yard sprint in Santa Cruz County three years in a row." He was lauded for "strict observance of honesty in all business transactions." A popular community man, Cornie Coghlan was known to have a "large circle of warm friends and admirers." By all accounts, he was an easygoing man, well liked by the crew at Cowell's.

A consummate Irishman, Coghlan had an affinity for his fellow countrymen and employed them in various capacities at Cowell's. The 1900 Census lists six Irish workers living there as well as one each from England, Scotland, and Finland. Island family names most closely associated with Cowell's were: Dougherty; Doyle; Flynn; Edwards; Buchanan; Wotton; Johnson; Lightheart; Kinkella; and Surina. (It is interesting to note that the aforementioned families have descendants living on San Juan Island today.) The 1880 Federal Census listed the Doughertys, a large Irish family that was to be closely associated with the lime works and the history of San Juan Island. At the time John Dougherty, 29, was cutting cordwood for McCurdy's operation. Forty years later in 1920, John was 69, still working at the site as a cooper. After 1880, Dougherty family members are listed at the site for every federal census, including the 1930 Census.

Census records show that the nationality of laborers and other skilled labor reflects immigration patterns to the islands as well as to the Pacific Northwest. The 1910 Census shows a change in the composition of the labor force. Instead of an Irish contingent, "9 Austrians," speaking Croatian are listed. (At this time Croatia was part of the Austria-Hungarian Empire.) However, the Doyles and the Doughertys were still there. One of the Doyles, Stephen, was listed as a teamster at the lime works. The Kinkellas, who lived in the log house still standing at the nearby San Juan County Park, are listed for the first time.

The "Austrians" made a deep impression on islanders. By all accounts their "shacks" were decorated and colorful, each with potted geraniums on the stoops. A number of the "Austrians" were expert fiddlers. Old-timers recall evenings of music and dancing at Cowell's. The sociable atmosphere at Cowell's was

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followed by the local newspaper. In 1894, while a general depression was sweeping the entire US, and the Pacific Northwest in particular, the following appeared in the September 13 issue of the *San Juan Islander*:

There will be a "Hard Times Ball" at the Union Grove hall, Friday, the 28th, under the auspices of "Cowell's Lime Kiln Club." Every body is cordially invited to come and have a good time. A hard times supper will be served at midnight. First class music by the San Juan Orchestra. Tickets, including supper, 75 cents. There will be no white shirts allowed.

Cornie Coghlan is said to have treated workers fairly, in keeping with Henry Cowell's practices at the Santa Cruz lime works. Old-timers generally make disparaging remarks about John S. McMillin and his son Paul, who packed a gun—a pistol in a leather holster, according to Stan Reitan—when he made his rounds at the plant (Stan Reitan 2005). Many continue to speak in a tone that is bitter and scathing when they say that workers at Roche Harbor were paid in scrip, redeemable only at the company store. However, when it comes to talking about Cowell's, old-islanders whose forebears worked there consistently remark: "Cowell paid in cash."

Cowell's, as it has been known to islanders for generations, was an economic mainstay for a number of families and farmers on the west side of the island, providing some with year-round employment, and others a way to supplement their farming income. It wasn't unusual for some of the island's large farm families to send their teenagers out to the quarry to add to the family's earnings. Nearby farmers were able to supplement their incomes by cutting and hauling cordwood to the kilns. One of them was Arthur Fleming, whose stepson, Ed Tuck, 92, explained that a good team could haul a cord and a half of wood at one time: "That was a big load." Arthur Fleming was able to make two round trips a day with his team, negotiating the steep and rocky terrain of Mt. Dallas with great skill and patience to bring three cords of four-foot lengths of fir to the kilns (Ed Tuck 2005).

Women were employed to cook for the entire 15-man crew at Cowell's. As a young woman, Esther Edwards Dougherty, whose father Daniel worked part time at the lime works, "did all the cooking and baking for 15 men at a wood cook stove, plus all the floor scrubbing, all of it for just \$100 a month." (*Friday Harbor Journal* December 5, 1979). Islanders recall that long tables stretched along the lower floor of the cookhouse; a screened porch off the side of the building served as a pantry and cooler where sides of beef were hung (Boswell & Hudson 2001:25).

The hard dangerous work at the quarries and kilns is still vivid in minds of those who once worked at Cowell's or Roche Harbor. At both sites the process of quarrying, burning, and packing lime was the same,

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although the operation at Cowell's was smaller, with nowhere near the output of Roche Harbor. San Juan Islander Stan Reitan, now in his 70s, described his family's life at Roche Harbor, where both his parents worked for many years, and where, as a teenager, he fired kilns on the graveyard shift. His father Paul "Claude" Reitan took the job as foreman of the quarry and plant at Roche Harbor in 1925, after running Mrs. Dally's lime works at White Point on San Juan Island. In 1925 Roche Harbor was still running full tilt, the cooperage still producing barrels to ship the lime. Men who "broke rock," as Stan put it, had long sinewy bodies; they knew how to wield a rock hammer all day long without straining themselves, and so did the men who stacked barrels, three high, a feat much bragged about by all lime workers (Stan Reitan 2005).

Lime kilns required regular cleaning. At Roche Harbor the graveyard shift was assigned the job of cleaning the fire boxes on Monday nights. "There were four boxes in each kiln to clean out. You used a big 75-pound hoe that was long enough to clean out lime rock that had spilled down into the fire area. The hoe would get pretty warm. There was still tremendous heat in the kilns," Stan recalled, going on to describe how the kilns were repaired. "It took a month to cool a kiln down so the bricklayers from the mainland could put in new fire brick."

Men who worked around lime had to put up with dust that coated everything around them, including their clothes, which ended up stiff with lime dust at the end of their shift. The dust also coated men's lungs. During a day's work, men were constantly breathing it. Lime rock was also hard on hands; men continually taped their raw and tender fingers to keep them from bleeding. Even for men who were careful and attentive, strong and methodical, manufacturing lime was a dangerous occupation.

Even though the work was hard and dangerous, and the pay mediocre at best, the atmosphere at Cowell's appears to have been more tolerant and convivial than at Roche Harbor. Apparently the Coghlands, devoted Catholics, did not press their religious or political beliefs on employees. An oft-repeated story goes like this: "You had to be Republican to work at Roche Harbor." By all accounts, John McMillin made sure his employees voted his way—Republican. Old time islander Etta Egeland was fond of telling this story: "My uncle was fired at Roche because his wife was a Democrat and demanded that McMillin count the one Democratic vote" (Etta Egeland 1998).

Between 1900 and 1911, the year Ernest Cowell died, San Juan Diamond Lime produced at Cowell's was purchased for use in the manufacturing of paper and pulp. "Paper rock," as it was called, was shipped in barrels by boat from a wharf extending into the small bay at the foot of the quarries. The lime was destined primarily for ports in Puget Sound and Portland. Lime produced at Cowell's also ended up on San Juan

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Island farms, often as white wash for dairy barns. "People went out there to get crushed rock to use on their dairy farms. They'd put fresh rock down by the barns so it'd be nice and clean there," old time farmer Fred Sundstrom said, recalling a trip to Cowell's (Fred Sundstrom 2005).

Old-timers who have been interviewed because of their knowledge of or familiarity with the site and its history are consistent in saying that kilns at Cowell's were shut down for good sometime between 1931 and 1935. At this time the lime works was under the management of "Cornie" Coghlan's fourth child, Emmet, who had assumed the role of general manager following his father's death. After Emmet Coghlan's death in 1944, it appears that S. H. Cowell did not send another manager to the site. According to E.A. "Bud" Geneste, his father Elmon served as Cowell's attorney during that time, handling the company's affairs in the islands.

The kiln's closure coincided with the Great Depression when the market or demand for lime severely declined. Also contributing to the closing of the lime works was antiquated or outdated technology. Since the processing of lime at Cowell's had not changed significantly in almost 60 years, it was inefficient, labor-intensive, and therefore not cost-effective to continue operations. Moreover, the deposits of high quality lime rock located in the quarries just above the kilns had been exhausted. The lower grade rock was too far away from the kilns, requiring more labor and materials to cart it back down the slope to the kilns. In short, the entire operation was proving to be cumbersome and too costly, particularly with the rise in shipping costs and fewer ships plying the waters of Puget Sound. By this time freight bound for West Coast cities was primarily being sent by rail. There was some market for agricultural lime in Eastern Washington, which meant it was packaged in sacks, hauled by barge or scows from Roche Harbor to Everett where it could easily be transferred to rail cars. At Cowell's there was no capacity for producing agricultural lime. Instead, the remaining lime was destined for pulp mills in Puget Sound.

After 1935 lime continued to be quarried at Cowell's, but instead of burning the lime rock, it was hauled, unprocessed, a mile and a half by truck to Smallpox Bay where scows or barges tied up at the dock, ready to be loaded in the more sheltered location. In 1940 the Olympic Portland Cement Company of Bellingham leased the Cowell site, quarrying lime rock from "a series of small knolls" at the eastern edge of the site. By this time quarrying was more mechanized. Lime rock was scooped up and loaded into trucks with a 3/8 yard Bucyrus shovel. The company also produced a small amount of ground limestone using a Williams No. 20 Slugger Mill powered by an 80-horsepower tractor engine (Boswell & Hudson 2001). Spalls were stock piled, later sold for the manufacturing of cement.

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After World War II, many of the structures were dismantled for their wood. What remained as substantial standing structures, as is evident from photographs dating from 1959, were the boardinghouse and the two kilns, along with the some of the trestle and shed structures that abutted them. The extensive shed structure to the downhill (water) side of the North Kiln was still standing, although in great disrepair. Today, the remains of lime quarrying and processing structures range from standing structures (the two kilns and the water heater) to foundations and scattered artifacts indicating the former presence of these features.

Cowell Family Legacy

By the close of the 19th Century the Cowell family was significant in the economic life of Northern California. In 1911, at age 53, Ernest Cowell died. Unlike his father, he specified a number of bequests; one of them concerned the company's long-time employees. The Henry Cowell & Cement Company rewarded their loyal and hard working employees following Ernest's death. Those who had been with the company for 20 years or more received \$1,000, and those in the company's employ for 10 years were given \$500. It seems likely that Cornelius Coghlan, who left California to take over management of the Cowell's San Juan Island site in 1891, would have received a bequest of \$1,000. According to San Juan County tax rolls Coghlan was residing at the company's site in 1911, listing more personal property that year than ever before or after: 1 carriage, \$40; 2 watches, \$10; house furnishings, \$35; libraries, books, scientific instruments, \$10.

In his will, Ernest formalized the family's substantial philanthropic endeavors. He made generous contributions to health and educational institutions in California, foremost among the University of California at Berkeley. Samuel H. (S.H.) Cowell took over the company's helm following his brother Ernest's death, conducting the family's business affairs until his own death 44 years later. Toward the end of his life he began to give large parcels of land away for conservation purposes, including what is now the Henry Cowell Redwoods State Park. And most fortunately, their vast "home ranch"—as well as the remnants of the once thriving lime works—has been preserved as the campus for the University of California at Santa Cruz.

S. H. Cowell was the last of the Cowells, all of whom were childless. Following his death in 1955, the S.H. Cowell Foundation was established to "carry on the philanthropy practiced by his family during their lifetimes." Since 1955 the Foundation has made significant financial contributions to the education, health, well being, and cultural lives of Californians by supporting programs devoted to: childcare; cultural enrichment; disabled or handicapped assistance; family planning; and youth. The Foundation took over the Cowell Lime and Cement Company in 1955, selling the lime works and property on San Juan Island in 1957 to Ruth Brown, Orcas Island doyenne and founder of Camp Four Winds at Deer Harbor.

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Limekiln Preserve

A group of island investors acquired the property after Brown's death, with plans for a large development and village, a project that was mired in legal challenges and never initiated. Instead, the quarries and remnants of the lime works were silent and empty of activity with nature reclaiming the landscape; it was a de facto park for some 20 years. In 1997 the San Juan County Land Bank purchased the site much beloved by islanders. Lime Kiln, as it is called today, is adjacent to a popular destination—Lime Kiln Point State Park and Lime Kiln Light Station. Many visitors walk over a rough trail—where the trestles and tracks leading to the kilns once stood—to get a close look at San Juan Lime Company/Cowell's kilns, the sole vivid remains of a once thriving industry.

THE NATURE, PROCESSING, AND USES OF LIMESTONE AND LIME

Limestone and Lime

Lime is produced from limestone, which is a form of calcite, a calcium compound. **Calcium** (Ca), the fifth most abundant element on earth, is a silvery-white, divalent metal, occurring combined in limestone, chalk, gypsum, etc. **Calcite**, or **Calcium Carbonate** (CaCO_3) is one of the commonest minerals, occurring in a great variety of crystalline forms and a major constituent of limestone, marble, and chalk. Chemically, it is described as a white, crystalline, water-insoluble, tasteless powder occurring in nature in various forms as calcite, chalk, and limestone. **Limestone** is any stone consisting wholly or mainly of calcium carbonate; some varieties suitable for burning into lime. **Lime** (CaO) is a white or grayish-white, odorless, lumpy, very slightly water soluble solid that when combined with water forms calcium hydroxide (slaked lime). It is obtained from calcium carbonate, limestone, or oyster shells. It is used chiefly in mortars, plasters, and cements, in bleaching powder (chlorinated lime), and in the manufacture of steel, paper, glass and various chemicals of calcium.

Limestone of San Juan County

Most of the limestone of San Juan County dates from the Permian Period (ca 220-270 million years ago), the last phase of the Paleozoic Era. Calcium that was dissolved in seawater combined with carbon dioxide to form the solid calcite, which then sank to the bottom of the ocean and formed layers. Calcium deposits were also created from organisms that absorbed calcium to form shells and skeletons and then died, leaving their remains to settle to the bottom. (Local limestone deposits contain evidence of this in the form of fossils of the Permian Period: fusulinid and other Foraminifera—most notably *Neoswagerina*—as well as

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algae.) These deposits were then condensed under pressure from heavy overburdens. Eventually, they were moved and deformed through various post-depositional geologic processes:

The limestones of western Washington were originally formed as horizontal or nearly horizontal layers, mounds, and lenses on the sea floor. They have since been lifted above the sea and tilted, complexly folded, squeezed into irregular shapes, and broken by faulting (Danner 1966:11).

Limestone is found in the older rocks forming the central portion of the San Juan archipelago. This belt extends from the northeastern portion of Orcas Island, across the island to the northern and western portions of San Juan, and includes the smaller islands in between such as Crane, Jones, and Shaw (see Map and Table).

The limestone deposits at the site consist of three large, irregular, lenticular beds ranging from 800-1,500 feet in length and 50-300 feet in width, as well as 11 smaller (less than 100 feet in length and 50 feet in width) pods. The stone ranges from blue to light gray in color and from dense to crystalline in texture. It is surrounded and sometimes interspersed by volcanic rocks, argillite, and chert. Although these deposits extend from sea level to over 320 feet in altitude, the quarries were concentrated in a bench-like area around 200-260 feet above sea level (Danner 1966:110-112).

While the largest Pacific Northwest deposits of limestone occur in eastern Washington, those in western Washington—as well as in nearby British Columbia, such as on Texada Island—were more extensively exploited because of their location near the water, which offered ease of accessibility and transportation, in addition to the general high quality of the deposits (1980 report; Danner 1966:84).

Quarrying

In San Juan County, limestone was quarried either in pits or shelves. Pit quarries, where miners dug down into the ground in successive layers, were established at Roche Harbor and Mitchell Bay, whereas at San Juan Lime Company and Cowell's miners removed the rock from the faces of ledges exposed on the hillsides.

Sections of rock were blasted from the vertical faces of the deposits and the resulting boulders were broken into smaller pieces for loading in the kilns. "Big holes," for blasting the rock off of the face, were drilled six to eight feet back from and parallel to the cliff's edge. Drilling was done by hand by a team of three men called a "doublejack": two men alternated hitting with a sledge hammer, while one held and turned the

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bit, sometimes adding water to get the "mud" out. A series of progressively longer drill bits was used until the holes were about 20 feet deep, and then a small amount of black powder was poured down the hole and ignited to form a larger chamber, a "springing hole." This chamber was filled with a large amount of black powder and then set off with sticks of dynamite, resulting in the face of the cliff being blown off onto the quarry floor. A "single jacker," using a kit with different size bits and a double headed hammer, would then drill holes in the boulders, into which sticks of dynamite or black powder with fuse would be inserted for blowing them up. There was usually a specific person who actually ignited the explosion, although jackers would sometimes do so. A 9- or 12-pound rock hammer with a narrow bit was used to break medium sized rocks into useable chunks (usually 8-12 inches in diameter), care being taken to waste as little rock as possible in small chips. This size of rock allowed the hot gases to pass around the rocks piled in the kilns in order to heat them thoroughly (Bauer 2003; Ed Tuck 1998).

These smaller rocks were then loaded by hand into rail or trestle cars (and later trucks) and moved by either manpower or draft horse to the main processing area. Temporary, 36"-gauge tracks were laid from the more permanent lines and trestles to the quarry currently being worked on. In some cases, a form of cable car system, operating by gravity, was used to convey the loads down the steep slopes to the sorting areas. The quarried limestone could then be either shipped unprocessed or burned in the kilns to produce lime.

Burning

Limestone (calcium carbonate - CaCO_3) must be subjected to a great heat in order to drive off carbon dioxide (CO_2), leaving pure lime (calcium oxide - CaO). This process, calcination or "burning," yields about 60% lime and 40% gas.

In order for this chemical reaction to occur, the limestone must be heated to temperatures ranging from 1650-2000 degrees Fahrenheit (900-1100 degrees Centigrade), and optimally around 1800 degrees Fahrenheit. This heating is done in kilns, the design of which varied through the nineteenth and early twentieth centuries. The three basic types of kilns were pot (or field), shaft (or vertical), and rotary.

Pot Kilns. Pot kilns consisted of a covered, one-time burning of the limestone. Some of them consisted of just a rock-lined pit in the ground, with the raw limestone mixed together with fuel (usually firewood) that was then burned (the so-called "heap kiln"). This fits a description of an old kiln in Pierce County:

The custom was to put in a layer of wood topped with a layer of rock and repeat the layers until the kiln was full. The wood was lighted and left. When the fire went out, the lime was ready (McDonald 1957).

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A more advanced design consisted of a masonry structure with a lower chamber for the fuel and an upper chamber that would contain the limestone arched within it. "An arch was first constructed from the rock; the arch went through the length of the kiln and the fire was placed under it" (Eselius 2004:16). According to the manager at the Home Ranch of the Henry Cowell Lime & Cement Company in Santa Cruz, California:

They have a regular 'archer,' a fellow that makes a business of it. He goes to work and lays a rock [at either end of the kiln]. Then the next rocks will come a little bit closer, ...and then on the top he'll have one that reaches across and that leaves it hollow underneath there. That's where the fire goes in. The top was all filled with rocks. The fire goes up though the rock and burns. After they get it started, the gas in the rock will catch fire and will burn (Eselius 2004:56).

In either design, a significant drawback of pot kilns was that the temperature of the burning could not be closely regulated. "Since no chemical determinations were run in those days, the men judged whether or not the rock was done by its appearance. At night the rock was transparent; in the day it had a yellow-golden color when cooked" (Eselius 2004:16).

Pot kilns were used at several of the lime quarrying sites on both Orcas and San Juan (McDonald 1960). It has even been surmised that one or more pot kilns were used early on by the San Juan Lime Company in order to test the grade of lime available—this may have been the original use of the site called Feature 10—but that cannot be determined without further archaeological testing.

Shaft Kilns. Shaft kilns consisted of vertical structures that were often constructed against the side of a hill near the quarry in order to facilitate the loading of the ore at the top of the shaft. An early version was filled with alternating layers of stone and fuel, which would then be ignited and left to burn for about 3 days, and then cooled for a day or so in order to remove the lime (hence the term "periodic" kiln). A later modification of this was an early version of the "continuous," "perpetual," or "draw" kiln, where the burnt stone was withdrawn from the bottom of the shaft and new stone and fuel were added to the top for continuous burning. The technical advantage of this was that the heat generated by the initial burning was not lost through the process of cooling down the kiln in order to empty out the full load.

Warren E. Emley, who wrote about the state of the art of lime manufacturing around 1927, describes the

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shaft kiln as:

...resembl[ing] a short, wide stack, of either square, round, or elliptical cross section. It consists of a casing of steel or stone which is lined with refractory material. The long, vertical chamber formed by this lining may be divided into three compartments by imaginary horizontal planes. The top compartment, called the hopper, is used for storing and preheating the middle compartment, the shaft. This shaft is the place where the lime is burned. It may be of either square, round, or elliptical cross section, independently of the outside of the kiln. ...At the bottom of the shaft, the third component (the cooler) is used for storing the lime after it is burned [Processed lime is removed from the cooler section.] ...The fuel used in burning the lime is consumed in the fire boxes usually arranged on two sides of the kiln. They are very similar to the common fire boxes in use under boilers (Emley 1927:22-23).

At San Juan Lime Company/Cowell's, the kilns were constructed of an inner lining of two courses of firebrick around a flattened oval that measured approximately 6 by 8 feet contained in squared outer walls of rough limestone with rubble fill in between. Large horizontal and vertical timber frame beams and metal tie rods were used to encase the structure and keep it together. This extended upward another 10' or so to form a wooden superstructure above the top of the stone shaft, which was used as the hopper for the unburnt limestone. Approximate dimensions of the masonry shafts were 18 feet high on the upslope side and 30 feet on the down slope, 18 feet wide (on the lime-removal side) and 20 deep (on the firebox sides). Sandstone was used in key places such as the arches over the bottom removal area as well as quoins of the shaft. The fireboxes, pairs of which were located midlevel on the north and south sides of the kilns, consisted of hinged steel doors covering arched openings lined with firebrick. Open-brickwork grates on the bottom let the ashes fall into cinder boxes below, for easy removal.

In order to increase the efficiency of the shaft kilns, steel chimneys were added to the top of the structure, improving the draft and therefore the consistent and uniform heating of the stone. However, this added to the difficulty of loading the stone into the shaft, because the doors that were generally located in a conical section that connected the chimney with the masonry shaft were small, requiring loading by hand or wheelbarrow (Emley 1927:33).

Rotary kilns

The third major type of kiln—rotary, which was principally used in the manufacture of Portland cement—was never built in San Juan County. It consisted of a large (6-8 feet in diameter and ranging from 60-120

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feet in length) steel cylinder that was set at a slight angle, with heat applied to the sides. Material introduced at the top would gradually make its way through a series of passages to the bottom as the cylinder was heated and rotated. Because this applied the heat uniformly to the stone or cement mix and thus there was less unburnt, wasted material, rotary kilns were more efficient than shaft kilns. That they were not constructed locally is a strong indication of the economics of the lime industry in San Juan County: owners of the kilns were willing to continue using antiquated technology until the limestone played out, but unwilling to invest in new, more efficient equipment.

Fuel. Wood—principally old growth Douglas fir (*Pseudotsuga menziesii*), although some pieces of red alder (*Alnus rubra*), western red cedar (*Thuja plicata*), or madrona (*Arbutus menziesii*) could be present—was the fuel used to burn limestone throughout the San Juan Islands. Cut into four-foot long split logs—“cord wood”—it took about 4 cords (a cord is 4 feet high by 8 feet long by 8 feet deep and there were about 120 sticks per cord) to fire a kiln continuously through a 24-hour period at San Juan Lime Company/Cowell's. In contrast, the more efficient steel-encased kilns at Roche Harbor burned about 3 cords per day. Wood was supplied by woodcutters and farmers clearing their land on Lopez, Orcas, and San Juan, as well as many of the smaller islands located in the San Juan archipelago and hauled by wagon or shipped by scow to the kiln sites. Wood cutters used a splitting gun and a glut (an “overgrown” wedge) and made \$1.25 a day if the cord wood man was good; a cord of wood delivered to Roche Harbor got about \$4.00 during the 1930s (Ed Tuck 1998).

Loading and Firing. At San Juan Lime Company/Cowell's, the quarrymen loaded the stone—about 15 tons—into the top of the shaft kiln, while the firemen, working twelve-hour shifts, fired the kiln and maintained the proper temperature (keeping it hot but not too hot). (At Roche Harbor, the kiln would be fired regularly—every hour, at 20 minutes to the hour.) “When the kiln is real hot there would be flames of burning gas visible at night 15 feet in the air above the stack” (Ed Tuck 1998). Guiding the mass of limestone through the shaft was often a tricky process:

If...the limestone was properly heated and calcined into lime by the time it reached the hottest section at the firebox level, the whole charge would expand and stick to the kiln walls, creating a large cavity when the lime was removed from the cooler below. It was at this point that the experience of each fireman came into play, both physically and knowingly. The task now was to strategically poke the key pieces of red-hot lime in order to break the hung-arch, and thus bring down the whole kiln charge in a rattling thump to fill the gap. In order to accomplish this maneuver every three or four hours, strategic openings were located in the kiln shell and brickwork. 10' to 20' foot[sic] steel rods were then pushed

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through these poke-holes to dislodge and to drop the lime and overlying twenty feet of preheating limestone, often a five-foot drop. Slow removal of the rod when the charge crashed down could knock the firemen over or bend the rod in a stuck position. (Bauer 2003).

Depending on the ability of the firemen, the firebrick had to be periodically replaced because the lime would chemically fuse with the surface of the bricks. The kilns would be shut down, and workmen would go inside the shafts to remove the big chunks of fused and melted firebrick and replace it with new brick. Large piles of discarded brick on the site bear witness to this process. Firebrick used for lining mainly came from England during the 19th century; later brick came from both British Columbia and Washington State.

From the time it passed the firebox to its drawing from the bottom was about 24 hours.

Barrel Making, Packing, and Processing

Following the burning process, the lime was broken into smaller pieces and packed in barrels. At Roche Harbor, the firemen who kept the kilns burning also drew the rock from the kiln, sorted out any unburned rock—"core"—and then packed the burned lime in barrels. At Cowell's they drew about every four hours (3 at Roche Harbor), with the average draw being 12-15 barrels (Ed Tuck 1998).

Although the San Juan Lime Company purchased staves elsewhere—specifically the Puyallup Stave Factory in the 1870s—the barrels were assembled at a cooperage on the site. The 1870 advertisement for the sale of the property noted "a large Cooper Shop with benches for 4 coopers to work," and the appraisal performed by court order the next year noted a cooper shop with 4 shave horses with benches, a set of cooper's tools, a grindstone, and 11 "Rack Wheels," as well as a stock of 1180 barrels on hand (Austin Hibbard Probate File).

The preparation of staves and heads was described in an account of the Roche Harbor works ("One Thousand Barrels a Day") printed in the August, 1889 edition of the *West Shore*:

Logs are taken to the mill in rafts or on barges, cut to twice the length of a stave, and are know as "stave bolts"... The bolts are hauled up an incline, at the head of which they encounter a saw that quickly saws them into lengths for staves. After being steamed, another cuts them to the proper thickness, and a third machine shapes them so that when put together they will have the required bildge[sic] in the center. They are then tied up in

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bundles, loaded on cars and passed through the dry kiln, where they are thoroughly seasoned, and are then stored away for use. Heads are made from bolts of a different length. The slabs, after being sawed out of the bolt and being thoroughly kiln dried, are laid at proper widths on another machine and sawed into round and perfect heads, three pieces usually going into one head...(*The West Shore* 1889:414).

The article goes on to describe the actual barrel-making process thus:

...The coopers work in sets of four, grouped about a stove, upon which the barrels are heated after being "set up" and before "hooping". From a pile of staves the cooper selects enough to make a barrel and places them in position by confining the upper ends in a heavy hoop and letting the lower ends rest upon the ground. Another hoop is then driven down toward the center of the barrel. The barrel is then reversed and the upper ends of the staves, which are narrower than the center and are about two inches apart, are drawn together by a rope loop placed over the ends and tightened by power from a treadle or windlass sufficiently to permit another strong hoop to be slipped over the top. The barrel is then set over a drying cylinder on the stove, and when sufficiently dry the regular hoops are adjusted, the heads set in, the edges of the staves planed, champered and crozed, and the completed barrel is then rolled along an incline to a warehouse, where it is stored for seasoning... (*The West Shore* 1889:414).

Although barrel production at site would not have been as extensive—most of the records of the labor force note only two to three coopers—the process itself was no doubt similar. At the San Juan Lime Company (and later Cowell's) works, the staves were bound together with "liners," which were made of some flexible sapling material such as fir, hazel or vine maple, which was split down the center and then soaked to gain flexibility, and bundled together in bunches of one hundred (McDonald 1990:91).

The rock, which was still in large chunks (6-8 inches in diameter), was raked out of the bottom part of the kilns by means of long (10-20') rods and channeled into a chute. From there it would be packed in barrels and the heads sealed in order to keep the lime from hydrating once again. "The lime was so hot...just cool enough so it wouldn't burn the barrel—that's when they started drawing it, and them poor fellows—I know some of them would just bleed at the nose" (Fred Wagner 1966). The barrels, weighing between 200 and 250 pounds each, were then transported to warehouses where they could be stored until shipped to market. Workers took great pride in being able to stack the heavy barrels three layers high (Ed Tuck 1998).

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Lime in its pure state, called "quicklime," may also be further converted to hydrated or slaked lime. This process could be done in several ways: water could be sprinkled onto the quicklime, and the lumps would crack open and form a dry powder; or the lime could be placed in a basket and immersed in water and then drawn up to complete the slaking process in the air. In either case, caution was necessary to control the chemical reaction that resulted, because it could be quite violent, even causing the water to boil. If left exposed to the air for a length of time, quick lime will naturally slake, but in the process it absorbs carbon dioxide and other impurities, which make it less useful. Quick lime could also be placed in a pit or vat and more water than necessary for slaking added, to form a paste, which could be kept for several months (McKee 1973:53).

Shipping

One of the advantages of limestone processing in San Juan County was proximity to water, which allowed easy shipment of barreled lime to Seattle, Tacoma, Victoria, and other Puget Sound cities as well as to ports as far away as San Francisco and Hawaii. Most local quarry operations had a wharf with attached warehouses, where the barreled lime could be stored and loaded for shipment. Historic photographs of San Juan Lime Company/Cowell's reveal a wharf with attached buildings and a crane for loading onto docked vessels.

Ships laden with barrels of lime, some stacked on open decks, were carrying a very dangerous cargo since quicklime that becomes wet is highly combustible. Many ships from Puget Sound—the so-called "Mosquito Fleet"—that plied significant West Coast trade routes (the three-to-five-day run from Puget Sound to San Francisco and the Vancouver or Victoria to Portland run, for example) suffered severe damage or sank as the result of fires ignited by their lime cargo. The sinking of the *T.W. Lake* on December 5, 1923, was one of the worst disasters to strike the "Mosquito Fleet." Caught in 72-mile-an-hour winds in Rosario Strait, the venerable steamboat foundered and sank with its cargo of 300 barrels of lime that night. The entire 15-man crew was lost.

Uses of Lime and Limestone

Lime has been used since ancient times for several purposes. The Egyptians used lime mortar on the Great Pyramids at Gizeh. The Greeks used lime as a mortar and plaster, but it is the Romans who are most well known for their use of lime in construction, including mixing it with natural cement to form concrete. After the decline of the Roman Empire, the use of concrete was forgotten until its rediscovery in the 1800s; lime mortar and plaster, however, continued to be used. During the period of significance of the San Juan Lime Company and Cowell's works, lime was used for several purposes—as a mortar and plaster or in the production of Portland cement, as well as a flux for smelting and papermaking operations—while

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limestone itself was used as paving and in the construction of masonry buildings.

Lime as mortar and plaster. The most common traditional use of lime was in mortar and plaster, which were formed by mixing it with sand and water. The process and proportions for mixing depended on the richness—fat or poor—and form—quick, slaked, or paste—of lime. Masons preferred “fat” limes, which they also described as being “rich” or “oily,” because they absorbed almost half their weight in water and produced more mortar; “meager” or “poor” limes absorbed less water and yielded a smaller quantity of mortar. Three methods of mixing were: adding dry pulverized quicklime to dry sand and then adding water; mixing slaked lime powder, sand, and water; and adding dry sand to lime paste (McKee 1973:64).

Prior to Portland cement, lime was the primary mortar for masonry—brick and stone—buildings. In addition, it could be used as a plaster covering for walls and other surfaces. Plaster also consists of lime, sand, and water, often with hair added, applied either directly to a masonry surface or on a wood lath structure. Slaked lime was mixed with water, salt, and other materials, and sometimes a pigment such as an ochre or earth tone, to be applied as a “whitewash” to plaster and other surfaces.

The requirement of masonry construction in cities and towns, particularly after catastrophic fires, led to an increase in the use of lime, especially on the West Coast. Early northwestern cities were generally constructed of material that was readily available, which in most cases was wood. A combination of factors, including frame construction, narrow lots, and inadequate water supply and fire-suppression equipment, led to fires getting out of hand in downtown areas, destroying several city blocks and hundreds of structures. Major 19th century urban conflagrations include Chicago (1871) and Boston (1872), and in the Pacific Northwest the year 1889 alone saw conflagrations in Bellingham, Ellensburg, and Seattle. City governments responded by requiring masonry construction in order to make structures fire resistive. After the June 6, 1889 fire in Seattle, for instance, the City Council passed an ordinance—allegedly based on those in Kansas City and San Francisco—requiring masonry construction (introduced on June 27th, it was passed July 1st) (Oschner and Anderson 2003:64). This in turn led to greater use of limestone and lime, both as stone and mortar in masonry buildings. For instance, an article in the April 1891 edition of *The Pacific Magazine* noted an increase in the number of kilns in San Juan County following the Seattle fire. Lime also factored as a major ingredient in a newly expanded material: Portland cement.

Portland cement. Although concrete was used as a construction material as early as the Roman Empire, renewed experimentation in its use did not occur until the 19th century, and it did not really take a prominent role in large structures until the beginning of the 20th century. In 1824 Joseph Aspdin invented a mixture produced by burning finely ground chalk with finely divided clay and called it “Portland Cement” after its resemblance to the high-quality building stone that came from Portland, England. The use

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of metal reinforcement in concrete dates from 1860, when S.T. Fowler applied for and obtained a patent for a reinforced concrete wall. Ten years later, William E. Ward used concrete reinforced with iron rods to build his house in Port Chester, NY. Rapid acceptance of concrete as a building material followed upon the experiments of Ernest L. Ransome, first in California and later in Massachusetts. The adoption of reinforced concrete for industrial buildings was furthered by the "factory style" designs—featuring an exposed concrete skeleton framing large sheets of glass—of Albert Kahn in Detroit and Richard E. Schmidt in Chicago (Conney 1987).

In 1886 the first rotary kilns, which could make cheaper, more uniform and reliable cement, were introduced from England. In 1909, Thomas Edison was issued a patent for a longer rotary kiln that he had developed at his Edison Cement Works in 1902, and he experimented with cast-in-place reinforced concrete homes in Union Township, NJ.

In Washington State, the first Portland cement was produced by the Washington Portland Cement Company, at Cement City, east of the Baker River and north of the Skagit River; although the plant was started June 1, 1905, it did not produce cement until May, 1907. In 1906, the Superior Portland Cement Company constructed a plant in Concrete, across the Baker River. Limestone for both plants was quarried northeast of Concrete (Danner 1966:273).

On nearby Vancouver Island in British Columbia, the Vancouver Portland Cement Company, under Robert P. Butchart, who had grown rich in the Portland cement business in Owen Sound, Ontario, during the mid 1880s, established a plant at Tod Inlet in 1904; by 1907, production had risen to 300,000 barrels per annum. The Associated Cement Company later began production of Portland cement in 1913 across the Saanich Inlet at Bamberton. These two companies later merged to form the British Columbia Cement Company, and cement production was transferred to Bamberton in 1921, while the Tod Inlet facilities were closed (Mathews 1947:95-6).

John S. McMillin attempted to establish, or sell the rights to, a Portland cement facility at Roche Harbor during 1904-5. He began talks with Butchart and businessmen in Eastern Canada; however, this attempt was actively opposed by Henry Cowell's son and successor, Ernest V. (E.V.) Cowell, with the result that a Portland cement facility was never established in San Juan County.

An early local example of the significant use of concrete as a building material was Robert Moran's development of Rosario on Orcas Island. Moran, a two-term mayor of Seattle who became both rich and famous for shipbuilding, retired for reasons of health to the former site of the Cascade Bay Lumber and

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Manufacturing Company at Newhall, where he designed and constructed a residence (1906-1909), round playhouse (1914), and several industrial structures including a power station and a workshop (1920s), all constructed of poured-in-place structural concrete. Concrete was also used in the Lime Kiln Light Station complex (1917) just to the south of the property.

Structural uses of Limestone: Road Beds and Building Stone. One of the common uses of limestone is in an aggregate form for roadbeds. In addition, quality raw stone can be used in the construction of buildings. Limestone blocks were used to construct several buildings for the San Juan Lime Company, including both the kilns and the foundations of the barn and cooperage. Needless to say, in using limestone for the construction of the kilns, care was taken to have a firebrick barrier between the heated shaft and the structural limestone itself.

It is not known whether limestone from the operations of the San Juan Lime Company or Cowell's was used for structural purposes other than on site, but material from these and other old quarries in San Juan County was used for the paving of local roads during the mid-twentieth century.

Limestone used for Pulp and Steel Mills. Limestone may also be used in the production of paper (in pulp mills) and as a flux in steelmaking. The Tacoma Lime Company developed a Pierce County limestone quarry of tufa in the 1880s. Limestone from this deposit was shipped to Tacoma for use as a flux in the Tacoma Smelter, as well as being used for agricultural lime and chicken grit (Danner 1966:442-443; McDonald 1957).

After the higher grade of limestone was quarried in San Juan County, the remaining lime rock was quarried for pulp mills in Everett (Everett Lime Company and the Soundville Company) and Seattle (Washington Pulp and Paper Company and Crown Zellerbach) as well as steel mills in Tacoma (Tacoma Smelter).

Limekiln Preserve. Today, although limestone is no longer being mined from the quarries on San Juan Island, it does still have a 'use': the aesthetic beauty provided for the many visitors to the San Juan County Land Bank's Limekiln Preserve and Washington State's Lime Kiln State Park. There is a series of trails throughout the former workings of the San Juan Lime Company/Cowell's, with interpretive signs, and the hiking public can now enjoy the natural beauty of the abandoned quarries and the ruins of former industrial buildings.

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Verbal Boundary Description

Beginning at the northwest corner of Section 24 T35N R4W, east approximately 500 feet; south approximately 1300 feet; west approximately 1500 feet to shoreline; north approximately 700 feet (meander) along shoreline; northeast approximately 300 feet; east approximately 1000 feet to west boundary line of Section 24 T35N R4W; north approximately 400 feet along west boundary line of Section 24 T35N R4W to beginning.

Boundary Justification

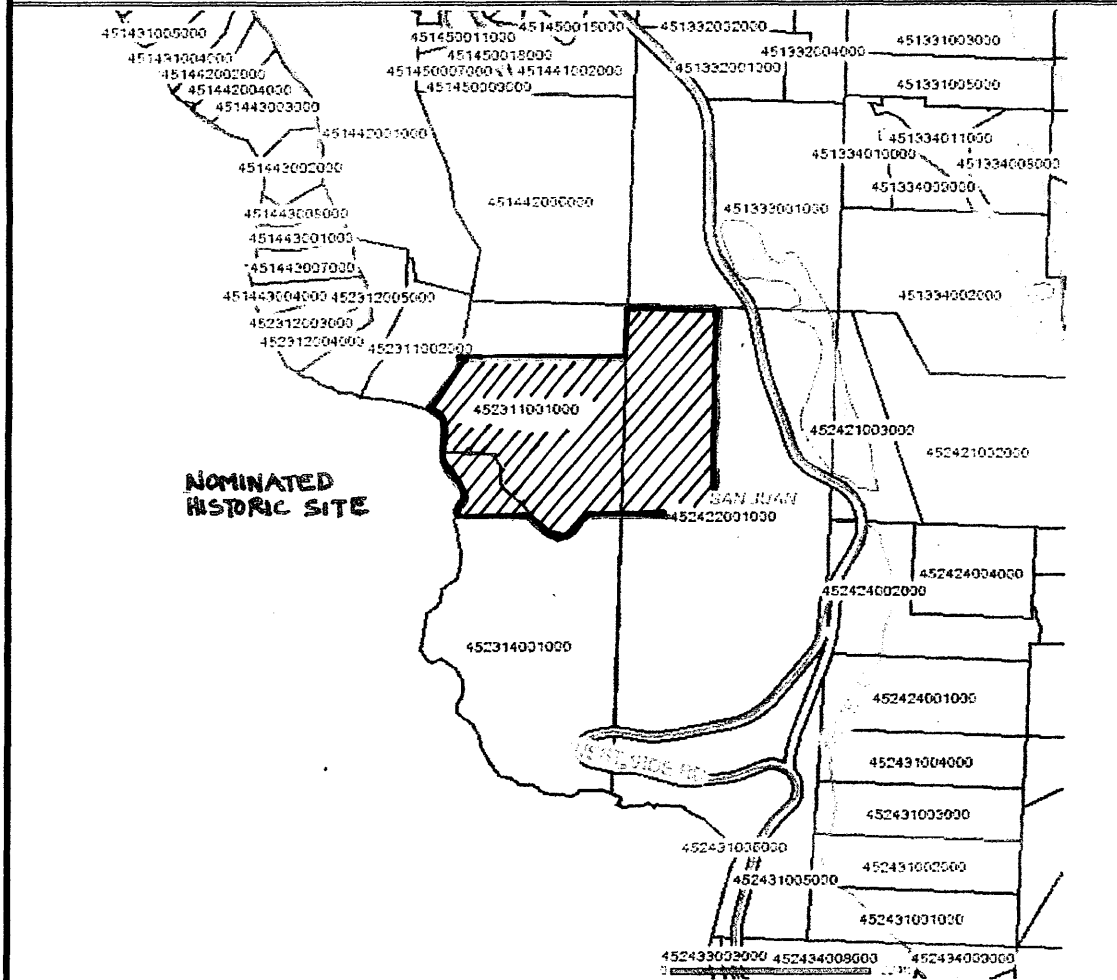
The nominated parcel consists of 40.8 acres of the original 300 plus acres, where for 75 years limestone was quarried, processed, packed, and then transported by ship to Puget Sound, West Coast, and Pacific Rim markets. The boundaries of the nominated parcel encompass the historic use of the site—the bench-like areas where the entire operation took place and quarries where limestone was extracted. Thus, all of the extant features of the lime operation are located within the site. The major quarries are also included in this area, rising 200 to 320' above sea level and overlooking the kilns and remnants of the historic activity or use.

The nominated parcel currently occupies two separate parcels / property owners—the major portion belonging to the San Juan County Land Bank's Limekiln Preserve, the smaller to the Washington State's Lime Kiln Point State Park.

Map Report: 07/11/2006

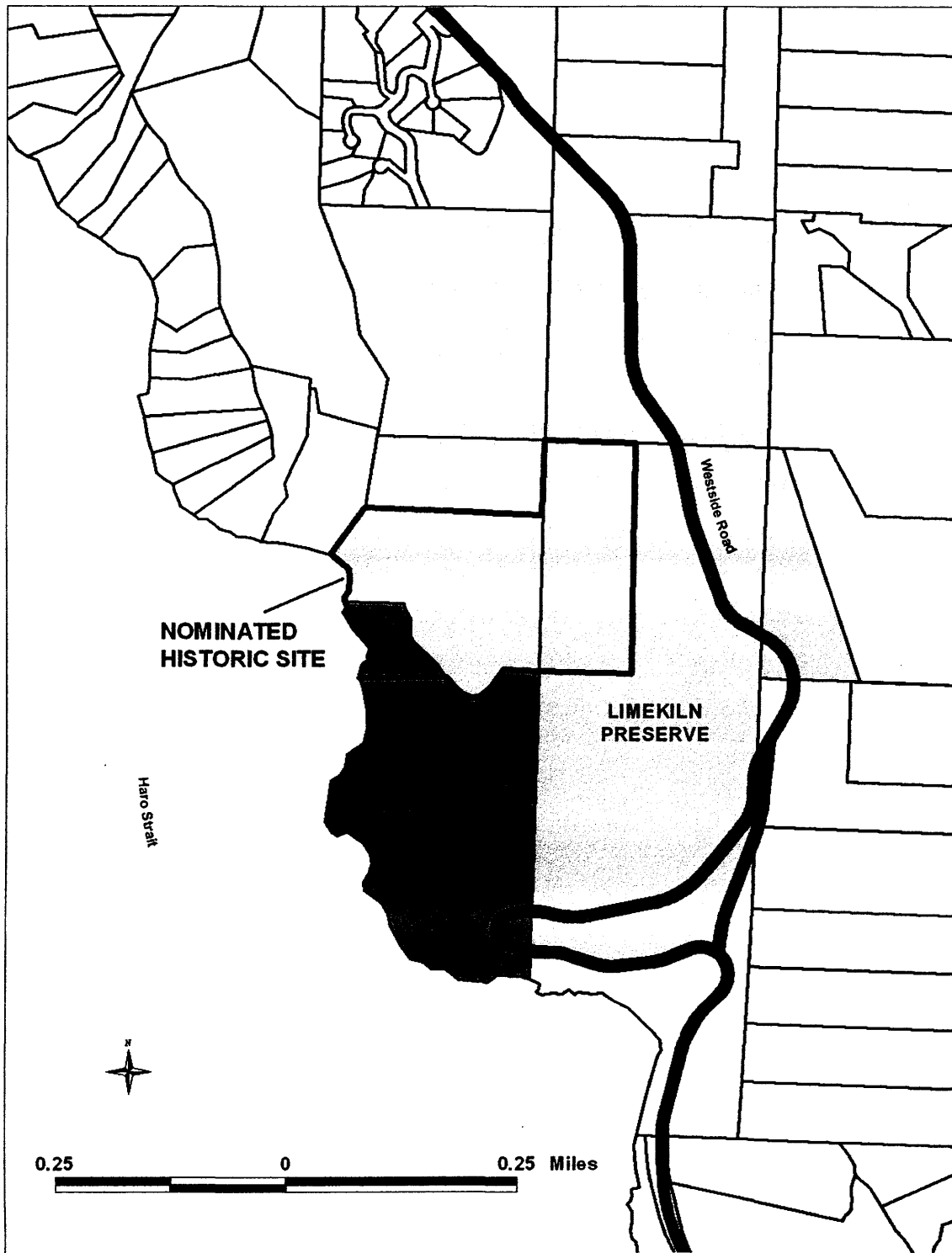
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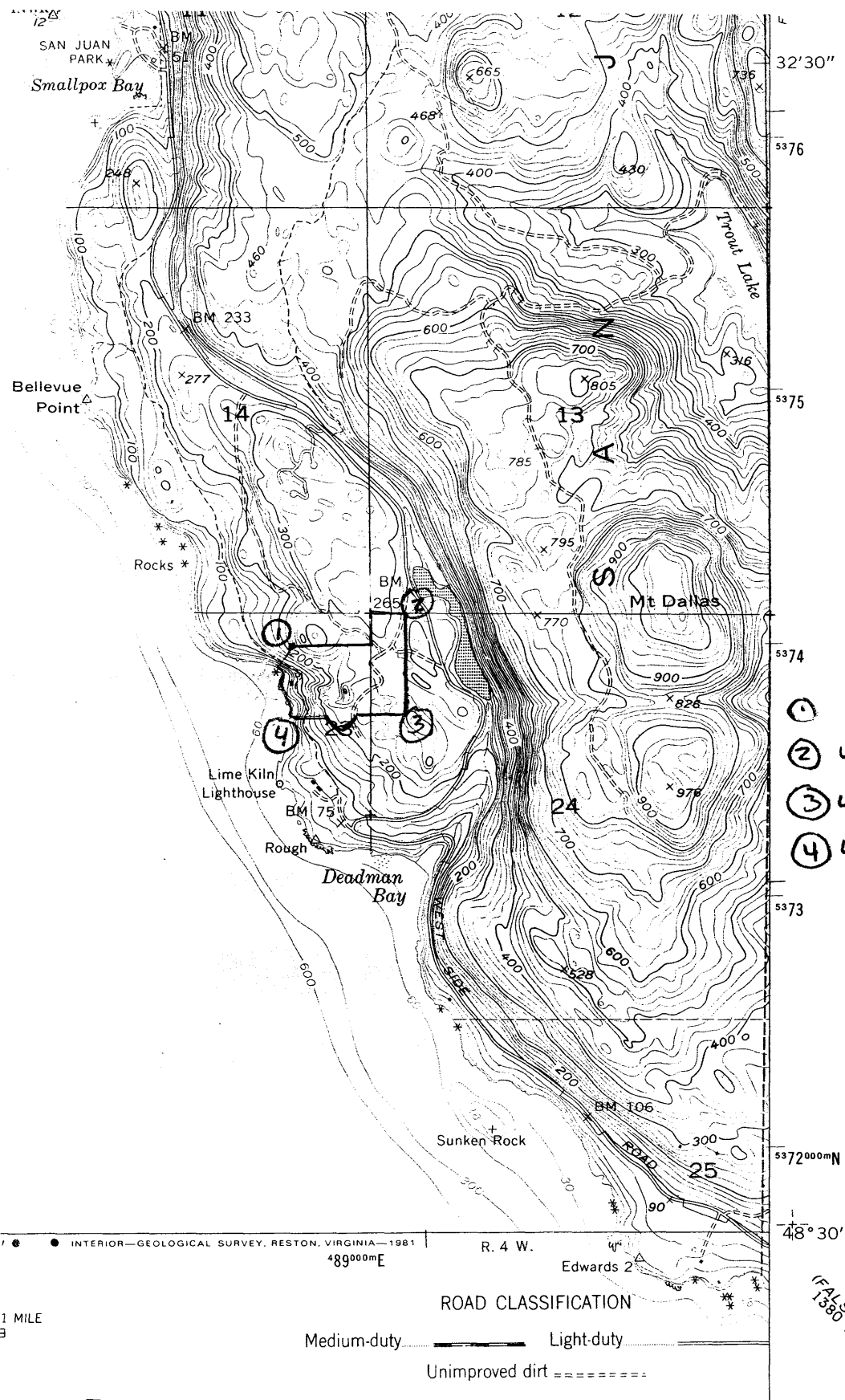


either San Juan County nor the Assessor warrants the accuracy, reliability or timeliness of any information provided. Any person or entity who relies on information obtained from this real property query does so at his or her own risk.

San Juan Lime Company/Cowell's
San Juan County, Washington
San Juan County Assessors Map with Tax Parcels and Nominated Site Boundaries
San Juan County Land Bank 2006



San Juan Lime Company/Cowell's
San Juan County, Washington
Property Boundaries with Proposed Site Boundary
San Juan County Land Bank 2006

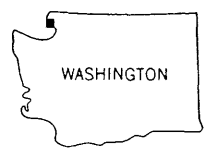


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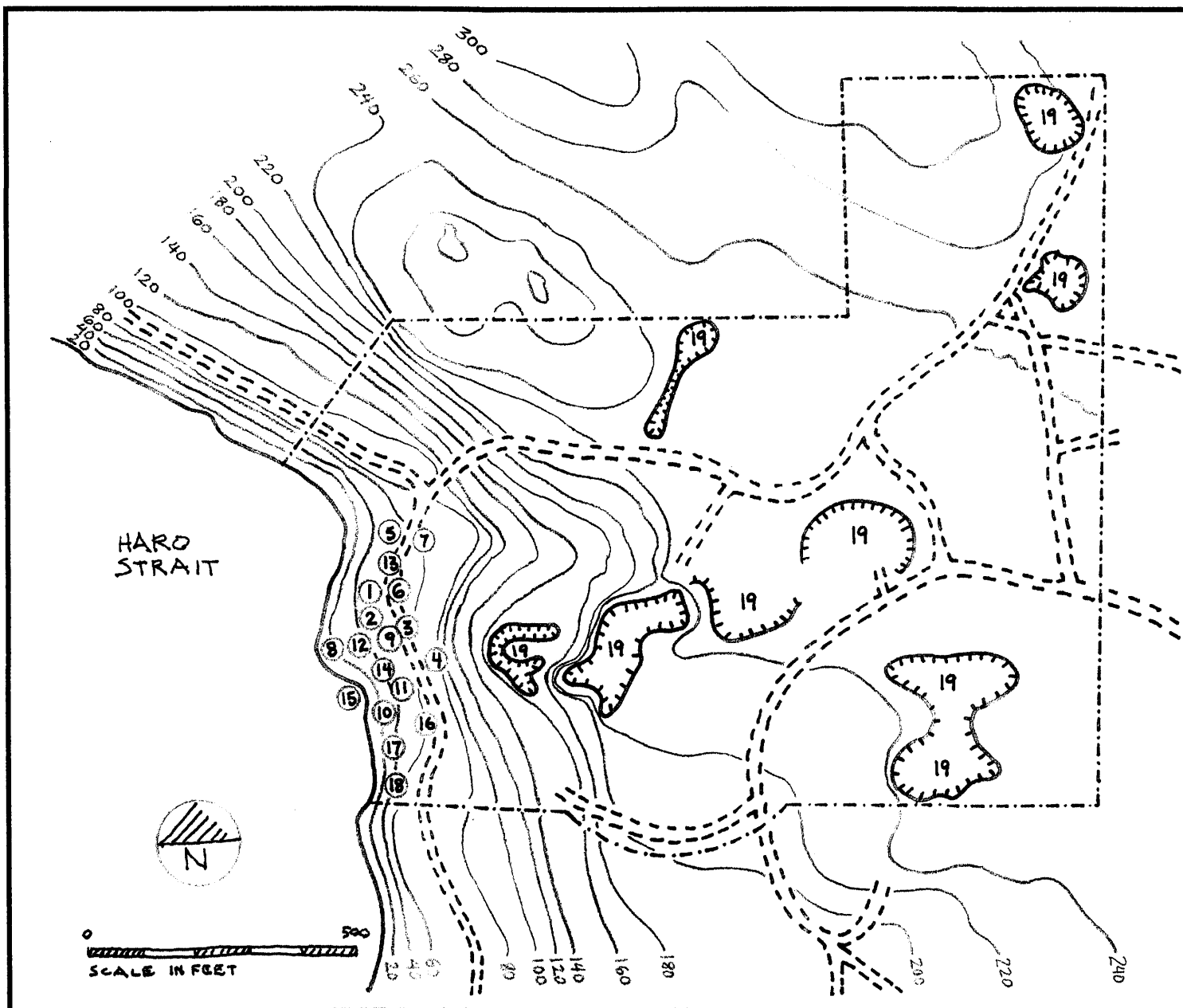
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- ④ 488796E 5373913N



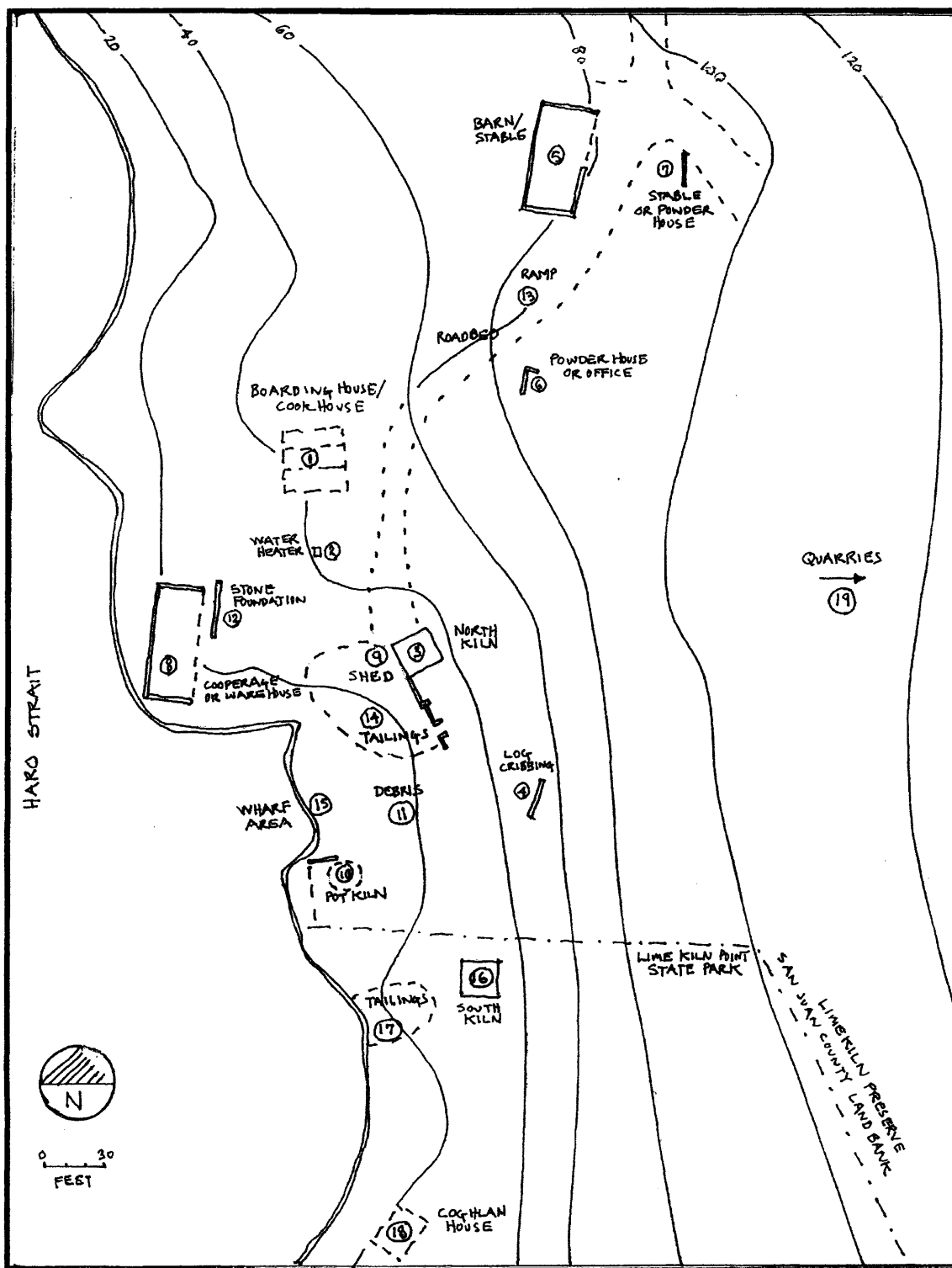
ROCHE HARBOR, WASH.
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Revisions shown in purple compiled by the Geological Survey from aerial photographs taken 1978 and other sources. This information not field checked. Map edited 1981

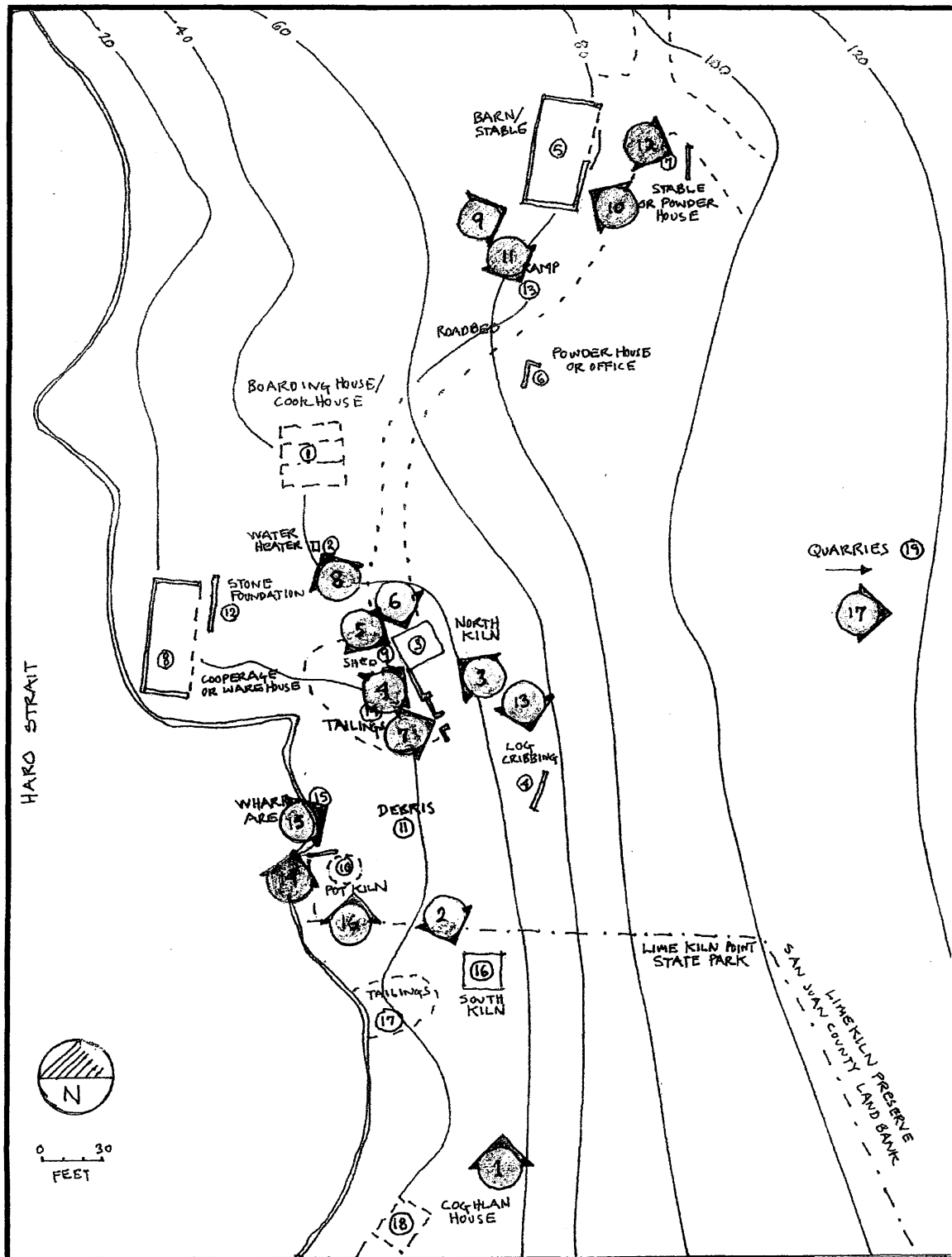
1954
PHOTOREVISED 1981
DMA 1381 II SW—SERIES V891



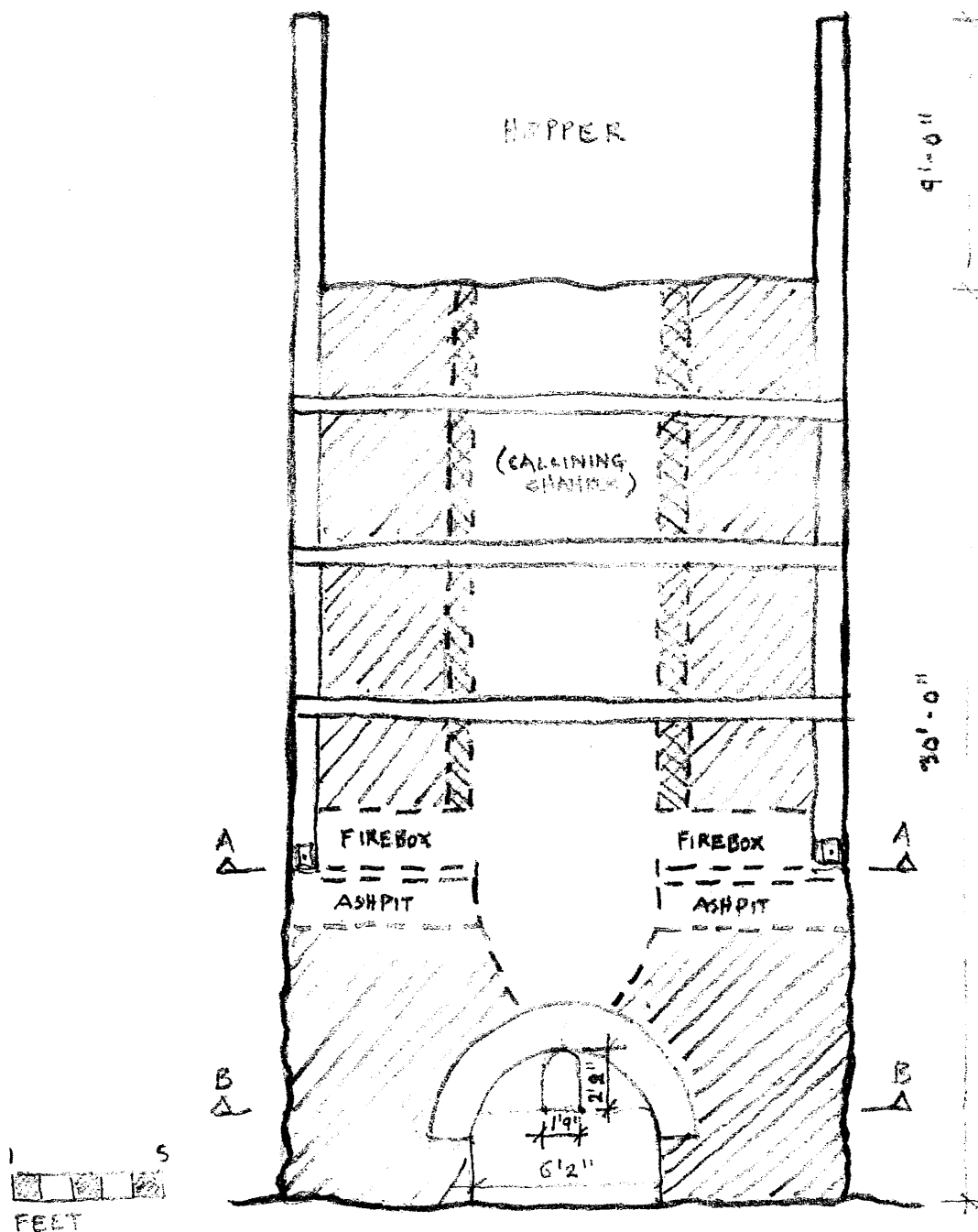
San Juan Lime Company/Cowell's
San Juan County, Washington
Detailed Site Map with Features Indicated
Boyd C. Pratt 2006



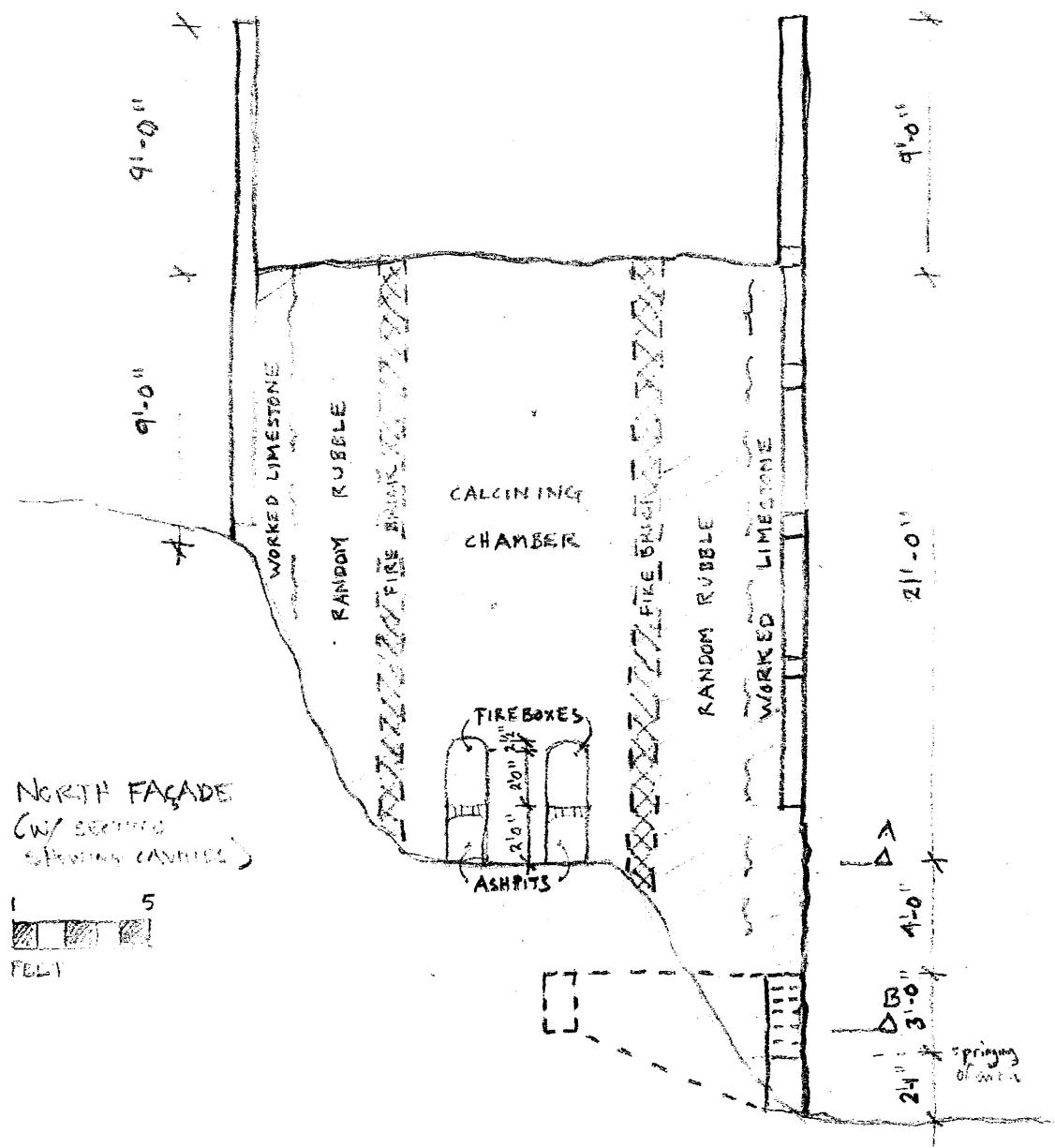
San Juan Lime Company/Cowell's
 San Juan County, Washington
Detailed Site Map with Features Indicated
 Boyd C. Pratt 2006



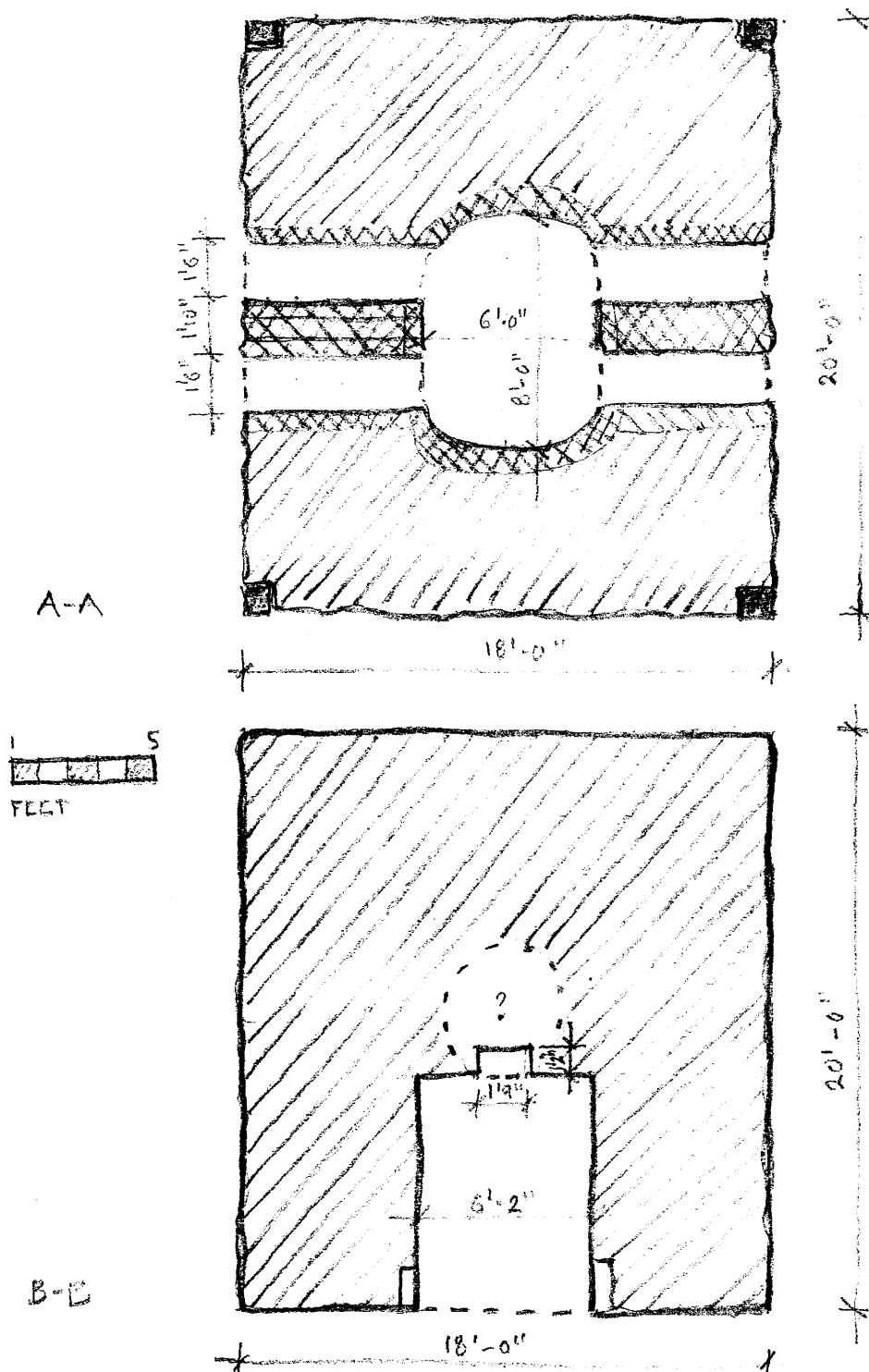
San Juan Lime Company/Cowell's
 San Juan County, Washington
Site Map with Photographic Views Indicated
 Boyd C. Pratt 2006



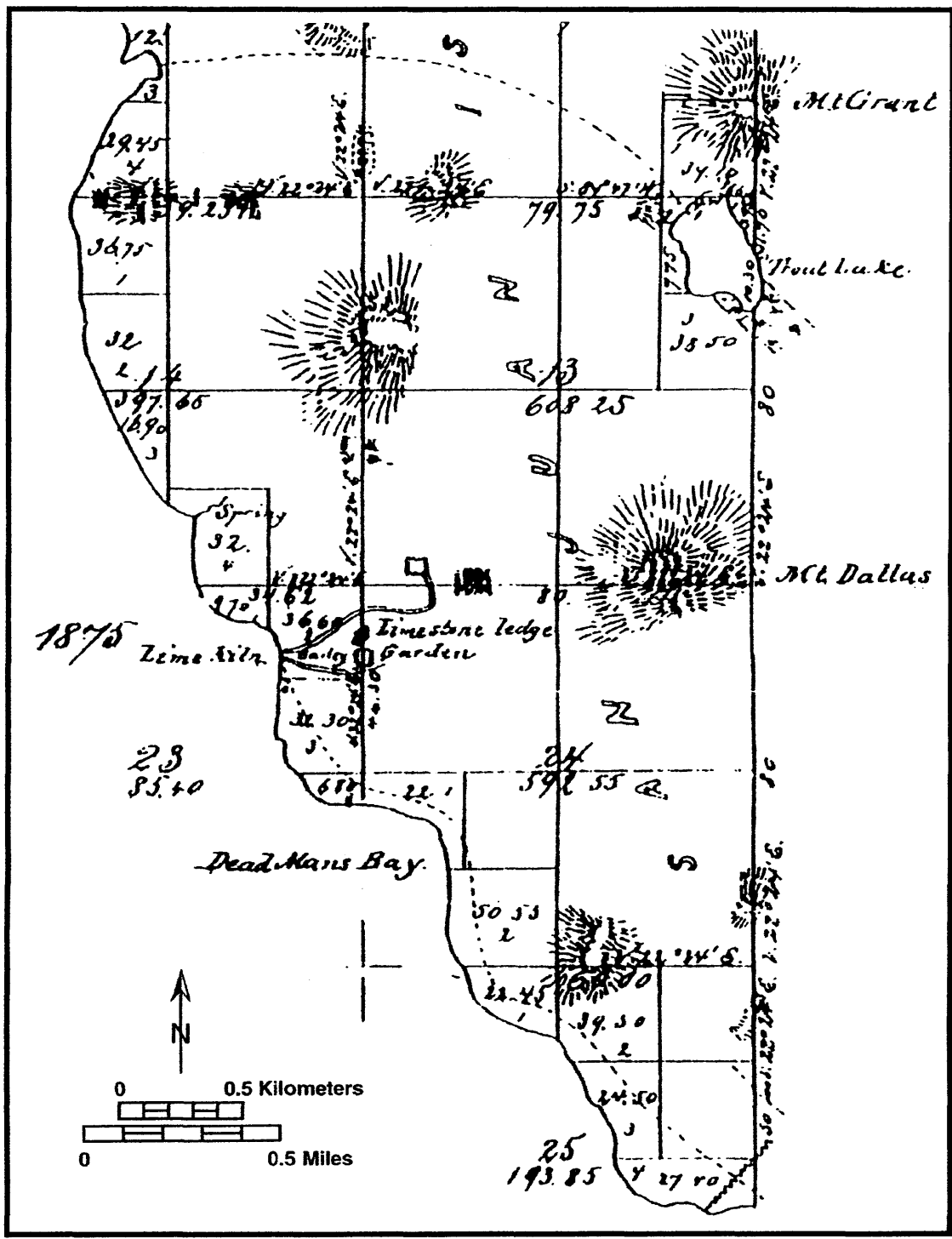
San Juan Lime Company/Cowell's
 San Juan County, Washington
North Kiln, West Elevation with Section Indicating Fireboxes and Calcining Chamber
 Boyd C. Pratt 2005



San Juan Lime Company/Cowell's
San Juan County, Washington
North Kiln, North Elevation with Section Indicating Calcining Chamber
Boyd C. Pratt 2005

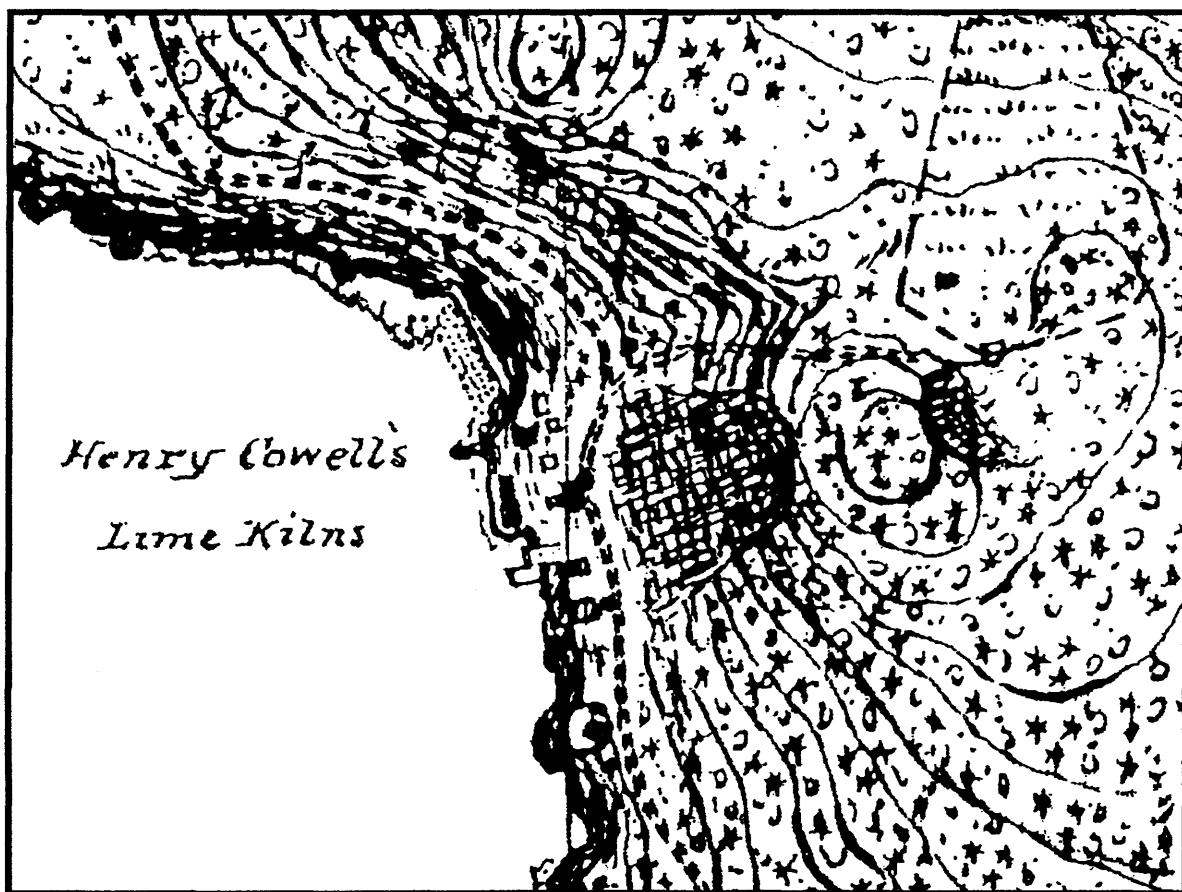


San Juan Lime Company/Cowell's
 San Juan County, Washington
North Kiln, Section A-A through the Fireboxes and B-B through the Removal Area
 Boyd C. Pratt 2005



LIME KILN

General Land Office Survey Plat, 1875
(Boswell and Hudson 2001)



HENRY COWELL'S LIME KILNS

**Detail from US Coast and Geodetic Survey Map
Topography of Washington Sound, Wash., San Juan and Henry Islands (1894)
(Boswell and Hudson 2001)**



**San Juan Lime Company/Cowell's
San Juan County, Washington**

Map of San Juan County Lime Kiln and Quarry Sites

Shading indicates areas of limestone deposits

**San Juan Lime Company/Cowell's
San Juan County, Washington**

Table of San Juan County Lime Kiln and Quarry Sites

#Name	Island	Location	History
1 <i>Wilson</i>	San Juan	Sec 29, 36-3W	pre1941 Everett Lime Co
2 <i>Krumdick</i>	San Juan	Sec 19, 36-3W	pre1941 quarrying
3 <i>Johnson</i>	San Juan	Sec 29, 36-3W	pre1941 Mitchell Bay Lime Co
4 <i>Eureka</i>	San Juan	Sec 34, 36-3W	pre1863, developed 1881-1890?
5 <i>Roche Harbor</i>	San Juan	Sec 23, 36-4W	pre1882; T&RH Lime Co 1886-1956
6 <i>Michell Bay</i>	San Juan	Sec 34, 36-4W	1933 Puget Sound Pulp & Timber Co
7 <i>Cowell's</i>	San Juan	Sec 23, 35-4W	1860-1886 SJ Lime Co; 1886-1957 Cowell's
8 <i>Limestone Point</i>	San Juan	Sec 18, 36-3 W	pre1927 Roche Harbor Lime & Cement
9 <i>Rocky Bay</i>	San Juan	Sec 29, 36-3 W	ca. 1929 pulp mill quarrying
10 <i>White Point</i>	San Juan	Sec 15, 36-4W	1923-? Orcas Lime Company
11 <i>Chuckanut</i>	Orcas	Sec 23, 37-1W	pre1925 Chuckanut Limestone Co.
12 <i>Payton (Flaherty)</i>	Orcas	Sec 19, 37-1W	???
13 <i>(Port) Langdon</i>	Orcas	Sec 25, 37-2W	1862 George Shotter; 1874 McLachlan et al.
14 <i>Red Cross</i>	Orcas	Sec 20, 37-2W	pre1943 RH?; 1940s Everett Lime Co.
15 <i>Soderberg</i>	Orcas	Sec 29/30, 37-2W	pre1927 Soderberg; Cowell; Everett Lime Co.
16 <i>Imperial Lime Co</i>	Orcas	Sec 31, 37-2W	Imperial Lime Co.; Cowell
17 <i>McGraw Kittinger</i>	Orcas	Sec 2, 36-2W	post 1927 Westerman Lime & Rock; Everett
18 <i>Pineo</i>	Orcas	Sec 3, 36-2W	1934-36 Soundview Company (Everett)
19 <i>West Sound</i>	Orcas	Sec 9, 36-2W	ca1935 Roche Harbor Lime & Cement Co
20 <i>Deer Harbor</i>	Orcas	??	??
21 <i>Cliff Island</i>	Cliff	Sec 25, 36-3W	1888-94 Tift; 1947 Manufacturers Mineral Co.
22 <i>Crane Island</i>	Crane	Sec 30/19, T 36-2W	???
23 <i>Henry Island</i>	Henry	Sec 15, 36-4W	pre1925 Roche Harbor Lime & Cement
24 <i>Lutz Quarry</i>	Shaw	Sec 30, 36-2W	1890s Tift

Sources: Danner 1966; Landes 1902; Mathews 1947.

Abbreviations:

Cowell's = Cowell Lime & Cement Company

Everett = Everett Lime Company

RH = Roche Harbor & Tacoma Lime Company

Note: "pre" and "post" preface specific dates given by sources for reports that documented ownership and use of the various sites.

Chart 1. San Juan Lime Company, 1860-1876

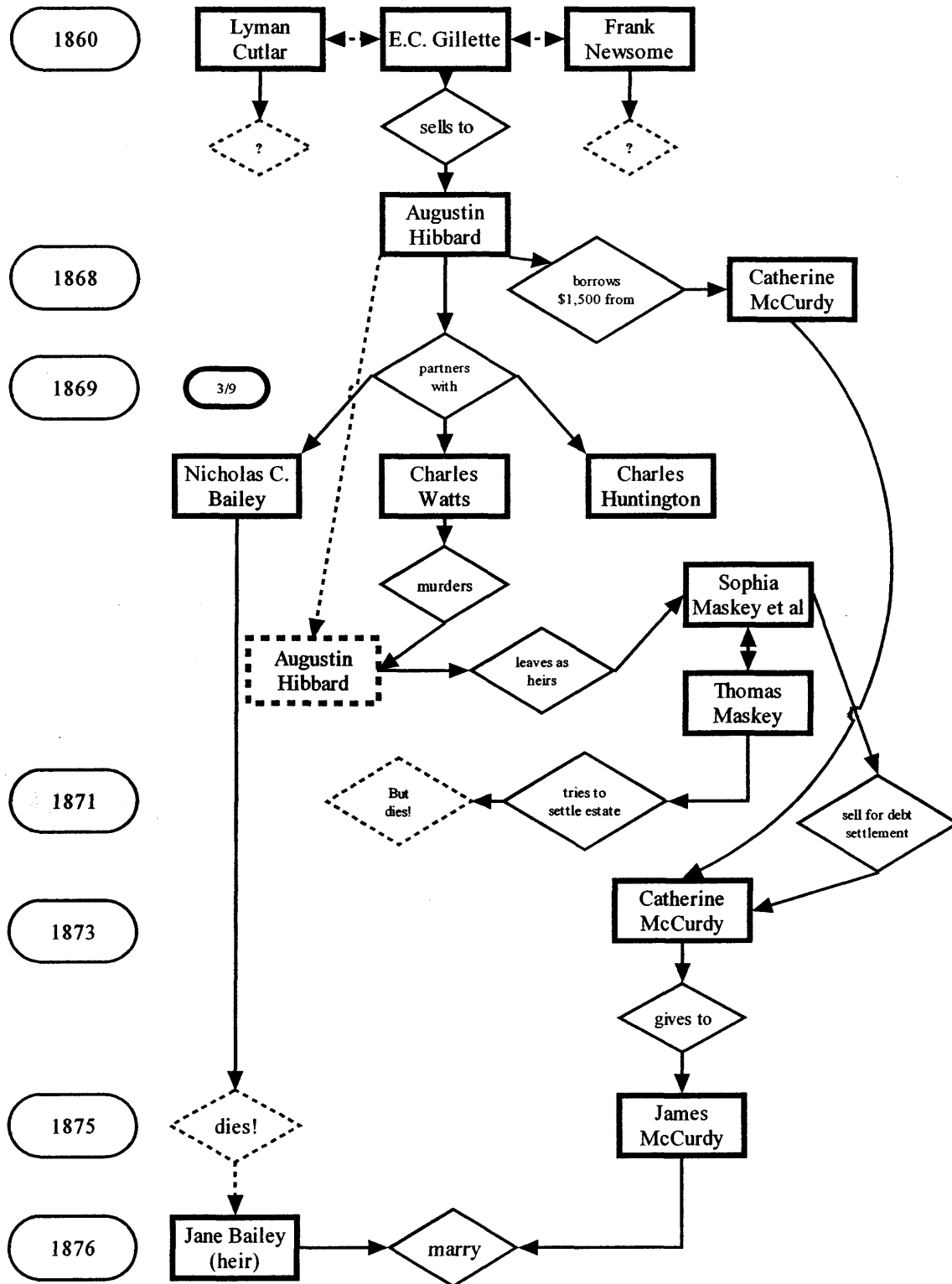
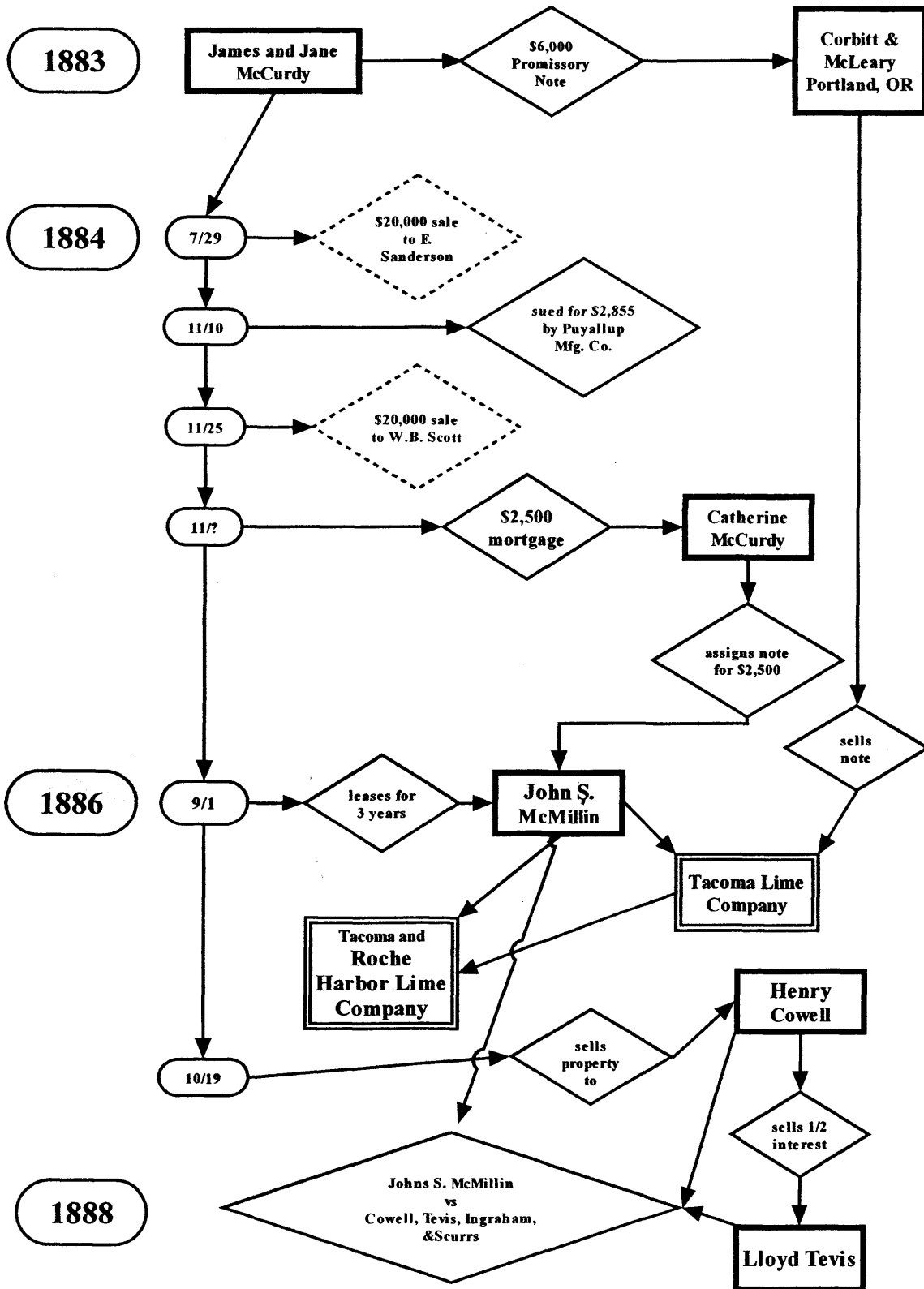
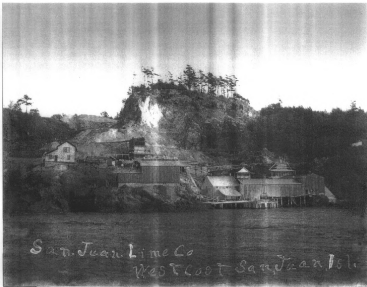


Chart 2. San Juan Lime Company, 1883-1888





San Juan Lime Co
West Coast San Juan Isl.





JULY 1902



JULY 1969



