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SUPPORTERS OF THE COMSTOCK: HISTORICAL ARCHAEOLOGY OF THE CARSON RIVER MERCURY SITE, DAYTON AND SILVER CITY, NEVADA

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E & E Project No. ZU1050
Summit/ARS Project No. 1375-001/978
State Permit No. 258

April 4, 2001

VOLUME 1

Environmental Engineering and Consulting Services

Summit Envirosolutions®

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VOLUME 1

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TABLE OF CONTENTS

CHAPTER 1

1.0 INTRODUCTION by Ronald L. Reno and Vickie L. Clay 1.1

1.1 THE CARSON RIVER MERCURY SITE 1.8
PROJECT DESCRIPTION 1.8
MS001 NORTH 1.8
MS001 SOUTH 1.11
MS002 . . . . . 1.11
MS004 . . . . . 1.12
MS030 . . . . . 1.12

1.2 THE SETTING 1.13
DAYTON 1.13
SILVER CITY 1.14

1.3 METHODS 1.15
HISTORICAL RESEARCH 1.15
INFORMAL INVENTORY 1.15
ARCHAEOLOGICAL INVENTORY AND EVALUATION 1.15
MS001 . . . . . 1.16
MS004 . . . . . 1.17
MS030 . . . . . 1.18
ARCHAEOLOGICAL MONITORING 1.18
ARCHAEOLOGICAL DATA RECOVERY 1.19
MS001 North 1.19
MS004 . . . . . 1.19
STRATIGRAPHIC ANALYSIS by Vickie L. Clay 1.20
LABORATORY PROCESSING AND ANALYSIS by C. Lynn Furnis
and Jeanne Albin 1.21
Cataloging 1.21
Organization of Artifacts Within Functional Categories 1.22
Artifact Analysis 1.22
Determining Minimum Numbers of Items (MNI) 1.23
Crossmending 1.24
Data Entry and Manipulation 1.24
Artifact References 1.25
FAUNAL REMAINS by Dave N. Schmitt, Jason Fancher, and

Sabra Gilbert-Young 1.26
SAFETY CONCERNS 1.26

1.4 RESEARCH ORIENTATION 1.29
MILLING 1.30
COMMUNITY 1.32
TRANSPORTATION 1.33
WATER SUPPLY 1.34
SIGNIFICANCE 1.35

1.5 REPORT ORGANIZATION 1.36

CHAPTER 2

2.0 MILLING ON THE COMSTOCK by Ronald L. Reno 2.1

2.1 EARLY EXPERIMENTS 2.1

2.2 THE WASHOE PAN PROCESS 2.5

2.3 CONSOLIDATION 2.14

2.4 TAILINGS MILLS 2.15

2.5 LEACHING, FLOTATION AND OTHER LATE DEVELOPMENTS 2.16

2.6 ASSAYING 2.16

2.6 SUMMARY 2.18

CHAPTER 3

3.0 KELLER & COMPANY MILL by Ronald L. Reno, Vickie L. Clay and C. Lynn Furnis 3.1

3.1 HISTORICAL ACCOUNTS 3.1

3.2 THE MAIN MILL AREA 3.9
MILL AREA ARTIFACTS (Fea 1) by C. Lynn Furnis 3.18

3.3 ASSAY AREA (Fea 6) 3.22
ASSAY AREA ARTIFACTS (Fea 6) 3.28

3.4 TAILINGS 3.33
MS001 NORTH TAILINGS 3.33
MS001 SOUTH TAILINGS 3.33

3.5 OTHER MILL FEATURES AND ARTIFACTS 3.37
ROCK POINT DITCH 3.37
Historic Context 3.37
Physical Remains 3.38
Ditch Summary 3.40

3.6 SUMMARY 3.40

CHAPTER 4

4.0 BIRDSALL AND CARPENTER MILL by Ronald L. Reno,
Vickie L. Clay, and C. Lynn Furnis 4.1

4.1 HISTORICAL ACCOUNTS 4.1

4.2 A PREDICTIVE MODEL 4.7
WASHOE PAN MILL 4.7
TAILINGS MILL 4.12
TAILINGS 4.14
REFINERY AND BLUESTONE PLANT 4.16
Sulphuric Acid Works 4.19
Bluestone Works 4.21
Ziervogel Process 4.21
THE PECK CONCENTRATOR 4.22

4.3 ARCHAEOLOGY OF THE BIRDSALL AND CARPENTER
QUARTZ MILL (1865-1869) 4.26

4.4 ARCHAEOLOGY OF THE LYON TAILINGS MILL AND
ASSOCIATED FACILITIES (1869-1896) 4.29
INSIDE THE MILL BUILDING AND ACCESS ROUTES 4.32
THE FURNACE HOUSE AND BULLION/TAILINGS BINS 4.41
MISCELLANEOUS HILLSIDE FEATURES 4.56

THE MILL YARD 4.62

4.5 ARCHAEOLOGY OF THE PECK MILL (1897)
AND POST-MILL USE (1897-2000) 4.66

4.6 TAILINGS 4.77

4.7 CHEMICAL AND SEDIMENT ANALYSES 4.77

4.8 DAYTON, CARSON VALLEY & SUTRO RAILROAD 4.81

4.10 SUMMARY 4.82

CHAPTER 5

5.0 SILVER CITY MINES, MILLS, AND COMMUNITY by Ronald L. Reno,
Vickie L. Clay, and C. Lynn Furnis 5.1

5.1 SILVER CITY: A COMMUNITY BASED ON MINES, MILLS, AND
TRANSPORTATION 5.1

5.2 DOCUMENTED ACTIVITIES NEAR MS030 . . . . . 5.5

5.3 ARCHAEOLOGICAL REMAINS AT MS030 . . . . . 5.7
PLACER MINING 5.7
MILLING 5.11
TRANSPORTATION AND MATERIALS STORAGE 5.11
DUMP by C. Lynn Furnis 5.11

5.4 SUMMARY 5.14

CHAPTER 6

6.0 THE COMMUNITY OF DAYTON by C. Lynn Furnis, Vickie L. Clay,
Dave Schmitt, Jason Fancher, and Sabra Gilbert-Young 6.1

6.1 COMMUNITY AS A THEORETICAL FRAMEWORK 6.3
ARCHAEOLOGICAL AND HISTORICAL RECORDS
RELATING TO DAYTON 6.5
Dayton in the Late 1860s 6.5

Dayton in the 1880s 6.6
Dayton in the 1890s 6.8

6.2 GENERAL SITE SURFACE ARTIFACTS (MS001) 6.8
SURFACE ARTIFACT CONCENTRATION (MS001) 6.10

6.3 ARTIFACTS FROM THE KELLER & CO MILL SITE (FEA 1, MS001) 6.11

6.4 ARTIFACTS FROM THE ASSAY OFFICE (FEA 6, MS001) 6.17
FEA 6, STR 2 . . . . . 6.18
Str 2 Discussion 6.26
FEA 6, STR 9 . . . . . 6.26
Str 9 Discussion 6.33
SUMMARY REMARKS ABOUT STR 2 AND STR 9 ARTIFACTS , FEA 6 . . . . 6.35

6.5 DOMESTIC TRASH DUMP (FEA 5, MS001) 6.35
ARTIFACTS FROM FEA 5 . . . . . 6.36
Fea 5 Discussion 6.45

6.6 DOMESTIC TRASH DUMP (FEA 7, MS001) 6.48
ARTIFACTS FROM FEA 7 . . . . . 6.48
Fea 7 Discussion 6.60

6.7 RIVER STREET DUGOUT (MS004, FEA I-8) 6.63
DUGOUT ARTIFACTS (FEA I-8) 6.63

6.8 DISCUSSIONS AND COMPARISONS OF THE FAUNAL ASSEMBLAGES
FROM MS001 AND MS004 . . . . . 6.67
SUMMARY 6.69

6.9. RESEARCH QUESTIONS 6.71

CHAPTER 7

7.0 TRANSPORTATION AND THE CARSON RIVER ROUTE 7.1

7.1 HISTORICAL SUMMARY 7.1
EXPLORATION 7.1
OVERLAND TRAIL 7.1
PONY EXPRESS TRAIL 7.6

WAGON ROAD 7.6
LINCOLN HIGHWAY AND US 50 . . . . . 7.6

7.2 EXISTING REMAINS OF THE TRAIL AND ROAD SYSTEM 7.12

7.3 A SECTION THROUGH THE ROAD by Vickie L. Clay 7.12

7.4 SUMMARY 7.17

CHAPTER 8

8.0 THE ROSE DITCH 8.1

8.1 HISTORICAL SUMMARY 8.1

8.2 EXISTING REMAINS OF THE DITCH 8.4

8.3 SURFACE DITCH DETAILS AT MS004 . . . . . 8.12

8.4 A SECTION THROUGH THE ROSE DITCH 8.12

8.5 SUMMARY 8.15

CHAPTER 9

9.0 HISTORICAL ARCHEOLOGY ON THE COMSTOCK PERIPHERY by Ronald L. Reno 9.1

9.1 MILLING 9.2

9.2 COMMUNITY 9.5

9.3 TRANSPORTATION 9.7

9.4 GROUP SERVICES 9.8

9.5 SIGNIFICANCE 9.8

9.6 FUTURE RESEARCH 9.10

CHAPTER 10

10.0 REFERENCES CITED 10.1

LIST OF APPENDICES

APPENDIX A: IMACS Site Forms

APPENDIX B: Sediment and Chemical Analysis

APPENDIX C: Artifact Catalog (Available separately in electronic format)

APPENDIX D: The Process Used at the Comstock for Refining Coppery Bullion Produced by Amalgamating Tailings by A. D. Hodges, Jr., 1886

APPENDIX E: Supplementary Excavation Profiles for the Birdsall Mill, MS994

LIST OF FIGURES

Figure 1.0-1. Location map for the Carson River Mercury Site 1.2
Figure 1.0-2. Topographic map of the Comstock and peripheral areas 1.3
Figure 1.1-1. Carson River Mercury Project study areas in Dayton 1.9
Figure 1.1-2. Carson River Mercury Project study areas in Silver City 1.10
Figure 1.3-1. Major secondary beef cuts and economic ranks 1.27
Figure 1.3-2. Hand excavation at MS001 . . . . . 1.28
Figure 1.3-3. Monitoring at MS004 . . . . . 1.28
Figure 2.1-1. An arrastra 2.4
Figure 2.2-1. Sectional drawing of a typical Washoe Process pan mill 2.5
Figure 2.2-2. Interior of a small early Washoe pan mill 2.6
Figure 2.2-3. Generalized flow chart for the Washoe Process 2.8
Figure 2.2-4. Reconstructed flow sheet for the Washoe Pan Process as used at Butte Mill 2.9
Figure 2.2-5. Machinery used in a typical Washoe Process mill 2.11
Figure 3.1-1. Keller & Co. millsite surveyed on Nov. 20, 1862 . . . . . 3.4
Figure 3.1-2. Dayton shortly after the turn of the century and view today 3.7
Figure 3.1-3. Site map for the Keller & Co. Mill and other features at MS001 . . . . . 3.8
Figure 3.2-1. Stratigraphic profiles in Fea 1, Keller & Co. Mill, MS001 North 3.10
Figure 3.2-2. Photographs of arrastra stones at Keller & Co. Mill, MS001 . . . . . 3.14
Figure 3.2-3. Plan view of Fea 5 and excavation layout, Fea 1, Keller & Co. Mill, MS001 . . . . . 3.15
Figure 3.2-4. Harris matrix, photographs, and stratigraphic profile, TP1, TP2, TP3, Keller & Co. Mill, MS001 . . . . . 3.16
Figure 3.2-5. Attachment boss from a Washoe pan muller shoe at the Keller & Co. Mill 3.19
Figure 3.3-1. Plan view and profile locations in Fea 6, Keller & Co. Mill, MS001 . . . . . 3.23
Figure 3.3-2. Photograph and stratigraphic profiles in Fea 6 at Keller & Co. Mill, MS001 . . . . . 3.24

Figure 3.3-3. Stratigraphic profiles of north and south walls, Fea 6, Keller & Co. Mill, MS001 . . . . . 3.27
Figure 3.3-4. Typical assay office artifacts 3.30
Figure 3.4-1. Stratigraphic profiles for Tr3, Tr4A, Tr4B at Keller & Co. Mill, MS001 . . . . . 3.34
Figure 3.4-2. Stratigraphic profiles for EU1, EU4, EU5, EU6 at Keller & Co. Mill, MS001 . . . . . 3.36
Figure 4.0-1. Base map of the Carson River Mercury Site, MS004 . . . . . 4.2
Figure 4.0-2. Detail of portion of the Figure 4.0-1 base map 4.3
Figure 4.1-1. Overview of the Douglass Mill from the southeast, twentieth century 4.4
Figure 4.1-2. Close-up of the Douglass Mill from the southeast, twentieth century 4.5
Figure 4.1-3. The Douglass Mill from the east, twentieth century 4.6
Figure 4.2-1. Reconstructed layout of Birdsall & Carpenter's Washoe process quartz mill in 1865-1866 . . . . . 4.10
Figure 4.2-2. Reconstructed flow sheet for the Washoe Pan Process as used at Birdsall & Carpenter's quartz mill 1865-1866 . . . . . 4.11
Figure 4.2-3. Flow chart for the Lyon Mill constructed from data by Hodges 4.18
Figure 4.3-1. Birdsall & Carpenter Quartz Mill (1865-1896) archaeology 4.27
Figure 4.3-2. Fea J-9 palisade stamp area foundation and possible north wall of Birdsall & Carpenter Mill 4.28
Figure 4.4-1. Lyon Tailings Mill (1869-1897) feature map 4.30
Figure 4.4-2. Lyon Tailings Mill cross-section with archaeological and reconstructed data 4.31
Figure 4.4-3. Photographs of features exposed in EU13 and EU14, Lyon Tailings Mill, MS004 . . . . . 4.33
Figure 4.4-4. Photographs, Harris matrix and stratigraphic profile of TP2, Fea J-4, MS004 . . . . . 4.35
Figure 4.4-5. Stratigraphic profile, photograph and Harris matrix for EU9 in Loc J, MS004 . . . . . 4.37
Figure 4.4-6. Stratigraphic profile, photograph and Harris matrix for Tr6, Fea J-6, MS004 . . . . . 4.40
Figure 4.4-7. Archaeology of the bullion furnace room at the Lyon Mill 4.42
Figure 4.4-8. Archaeological evidence of west wall of bullion furnace room and roasting furnace 4.44
Figure 4.4-9. Photographs, Harris matrix and stratigraphic profile of EU1, Loc C, MS004 . . . . . 4.45
Figure 4.4-10. Harris matrix, photographs and stratigraphic profile of TP8, Fea C-2 and C-3 . . . . . 4.47
Figure 4.4-11. Harris matrix, photographs and stratigraphic profile of Tr 8, MS004 . . . . . 4.50
Figure 4.4-12. Photographs, Harris matrix and stratigraphic profile of Tr 9, MS004 . . . . . 4.51
Figure 4.4-13. Photographs, stratigraphic profile and Harris matrix of Tr 10, MS004 . . . . . 4.52
Figure 4.4-14. Artifacts from Loc D and Loc C, MS004 . . . . . 4.54

Figure 4.4-15. Photographs, Harris matrix and stratigraphic profile of TP6, Fea H-4 and Fea H-6, MS004 . . . . . 4.57
Figure 4.4-16. Stratigraphic profile, Harris matrix and photographs of Fea F-2 in TP5, MS004 . . . . . 4.60
Figure 4.4-17. Photograph and stratigraphic profile for Tr C in Loc I, MS004 . . . . . 4.63
Figure 4.4-18. Harris Matrix and stratigraphic profile for EU5 in Loc L, MS004 . . . . . 4.64
Figure 4.5-1. Peck Mill (1897) and post-mill feature map 4.67
Figure 4.5-2. Harris matrix, photographs and stratigraphic profiles for TP3 and TP4 at Birdsall & Carpenter Mill 4.69
Figure 4.5-3. Photographs, stratigraphic profile and Harris matrix for EU6 in Loc B/C, Lyon and Peck Mill periods, MS004 . . . . . 4.71
Figure 4.5-4. Harris matrix, photographs and stratigraphic profile TP9, Fea B-12 Peck Mill period 4.74
Figure 5.1-1. GLO township survey plat of Silver City, mapped in 1865-1867 . . . . . 5.2
Figure 5.1-2. Silver City as mapped by the Wheeler Survey in 1877 . . . . . 5.4
Figure 5.2-1. Portion of Silver City in American Ravine 5.6
Figure 5.3-1. Surface site map of Silver City site MS030 . . . . . 5.8
Figure 5.3-2. Subsurface deposits and cross-section location at Silver City site MS030 . . . . 5.9
Figure 5.3-3. Stratigraphic profile, Harris matrix, and photograph at Silver City site MS030 . . . . . 5.10
Figure 6.2-1. Site map for the Keller & Co. Mill and other features at MS001 . . . . . 6.9
Figure 6.4-1. Ornate black glass button, Fea 6 at MS001 . . . . . 6.25
Figure 6.4-2. Code, Elfelt & Co. Florida Water bottles, Fea 6 . . . . . 6.29
Figure 6.4-3. Powell stoneware bulk ink bottle, from Str 9, Fea 6, MS001 . . . . . 6.31
Figure 6.5-1. Miniature porcelain saucer, Fea 5, MS001 . . . . . 6.37
Figure 6.5-2. Selected butchered bones from Fea 5 . . . . . 6.39
Figure 6.5-3. Burgess & Goddard ceramic mark, Fea 5, MS-001 . . . . . 6.42
Figure 6.5-4. Ornate black glass button, Fea 5, MS001 . . . . . 6.44
Figure 6.5-5. Artifact time ranges from Fea 5, MS001 . . . . . 6.47
Figure 6.6-1. Plan view of Fea 7 and excavation layout at site MS001 . . . . . 6.49
Figure 6.6-2. Photograph, Harris matrix, and stratigraphic profile, EU1, Fea 7, MS001 . . . 6.50
Figure 6.6-3. Selected butchered beef, pork, and lamb bones from Fea 7 . . . . . 6.53
Figure 6.6-4. Prince of Wales ceramic mark on wie saucer base, Fea 7, MS001 . . . . . 6.57
Figure 6.6-5. Toy teacup of porcelain from Japan, Fea 7, MS001 . . . . . 6.61
Figure 6.7-1. Fea I-8 dugout plan view and photographs of floor 6.64
Figure 6.7-2. Photograph and stratigraphic profile for Tr A and Fea I-8 dugout in Loc I, MS004 . . . . . 6.68
Figure 6.8-1. Proportions of pork, lamb, and beef bones from feature investigations at 26Ly529 . . . . . 6.70
Figure 6.8-2. Proportions of pork, lamb, and beef bones recovered from selected Chinese historic sites/components in California and Nevada 6.70

Figure 6.9-1. Proportions of pork, lamb, and beef bones recovered from selected Euroamerican sites/contexts in Nevada 6.77
Figure 7.1-1. Recorded exploration in Nevada during the 1800s 7.2
Figure 7.1-2. Captain James Simpson's travels through Nevada in 1859 . . . . . 7.4
Figure 7.1-3. GLO 1866 T.16N, R.21E 7.5
Figure 7.1-4. Pony Express Route through western Nevada with stations 7.7
Figure 7.1-5. The Lincoln Highway Association map of the route across western Nevada . . 7.9
Figure 7.1-6. NSDH 1932 map of Route 2A (alternate Lincoln Highway) 7.10
Figure 7.1-7. NSDH 1932 plan indicating cross sections of road at stake and location of project trench 7.11
Figure 7.2-1. Site location map of Lincoln Highway segment in project area 7.13
Figure 7.3-1. Stratigraphic profile, photograph of strata, Harris matrix and location map of Lincoln Highway in Dayton 7.14
Figure 7.3-2. Overview of abandoned segment of US Hwy 50 before trenching 7.16
Figure 7.3-3. View toward Dayton on abandoned segment of US Hwy 50 . . . . . 7.16
Figure 7.3-4. Lincoln Highway gravel stratigraphy 7.18
Figure 8.0-1. Location map for the Rose Ditch 8.2
Figure 8.2-1. Portion of the Rose Ditch south of US Hwy 50 . . . . . 8.5
Figure 8.2-2. Start of northeast portion of the Rose Ditch from US Hwy 50 . . . . . 8.5
Figure 8.2-3. Typical hillside segment of the Rose Ditch southwest of Dayton 8.7
Figure 8.2-4. Rock retaining wall in the Rose Ditch revealed by berm collapse 8.7
Figure 8.2-5. Rose Ditch southwest Dayton 8.8
Figure 8.2-6. Detail of location selected for diversion and culvert 8.8
Figure 8.2-7. Erosional damage to Rose Ditch berm southwest of Dayton 8.9
Figure 8.2-8. Typical segment of Rose Ditch above the Birdsall Mill 8.9
Figure 8.2-9. Modern storm water diversion dam in the Rose Ditch southwest of the Birdsall Mill 8.10
Figure 8.2-10. Gully below modern storm water diversion dam in the Rose Ditch southwest of the Birdsall Mill 8.10
Figure 8.2-11. Terrace or road above the Rose Ditch above Birdsall Mill 8.11
Figure 8.2-12. Reservoir at the northern terminus of the Rose Ditch 8.11
Figure 8.4-1. Harris matrix, stratigraphic profile, and photograph of trench through the Rose Ditch berm 8.13

LIST OF TABLES

Table 1.0.1. Archaeological Sites and Loci at the Carson River Mercury Site 1.3
Table 1.0.2. Summary of Cultural Resources Work Associated with the Carson River Mercury site 1.5
Table 3.1-1. Periods at the Keller & Co. Mill and Vicinity of MS001 ..... 3.2
Table 3.2-1. Mill-related Artifacts from Fea 1, Testing Phase at the Keller & Co. Mill Site, MS001 ..... 3.21
Table 3.2-2. Mill-related Artifacts from Fea 1, TP3, at the Keller & Co. Mill Site, MS001 ..... 3.22
Table 3.3-1. Mill-related Artifacts from the Keller & Co. Mill Site Assay Office, Fea 6, MS001 ..... 3.31
Table 4.2-1. Periods at the Birdsall Mill and Vicinity of MS004 ..... 4.8
Table 4.2-2. Items at Sheriff's Sale of Peck's Improvements to the Douglass Mill 4.24
Table 4.4-1. Architectural Artifacts from Loc C, Loc D, and Loc E at the Lyon Mill Site, MS004 ..... 4.53
Table 4.7-1. Chemical sample analyses for MS004 ..... 4.78
Table 4.7-2. Ratios of Mercury to Gold and Silver at the Area of High Mercury Concentration at MS004 ..... 4.80
Table 5.3-1. Artifacts Observed at MS030 ..... 5.14
Table 6.2-1. Surface Artifacts from MS001 Grouped by Functional Category 6.11
Table 6.3-1. Domestic Artifacts from Fea 1, Testing Phase at the Keller & Co. Mill Site, MS001 ..... 6.12
Table 6.3-2. Domestic Artifacts from Fea 1, TP3, at the Keller & Co. Mill Site, MS001
Table 6.3-3. Number of Identified Animal Bones per Taxon/Animal Size Class from Feature Investigations and Loc I 6.15
Table 6.3-4. Numbers of Identified Large Mammal Bone and Large Mammal Bone Fragments by Stratum, Fea 1 ..... 6.15
Table 6.4-1. Non-mill Artifacts from the Assay Office, Fea 6, MS001, Summarized by Functional Group 6.17
Table 6.4-2. *Termini Post Quem* and Estimated Years of Deposition for Assay Office, Fea 6, Strata 6.19
Table 6.4-3. Artifacts from Selected Strata within the Assay Office, Fea 6, Organized by Function 6.20
Table 6.4-4. Types and Numbers of Identified Beef, Pork, and Lamb Bones from Fea Investigations 6.22
Table 6.4-5. Numbers of Identified Large Mammal Bone and Large Mammal Bone Fragments from Selected Strata and Assay Area 1, Fea 6 ..... 6.23
Table 6.4-6. Types and Numbers of Identified Beef Cuts recovered from Stratigraphic Excavations, Fea 6 ..... 6.23
Table 6.4-7. Embossings on Florida Water Bottles Reused as Ketchup Bottles from Fea 6, Str 9 ..... 6.28
Table 6.4-8. Personal Artifacts from Str 9, Assay Office, Fea 6, MS001 ..... 6.32

Table 6.4-9. Known Manufacturers and Origins of Str 9 Artifacts, Assay Office (Fea 6) 6.34
Table 6.5-1. Fea 5 Artifacts by Functional Group, from MS001 . . . . . 6.36
Table 6.5-2. Architectural Artifacts from Fea 5, MS001 . . . . . 6.38
Table 6.5-3. Food-related Artifacts from Fea 5, MS001 . . . . . 6.40
Table 6.6-1. Artifacts from Fea 7, Organized by Functional Group, MS001 . . . . . 6.48
Table 6.6-2. Food-related Artifacts from Fea 7, MS001 . . . . . 6.55
Table 6.8-1. Numbers of Beef Bones by Economic Rank/Quality from Fea Investigations, 26Ly529 . . . . . 6.67
Table 6.9-1. Ceramic Makers' Marks from MS001, Trash Dump Features 6.74

1.0 INTRODUCTION

by Ronald L. Reno and Vickie L. Clay

With discovery of placer gold along the Carson River near present-day Dayton, a small-scale placer mining district came into existence. Placer mining rapidly spread into nearby canyons and supported several tiny settlements along with support features such as roads and ditches. Completely overshadowed by mining events in California, the district was a mining sideshow until 1859 when discovery of lode silver and gold mines caused the ensuing "Rush to Washoe" and rapid development of an outpost of frontier industrialism. The location of these communities in relation to one another and to local topography is shown in Figures 1.0-1 and 1.0-2.

A side-effect of this development was a need to import massive quantities of mercury (quicksilver) to enable successful recovery of the silver and gold in mills built for that purpose throughout the district. Despite strenuous efforts to recycle this expensive reagent, loss was inevitable. Most of the imported mercury remains scattered throughout the district in various forms of deposits and in various chemical combinations.

This report is an outgrowth of efforts by the United States Environmental Protection Agency (EPA) to cleanup areas where the mercury attains high enough levels to pose a health risk to the current population. This cleanup involved removing soil to safer repositories elsewhere. An unavoidable aspect of this cleanup was disturbance of portions of the rich archaeological record of the Comstock. Archaeological sites at the EPA study areas are summarized in Table 1.0-1.

The primary goal of the work reported here was for Archaeological Research Services, Inc. (ARS) and later, Summit Envirosolutions (following its acquisition of ARS), to provide archaeological services to the EPA designed to comply with requirements of Section 106 of the *National Historic Preservation Act* for agencies to avoid or minimize adverse effects to significant archaeological properties eligible for the *National Register of Historic Places* (NRHP). ARS's work was done under contract with Ecology and Environment (E&E). Fieldwork was done in several phases from 1996 through 1999. These phases are summarized in Table 1.0-2 and discussed in further detail below.

The first phase of study was an informal reconnaissance of the study area in March and April 1996, reported in Reno (1996). This phase resulted in recommendations for further archaeological work likely to be needed to take the project through to completion.

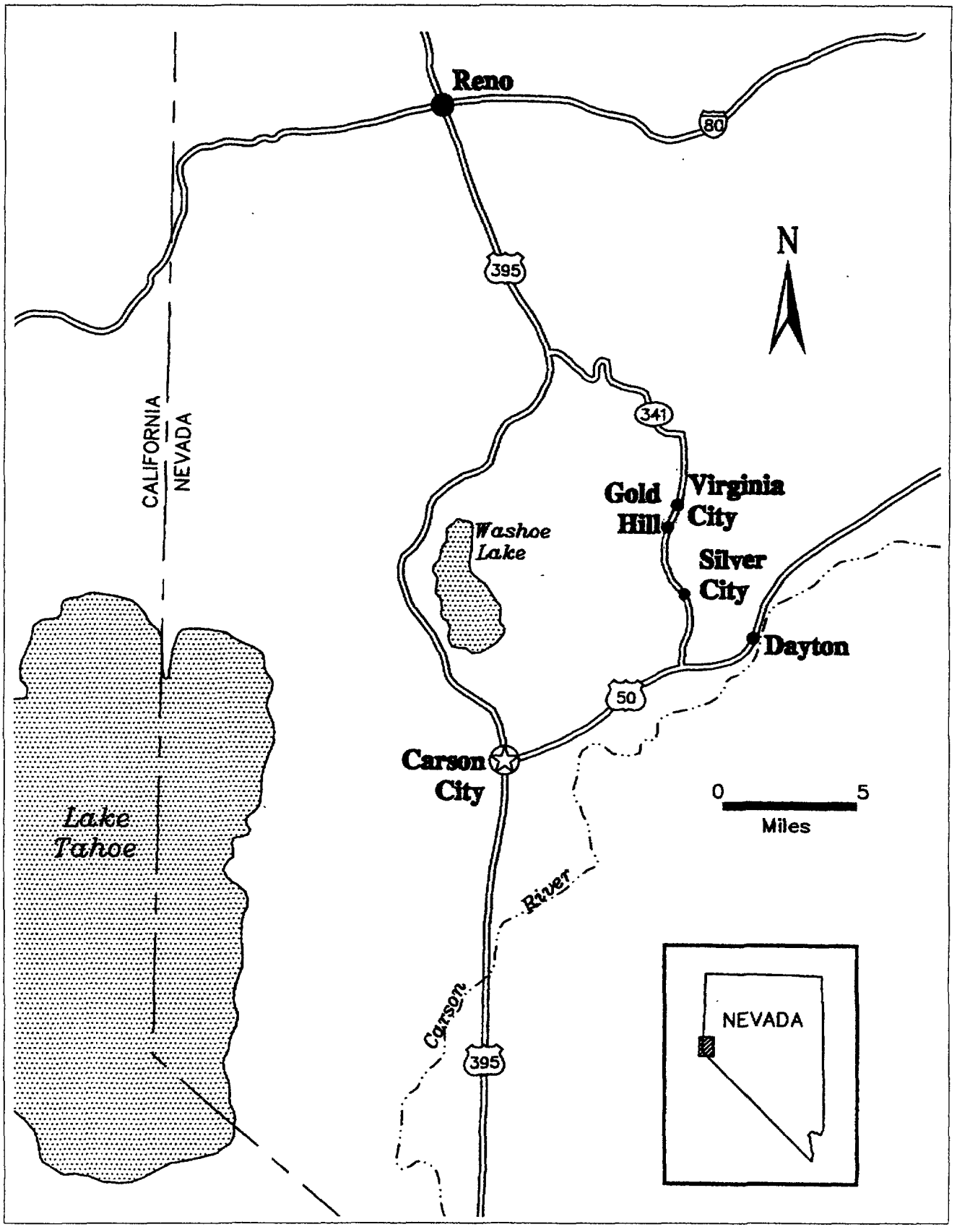


Figure 1.0-1. Location map for the Carson River Mercury Site at Dayton and Silver City, Nevada.

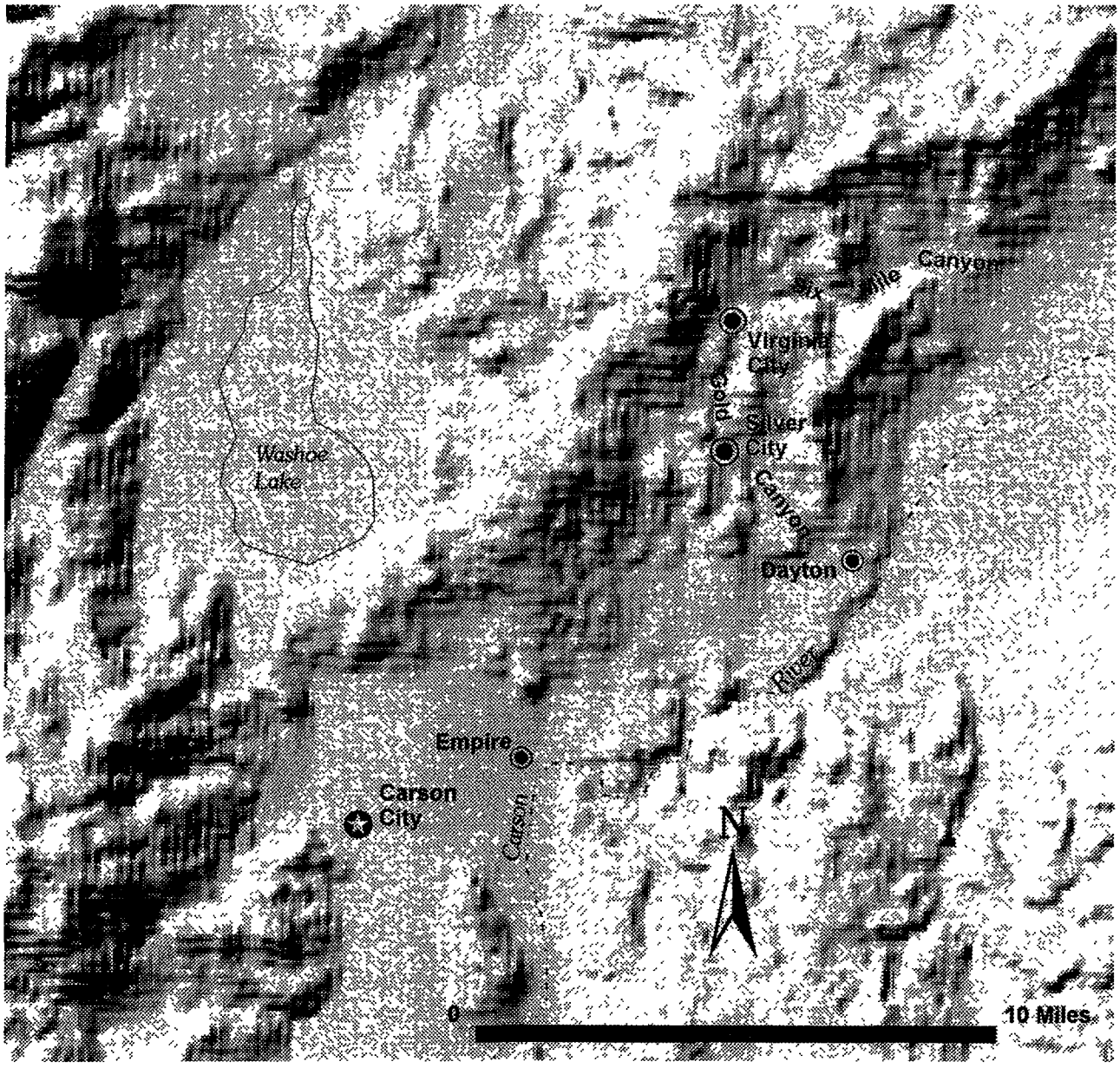


Figure 1.0-2. Topographic map of the Comstock and peripheral areas.

Table 1.0-1. Archaeological Sites and Loci at the Carson River Mercury Site.

Location	State No. 26Ly	BLM No. CrNV-03-	Temp/ Locus No.	Name	Relation of Project Area to:		Archaeological Work Level		
					Comstock Historic Dist. (State)	Virginia City Historic Dist (Federal)	Surface Recording	Monitoring	Excavation
DAYTON									
MS001	529	1581	894-1	Dayton: Keller & Co. Mill etc.	Outside	Outside	X	X	X
			894-2	Dayton: Rock Point Ditch	Outside	Outside	X		
MS002	529	1581	NA	Dayton: No cultural remains	Adjacent	Inside			
MS004	529	1581	15	Dayton: Birdsall & Carpenter Mill, etc.	Outside	Adjacent *	X	X	X
	938	NA	NA	Lincoln Highway	Outside **	Adjacent **	X	X	
	939	NA	NA	Rose Ditch	Outside	Adjacent	X	X	
	NA	1584	NA	Dayton, Sutro and Carson Valley Railroad	Outside **	Adjacent **			
SILVER CITY									
MS030	83	1608	894-3	Silver City	Inside	Inside	X	X	

* = Douglas St. parcel deleted from project area ** = Linear sites may extend into these districts NA = Not Assigned

Table 1.0-2. Summary of Cultural Resources Work Associated with the Carson River Mercury Site.

Phase	Date	Description	Reference
1	Mar-Apr 1996	Informal reconnaissance of the study area.	Reno (1996)
2	Oct-Dec 1996	Inventory and evaluation at MS001 North, MS001 South, and MS030.	Reno and Clay (1996)
3	Aug 1998	Monitoring at MS030.	N/A
4	Aug-Sept 1998	Monitoring at MS001.	N/A
5	Aug-Sept 1998	Data recovery at MS001 North at unexpected discoveries.	ARS (1998a)
6	Sept-Oct 1998	Inventory and evaluation at MS004.	ARS (1998b)
7	Sept 1998	Architectural evaluation at MS004.	Mikesell (1998)
8	Nov-Dec 1998	Data recovery at MS004 at features exposed by testing and at unexpected discoveries.	
9	Dec 1998-Oct 1999	Monitoring at MS002 and MS004.	N/A
10	Nov 1999	Recording and evaluation of sections through Rose Ditch and old US 50 at MS004.	N/A
11	Dec 1999-Aug 2000	Preparation of final report.	

The second phase was in October to December 1996. Since no cultural resources were found at MS002 in Dayton, this area was excluded from testing and evaluation. Spot checks during remediation at MS002 confirmed the lack of cultural resources in the project area. As the project was designed at that time, it appeared that cultural resources also would not be encountered at MS004 in Dayton so a testing program was not done there either. The purpose of this phase of study at MS001 in Dayton and MS030 in Silver City was threefold. First, it was to document surface archaeological remains of the three archaeological sites (26Ly529 Locus 894-1; 26Ly529 Locus 894-2; and 26Ly83 Locus 894-3) on standard Intermountain Antiquities Computer System (IMACS) forms and test for the possibility of archaeological deposits within the zone planned for subsurface ground disturbance as part of the Carson River Mercury Site remediation project. Second, this information was used to make recommendations about the significance of these loci in relation to criteria for inclusion in the NRHP. None of the loci were found to be contributing to the significance of either Dayton or Silver City. Third,

recommendations for the management of these loci were offered based on locus content and potential significance. This approach to cultural resources on the Comstock conforms to standard procedures in Nevada and to recommendations made specifically for highly sensitive historical areas of the Comstock made by Reno (1990). Specific recommendations at that time included:

1. Continuing with the proposed remediation of the mercury-laden sediments as planned.

2. Since our testing efforts were limited to a small percentage of the site area, archaeological monitoring was recommended at all areas where remediation would involve excavation. The monitor would collect additional subsurface information on site structure and content during remediation.

3. Based on available information, it was not anticipated that additional significant resources would be found during remediation, but should they be uncovered, the monitor would immediately notify E&E.

4. A contingency plan should be in place for conducting archaeological data recovery should intact buried features or artifact deposits be encountered; this plan should be developed between EPA and the Nevada State Historic Preservation Office (SHPO) before onset of remediation work to avoid delays due to consultations.

Ultimately, recommendation 1 was carried through to completion. Recommendation 2 was done in all areas except for a portion of MS004. Although mainly accurate, there were several locations at MS001 and MS004 where unanticipated significant remains were encountered during monitoring. Consultations and enhanced data recovery efforts were immediately implemented to mitigate project impacts to these archaeological remains.

The third phase was monitoring at MS030. This work was done during August 1998. It resulted in expected continued recording of an extensive historic artifact concentration on the site. Although additional features were discovered, they could be recorded to an adequate level in the course of monitoring and did not require additional consultation or archaeological excavations.

The fourth phase was monitoring at MS001 from August to September 1998. For the most part this large area yielded additional archaeological information about artifacts and features within the capabilities of the monitoring team to record.

However, in three small locations features and artifact concentrations were found that appeared to have significant information value. Construction was halted at these areas while a discovery plan for archaeological excavation could be drafted, approved, and executed as a fifth phase of work also spanning the period from August to September 1998. For the most part remediation work at other parts of this extensive project area continued while archaeological studies were taking place.

The rest of the fieldwork was not anticipated when the project was originally designed. Based on recommendations from Phase 1, the hillside at MS004 with visible mill remnants was not to be impacted by the project. In the course of project design and execution it was determined at a rather late date that the hillside would have to be cut back to eliminate an unstable slope. The sixth project phase was inventory and evaluation of MS004. This yielded recommendations for additional archaeological excavation and monitoring of this site, along with recommendations about which portions of the site were to be avoided by hillside grooming. This phase was completed in September to October 1998.

Phase 7 of cultural resources work was evaluation of several standing buildings on MS004 during September 1998. None were found significant and were removed before remediation.

Phase 8 was archaeological data recovery during November and December 1998 at hillside features exposed by testing at MS004. It also involved the start of a much more complex data recovery effort on the large terrace by River Street where testing with several backhoe trenches failed to indicate anything of interest subsurface. Unfortunately for our archaeological testing effort, the buildings slated for removal did not allow for testing in precisely the areas where the archaeological features were most concentrated. Even more unfortunate, these same places held the highest mercury concentrations found during the project, requiring much deeper excavations than planned precisely in the place where archaeological remains were profuse and complex. The challenge this posed to archaeological monitors, excavation contractors, E&E supervisors, and the EPA can be imagined.

Phase 9, from December 1998 to October 1999, involved monitoring at MS004 and spot checks at MS002. As noted above, this monitoring involved extensive archaeological recording of mill-related features within an environment of higher mercury levels than predicted by the extensive program of site characterization.

Phase 10 took place in November 1999. This phase was recording and evaluating sections dug by the EPA through the Rose Ditch and the Lincoln Highway (Old US 50). Neither excavation was done for archaeological purposes, so this work was a continuation of monitoring efforts.

The last phase has been the analysis of all the archaeological information collected over the course of nearly four years of work on this project. The end result is this report and the project archives.

1.1 THE CARSON RIVER MERCURY SITE

PROJECT DESCRIPTION

The EPA has removed mercury-contaminated soils from several areas in Dayton (Figure 1.1-1) and Silver City (Figure 1.1-2), Lyon County, Nevada. The area of potential effects (APE) is limited to areas where mechanical excavation, construction, or other ground disturbance has taken place. The Carson River Mercury Site is a federal undertaking since it involves expenditure of federal funds and administration by a federal agency – even though the project is entirely on private land.

MS001 NORTH (Dayton, SE¼ NW¼ SE¼ Sec. 23, T.16N R.21E, USGS Dayton 7.5')

This parcel is located on an alluvial terrace adjacent to the west bank of the Carson River. It comprises the back yards of several houses along Railroad Street. Historically this entire area has been on the edges of Dayton.

Soils mapped along this portion of the Carson River in the study area include Fallon fine sandy loam along the floodplain representing generally fine-grained overbank deposits. Veta very gravelly sandy loam on the first terrace west of the floodplain, originating as alluvial fan gravels emanates from Gold Canyon onto the Carson River floodplain (Archer 1984: Sheet No. 10). Fallon soils are characterized by an upper 25 cm thick pale brown, fine sandy loam over a 125 cm thick, light brownish gray loam, silt loam, fine sandy loam, loamy sand, and sand. The seasonal water table extends from 1-1.5 m below surface, and this soil floods frequently between March and November (Archer 1984:45). These soils comprise the majority of the project area. Veta soils are typically light brownish gray very gravelly sandy loam in the upper 15 cm and pale brown extremely gravel loam to 30 cm below surface; from 30 cm to 150 cm the soil is light brownish gray and light gray very gravelly sandy loam and gravelly coarse sandy loam. Remnants of both soils were found in project excavations as were a number of industrial and redeposited cultural sediments. Clearly, the location of this millsite on a very active floodplain, adjacent a water source necessary for the milling process, with continual modifications to both the milling technologies and water containment, channels, ditches, etc., makes the stratigraphic and surficial descriptions both interesting and complex. Both the natural and cultural environments at this millsite are so dynamic the presence of anything related to the mill seems, given floods and land modifications, a consequence of luck.

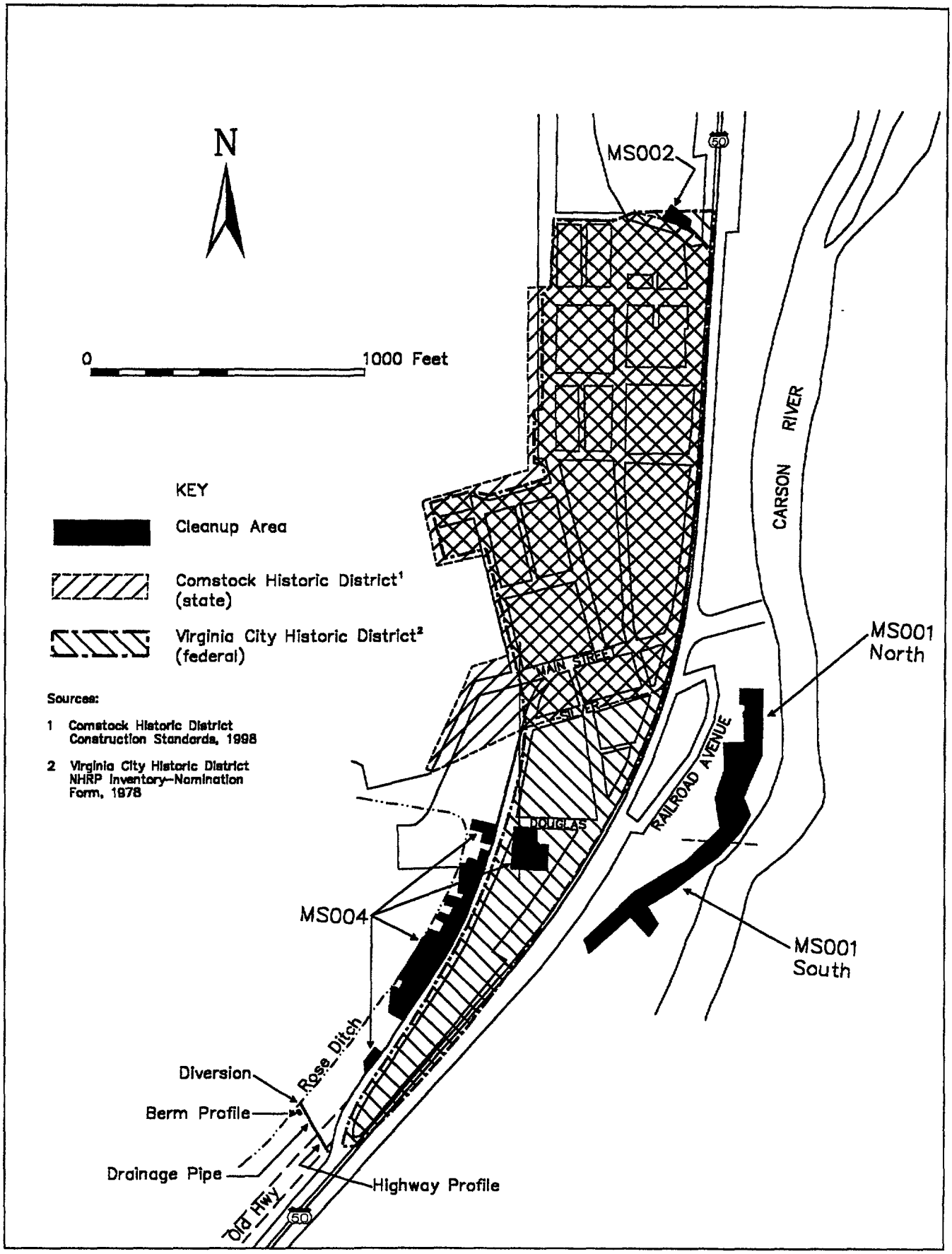
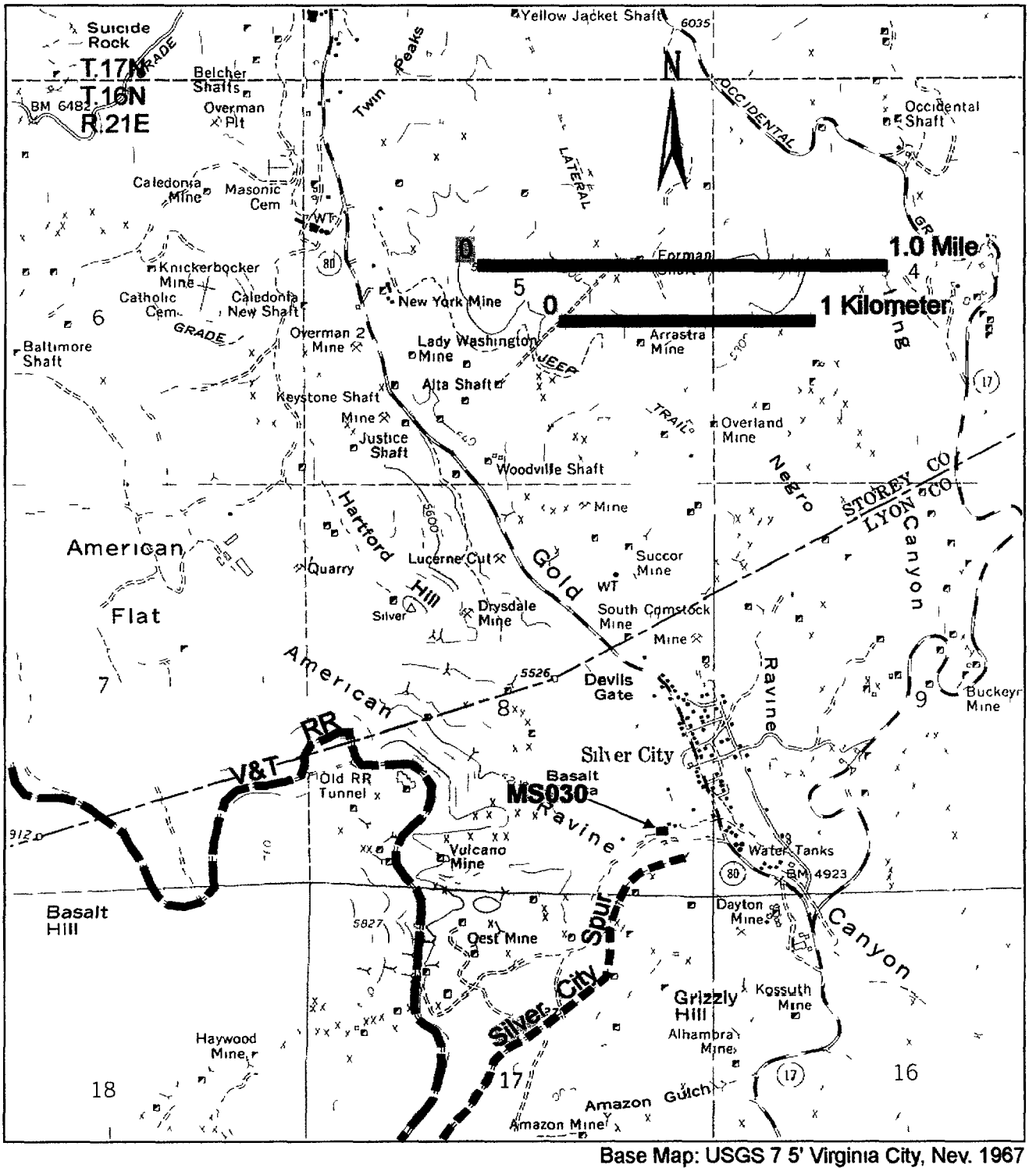


Figure 1.1–1. Carson River Mercury Project study areas in Dayton.



Base Map: USGS 7 5' Virginia City, Nev. 1967

Figure 1 1-2 Carson River Mercury Project study area in Silver City

Two historic properties lie partly within this parcel; they are the Rock Point Ditch and the Keller & Co. Mill. In addition there are domestic artifacts and a possible assay area. Further complicating the interpretation of archaeological remains is that the study area adjoins and is immediately behind the railroad yard of the Carson & Colorado Railroad, later the Southern Pacific Railroad. Houses for the agent and section foreman occupied the lot immediately west of MS001 along with the small train depot.

Project impacts consist of stripping from one to two ft of soil from this area and replacing it with backfill. Heavy equipment drove over this and all other project areas while stripping and backfilling was in progress.

MS001 SOUTH (Dayton, SE¼ NW¼ SE¼ Sec. 23 T.16N R.21E, USGS Dayton 7.5')

The study area was inundated by the reservoir for the Keller & Co. Mill, and was part of the main channel of the Carson River during the 1880s. It is adjacent to a relic meander of the Carson River that was used as a reservoir feeding the Rock Point Ditch in later years. This portion of the water system is well shown on the 1909 Dayton Map. At some point after abandonment of the ditch system this area was leveled for use as a pasture. Extensive areas were bladed in the course of making a pond adjacent to the Carson River. The division between MS001 North and South only has significance in relation to modern property lines. The artifact scatter related to the Keller & Co. Mill continues into this area. Similarly, although presently obscured, the Rock Point Ditch also extended into MS001 South. It is likely that the alignment of cottonwoods shown on the site map included with the site form reflects the location of the former ditch bank. This area was stripped to a depth of 1 to 2 ft, which was replaced by fill.

MS002 (Dayton, NE¼ SW¼ NE¼ Sec. 23 T.16N, R.21E, USGS Dayton 7.5')

As shown on Figure 1.1-1, MS002 is located in the midst of modern Dayton, but is well north of the historic center of town. Its main claim to historic interest is the proximity to the Mineral Rapids Mill site (26Ly529 Locus 1). The area for remediation is within a modern trailer park. and surface inspection showed that it was unlikely to yield any interpretable remains based on the minimal amount of soil removal – 6 inches – proposed for this area. Spot checks during soil removal confirmed this conclusion, therefore MS002 is not further discussed in this report. This negative result is identical with that of a previous inventory of the adjacent and much larger parcel for the new post office, where no intact remains of the mill were found (Kautz and Mires 1996). Although the Crown Point Mill ditch runs adjacent to MS002, it is on the other side of a fence line and was not impacted in any way by the project.

MS004 (Dayton, NW¼ SW¼ SE¼ Sec. 23 T.16N, R.21E, USGS Dayton 7.5')

This study area is located on stream terraces and hillslopes on the southwest edge of Dayton. Within the study area there is almost nothing remaining of natural landscape. Rather there is an immensely complex system of cut and fill features related to several episodes of mill building, ditch construction and maintenance, road building, railroad construction, numerous demolition episodes including major recontouring of older features, and house construction.

The terraces below the mill at the approximate level of River Street were bladed to a depth of about 6 inches prior to backfilling except in an area of high mercury content that was excavated to 3 ft below surface in some areas. A retaining wall was be constructed along the rear (west side) of the terraces along the foot of the slope. Construction of this retaining wall involved digging a footing trench about 4½ ft wide and 2½ ft deep for the length of the wall. Much of the slope above the wall did not need to be altered, but several areas were removed to prevent slope collapse onto the wall.

A water diversion was constructed in the Rose Ditch at the southern end of the MS004 area. Stormwater will be contained in a head box and pipeline leading through the ditch berm and down to a natural sump by US Hwy 50. Pipeline construction involved digging a section through the ditch and berm, placing the pipe, and backfilling, returning the area to an approximation of its original contours. In addition to sectioning the Rose Ditch, the pipeline cut across an abandoned segment of old US Hwy 50, which is also a segment of the original Lincoln Highway through Dayton.

MS030 (Silver City, NW¼ SE¼ SE¼ Sec. 8, T.16N R.21E, USGS, Virginia City 7.5')

As shown in Figure 1.1-2, MS030 is located on the south bank of the small creek emanating from American Flat. This is a narrow, steep-sided gorge with minimal alluvial deposits resting on and interfingered with colluvial debris. The area of the cleanup includes a small, relatively flat area adjacent to the present graded American Flat Road. From there it drops rapidly down to a low terrace next to the stream. No natural sediments are present in this area, which is composed of a combination of debris bladed off the side of the road, numerous artifacts, mill tailings, and mine waste rock.

Project excavations here were by far the deepest in the study area. As much as 13 ft of cultural fill was removed near the center of MS030. There is no indication that undisturbed sediments were encountered. Indeed, it is likely that placer miners scoured this part of the ravine down to bedrock during their decades of persistent but unsystematic and undocumented activity before it became an extension of Silver City.

1.2 THE SETTING

Both of the project areas are on the periphery of the great Comstock Lode, but were critical to its development. They channeled important resources into the Comstock and were both places where metals were removed from raw ore at numerous mills. Both areas owed their existence to placement at favorable locations in the regional transportation net, but these placements had their own characters. Silver City is on a route to the heart of the Comstock, while Dayton is also on one of the major east-west routes across the Great Basin. While Silver City is set in rugged mountain terrain, Dayton is placed on an alluvial valley adjacent to the Carson River.

DAYTON

Dayton is located on the banks of the Carson River, where it continues to be a stop on US Hwy 50, the successor to the central route of the emigrant trail. Its particular position along the river was determined by the confluence of the ephemeral stream down Gold Canyon from the Comstock Lode at this location. Although the Carson River flows generally eastward from the Sierra Nevada range of mountains toward the Carson Sink, the reach of the river at Dayton flows almost due north. Water from the Carson River is abundant for most purposes in town, though its flow greatly diminishes during summer and fall, while at disturbingly frequent intervals, it floods portions of town, hitting metallurgical reduction mills along its banks with particular severity. Gold Canyon, on the west side of town, only hosts an ephemeral stream, so reliable water was not available along it. The floodplain and river terraces contained cottonwood groves, willows, and grasslands before being built over. Low hills surrounding town are covered with a typical big sagebrush plant community. At higher elevations, particularly in the Pinenut Mountains to the south, groves of juniper and pinyon pine supplied fuel to town. This wood source was supplemented by timber and cordwood, seasonally floated down the Carson River before the channel was blocked by numerous diversion dams.

Dayton is located on one of the main branches of the Emigrant Trail and became an important stopping point, a day's travel from Eagle Valley, where Carson City would eventually be built. It is also near the original discovery point of placer gold emanating from the Comstock Lode at the head of Gold Canyon. It gained additional importance when it became the site of part of the far-flung metal milling industry centered on the Comstock and also served as the local supply center for ranches scattered along the valley of the Carson River. Dayton had political importance, until recently, as the county seat of Lyon County.

Although Fremont passed through the area in 1844, and some other travelers followed, non-Native American settlement did not begin until the population movements associated with the rush for California gold. The first discovery of gold in Nevada was at this site in 1849, a fact

leading to the recent sesquicentennial celebration in Dayton. A small number of placer miners began working the Gold Canyon placers on a small scale starting in 1850, an occupation that has continued at various scales to the present. Although much smaller than what could be termed a town, this settlement has a strong claim for the oldest non-native occupation in the state. Spafford Hall established his trading post in a log structure the same year. This station was known as McMartin's with a change in ownership and later passed to Major Ormsby before his demise in the Pyramid Lake Indian War. The station was well placed to serve the basic needs of both the local mining population and those of emigrants, since it was at the end of the Ten Mile Desert across the Carson Plains, and was the first stop after Dutch Nick's Station. During the early 1850s, placering was low enough in the canyon for miners to work directly out of the station. By late in the decade this activity had spread to the head of this and adjoining canyons, including the areas where silver and gold lode mines would be discovered starting in 1859 (Bancroft 1890:93; DeQuille 1876:9; Hazlett 1922:14,16; Kelly 1862:213).

Placer mining was aided in the late 1850s by completion of a ditch to carry water from the Carson River to Gold Canyon. This ditch, variously called the Rose Ditch, Douglass Ditch, and the Dayton Town Ditch, is discussed in detail later in this report. After its initial purpose for existence diminished it served until recently to provide water for mills and the growing town. Ditch contractors also served as the reason for importing Chinese labor into the area. These Chinese and later additions worked the placers, giving the town one of its early names – Chinatown (DeQuille 1876:10).

The community was a small one through the end of the 1850s, with a maximum population of about 150-200. Only a single row of buildings existed and many miners continued to live in tents (Bancroft 1890:95; Burton 1861:554; Simpson 1876:90-91).

SILVER CITY

Silver City has a somewhat shorter history than Dayton. It was explored for placer gold soon after the Dayton area, but a community did not appear there until interest in the uplands increased with discovery of the Comstock Lode in 1859. The town of Silver City started to grow that year and became a permanent fixture on the regional landscape to this day. Hopes for lode riches soon dwindled to less ambitious ones, such as for mines that would merely make a reasonable income. The city was significant more as a milling and transportation center for the Comstock than for its own mines. Small-scale mining and milling continued to play an important role in the regional economy.

1.3 METHODS

Historical archaeological investigations cannot be limited to the archaeological remains in the ground. A combination of sources was used to extract as much meaning as possible from the remains in the APE and to provide a contribution to historical, archaeological, and anthropological scholarship about mining technology and communities in the American West. Background historical research including chain of title has already been collected by the EPA or its contractors and by ARS. The current project built on these materials in search of the peculiar kinds of data needed to inform archaeological inquiry.

HISTORICAL RESEARCH

Site-specific research focused on various federal, state, and local repositories. Research was done at the Nevada State Historical Society; the University of Nevada, Reno, Special Collections; University of Nevada Getchell Library; University of Nevada Mackay School of Mines Library; the State Engineer's Office at the Division of Water Resources; Nevada State Archives; Nevada State Library; Nevada Department of Transportation; Comstock Historic District Commission; and the Nevada Bureau of Mines and Geology. Work at these repositories included the examination of newspapers, census records, maps, aerial photographs, and other official records. Historic maps were used extensively to study the alignment of historic transportation routes and land use patterns as they changed through time. Extensive comparative literature was consulted regarding the specifics of mining technology as applied to the Comstock. Federal agency records such as survey notes and plats were examined at USDI Bureau of Land Management state and field offices in Carson City and Reno.

Local level research consisted of searches in Utah Territorial and Lyon County records available in Yerington and in microform at the Nevada State Library.

INFORMAL INVENTORY

The informal inventory that comprised the initial phase of this project was done by acquiring a baseline of readily available comparative information, reviewing existing data collected by the EPA and its contractors for the area, and by visiting each portion of the project area.

ARCHAEOLOGICAL INVENTORY AND EVALUATION

Prefield literature consultation included an earlier preliminary archaeological reconnaissance of the parcels (Reno 1996), the *Final Title Reports of the Comstock Mills at Carson River Mercury Site* (SAIC 1993), specific maps and plats of the study area from the Lyon

County Courthouse and the BLM State Office, and contextual information about the named mills available at other local repositories. Records of previous archaeological research were consulted at the Nevada State Museum and Nevada Department of Transportation.

The methods of inventory and evaluation varied for each portion of the study area, so they are discussed separately here.

MS001

Machine excavation by a backhoe, under the supervision of an archaeologist, was done in the two known features at MS001 North. To reduce danger of mercury poisoning, additional field workers kept the excavations water-sprayed for dust suppression. This procedure was followed throughout the mechanical excavations and during the sifting of sediments. Four trenches were excavated to a maximum depth of 4 ft. Exposed strata were illustrated, photographed, and described by the geoarchaeologists on the team. Texture descriptions for this project are not as precise as usual due to the decision to handle the sediments with latex or nitrile gloves. Artifacts and features were described as well. After each description was completed, the trench was then backfilled by the backhoe.

Six hand-dug excavation units were placed in known or suspected artifact concentrations at MS001. Two of the hand-dug units were excavated off trenches. The remainder were separate test pits, excavated by arbitrary 10 cm levels. All deposits were screened using ¼ inch mesh hardware cloth; sediments and artifacts were described by level or stratum. Artifact descriptions were made adequate for identifying site chronology, function, and specific concerns such as gender and age indicators. Artifact bags from MS001 North were boxed and reburied in the bottom of EU1, with enough depth to survive undisturbed subsequent re-excavation of the entire area during remediation. Artifact bags from MS001 South were boxed and reburied in the bottom of EU6. In addition to avoiding the question of curating objects from private property at this early stage of the project, this procedure avoided the possibility of transferring mercury-contaminated objects off the site. Two arrastra stones were discovered at MS001 North. These two objects were cleaned, removed to the edge of the study area, and shown to the landowner with a recommendation that they be donated to the Dayton Historical Society.

Site recording on IMACS forms was confined to the parcels within the project area. These site forms were included with the testing and evaluation report. Surficial artifacts and features, backhoe trenches, and hand-dug units were plotted on base maps provided by E & E and site locations were plotted on USGS 7.5' maps.

MS004

IMACS site forms or addenda to existing forms were produced for two sites within or adjacent to the APE. These sites are the Rose Ditch, and the Lincoln Highway. In accordance with Nevada SHPO guidelines (Nevada State Historic Preservation Office 1994:13), the full extent of both of these sites in Lyon County was documented at a general level from historic documents, while detailed description and study was limited to the project APE. The forms are in Appendix A. The Birdsall Mill has already been recorded as a locus of the site of Dayton and this report constitutes a major update on information about the mill.

No detailed surface map of the features at the Birdsall Mill existed prior to this project. Due to the complexity of these features and extreme relief of the site, a total station-generated contour and feature map was prepared. This involved one day of fieldwork for a mapping specialist from Gnomon (an archaeological mapping subcontractor) assisted by an ARS archaeologist, one day of time for Gnomon to produce the field maps, and two days for a team of two archaeologists to complete surface recording of the many features (terraces, rock walls, timber remnants, etc.) on site. Features and proposed excavations were marked with numbered stakes. Existing survey data files generated by E&E subcontractors were utilized by Gnomon to help produce the archaeological base map.

Additional research was conducted for both of the linear sites that pass into or are in close proximity to the APE. This included a visit to the archaeological archives at the Nevada State Museum, contact with the Northern Nevada Railroad Museum, Nevada Department of Transportation, and the Nevada Division of Water Resources, all in Carson City. Only the portions of the ditch and road within or adjacent to the APE were be recorded in the field. Initially it was thought that a site form would be created for the Dayton, Sutro, and Carson Valley Railroad as well, but not enough information about this site was uncovered in the project area to make this a reasonable task.

Testing at this site involved severe constraints that greatly reduced the accuracy of predictions for non-tested portions of the APE:

- Presence of buildings scheduled for demolition eliminated access to a large portion of the APE.
- Steepness of slopes made mechanical testing unavailable in most places on the slope.
- Extreme depth of cultural deposits visible in existing exposures (in excess of 3 m) made it impossible to hand excavate the full depth of cultural deposits in areas where mechanical excavation was also impossible.

- Construction constraints made it impossible to make appropriate test excavations in most of the wall footing areas.

All of these factors combined limited the possible predictive results of the testing plan, requiring much flexibility in later approaches to monitoring, further testing, and data recovery.

Backhoe trenches were placed where possible, between buildings or other modern improvements on the lower part of the project area. Hand-dug excavation units were used for testing higher up the slope. These formal units were supplemented by cleaning off various parts of the extensive exposures made by existing mechanical excavations into the slope.

Recording and evaluation of the Rose Ditch included obtaining enough historical data to generate a site form. The cut through the ditch berm and pipeline trench were monitored during construction. Finally, the pipeline construction trench through the Rose Ditch was drawn to scale, photographed, and described.

Little of the proposed retaining wall area was accessible for archaeological testing. Much of it was under buildings, sheds, or trailers scheduled for removal and the rest is in very active yards. All buildings were still occupied. Further, construction plans relied on footing excavation in sediments undisturbed by such things as archaeological backhoe trenches or test pits. With these constraints, monitoring was the only recourse. Discovery of mill remnants within the wall footing excavations was considered extremely likely. Appropriate data recovery of such remnants could only be properly considered after they have been encountered by construction and some determination was made of their nature, extent, and significance. With this in mind, delays during wall construction were expected. Five backhoe trenches with a total length of 80-100 ft crosscut the proposed wall footing.

MS030

Inventory and evaluation at this portion of the study area was done on the basis of exposures made in the surface of the site by a bulldozer operated for the purpose of mineral exploration in the area. This resulted in enough data to characterize the artifact dump while indicating that archaeological testing would involve as much mechanical excavation as the remediation, so monitoring during remediation was judged the best course to follow.

ARCHAEOLOGICAL MONITORING

Archaeological monitoring was done in most parts of the project area while ground disturbance was taking place. The monitor was tasked with recording minor features and

individual artifacts as they turned up, keeping a reasonable map of these things, stopping the equipment to check out objects or sediments that could be of archaeological importance (not an easy thing to do with machinery as large as a track hoe), making an immediate judgement as to whether this part of the study area should be shut down while additional archaeologists were brought in to consult on the find, and finally, assist in assessing the significance of the exposed cultural materials.

In the course of construction large amounts of archaeological data were collected, some of which led to significance assessments leading to additional data recovery at MS001 and MS004. An unanticipated benefit of archaeological monitoring was that having an archaeologist closely examining the machine excavations led to the unexpected discovery of liquid mercury in the "Hot Zone" of MS004 and greatly aided efforts to delimit the boundaries of this zone for remediation purposes.

ARCHAEOLOGICAL DATA RECOVERY

MS001 North

At all three locations, ARS conducted detailed archaeological research to obtain a reasonable sample of the remaining information. Since the locations were quite small and a proportion of each had already been eliminated by mechanical excavation, comparatively large percentages of the archaeological deposits were recommended for hand excavation. In all locations, the 1x1 m grid already in place for testing and evaluation procedures (done informally by monitors) was expanded. Excavation was done stratigraphically by 1x1 m unit; all removed fill was sifted in ¼ inch mesh screens.

MS004

Archaeological data recovery in this area was done entirely differently in the slope versus the River Street terrace. A track hoe was employed to cut a series of step trenches down the slope. These trenches were described, drawn to scale, and photographed. After preliminary field analysis hand excavation units were extended from the sides of the trenches in areas where intact features were visible.

The extensive wood foundation, complex of launders (troughs for carrying materials suspended in water), tanks, ponds, and dugout found at the lower terrace were exposed first by mechanical excavation, then selected portions were hand excavated. Only fill from the domestic dugout was screened for artifacts. Most other excavation was oriented at exposing features. Due to the high toxicity of most of this area, very few sediment samples were taken for laboratory analysis. Although construction stopped in the immediate area for an initial intense phase of

hand excavation, most of the foundations were described and mapped during ongoing mechanical removal of sediments during remediation work.

Hundreds of soil samples were taken from specific archaeological contexts at MS004. All samples were identified by feature and stratum. Many were used to make sediment descriptions in a more controlled laboratory environment, but it was envisioned that a small subset would be selected for more detailed chemical analysis.

STRATIGRAPHIC ANALYSIS by Vickie L. Clay

Much archaeological work on historic sites in recent years has used the Harris matrix and related concepts identified in Harris (1989) and elaborated on in Harris et al. (1993) to analyze the complex stratigraphic relationships typical of such sites. The matrix itself is no more than an array of boxes printed on a sheet of paper. This serves as a form for thinking out relationships among deposits and interfaces by labeling each within a box, and connecting the boxes with lines representing either superposition of strata (with the most recent on top of the diagram), or horizontal correlations of strata deposited at the same time. All stratigraphic analysis for the data recovery portion of this project was built around the Harris Matrix and related concepts with some modifications. Recognizable strata (Str) and major discernable interfaces (Int) in the project area sites were numbered and described from surface to base of excavation. Much of the stratigraphic work discussed here was completed on vertical faces of backhoe trench and unit excavations bisecting obvious historic features.

Stratigraphic excavation proceeds from surface to subsurface with both perceived surfaces and deposits between these surfaces given numbers and descriptions. Each archaeologist or geoarchaeologist excavating a unit or trench usually sees the strata and interfaces differently. Lighting can also play a major role in the detection of strata and interfaces regardless of the laws of stratigraphy. Pronounced color changes and obvious features are usually recorded by everyone; however, more subtle textural and structural changes are not always clear and may be missed. Similarly, some color and structural changes may be contained as mottles within one stratigraphic unit, and these can be confused and labeled as multiple strata or interfaces.

Elements of archaeological stratigraphy adapted from Harris (1989) and applied to this project include labeling and description of cultural layers (such as feature fill), upstanding strata (such as foundations), horizontal and vertical feature interfaces (boundaries of features such as cellar cuts or privy pits), interfaces of destruction (tops of layers removed during feature construction), and natural strata in their relative sequence from youngest to oldest, following the ideas of superposition. The stratigraphic sequence (Harris matrix) is discussed for all trenches, sites, or features as an explanatory tool for each segment of the project area under study. All

stratigraphic labels and numbers used are arbitrary. On certain sites, identical strata were given the same designation, while on other sites different numbers were assigned to similar strata. Additionally, letters were assigned in some cases where facies changes occurred in the same stratigraphic position along a trench wall profile, although at other times these facies changes were given separate numbers. In most cases we did not follow each stratum horizontally to such a degree to understand its three dimensional extent across the site; rather, many deposits and interfaces are known only from their backhoe trench profile map. In contrast to Harris (1989), site formation processes as well as ongoing processes are considered as part of the site context and contributors to the overall archaeological stratigraphy.

Stratigraphic profiles presented in this document illustrate the stratigraphic sequence as perceived by ARS geoarchaeologists with interfaces labeled as heavy black lines, normal superposed deposits separated by thin black lines, and inferred but not clearly visible boundaries mapped as dashed black lines. Microstratigraphic distinctions, though often perceived in the field, were not considered sufficiently meaningful to warrant the time required for their analysis. Numbers in deposits and on interfaces are keyed to standard soil/sedimentary deposit descriptions including Munsell color (dry and moist), mottle color, texture, structure, inclusions, chemical characteristics, and boundary. Descriptions are presented using USDA Soil Survey standards (1975, 1988) and follow that tradition. When clear sedimentary structures are present these too are noted in the section on structure using Reineck and Singh (1980).

Harris matrices were prepared for each site, and in more complex sites such as MS004, for each locus or level in the mill. These include the numbered stratigraphic sequence, the interpreted associations, and the temporal affiliation, if known.

LABORATORY PROCESSING AND ANALYSIS by C. Lynn Furnis and Jeanne Albin

Cataloging

All artifacts except small repetitive fragments were saved for analysis. Collected materials were decontaminated by personnel trained for handling hazardous materials before forwarding them to the lab for analysis. Since the artifacts belong to private landowners, they were not marked or packaged for curation. Instead, artifacts that the landowner wished to donate to a project display at the Dayton Museum were separated from fragments. ARS included a letter recommending such donation when the materials were returned to the landowner. Artifact analysis was for minimum artifact counts per context, function, age, gender, economic scaling, ethnicity, taphonomy (post-depositional alterations), and idiosyncracies.

Catalog data is in two categories. Provenience data, including site, locus, feature, stratum, and other location information is entered off field reference logs into a computerized

database. This is linked with a second database that contains basic descriptive and functional attributes of each artifact. In many instances this information is adequate for subsequent analysis and report preparation but for items with additional interpretive potential additional analytical information is tiered onto the basic catalog as needed.

Organization of Artifacts Within Functional Categories

ARS routinely employs a particular system of historical artifact organization for cataloging and analysis purposes. The system is hierarchical and is based on functional classifications that reflect most facets of nineteenth and twentieth century life. It is a modified version of the classification systems developed by Stanley South (1977), Roderick Sprague (1980), Charles Zeier (1985 and Zeier and Furnis 1989). The groupings created by this organizing scheme are the basis for most of the summary tables and artifact description sections presented in this report.

At the top of the functional scheme is the Artifact Group, that includes the most broad, very general categories such as Architecture, Domestic, Food, Group Service, Personal, Transportation, and others. The next lower stratum consists of artifact classes, into which each artifact group is subdivided. For example, Material, Hardware, Lighting, and Heating and Cooling are artifact classes within the Architecture artifact group. The third and most specific categories are known as Artifact Types, and consist of such groupings as cut nail, roofing nail, spike, hinge, or door lock within the Hardware artifact class, that is subsumed under the Architecture artifact group.

The ARS functional hierarchy differs from the Zeier functional scheme in that food-related artifacts are not included with Domestic Items, but instead are placed in their own artifact groups of Ecofact (including items such as plant and animal remains), Food Containers, and Food Preparation and Consumption (Zeier 1985:36). All other first- and second-level groupings are virtually the same.

Artifact Analysis

Artifact analysis built upon the catalog in two ways. First, the analyst attempted to refine the data that had already been gathered, by confirming or changing the basic catalog data, especially regarding material types, functional class, initial and final dates of manufacture, and subtle marks on artifacts, such as patent dates, pattern names, logos, and the like. Second, the artifact analyst expanded on the catalog by creating additional sets of computer file fields tailored to the analysis of glass artifacts, of ceramic vessels, of common metal artifacts, and of miscellaneous artifacts of wood, plastic, rubber, and other less common artifact materials.

The analytical data that were gathered included: 1) minimum numbers of items (MNI), 2) manufacturing techniques used to create the artifacts, 3) artifact shape, 4) decorative techniques, 5) lengths, widths, and diameters of measurable artifacts, 6) volume of containers, 7) modification or re-use of artifacts, 8) crossmended pieces, 9) manufacturers' names, 10) origins of artifacts, 11) gender and age indicators, and 12) relative worth of artifacts when new.

Determining Minimum Numbers of Items (MNI)

The common and important exercise of determining how many complete historic-period objects are represented by the whole and fragmentary artifacts collected from a site was carried out on the assemblages from MS001 and MS004. Crossmending and counting of different parts of similar artifacts as single objects played a big part in this exercise. Since the loci of MS001 and MS004 were far removed from each other in horizontal space, their artifact assemblages were assumed to be discrete. No attempts at crossmending artifacts were made between the assemblages of these loci. But within each of the two loci, space was archaeologically defined by feature and non-feature areas, and artifacts from each discrete feature and its immediate non-feature area were considered for crossmending of artifacts. Artifacts from the non-feature areas also were treated as discrete assemblages so that crossmending and minimum counting of pieces was accomplished within those artifact groups. No attempt was made to crossmend glass or other sherds between two or more features unless 1) the features were located very close together, horizontally or vertically, or 2) similar pieces of unique or unusual artifacts from distant areas within a locus were noted by the analyst. Then, such pieces were further investigated for possible matches.

A standard method was employed for determining minimum numbers of items, referred to as MNI. Every complete artifact was counted as one MNI unless it was present as a part of a larger artifact at the site. For instance, if a complete shoe nail was found, it was counted as one artifact (1 MNI) unless it was found embedded in a leather shoe sole, or a shoe with similar nails or only nail holes were found within the same assemblage. In these cases, all the parts that were thought to be part of one shoe were counted as one object, i.e., as one MNI. For fragmentary glass or ceramic containers, numbers of finishes and bases were tallied for each color of glass. Then those finish and base types were studied to determine how many could possibly be parts of the same vessels. The paired parts were counted as one, single vessel. Bases and finishes that did not seem compatible were counted as two MNI. Body sherds of matching colors were counted as zero MNI, unless the body parts were considered to be parts of bottles not represented by any of the bases or finishes.

For metal containers, a similar method was employed. Can ends and can bodies of particular dimension and construction were reviewed. Ends that had been cut or pierced versus those that had not been opened were noted. Then, each two ends of the same diameter or width,

same manufacturing technique (e.g., crimped seams), but one opened end and one unopened end were counted as one vessel. If can bodies were present with dimensions that matched the ends, then these were counted as zero MNI. Can bodies with differing dimensions were counted as individual MNI. Container fragments that could not be measured or defined were counted as zero MNI.

In the case of ceramic vessels, many attributes were considered in determining MNI. Rim diameters and shapes were noted, as well as basic form, body fabric, presence and color of glaze or slip, decorative treatment (transfer printing, molding, paint), crossmending, and makers' marks. If many small pieces were decorated with the same glaze and floral decals, but seemed to have at least two different rim diameters, then two MNI were counted. For sites with only body fragments present, ware type, body thickness, decoration, glaze color, and crazing were used to determine minimum number of vessels. All of one type were counted as one artifact.

For metal nails and tacks, all complete fasteners were counted as individual MNI. Each fastener with only a head, or with head and partial shank present was counted as one artifact. Shank fragments were counted as zero artifacts.

Minimum numbers of window panes were determined by considering two attributes together – glass color and glass thickness. All the sherds from one feature or non-feature area that had the same color and thickness were counted as one pane.

Crossmending

Crossmending of artifact fragments was attempted as noted above, within assemblages from discrete loci and from defined feature and non-feature areas. Efforts were made to match pieces from different strata within the same features as a way of determining time and event associations, stratum disturbances, etc. Crossmending was tried for inter-feature artifacts only when similar types of artifacts were noted from adjoining features, or when distinctive artifact pieces were recognized from features located far from each other.

Data Entry and Manipulation

All analytical forms were completed by hand, then the new 16 to 18 fields of data were entered into existing computer catalog databases. The software used were *dBase III Plus, dBase IV, Reflex, and R&R Report Writer.* The databases were then filtered, sorted, and indexed in numerous ways by the analyst, so as to consider the assemblage according to functional groups, to material types, to feature associations, to date ranges, or other useful kinds of groupings. This manipulation of data proved especially valuable for comparing and contrasting feature

assemblages with each other, or for comparing the strata within a single feature. Patterns of site use and contents were revealed through such comparisons.

Artifact References

Numerous standard publications were relied upon for identification, temporal, manufacturing, origins, and functional information about artifacts. For identification of all kinds of common architectural, household, craft, personal, transportation, and other artifacts, historic-period American mail-order catalogs were used, including the *Illustrated Catalogue of American Hardware of the Russell and Erwin Manufacturing Company*(Anonymous 1980), *1891 Edition of the Weinstock Lubin Co. Catalog* (Henley and Teichroew 1975), *J. A. Williams & Co.'s Complete General Catalogue No.3* (Williams ca. 1922), and Sears & Roebuck catalogs for 1897 and 1902 (Amory 1969; Israel 1968).

Glass vessel references include Julian Toulouse's large works on bottle makers and marks (1971), and on American fruit jars, closures, and lids (1969), as well as Wilson & Wilson's *Spirit Bottles of the Old West (1968), The Bottle Book* (Fike 1987), *Collecting Bottles*, by Cecil Munsey (1970), *The Bottles of Old Sacramento: A Study of Nineteenth-Century Glass and Ceramic Retail Containers Part I* (Schulz et al. 1980), and an article on machine-made glass containers by George L. Miller and Catherine Sullivan (1984).

References routinely used for ceramic artifact identification consist of Geoffrey Godden's *Encyclopedia of British Pottery and Porcelain Marks* (1983), Gates and Ormerod's work on the American potteries of East Liverpool, Ohio, and environs (1982), Jean Wetherbee's *White Ironstone: A Collector's Guide* (1996), and a California Archeological Report – *Ceramic Marks from Old Sacramento* (Praetzellis et al. 1983).

Metal food and drink containers were researched in several of James Rock's articles and manuscripts on tin-plated cans (1980, 1984, 1987, 1988) and in Don Simonis's milk can chronology chart (n.d.).

Makers' marks on metal, glass, and ceramic artifacts were sought in Hull-Walski and Ayres' *The Historical Archaeology of Dam Construction Camps in Central Arizona* (1989). And for general, all-around identification of artifacts Robert Herskovitz' *Fort Bowie Material Culture* (1978) and Dale Berge's *Simpson Springs Station: Historical Archaeology in Western Utah* (1980) were consulted.

References for specialized milling equipment are cited below where appropriate.

FAUNAL REMAINS by Dave N. Schmitt, Jason Fancher, and Sabra Gilbert-Young.

Bones and bone fragments were identified by direct comparison with vertebrate collections housed at the Department of Anthropology Zooarchaeological Laboratory at Washington State University and those in possession of the authors. In a few instances texts were consulted on mammalian osteology (Amorosi 1989; Brown and Gustafson 1979) to assist in specimen identification. Some unidentifiable fragments were tallied by animal size class (e.g., large or mammal) on the basis of overall morphology, especially bone thickness. Specimens identified as large mammal consist mainly of pig, sheep, and cow cancellous bone pieces and small cortical fragments that could not be identified to a specific taxon. All bones were quantified by the number of identified specimens (NISP; Grayson 1984) per taxon or size class. Specimen recordation included species, skeletal element, and bone segment. Identified cow (beef) bones also were tallied by late nineteenth century retail cut types defined by Schulz and Gust (1983a, 1983b) (Figure 1.3-1). Evidence of burning and butcher mark locations and types (saw cuts and/or knife striae) were recorded for each specimen and are described below. Some butchered cow-sized bones lacking landmarks necessary for species-specific identification (e.g., rib shafts) were identified as cow (*Bos* sp.) bones and are included with identified specimens in discussions of beef use and economic means.

SAFETY CONCERNS

Prefield work included development of a site-specific safety plan designed to meet general criteria in the E&E safety plan as amended along with alterations required by archaeological work. This plan is included as Appendix C in Reno and Clay (1996).

Due to the necessity of working in proximity to known mercury contamination, all field personnel and lab personnel tasked with artifact cleaning or sediment analysis were required to have completed a 40 hour course in hazardous waste site operations for general site workers and required updates as specified in 29 CFR 1910.120.

In addition to measures taken to provide protection from falls, wall collapses, and encounters with heavy equipment, special attention was given to limit possibilities of exposure to mercury. The more important of these measures included use of water sprays to reduce amounts of particulates in the air, use of breather masks with mercury filters in situations where particles were present or other indications were present suggesting the possibility of levels above E&E action levels, air monitoring by E&E, use of personal mercury dosimeter tags, use of protective coveralls and gloves, and in some cases the use of protective overboots as well. Field workers in typical monitoring and archaeological excavation situations are shown in Figures 1.3-2 and 1.3-3.

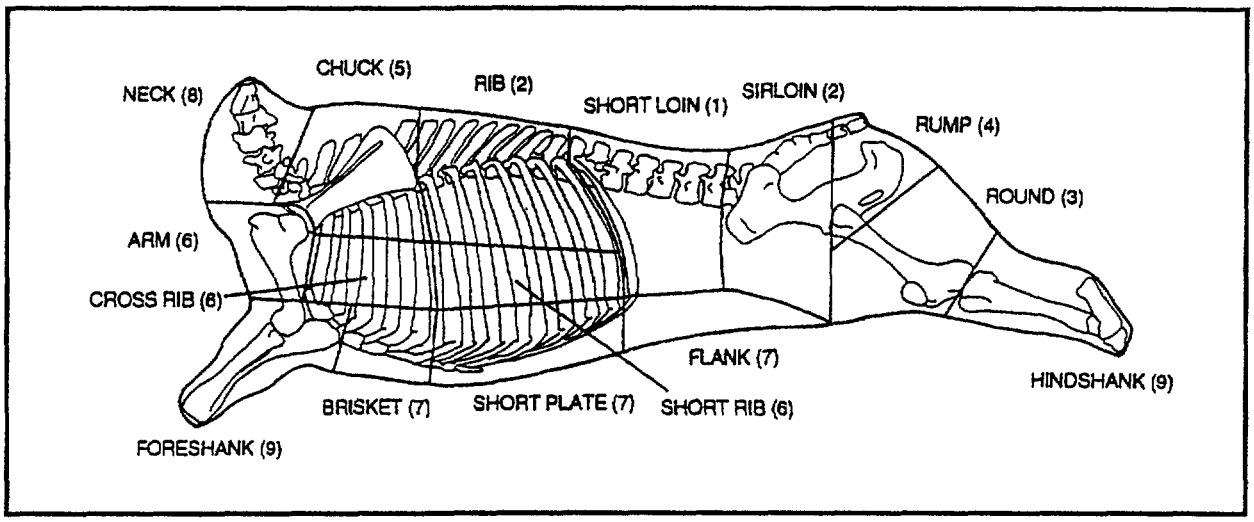


Figure 1.3-1. Major secondary beef cuts and economic ranks (parentheses) based on late nineteenth century retail values (after Schulz and Gust 1983a, 1983b).

Figure 1 3-3 Monitoring at MS004. (Roll BW591, fr 10)

Figure 1 3-2 Hand excaction at MS001 (Roll VC, fr.10)

1.4 RESEARCH ORIENTATION

Preliminary documentary study and visits to the project area indicated that there was almost no likelihood of encountering any significant prehistoric archaeological remains in the project area. This supposition was confirmed with the finding of only a few scattered pieces of debitage (waste products from stone tool production and maintenance) during the entire project. Therefore, all of the research objectives were confined to non-Native American research domains and problems

Hattori (1991) identifies five time periods that apply to materials and information related to the *Mining and Mining-Related – The Comstock Era* theme recovered as a result of this treatment plan:

1850-1858	Gold Canyon Placers (Rose Ditch, MS030 placer deposits)
1859-1863	Comstock Bonanza (MS001, MS004, MS030 for this and subsequent periods)
1864-1872	Comstock Fluctuations
1873-1880	Big Bonanza
1880-	End of the Comstock Era

This project relates to the following sub-themes identified by Hattori:

Land Usage –

Townsite Development and City Planning: Peripheral dumping patterns at MS001 and MS030; urban water system at MS004; layout of peripheral industrial milling complexes at MS001 and MS004.

Historic Landscapes: Major restructuring of natural landscape into a cultural one is documented in detail at MS001, MS004, and MS030.

Transportation and Communication –

Commercial Overland: Lincoln Highway and abandoned US Hwy 50 at MS004.

Railroads: Status of standard, narrow and baby-gauge spurs at MS004.

Commerce and Industry –

Mining and milling remains at all locations.

Mercantile Establishments: Indications of butcher shops and general merchandise stores from artifact concentrations at MS001; bluestone sales associated with MS004.

Lumber: Storage lot at MS030.

The People –

Chinese: Urban dwellers at MS001; ditch construction workers and mill laborers associated with MS004.

Aside from their placer gold deposits, Dayton and Silver City have been important for support facilities offered the lode areas of the Comstock. Hattori notes the importance of including such support areas in mining district studies. Dayton and to a lesser extent Silver City are also excellent illustrations of the point made by Hattori that towns of this period are likely to have extensive buried resources.

All study areas also relate to the *Mining - Early Twentieth Century* theme, but details about this theme have not yet been incorporated into the State Plan.

Most research questions detailed below relate directly to a social/economic approach to a mining district study as recommended by Edaburn (1982:246), in particular status patterns, settlement/community patterns, ethnicity and ethnic relations, and social organization. In the assay area the focus of study was industrial technology since the feature is not associated with a larger feature system allowing study of overall workplace organization.

Little formal archaeological work has been done in Dayton. The major documentation has been from the perspective of historical architecture. This was done in a 1980 building survey and 1987 supplement (Heritage Conservation and Recreation Service [HCRS] 1980; Comstock Project 87 1987). While the area was included as part of generalized archaeological model for the Comstock (HCRS 1980), it was not part of subsequent sample surveying to supplement that model (Hardesty et al. 1982). A series of inventories have been done along the present route of US 50, along with an inventory for the new post office, and another for the lots adjacent to the historic Bluestone Building. The only project that has undertaken any level of subsurface work was the monitoring and test excavations completed along the AT&T fiber optic trench through town (Reno 1989).

MILLING

The most essential research objective is documenting the diversity of mill feature systems on the Comstock. This is important for two reasons. First, this is the region where the Washoe

Process of pan amalgamation was developed. This was not a single event isolated in a single mill, but a process spread over the course of several years and variously expressed in numerous mills throughout the district. Second, the mill feature systems changed through time and in various places of the mills. This means that there is no "type" locality or period for the milling processes, but constantly shifting technology in response to market needs, availability of new techniques, whim of millers, different ore supplies, availability of inexpensive used equipment, and so on.

Additional aspects of this diversity to be documented in relation to the larger milling system on the Comstock are subsidiary industries and tasks that were often not tied to specific mills. These tasks include refining, assaying, production or redistribution of essential reagents, and support systems such as blacksmith shops. Indeed, from the point of view of a mill flowsheet, everything else in the mining district, whether it be foundry, boarding house, saloon, mine, or court house, was of importance solely in regard as to how it contributed in its way to getting materials, equipment, labor, or ore into the mill for the purpose of sending concentrated precious metals out of the district. In this sense, there is no more central place to search for understanding a mining district than its mills. This is an interesting and fruitful avenue of research since it counters the approach taken by most of the documentary literature, which focuses mainly on the mining community and the mines themselves.

Interpretation of this technological diversity can take various forms. Two important contrastive models are those of evolutionary ecology and ideology. Interpretation based on an evolutionary model seeks to explain diversity and selection of certain possible technologies on the basis of survival as determined by some kind of common currency or measure. Usually, particularly in a modernization paradigm, this currency is efficiency. Millers were constantly searching for efficiency, but this was with variable success. Also, it is possible to sometimes discern instances where the material cultural or documentary record contradict expectations of economic efficiency.

Ideological models counterbalance the somewhat mechanistic evolutionary models by explicitly exploring the possibilities that cultural factors overbalance those derived from non-cultural analogs, whether they be from biology, physics, or classic economics. Examples that are likely on the Comstock are situations where conspicuous waste was acceptable or perhaps even sought out, either in a strategy aimed at high short-term returns at the expense of overall milling efficiency (in terms of values allowed to escape the mill into tailings), or a strategy that involved construction of physical plants that were far more ostentatious than their pedestrian function required. This attitude contrasts with another that can be expected at least in some mill settings, which is one of puritanical thrift. This may be exhibited archaeologically by extensive recycling and use of machinery long past what seems a normal life expectancy. Curiously enough, either of these ideological approaches may have adaptive value. If survival of a mill depends on

impressing absentee stockholders, photographs and descriptions of lavish physical plants may generate needed working capital. Conversely, extreme thrift can damage a milling operation by avoiding advantageous but expensive improvements, or by using machinery that is not only cheap, but mechanically inefficient – or failing to properly maintain equipment. Related to the ideological issue is the cultural function of the mill. Many mills on the Comstock were highly successful at making money by obtaining loans or selling company stocks despite deplorable returns in a metallurgical sense.

Given the high impact of mills on the local landscape, the mill/landscape relationship is a critical research domain. An important research question includes discerning the degree of landscape alteration caused by milling. This includes terracing, generation of tailings flows and impoundments, and invisible landscape effects such as industrial pollution – primarily by mercury in this case. The millers were not oblivious to the constraints of the natural landscape. There is a complex interplay between human capability to overcome environmental obstacles versus the alternative approach of attempting to blend with them in some sort of harmony. Examples include decisions on whether to locate on hillsides for best gravity transport of materials within the mill versus locating on a river floodplain to use water power in the most inexpensive way possible. Deciding to select one of these choices meant using a natural resource in the simplest way, but either choice implies a need to overcome another environmental constraint. Similar decisions are implied in every mill location on the Comstock. Moreover, the mill environment was rapidly changing due to both natural causes, such as floods, and cultural ones, such as construction of alternative transportation methods (particularly railroads) or changes in water delivery infrastructure.

COMMUNITY

The four trash deposits at MS001 appear to relate to distinct households or businesses within Dayton. Even though they most likely cannot be tied to specific households in the documentary record, their characteristics can be used to approach research questions in consumer product availability and use. Examples of such dumps have not yet been formally documented in Dayton and this constitutes a data gap. The dump at MS030 is more communal in nature, but can be used to address questions oriented toward the small community as a whole. Research questions to be addressed by all deposits include the following:

- How do the consumer goods present in the district peripheral areas of Dayton and Silver City relate to those deposited in the archaeological record at the core areas of Virginia City and Gold Hill?

- How does consumer product availability here compare to that at other locations in the western United States?

- Is there a distinctive pattern to the commodities found in these trash deposits?
- Does the trash deposition appear to be secondary dumping from the main part of Dayton and Silver City or from adjacent residences or businesses?
- Is there any indication of ethnic butchering patterns in the artifact and bone assemblages at MS001?
- Can any indication of the demographics of household composition (including age and gender) be inferred from the artifacts?
- What do these trash deposits reveal about life in late nineteenth century Dayton and mid-twentieth century Silver City?

TRANSPORTATION by Barbara J. Mackey

Transportation activities for the study area consist of linear trail/road resources of the Overland Trail, Pony Express, Lincoln Highway, and US Hwy 50 reflecting the changes over time of a transportation corridor. An industrial development study using a technological approach suggested by Edaburn (1982:246) focuses on the engineering development, methods and equipment of construction, and maintenance of transportation site types. Significant features such as stations encompassing research domains of a social and economic approach are outside of the project. Other transportation systems, e.g., the Dayton, Sutro, and Carson Valley Railroad and the Carson River as a waterway are also beyond the scope of the study area.

Road elements whether trails, dirt roads, or paved roads reflect differences in scale of transportation systems. Typically, modern systems are built upon earlier expressions of transportation routes and corridors of least resistance (Myhrer 1993). Technology and necessities transform systems through phases of exploration, construction, use, maintenance, abandonment, and/or reuse. *The Comprehensive Management and Use Plan/Final Environmental Impact Statement* for the Oregon, California, Mormon Pioneer, and Pony Express National Historic Trails (NPS 1999) expresses concerns for retaining trail integrity, the cultural landscape, interpretation, and use. Research issues are limited to proper identification of the trails; constructed features such as bridges, fords, rock retaining walls, and road cuts; and changes or maintenance over time. Historic use and economic importance of the Pony Express and the Emigrant Trail have been the subject of numerous investigations locally, regionally, and nationally. More extensive research domains hinge on the presences of stations, campsites, and debris. Similarly, research domains for Wagon Road Systems and Automobile Road Systems

address constructed features and maintenance. The economic importance, management, and use of the road systems reflect changes of transportation networks through time.

Pertinent research questions enumerated by Kolvet et al. (1998b:51; Murphy 1995:17-18; and Ataman et al. 2000) address local construction, maintenance, and realignments issues germane to the project resources:

- Does the road segment demonstrate formal construction, establishment through use, and/or maintenance?
- Were engineering standards used? Was the road designed for efficient and safe use or were corners cut to save construction costs?
- Who designed and built the road? What equipment was used? Were new designs or technologies used? Where is the nearest construction camp?
- Can the property address the evolution of road systems in Nevada or civil engineering practices over the years?
- What types of traffic used the road? Has use changed?
- Does the property show how the system affected the economics of the area?
- Does the property support the historical record?

WATER SUPPLY by Barbara J. Mackey

Water as a necessity for survival has been capitalized upon and converted to a commodity by governing entities, entrepreneurs, and environmentalists. Water engineering has played an important part in the success and failure of most regions of the world but particularly in the western United States. Regardless of the quantity, quality, and availability, water shaped and altered the landscape and influenced the settlement of an area. The Carson River and ephemeral drainages in Gold Canyon influenced the development of the project area. The water supply was used for placering, milling, and the community since the 1850s. Typically irrigation works are built, owned, and operated by an irrigation district, company, or public reclamation project. The water systems in the study area are no exception. The operation of the Rose Ditch since its inception as a placering ditch has been an entrepreneurial venture linked to company and individual speculation. The technological approach to studying the engineering, construction methods and equipment, and maintenance of the water supply for industrial sites is posed by Edaburn (1982) as a research unit. The supply source, engineered velocity of ditches,

conveyance features, and distribution methods are system elements subject to physical standards and construction irregularities. Along with archival documentation, these elements are integral to addressing research for the Rose Ditch.

- Do physical characteristics of the system provide construction and maintenance information?
- Was the system engineered? If so, who designed and built it? Were members of certain ethnic groups used to construct the system? With what equipment?
- Are there any unique or unusual construction features?
- Was the system successful? What was the length of operation? Was the ditch or entire system only ephemerally useful?

SIGNIFICANCE

The four criteria for evaluating the significance of archaeological sites in terms of eligibility for inclusion in the NRHP are as follows (36CFR60):

> The quality of significance ... is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:
>
> A. That are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> B. That are associated with the lives of persons significant in our past; or
>
> C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> D. That have yielded, or may be likely to yield, information important in prehistory or history.

In addition, properties less than 50 years old are not normally eligible for the NRHP. Since the National Park Service emphasizes that a property qualifying for the NRHP must both be associated with an important historic context and "retain historic integrity of those features necessary to convey its significance," it is clear that significant historical archaeological sites are likely to relate to more than one criterion (*National Register Bulletin* 15, How to Apply the National Register Criteria for Evaluation:3).

MS030 is within the federal Virginia City Historic District. It therefore is subject to provisions of 36 CFR 800 Subpart C in addition to the other regulations in 36 CFR 800 relating to complying with Section 106.

Due to the extensive and interrelated nature of the material culture of the sites encountered during this project, the primary question normally has not been whether the site as a whole is significant – in all cases the site assigned a state site number in Table 1.0-1 is clearly significant. Instead, the significance question is whether the portion of the site identified as a locus in some way contributes to the overall significance of the site. Crafting means of mitigating possible project effects to these archaeological remains has been different in all cases, depending on the reasons that the archaeological remains are significant. The outcome of these site-by-site and locus-by-locus evaluations is summarized in Chapter 9.

1.5 REPORT ORGANIZATION

The main body of this report presents and discusses documentary and archaeological information primarily on a thematic basis and secondarily by EPA study area. This approach was chosen to facilitate discussion of matters considered important in the *Comprehensive Nevada Preservation Plan*, with its strong thematic orientation. Chapter 2 summarizes milling practices used at or in the vicinity of all of the study areas. The EPA orientation assures the primacy of milling since the project is aimed at cleaning up the residues of this industry. Chapter 3 covers the Keller & Co. Mill and its successors in Dayton. Much of this information is from the preliminary testing report, but it has been enhanced by data collected during monitoring and data recovery. Chapter 4 covers the extensive remains of the Birdsall & Carpenter Mill and its successors in Dayton. Chapter 5 covers the four activities identified at MS030 in Silver City – placer mining, milling, transportation and storage of materials needed for local milling, and trash dumping. Chapter 6 returns to Dayton to examine the various remains of the community found at MS001 and MS004. The subject of Chapter 7 is road transportation in Dayton, particularly the Carson River route that became part of the Lincoln Highway system and later US 50. The two railroads on or adjacent to the study area are not discussed separately here, but rather in the general discussions of MS001 and MS004 since no intact features related to these railroads were found. Chapter 8 focuses on the Rose Ditch that once provided water for the Gold Canyon placers, the Birdsall & Carpenter Mill and the town of Dayton. The final chapter revisits all of these themes and considers them and the district in relation to the notion of studying a mining district from the point of view of the district periphery.

2.0 MILLING ON THE COMSTOCK

by Ronald L. Reno

Discovery of the great silver mine of the Comstock Lode was a truly mixed blessing for its discoverers. Suddenly the self-contained world of the gold placer miners, in which individuals or small companies could remove and concentrate their own product for market with little or no capital, disappeared. The silver required relatively complex milling and concentrating procedures to isolate a marketable product. The underground mining of the lode required extensive workings supported by a major influx of outside capital raised primarily on the San Francisco Stock Exchange. Although the mines and the mining community have taken center stage in popular culture related to the Comstock, behind it all was the necessity for a much more mundane experiment in applied chemistry – development of an adequately efficient concentrating procedure to wrest the values from the earth at a low enough cost to pay for all. With rare exceptions, the glittering product of the Comstock was not to be seen in native gold and silver in the mines, but rather in stacks of bullion somehow extracted from the muddy chemical enriched waters flowing purposefully through the mills, a mixture given the descriptive but hardly exciting name "pulp."

Simple beneficiation methods using hand-operated pans and rockers were adequate for the small-scale gold placering that took place through the 1850s. When lodes were first worked for gold alone, arrastras without further attendant facilities provided adequate returns from the rich surficial Comstock ore. With the discovery that large values of silver were being lost, the gold miners found themselves confronting a metallurgical problem outside of their experience. The immediate solution in 1859 was to export the ore to San Francisco for reduction (Lord 1883:62). This expensive expedient soon gave way to the development of a flourishing milling industry centered on the Comstock.

2.1 EARLY EXPERIMENTS

The first two years of ore processing following the discovery of silver ore comprised an explosion of innovations built into a plethora of distinctive mills. By 1861 this resulted in small mills scattered across the landscape, many in places lacking either adequate water (a typical mill requiring 50,000 to 75,000 gallons daily) or transportation to support a mill. Seeming a rapid route to tap into the riches of the Comstock for those that did not have a share in the lode itself, mill entrepreneurs rapidly created a capacity far exceeding total production of the mines. The great small mill building bubble burst and most of the mills went out of business in 1862 (Lord 1883:113, 116).

The small mills, along with a few very large ones, were placed on the terrain on the basis of contradictory assumptions. Many were placed on the bottoms of Gold, Sixmile, and Sevenmile canyons in an effort to stay as close as possible to the mines. All of these mills

enjoyed low transportation costs but suffered from a lack of large or reliable water sources. This forced most of them to rely on steam plants for motive power. The mills strung along the lower reaches of the Carson River in the vicinity of Dayton were located on the premise that cheap water power would offset transportation costs. Transportation remained a costly item in this portion of the district and greatly limited the milling industry there. While wagon transport was the only option, ore wagons from the lode could travel to Dayton, unload, and return with cordwood or charcoal from the Pine Nut Mountains, just south of Dayton (Figure 1.0-2). A similar tactic was adopted by millers that located all along the east shore of Washoe and Little Washoe lakes and in one instance, on the west side of the lake. All of these mills depended on the ore wagons returning over the rugged Jumbo Grade laden with timber cut in the Carson Range, a subrange of the Sierra Nevada Mountains immediately west of Washoe Valley. Although some milling continued to occur in these places, the advent of the V&TRR in 1872, suddenly made the portion of the Carson River between Mound House and Carson City the premier location with ample water from the river along with ready supplies of fuel and ore via railroad spurs. It was in this area that the most dense concentration of the largest mills were situated throughout the mature period of the Comstock.

High grade "first class" silver ore was generally treated with roasting processes of German origin. Other ore was dealt with a variety of less expensive processes of Hispanic origin.

The simplest technique used was the Mexican Patio Process. DeQuille (1876:260) describes how this was done on the Comstock:

> The pulverized ore is made up into a thick mortar on a floor of planks or stone (which is the patio), when salt and sulphate of copper are added and mixed in, and the pile of mortar is built up in the shape of a mound and allowed to heat and sweat.
>
> After a proper time has elapsed the mound is pulled down and spread about, when quicksilver is sprinkled upon the mass and well worked in and it is again made up into a mound-shaped pile to heat. This pulling down and building up, spreading about, and airing is several times repeated, and the whole operation lasts a number of days, when finally the mass of mortar is washed and the quicksilver and amalgam secured.

This technique has a low rate of recovery, is extremely time-consuming with ore on a patio for a month or more, and depends on favorable atmospheric conditions for heating.

Coarse crushing for either of these processes could be done with sledge hammers or a stamp mill, while fine crushing was done in one or more arrastras. An arrastra is a simple device consisting of a circular patio paved with thick stone blocks. A vertical axle in the center of the patio supports a horizontal cross-bar that hauls drag stones around the patio. These stones are

attached to the bar with chains. An arrastra powered by a mule is shown in Figure 2.1-1. This form of power was used on the earlier arrastras on the Comstock, but by substituting gearing and linkage to a power train it was possible to power the arrastras with either water wheels or steam plants. A low stone wall around the perimeter of the arrastra kept ore on the working surface.

A somewhat more elaborate technique is the kettle or cazo process, in which crushed ore and salt are heated with water in a copper kettle until it boils. At this point mercury is added and the pulp stirred by hand for several hours. After boiling, the pulp is washed with water to remove tailings, leaving behind heavy amalgam. The chemistry of this process is interesting, since the copper kettle provides the reagent needed to react with the salt and silver chloride to reduce silver to metal amenable for amalgamation with mercury (Oberbillig 1967:13).

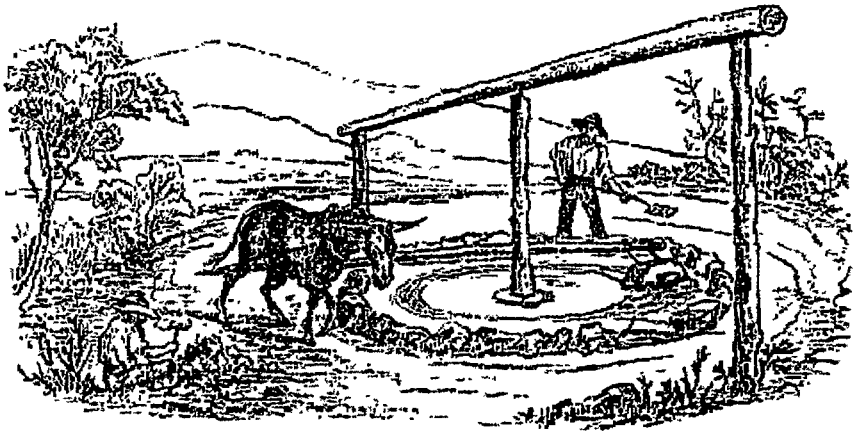
The German Freiburg Process involves dry crushing of the ore and preliminary roasting of the ore with salt, converting the silver sulphide to silver chloride. Then the ore was generally placed into revolving barrels with iron, mercury, and copper sulphate for amalgamation. Roasting could be used as a pretreatment for amalgamation in vats or pans as well. Following amalgamation, the heavy portion was washed with water for pressing and retorting to remove the mercury (Oberbillig 1967:13). Although the merits of roasting Comstock ores were highly lauded at first, particularly by prominent miller Guido Küstel (e.g., 1863:90-91), many of the plants relying on this process either shut down or converted to the Washoe Process.

2.2 THE WASHOE PAN PROCESS

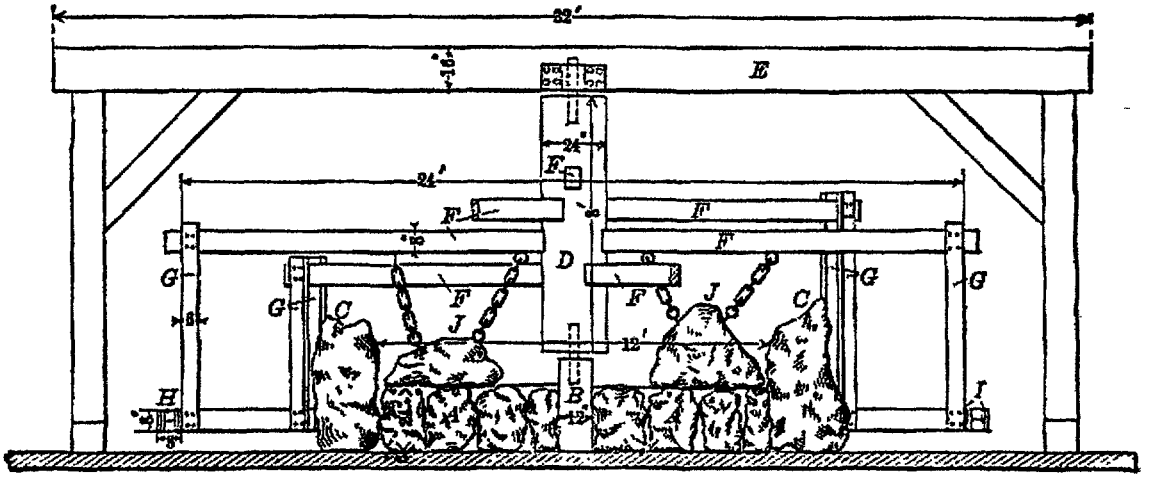
The first two mills to employ the rudiments of the Washoe Pan Process (also called the Washoe Process or simply the Wet Process) were completed in August 1860. Of these, the one credited with most of the new innovation is Almarin Paul's mill in Silver City while Paul himself became one of the chief publicists for this process in opposition to Küstel (Lord 1883:86).

Before describing the process, it is useful to examine a specific mill for an overview of the physical plant required to subject ore to the Washoe Process. Such a mill is shown in section in Figure 2.2-1 and an interior view of the layout is in Figure 2.2-2. An image of a typical small Comstock pan mill from the early period of mill construction, the Hoosier State Mill, is provided by the *Mining and Scientific Press*, from an article in the *Virginia City Trespass* (MSP 1867:15:311):

> The mill is run by a 14-inch cylinder engine of about 100-horse capacity, and it propels the large lot of machinery with great ease. The steam is supplied from two tubular boilers, one 44 inches in diameter and 15 ft. in length, the other 54 inches in diameter and 16 ft. in length. The superheated steam which is saved makes a great credit in favor of fuel used. Eighteen 700-pound stamps, in four batteries, crush daily about 40 tons of ore from the Chollar mine. Each stamp



A. Overview of Mexican arrastra observed by Egleston in 1887 (Hardesty 1988:10)



B. Section (Richards 1909:138)

Figure 2.1-1. An arrastra.

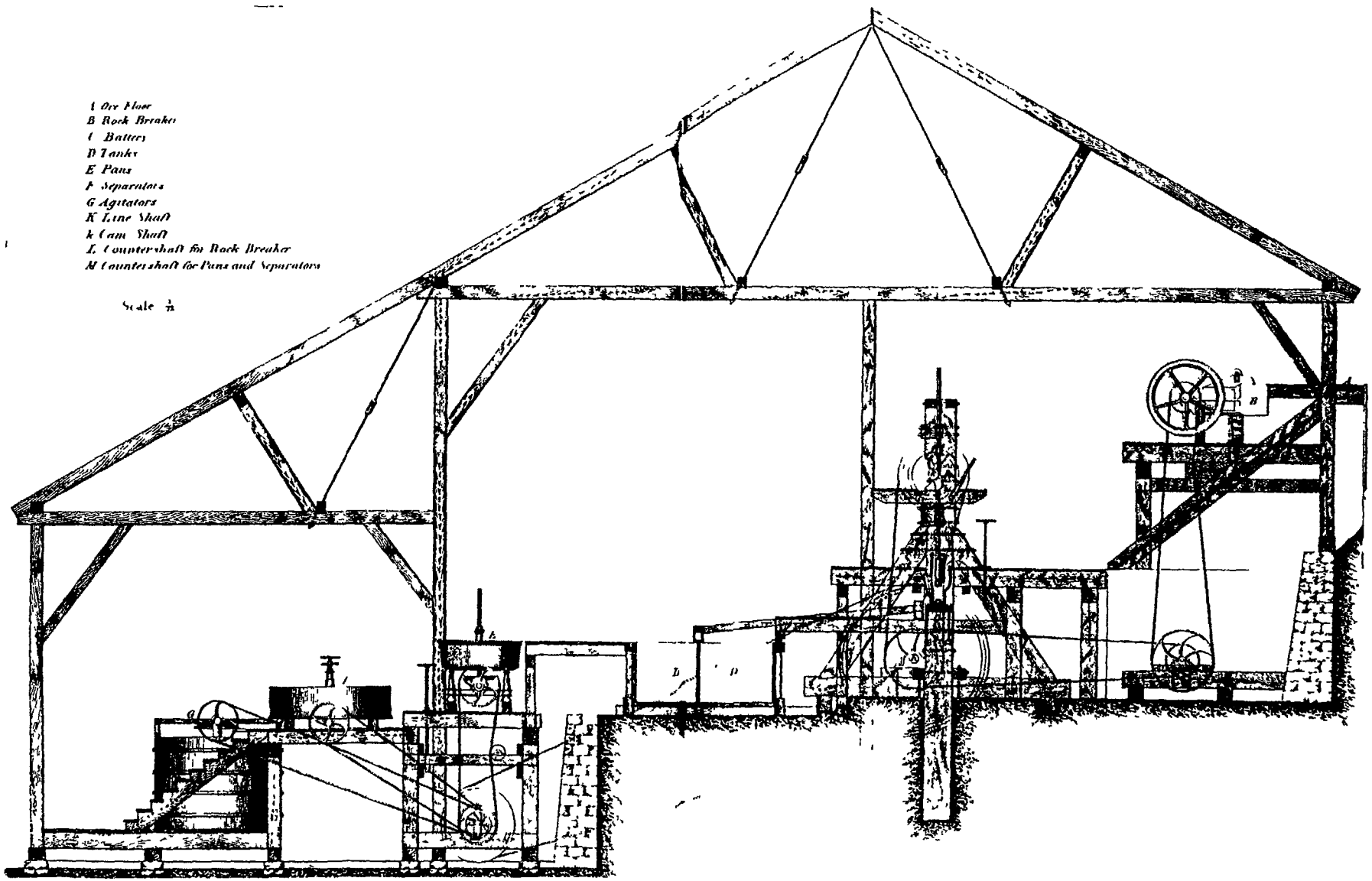


Figure 2.2-1. Sectional drawing of a typical Washoe Process pan mill (Hague 1870 Pl.xxiii).

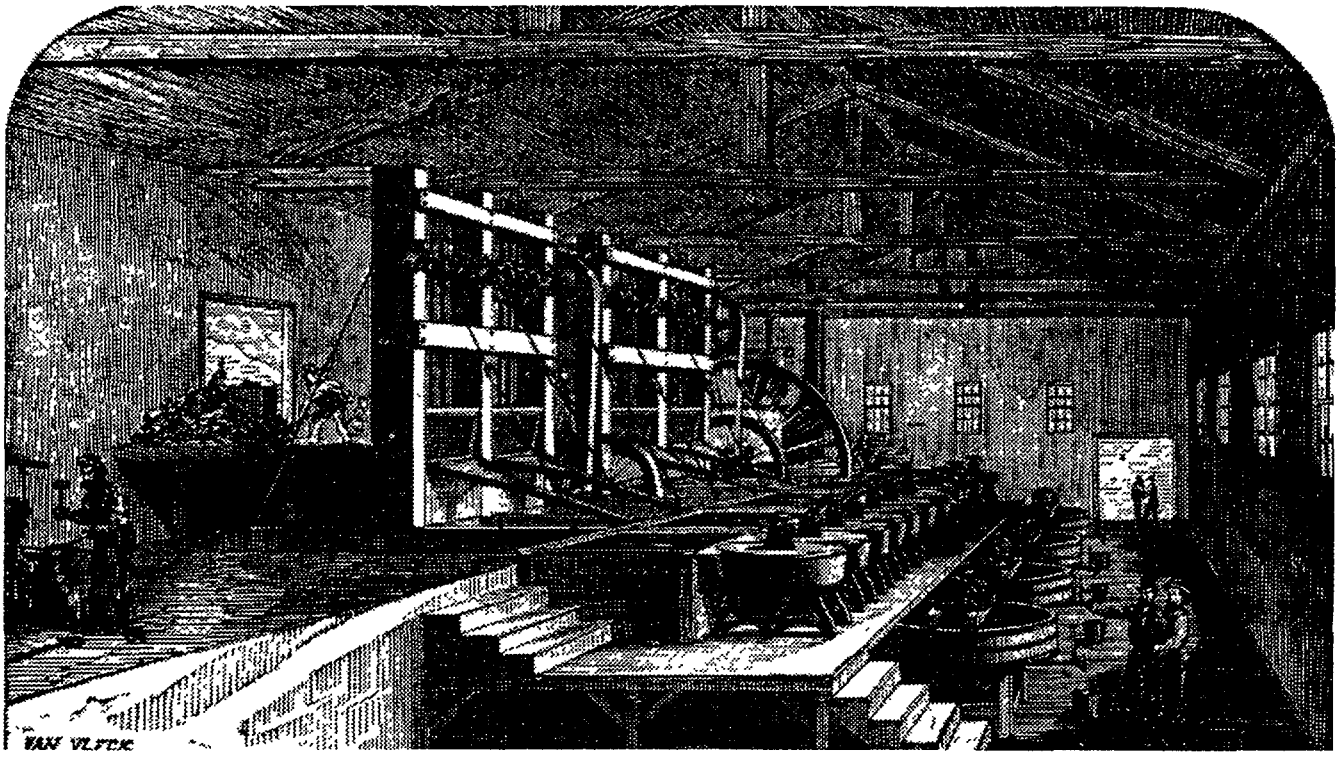


Figure 2.2-2. Interior of a small early Washoe pan mill (Bailey 1996:13).

> drops 9 ins. and 80 times a minute, yet with all this immediate weight the battery frames are not susceptible of a jar, so firm are the battery-blocks set in the earth. The ore, properly crushed, passes through transverse troughs directly to six 8-ft. settling vats, thence to eight of Greeley's improved pans, where it is ground and amalgamated for five hours; then to four huge sheet-iron settlers just below, and then to three agitators, yet beneath, from whence the tailings run over 400 ft. of blankets to the cañon, where again they are corraled in a large reservoir, for use at some future day. At the south side of the mill are six Knox pans, which are in constant use working sulphurets and cleaning amalgam. One of the most noticeable improvements of the whole concern in the ease with which every portion of the gearing can be reached and repaired. One can walk erect among the wheels and pulleys, and belts and shafts: so if anything gets out of order it may be reached without delay. Again, the water from the batteries is saved and used again. Signal bells from the batteries and amalgamating room connect with the engine room. So in case of accident the engine may at once be stopped.

The process used here was a direct descendent of the patio, kettle, and barrel processes described above, along with using an improved version of the venerable stamp mill (Oberbillig 1967). The main innovations made on the Comstock were the introduction of steam for motive power, raising the temperature of the ore at critical stages of the process, and substitution of iron machinery, especially the Washoe amalgamation pans, for stone and wood appliances. The main benefit of these changes was the compression of a very long process into the space of a few hours. A host of smaller innovations were also used, many of which were discarded as worthless during the first decade of trial-and-error development. The Washoe Process was widely acclaimed in the contemporary literature as the first major metallurgical process developed in the United States. It was the pride of American metallurgists and was widely emulated in the late nineteenth century before being eclipsed by processes such as cyanide leaching and flotation.

Unlike the free-milling gold ore of California that could simply be crushed and amalgamated, the Washoe Process was able to amalgamate sulphide ores of silver by converting the ore to a chloride or metallic silver. The following description of the process is mainly derived from classic accounts by Guido Küstel (1863), James D. Hague (1870:194-231, 273-293), Rossiter Raymond (1873:465-477), J. M. Adams (1874), Dan DeQuille (1876:254-261), and Eliot Lord (1883:117-122). Descriptions of individual pieces of machinery are provided by William P. Blake (1871). These accounts from the heyday of the process are supplemented with retrospective studies, particularly those of Robert H. Richards (1908), G. McM. Ross (1913), and Ernest Oberbillig (1967).

A generalized flow sheet for the Washoe Process is reproduced in Figure 2.2-3. This is supplemented for a flow sheet specific to the small Nevada Butte Mining Company Mill utilizing the Washoe Process in the Battle Mountain District of Nevada (Figure 2.2-4).

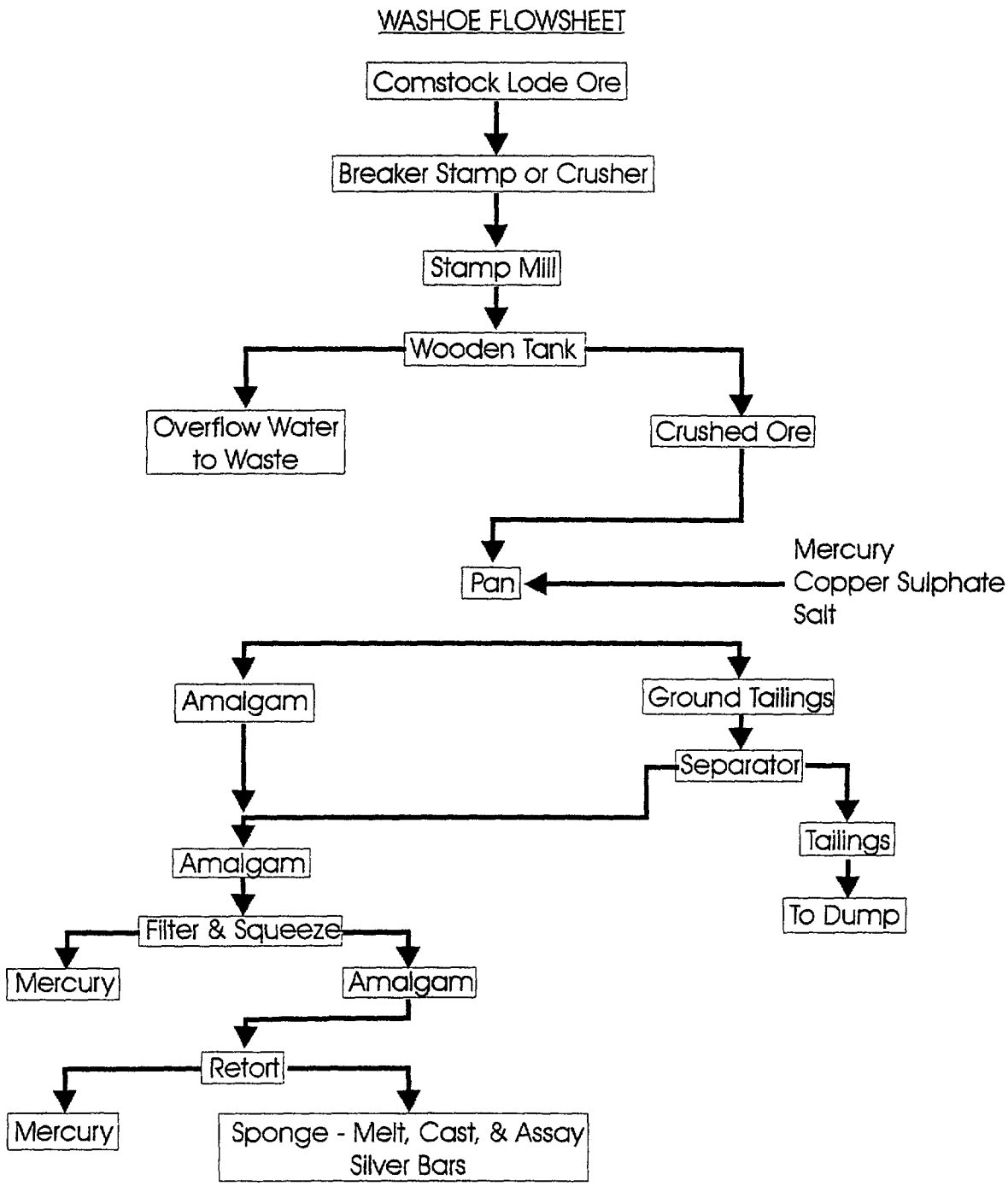


Figure 2.2-3. Generalized flow chart for the Washoe Process (after Oberbillig 1967:25).

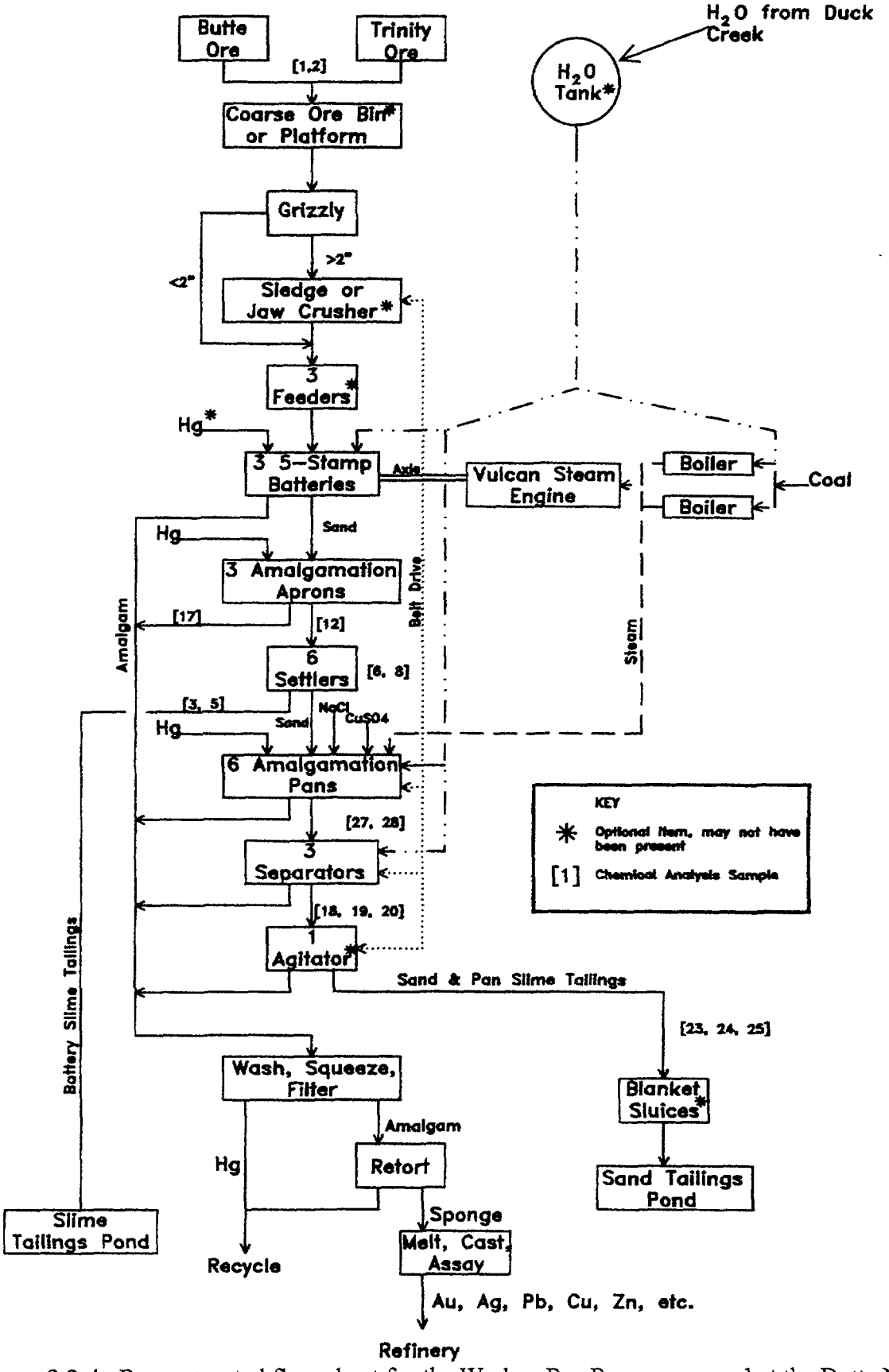


Figure 2.2-4. Reconstructed flow sheet for the Washoe Pan Process as used at the Butte Mill (Reno et al. 1999:4.12).

First it was necessary to get ore to the mill and store enough of a supply to keep the mill in operation. Ore was generally delivered to the top level of a mill located on a hillside so gravity could be used to move various materials through the mill during processing. Although some mills merely delivered ore to piles, ore bins were usually installed. Since stamp mills did not work well with ore larger than about 2 inches in diameter, a grizzly (an array of bars at fixed intervals) was usually placed below the coarse ore bins. Oversize materials that did not pass through the grizzly were broken up until they were small enough to pass. On small mills this was sometimes done by hand with a sledge hammer, but by the 1870s most mills had installed a Blake jaw crusher, available since 1861, to do this work. The mill in Figure 2.2-2 lacks a crusher or ore bin. A jaw crusher is shown in profile at the highest level of Figure 2.2-1. These remarkable crushers are still widely used today with almost no change from the original design. Working much like a huge nut cracker, they greatly reduced the amount of breaking that had to be done by hand. Sledge hammer work was never eliminated since ore would get stuck in the grizzly or would be too large for even the jaw crusher to handle. Aside from the strenuousness and danger of this work, there was the constant problem of sledge hammer heads dropping or breaking off and falling into the ore bins or jaw crusher. A battery of stamps would have to be shut down to remove such an object, which could cause considerable damage before detection.

Correctly sized ore then had to be passed into another crusher capable of reducing particle size to the fine sand (20-40 mesh per inch) ideal for the process. Early on, most mills relied on human feeders to shovel material into the crushers. A single man could do the feeding at a small mill such as the Hoosier State Mill described above or at the mill illustrated in figure 2.2-2. He had to be an energetic and highly skilled worker to keep the stamps running at maximum efficiency. By the 1870s several automatic devices had been developed to feed the proper amount of ore to the stamps. These feeders are small hoppers whose discharge is regulated by the amount of ore within the crusher. Secondary crushing was universally done by variants of stamp mills. The most common design, called the California stamp mill, was normally set in batteries of four or five stamps (Figure 2.2-5A). Individual stamps generally weighed from 500 to 1,000 pounds. After an initial disastrous experiment with dry crushing in the stamps, water was universally introduced to the stamp batteries. In some cases mercury was added to the ore at this stage as well to begin amalgamation of free gold. Amalgamation was also done on mercury spread on copper plates fixed on the aprons catching the outflow from the stamps. These inclined aprons are clearly visible in Figure 2.2-2. The size of particles leaving the stamp batteries was regulated by the use of mesh screens or perforated plates of sheet iron.

The stream of pulverized ore was then directed into a series of settling tanks or vats, usually called settlers:

> These tanks are usually built of plank, are 3 or 4 feet deep by 5 or 6 or more feet square, and are so arranged as to have communication with each other near the top, so that the stream of water carrying the crushed ore in suspension, having

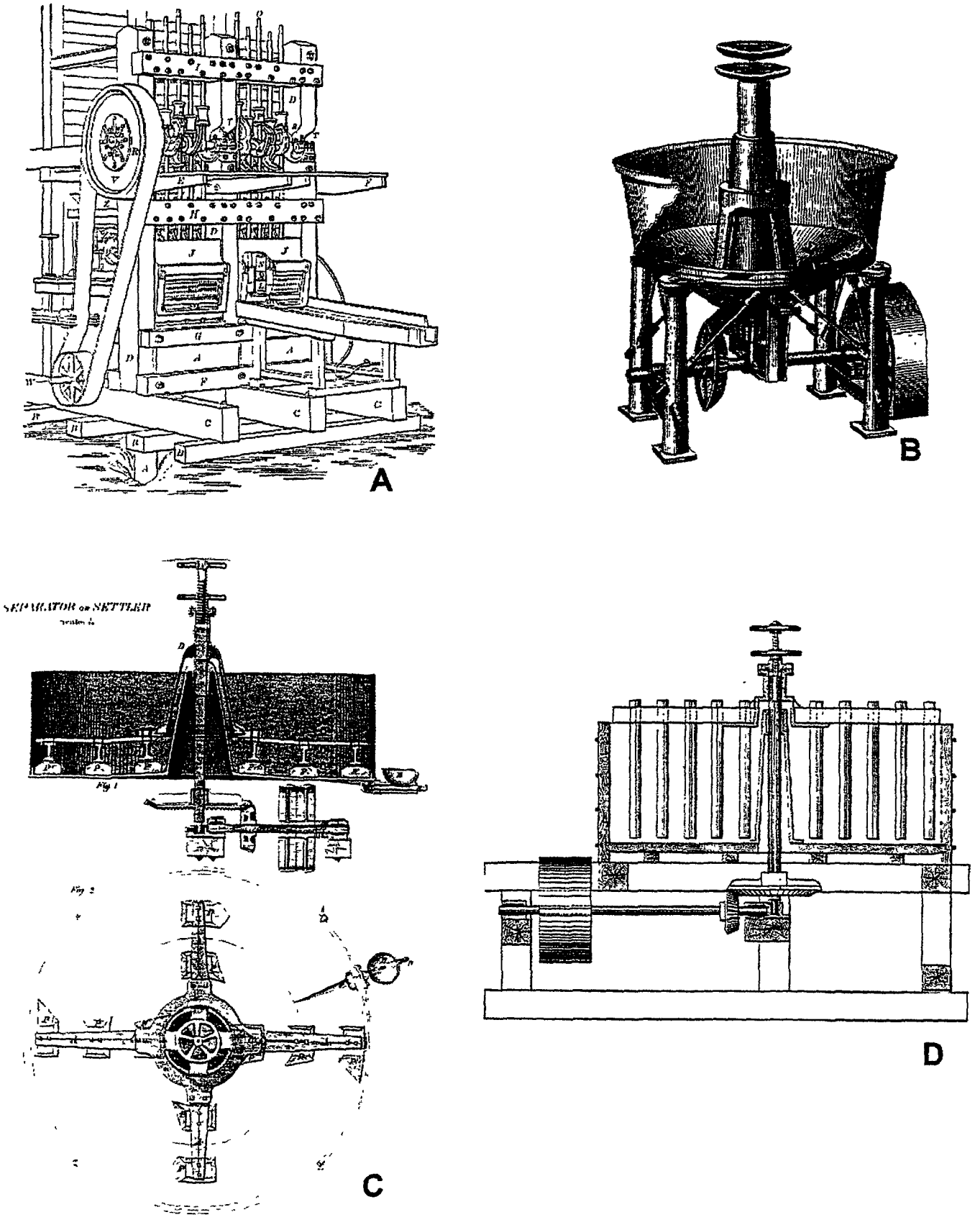


Figure 2.2-5. Machinery used in a typical Washoe Process mill. A, stamp battery (Richards 1908:144); B, Hepburn and Peterson's Pan (Lord 1883:126); C, separator (Hague 1870 Pl.xvii); D, agitator (Richards 1908:779).

> filled one tank may pass into the next, and so on through several, depositing the material and not finally leaving the tanks until it has become tolerably clear. [Hague 1870:196]

In addition to the main settlers that mainly accumulated sand, additional settlers could be added to the end of the circuit to try to collect some of the slimes. Overflow from the main settlers had to be left standing in the slime settlers for a long time to let some portion of the slimes accumulate. This solution to the slime problem was only partial due to the long periods of time required for the fine particles to settle out. The position of the row of settlers is shown in the middle of the cross section (Figure 2.2-1) and of the lithograph, where they are easy to spot as the only square to rectangular appliances in the mill (Figure 2.2-2). The system of settlers was designed so individual tanks could be isolated from the circuit. Once filled with sediment a settler was emptied by shovel. The clarified water with its proportion of silt and clay-sized particles, along with a proportion of the precious metals, was run off to tailings as slimes. These slimes were usually collected in a pond to settle, pending development of a technique capable of reworking the materials to extract the high losses. On the way to the slime ponds, the slimes were run over rough-bottomed blanket sluices to collect the heavier portion as concentrates for further milling.

The stamp sands in the settlers were wheeled to the series of fine grinding and amalgamation pans immediately downslope. The most important single appliance in the mill, these Washoe pans were the primary focus of a flurry of competing patents and variants through the 1860s. An example is shown in Figure 2.2-5B. Hague (1870:197) describes the typical features of the pans as follows:

> The common features are a round tub...usually of cast-iron, but sometimes with wooden sides, 4 to 6 feet in diameter and about 2 feet deep, having a hollow pillar cast in the center within which is an upright shaft projecting above the top of the pillar that may be set in revolution by gearing below the pan. To the top of this shaft is attached, by means of a key or feather, a yoke or driver by which the muller or upper grinding surface is set in motion. To the bottom of the pan, on the inside, is fixed a false bottom of iron, cast either in sections, commonly called dies, or in one piece, having a diameter a little less than that of the pan, and with a hole in the center adapted to the central pillar. This serves as the lower grinding surface. The muller, forming the upper grinding surface, is usually a circular plate of iron corresponding in size and form to the false bottom just described, having a diameter nearly equal to that of the pan, and a flat, conical, or concoidal form, according to the shape of the pan-bottom. It under side is furnished with shoes or facings of iron, about an inch thick, that may be removed when worn down and replaced by new. The muller is attached to the driver, which is put on and over the central pillar of the pan and, being connected with the interior upright shaft as above described, is thus caused to revolve.

The muller was designed to be raised for agitation or lowered for grinding. When charging the pan, sand, water, and live steam were admitted with the muller in grinding position. A large charge of quicksilver was added at this time. The temperature was raised to about 200 degrees F to speed amalgamation. The consumption of quicksilver was a major milling expense:

> The quantity varies greatly in different mills, the ordinary supply being about 60 or 70 pounds to a charge of ore consisting of 1,200 or 1,500 pounds. In some mills a quantity, varying from 75 to 200 or even 300 pounds, is put into a pan when starting up after a clean-up, and subsequently a regular addition of 50 or 60 pounds made with each charge. [Hague 1870:199]

By the late 1860s, most of the bogus "chemicals" added to the pans in attempts to enhance amalgamation had been discarded as worthless. Only the time-tested additives of common salt and copper sulphate (bluestone or copper vitriol) remained in common use. Amounts varied from about a quarter pound to four pounds per charge with the proportion determined by the intuition of the miller. The efficacy of chemicals and the proper amounts provided ground for stirring debates in the technical journals. In a series of controlled tests with Comstock ores, Hague could distinguish no benefits from salt or bluestone either. Generally the fine grinding in the pans occupied about two hours and perhaps another three were used for amalgamation. By adding water to the thickened pulp, the pans were emptied through drains.

From the pans, the pulp was run into separators.[1] These are tanks looking similar to the pans. An example is shown in Figure 2.2-5B. These tanks were usually larger then pans with 7-8 ft diameters and were of lighter construction, either of iron or wood with iron bottoms. Arms mounted on a central shaft carried stirrers, generally equipped with wooden blocks that rested on the bottom. Rotation was much slower, serving only to keep the lighter materials in suspension so the heavier amalgam and quicksilver could sink to the bottom. They were commonly installed at a ratio of one separator to two pans. It normally took from two to four hours for a separator to process its charge. Additional water was added to dilute the charge and facilitate separation. Pulp was removed as overflow through successively lower outlets. Liquid quicksilver and amalgam were drawn off through a fitting in the bottom of the separator.

An optional piece of equipment was an agitator. Pulp from the pans and other liquid discharges from throughout the mill were run into these 6-12 ft diameter tanks, equipped with stirring devices. An example is shown in Figure 2.2-5D. An agitator is present in the mill profile (Figure 2.2-1) but none are present in mill illustrated in Figure 2.2-2. These devices collected small amounts of quicksilver and amalgam still remaining in the pulp after separation. They were emptied and cleaned out on an infrequent basis.

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[1]Confusingly, both the sand settling tanks below the stamps and mercury/amalgam settling tanks below the pans were called *settlers*. In this discussion, the former will be termed settlers and the latter will be referenced by the alternative contemporary term *separators*.

Sand tailings passed out of the mill and were generally sent to a different tailings pond than the slimes. Recovery from a pan mill was usually 60-75 percent, although with intensive use of blanket sluices and reworking of the tailings following weathering (another reaction that converted sulphides to oxides) total recovery could be increased to 85-90 percent.

Quicksilver and amalgam were recovered at various locations throughout the milling circuit. In addition to the regular collections mentioned above, each part of the mill that came in contact with the pulp was disassembled and cleaned periodically. This cleanup included scraping to remove hard amalgam. Liquid quicksilver and amalgam were washed, sometimes with the aid of a small pan similar to a separator, and strained through canvas, sometimes with the aide of a hydraulic press. Quicksilver passed through this filter and was ready for reuse. Amalgam from all of these sources was heated in a retort. Quicksilver was condensed and reused while the remaining ore concentrate (sponge) was melted, cast in a mold, assayed, and shipped to a refinery.

Mills of this period normally operated two 12 hour shifts daily. The mills typically ran day and night, except Sundays, when cleanup and repairs were done (Browne and Taylor 1867:121). Nearly every aspect of mill operation demanded experience and judgement for the mill to have a chance at being successful. The process constantly had to be adjusted for changes in ore, machinery was altered, the circuit changed, and chemical additives were modified – all at the discretion of the millers. The skill level required, even of a task seemingly as menial as shoveling ore into the stamps is illustrated by contemporary comments about the feeder:

> ...the automatic feed is more economical than to have a man feeding who is careless, lazy, or inexperienced...but if the mill is pressed with work...the self-feeding apparatus is not so good as a man active, faithful, and skillful. Even if he must be paid $5 a day, he will more than earn his wages by the increased production of the whole mill.... The skillful workman will feed low and uniformly, and not by sight, but by the sound of each stamp. [Adams 1874:409]

According to James (1998:241) the last Washoe pan mill on the Comstock was built in 1887, but there is evidence that other smaller ones were constructed in Gold Canyon at least into the late 1890s.

2.3 CONSOLIDATION

Consolidation of mining interests on the Comstock started almost immediately, but did not reach major proportions until the Bank of California started its campaign of economic conquest on the lode that made it preeminent from 1867 to 1875. The hegemony of the Bank was ensured by its construction of the V&TRR, giving it a monopoly on the major transportation

link to the outside world. Further consolidation was effected by the rival Bonanza Firm, starting in 1869 (Elliott 1987:125-128).

Consolidation of the mills into larger and perhaps more efficient operations was delayed by a willingness of mine owners to have their ore processed at the many small custom mills rather than invest the time and capital required to develop mills devoted to the ore from single mines or groups of mining interests. This hurry to get a rapid profit was estimated by Lord (1883:128) to cost the companies an average of $24 per ton, about twice the cost of reduction at a well-managed facility. Ironically, this overreaching of resources by small mills encouraged consolidation in the end. The Bank of California extended loans to many of the milling operations and acquired many of them when they collapsed. Some continued to be run by the Bank, while most others simply disappeared as meaningful competition.

By the early 1870s, the Carson River mills in Ormsby County tied into the V&TRR had 16, 20, 34, 40, 44, and 56 stamps and other facilities scaled to match the numbers of these crushers (Mineralogist 1872:117). In contrast, the typical early 1860s mill was likely to have something more like 15 to 20 lighter stamps.

2.4 TAILINGS MILLS

It did not take long for operators to realize that the Washoe pan process was not very effective on silt and clay-sized particles, called slimes or slums. At first these slimes were simply allowed to wash away but soon a major effort was made to recover the values. The first remedy was to install miles of fabric-lined "blanket sluices" below the mills to try to salvage the precious metals. The concentrates from the sluices (blanket washings) could then be sent to a smelter in California, or reprocessed at a local pan mill. For example, the Janin and Park mill specialized in this form of tailings work in 1867 and Janin made his reputation on advances in recovering values from tailings. During that year there were 75 sets of tailing sluices operating in Gold Canyon and additional sluices in Sixmile Canyon. Mills working tailings could process the concentrates for $10 per ton (MSP 1867 14:279; 15:231).

Tailings mills on the Comstock processed three classes of material. The sands and pan slimes had already passed through a complete recovery process in which varying parts of the values were removed. Slimes had not been processed and thus generally contained much higher values than the sands. The third class is the concentrates gleaned from blanket sluices. Typical assays of sand ranged from $5-7 and of slimes from $15-25 per ton (Hodges 1886:1). Aside from not requiring stamps and often using larger pans of composite iron and wood construction, the process was generally the same as that of the later stages of the Washoe process.

The Lyon Mill was one of the premier tailings mills on the Comstock. Since there is an excellent summary of the tailing process as applied to that particular mill (included as Appendix D), discussion of these particulars will be postponed until Chapter 4.

2.5 LEACHING, FLOTATION AND OTHER LATE DEVELOPMENTS

Application of the cyanide leaching process to gold, and to a lesser extent silver, milling revolutionized the industry to such an extent that mining historian Otis Young (1970:285) has identified this single technological innovation as marking the end of the mining frontier. The basic process is very simple. Gold and silver is dissolved in a solution of sodium (occasionally potassium) cyanide in water by agitating ore in the solution. Gold is precipitated out of the solution using metallic zinc while silver requires other precipitants such as calcium or sodium sulphide.

The Comstock was not in the forefront of leaching technology. Instead, it reflected developments spreading out from other districts. The first practical use of the process was in Scotland in 1887. It proved commercially viable in New Zealand and Africa in the early 1890s and by 1897 the process was in use worldwide. The first experiment with a cyanide leaching plant to process Comstock ores – at Washoe Lake in 1896 – was typical of this global expansion. From 1897 on, experimental cyanide plants were in use throughout the district. Successful application of the new technique for the ores, particularly the slime content, took several years, as exemplified by the Butters Mill, completed in 1901, and the highly efficient Crown Point Mill, constructed during the 1930s depression (Hoffmann 1907:191; James 1998: 242; Laist 1947:150; Thompson 1915:123-127; Young 1970:283-285). A variety of cyanide leaching techniques continue to be used by Comstock millers to the present.

More details will not be provided about this highly efficient process that could be used economically at almost any scale, and has made possible the milling of low grade ores and previously discarded tailings. Although it was thought that cyaniding might have been undertaken at the Douglass Mill, this hypothesis has been discarded as is discussed in Chapter 4. Similarly, twentieth century developments in crushers, gravity concentration, and separation by flotation never came into play at the mills subjected to study during the Carson River Mercury Project.

2.6 ASSAYING

Assaying the values present in ore coming into the mill, of the marketable output, and of the lost tailing was an essential part of every mill operation, though it was not undertaken with anything like the scale seen at modern mills and only a few of the larger mills had their own office. Unlike milling practice, assaying changed little from the late nineteenth century to the

mid-twentieth century when a variety of new techniques began to be developed. DeQuille (1876:265-266) provides a description of typical Comstock practice that cannot be improved upon. It is presented as written except that items identified at the assay office debris concentration near the Keller & Co. Mill described in Chapter 3 are highlighted:

> The assay-office of the Consolidated Virginia Mining Company is a large and handsomely constructed building standing a short distance south of the main hoisting works. It is divided into a number of rooms, in which are the several departments of the business. In the melting-room are six **furnaces** ranged in a row, in which are placed the melting-pots, which are made of **plumbago** [graphite]. These pots [**crucibles**] are capable of holding 300 pounds of silver each, but the quantity melted is generally from 220 to 230 pounds, sufficient to make two large bars or "bricks," as they are commonly called.
>
> After the silver is thoroughly melted, it is well stirred up and the dross that rises to the surface is skimmed off. The pots are then lifted out of the furnace, and the molten silver is poured into iron molds which form the bars, weighing a little over 100 pounds each.
>
> When the pots of molten silver are lifted out of the furnace, a small quantity of the liquid mass is taken from the surface in a little ladle.
>
> The silver thus taken out is thrown into water, when it scatters, and spreads out in a thousand fantastic shapes. ... They are called "granulations" and it is from these particles of silver that the assays are made by which the value of the bar is known.
>
> As the molten silver is poured from the pot, in molding the second and last bar, the little ladle is dipped quite down to the bottom of the pot and a small quantity of the liquid metal is taken out and thrown into cold water, as was the first. The resulting granulations are assayed, and the two assays must agree exactly or all is to be done over again before the bars can be stamped with their value in silver and gold. ...
>
> In making an assay of the granulated silver, a French gramme in weight is taken. This is wrapped up in a **thin sheet of pure lead** – lead that contains no silver – when it is put into a **cupel, made of bone ashes**, and the whole is then placed in a muffle-furnace. In the great heat of this furnace both lead and silver are soon liquefied, when the lead is absorbed by the cupel, carrying with it whatever base metal there may be in the gramme of bullion. The "button" left at the end of this process of cupellation is weighed, when is ascertained the weight in fine metal – gold and silver.

> The bullion is now hammered out till it forms a thin sheet, when it is placed in an annealed glass flask, called a matrass, and strong **nitric acid** is poured over it. The flask is then placed in a sand-bath (a sort of oven, the bottom of which is covered to the depth of an inch or more with hot sand) and the flattened button is boiled in the acid until all the silver in it is dissolved. The gold, which remains in the bottom of the flask in the form of a fine powder, is collected in an **unglazed porcelain crucible.** The crucible is placed in a warm place until the gold has dried, when it is put into a furnace and annealed – heated until the particles unite and form what is called "matte."
>
> It is then removed from the crucible and carefully weighed. The weight of this matter shows the gold contained in the button, and the loss in the weight – that which was dissolved out of the original button by the action of the nitric acid – represents the silver. The bars being next accurately weighed, their value is determined from the amount of gold and silver found in the sample of one gramme taken from the silver of which the bars were molded. ...
>
> There is a separate room in which the weighing is done and the calculations made. All in this room is as neat and clean as in the finest parlor. In another room are the muffle-furnace and sand-bath, and in still another the furnace where the assays are made, also a still for distilling water. In **ore** assays, 200 grains of finely powdered ore are placed in a **small earthen crucible**; a proper quantity of flux is added, and the whole is then placed in the furnace and melted. After the mass has remained in the molten state a sufficient length of time, the crucible is taken out and allowed to cool. When cold it is broken by a blow with a hammer, and the button deposited by the ore is found at its bottom. The button is then assayed in the same way as the granulations taken from the melting-pot, and from the result the value per ton of the ore is calculated.

2.6 SUMMARY

The introduction of precious-metals milling processes onto the Comstock starting with discovery of the lode mines in 1859 resulted in the sudden insertion of industrial-scale applied chemical processes into what had been wilderness. This insertion was dramatic and chaotic. In classic form predicted by evolutionary ecology, a period of rampant competition followed when various alternatives were introduced and the ones that were seen as most adaptive for a combination of cultural and economic reasons were retained.

In retrospect, there was very little actually new in the new Washoe Process. Most of the parts were present in varying degrees in extant technologies. Critical cultural factors interceded to make the Washoe Process so popular. These were the need for haste in the environment of

competitive capitalism – requiring a rapid reduction process, and the need for maximizing mechanization to reduce the need for labor – which was expensive and in short supply. Increased recovery rates were important due to the high costs of mining, labor, and materials. Still, contemporary accounts make it clear that once a baseline recovery rate was met, little effort was made to make the milling operations more efficient. Assaying and accounting procedures were amazingly slipshod by modern standards. Also, there was the cultural impression that the Comstock was opening the door on unlimited and ever-growing wealth – it simply did not seem important to work for small savings.

There was nothing subtle in this intrusion of the Industrial Revolution onto the western landscape. This was the high point of the Steam Age, when huge engines accomplished what could later be done by small diesel or gasoline plants or by transmitted electrical power. To operate, the mills required massive amounts of cordwood to fuel the engines, along with that needed for roasting, retorting, and other purposes. Finally, the mills necessitated development of a local and regional transportation system and created huge demands on scarce water supplies in an arid area.

Aside from the changes in how processing changed from one oriented toward amalgamation toward a variety of different processes, a major change in the twentieth century mills was the application of gasoline, diesel, or electric power plants to running the mills. This had three distinct effects. First, it allowed mills to divide up their processes into smaller units based primarily on metallurgical needs, rather than the dictates of linear belt drive trains tied to water wheels or steam engines (Taggart 1947:117). Small motors could be placed on individual machines. Second, due to a reduction of cost of power, it allowed mills to be situated on flatter ground. It was no longer of prime importance (though it was still a strong consideration) to use gravity flow everywhere in the mill. Various bucket and belt conveyors were rapidly devised to run materials uphill at will throughout the mill. The third effect was one of helping to divest milling of its former placement in mill seats where water was readily available in large quantities. The newer techniques put a high premium on recycling mill water with the contained reagents and values. This, plus the development of highly efficient dewatering machines for the tailings, plus the availability of strong and portable power sources, enabled millers to switch to much more of a "mapping on" strategy of mill placement close to ore bodies. Small cyanide plants, mechanical separation plants, and flotation plants are often seen located high up canyons near or at specific mines.

3.0 KELLER & COMPANY MILL

by Ronald L. Reno, Vickie L. Clay, and C. Lynn Furnis

This mill was built in 1861 as a water-powered stamp and arrastra plant to process ore from the Comstock Lode. By 1865 the mill was reconfigured. Power continued to be provided by a water wheel but the arrastras were replaced by Wheeler pans. This required a source of steam, so a boiler was added. The mill was dismantled by 1866. If the dismantling had been incomplete, leaving in-place artifact deposits, room outlines, and foundations, a great deal of information could have been derived from the mill archaeologically. Unfortunately, test excavations including backhoe trenches and hand-dug test pits showed that the mill area was massively disturbed after dismantling (Reno and Clay 1996). Although many artifacts are present on site, they lack necessary contexts for meaningful interpretation. Due to this poor preservation, the mill was not regarded as significant and was not selected for additional archaeological work during remediation. The mill ruins are in the southeast portion of MS001 (Figure 1.0-2). Although not specifically selected for additional work, supplementary information about the mill yard and its depositional history was obtained during monitoring and during excavations at Fea 5. Structural remains of what may have been an assay shop were found during monitoring at Fea 6. Data recovery at these features is documented in this chapter along with a review of the testing and evaluation data.

3.1 HISTORICAL ACCOUNTS

As part of the SAIC study, Piedmont Engineering Co. resurveyed millsite boundaries and relocated prominent cultural features. Much of MS001 is within the Keller & Co. Millsite, also known as the Lindauer & Hirschman Quartz Mill and the Sweetapple Mill. The stamp mill, powered by steam and water, was built in 1861 and dismantled in 1866 (SAIC 1993[1]:56, 59). This 1861 construction event marks the opening of the first period and phase of cultural activity at MS001 that could be identified from cultural remains on the ground. An overview of historic activity at MS001 is provided in Table 3.1-1.

The Keller & Co. Mill was owned by Joseph Keller and Isaac Cohen. These were two of Dayton's staunchest citizens whose primary business was the Old Pioneer Log Store (Kelly 1862:213, 219). The tiny mill is described as follows by Kelly (1862:219):

> KELLER & CO'S MILL—situated on the west side of the river, a few hundred yards below the Aurora, is sixty by seventy-five feet in extent; runs five stamps, and four arrastras, crushing about twenty tons of rock per day. It is driven by a center-discharge wheel, employs eight hands, and works the ore for both gold and silver.

Table 3.1-1. Periods at the Keller & Co. Mill and Vicinity of MS001.

Period	Phase	Date	Mill	Fea 5	Fea 6	Fea 7	Tailings	Rock Point Ditch	C&CRR
I	1	1861-1864	Keller & Co. Arrastra Mill built.	NA	NA	NA	Likely sent into river. Largely sand with high values.	NA	NA
	2	c1865	Lindauer & Co. Pan Mill rebuilt with Washoe pans and steam boiler.			NA	Likely sent into river. Both sand and silt with high to moderate values.		
	3	1866	Dismantled. Community peripheral area.	Dismantling debris from mill.		NA	None.		
II	1	1867-1879	Abandoned	Trench dug in mill debris and domestic debris dumped on top.		NA	Accumulation from other mills upstream.		
III	1	1880-1934	Abandoned, back lot behind RR station.		Lower strata and most assay debris c1880; upper strata early 1900s.	Late 1890s possible restaurant and household trash dump	Possibly used as temporary storage for tailings dredged from river.	Constructed in 1908.	Construction and use. Back lots between railroad station and river.
IV	1	1935-present	Abandoned, back lots behind residences.	Mixing of surficial artifacts.	Buried under shallow surface deposits.	NA	None except as overbank flood debris.	Abandoned and dismantled.	Abandoned and dismantled.

Based on the tonnage five stamps could crush at other mills in the area at a slightly later date, it is likely that this mill was actually processing somewhere between three and eight tons daily. The mill is shown under the Keller & Co. name on Bancroft's 1862 map (Ansari 1989:83).

The millsite was surveyed on November 20, 1862, for Abram Lindauer, Moses Hirschman (also spelled Hirshman), and Henry Sweetapple (Surveys A:209). This plat, Figure 3.1-1, shows a single rectangular mill building adjacent to a dam across the Carson River. The mill race runs along the southeast side of the building. An 1863 survey for a nearby mill confirms this general layout (Surveys A:298). This survey was undertaken to facilitate a transfer of title on November 28 to Lindauer and Hirshman of Gold Hill by the original owners, Keller, his wife Rosalla, and Cohen for $13,000 (Deeds A:551).

Lindauer sold "one half of two fifths" share of the Keller & Co. mill and other assets on the Comstock to Hirschman on December 8, 1862, for $10,000 (Deeds A:646). On February 26, 1864, Hirshman sold an undivided one-fifth part of the mill to Henry Sweetapple for $5000 (Deeds C:373). Hirschman sold a further two-fifths of the property to A. Block of San Francisco for $10,000 on September 13, 1864 (Deeds D:195). Lindauer sold his remaining share of the mill formerly known as the Keller Mill and now known as the Lindauer and Hirschman Mill along with the land to Lewis Gerstle, also of San Francisco, for $19,000 on October 7, 1865. Block and Gerstle appeared to be speculators not interested in directly running the mill.

The 1865 township survey plat (with 1865 revisions) shows the correct location of the Sweetapple Mill in the study area. The mill site was referred to under Sweetapple's name (sometimes changed to Sweet Apple) on later maps. Butler and Ives' (1865 v.R13, Fiche 6:367) survey notes include bearings from section corners that confirm this location when plotted on a modern map.

The conversion of the mill from one based on fine grinding by arrastras to its second phase of operation as a pan mill is documented in the April 4, 1865 issue of the Gold Hill News which noted "Sweetapple's mill, of twelve stamps, water and steam power, is at work reducing Gold Hill and Savage ore." On June 5, the same paper summarized the mill slightly differently:

> *Lindauer & Hirschman M.* – Lindauer, Hirschman & Sweetaple, proprietors; H. Sweetapple, Superintendent; water power, fifteen stamps, ten pans; nine men employed; one cord wood used per week; twenty tons quartz crushed per day, from the Gold Hill Consolidated mine.

The specification of water rather than steam power, along with the small amount of cordwood used, suggests that the mill continued to rely on its water wheel for running its machinery. The boiler would have served primarily to provide steam to heat the pulp processed in the pans.

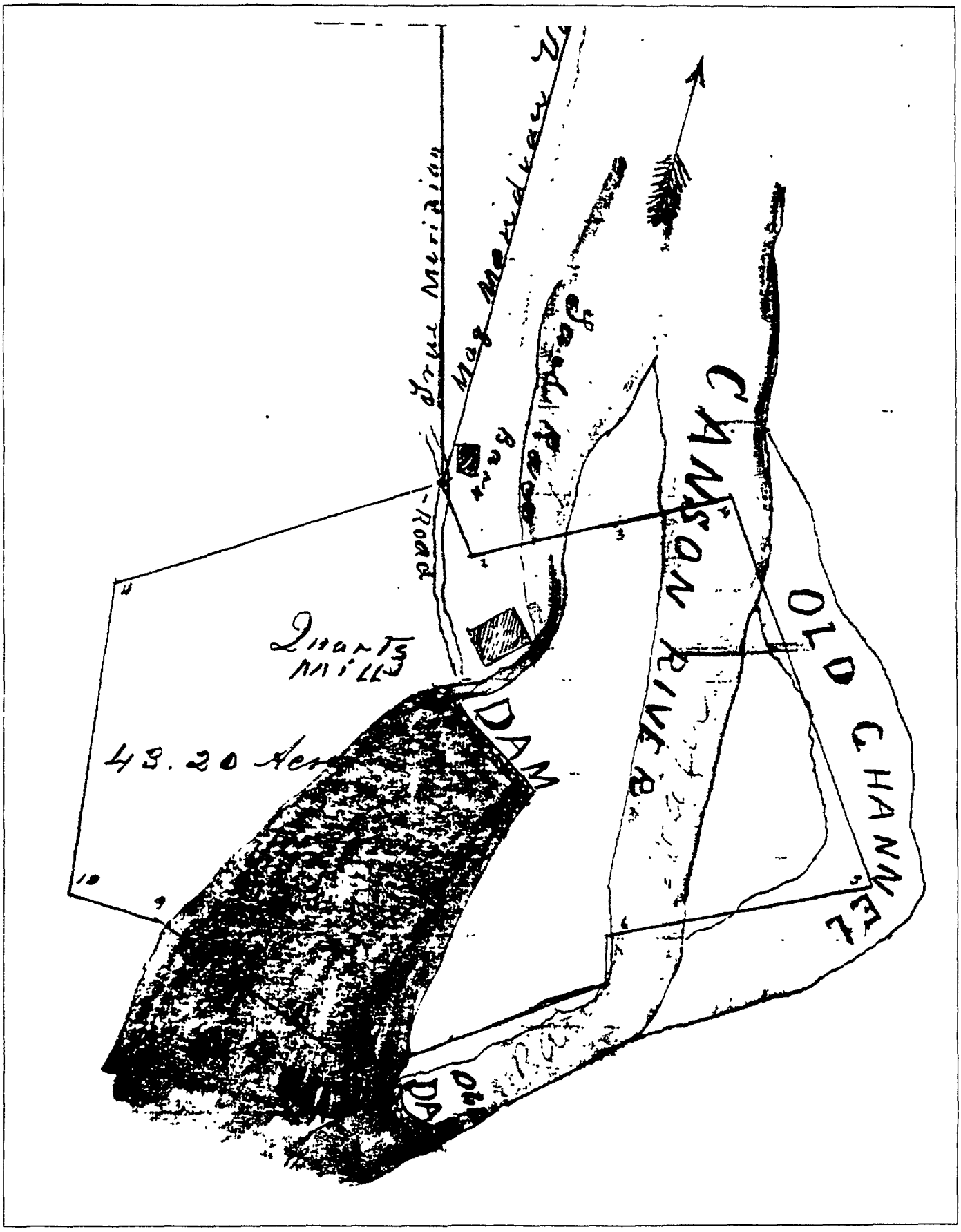


Figure 3.1-1. Keller and Company millsite surveyed on Nov. 20,1862 for Lindauer, Hirschmann, and Sweetapple (Surveys A:209). Plat has been enlarged.

Sweetapple made a profit in October 17, 1865, when he sold his one-fifth share to the Imperial Silver Mining Company of California for $12,000 (Deeds D:843). On October 27, Block sold his 2/5 share for $24,000 (Deeds D:840). The same day Imperial purchased the final 2/5 share from Lewis Gerstle for an additional $24,000, thus obtaining complete control of the property (Deeds D:838). The SAIC title search indicates a break in the chain of title at this point. It is not known what the Imperial Silver Mining Company did with the property after the mill was dismantled. For later title history refer to the SAIC document.

Ansari (1989:83) discusses the Lindauer & Co. Mill:

> Reported in 1865 to be water-powered, to have 15 stamps and 10 pans, to burn one cord of wood per week, to employ 9 men, and to crush 20 tons a day from the Gold Hill Consolidated Mine [data from the 1865 report of the Surveyor General]. At that time Lindauer, Hirshman, and Sweetapple were proprietors. It was also known as the Lindauer & Hirshman Mill. In 1866 the *Territorial Enterprise* reported it to be operating exclusively as a tailings mill, getting much of its supply of tailings from the Rock Point Mill.

In 1865-1866 the Nevada State Mineralogist (State Mineralogist 1877) collected data on the Lindauer & Co. mill just before it was dismantled by the end of 1866. It had been extensively remodeled since 1861 if not entirely rebuilt. The mineralogist notes that it could crush up to 20 tons daily with its 15 stamps totaling 480 pounds. The arrastras were replaced by 10 Wheeler amalgamation pans. Wheeler pans were flat-bottomed and were one of the more popular of the many pan styles available during this period of rapid development in pan technology. The mill was powered by a combination of steam and water, consuming 2½ cords of wood daily. These statistics indicate that it was an average Comstock pan mill of this early period characterized by a multitude of small mills. Although this mill could have processed tailings concentrates, it lacked the specialization needed to survive; another rebuild with larger tailings pans would have been required.

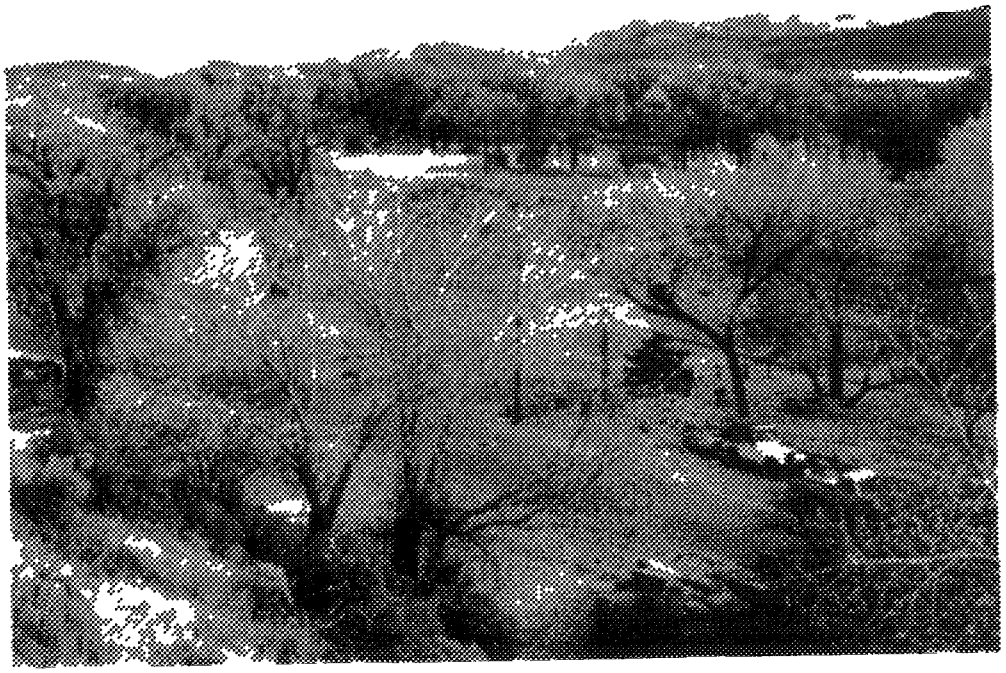
An 1885 map shows no buildings at the Sweetapple mill site, and the dam is no longer in evidence, although the Carson River is extremely wide in this area (Map in evidence for Third District Court, Lyon County, Nevada, Luigi Casei et al. vs. C. C. Stevenson, on file in Clerk's office). Evidently the dam had washed out, leaving the main channel of the Carson River flowing over the former mill and tailrace.

The 1905 assessor's map of Dayton extends into the study area. This map shows the railroad yard and houses for the Nevada and California (formerly Carson and Colorado) Railroad that was active from 1880 to 1934. It also shows the alignment of the Rock Point Ditch. These locations are shown better on the 1909 map and are discussed below. The mill seat is identified as the "Sweet Apple Mill Site" under control of the Union M. & M. Co.

On the 1909 Dayton Map the area currently occupied by houses and backlots was the site of the Southern Pacific Railroad Yard. Residences of the railroad agent and the section foreman occupied the rear of the yard while a small depot was adjacent to the right-of-way in what is now Railroad Street. The Rock Point Mill Race corresponds to its presently discernable location. A photograph of the MS001 area taken about this time clearly shows the railroad yard improvements (Figure 3.1-2). Several landscape features appear in this photo. A sagebrush-covered mound is present behind the railroad residences, situated approximately halfway between the back sheds and the river. This mound may well be the one (Fea 1) bisected by Tr 1 and Tr 2 during our testing activities as its shape, an unevenly truncated pyramid with highpoint at the downstream edge, and location, closely resemble the trenched mound (Figure 3.1-3). The mound is located just west of the active channel of the Carson River and just downstream from an oxbow in the river that served as the reservoir for the expanded Rock Point Mill Race. Much of this oxbow was later buried by tailings deposition and subsequent leveling for an agricultural field although a small reservoir remains.

During floods or above-average runoff this mound is subjected to the most intense erosive power along its eastern and southern edges. Major floods on the Carson River have been recorded in 1861-2 (washing away a number of mills), 1867-68, 1871-2, 1907, 1928, 1937, 1950, 1955, 1963, 1964, 1986, and 1997 (Dangberg 1975:18-21, 347; Pupacko et al. 1990; Rigby et al. 1998). The 1867 flood also caused severe damage or total destruction to mills along the river (MSP 1867 14:23; 1868 16). During the 1997 flood the mound was completely surrounded by floodwater with only a few feet at the top visible.

A ditch may be present in Figure 3.1-2 extending from the eastern edge of the sagebrush-covered point bar to the inside of the aforementioned berm, although no ditches are clearly indicated. Also notable is the light coloring of the surficial sediments in the sagebrush covered area north of the meander and south of the railroad residences. This material strongly resembles mill tailings located just west of the railroad tracks and may represent outwash and/or flood water redeposition of some of this material in the project area. A gravel accumulation along the north central bank of the meander appears cultural in origin and may be related to the ditch, to a ford in the river, or to bank stabilization on the cutting edge of the meander channel. Thus, by the time this photograph was taken in the early 1900s, the Keller & Co. Millsite is not present although the current Fea 1 mound appears present and covered with sagebrush. Additionally, the headrace to the mill does not appear to be in use or visible from the early twentieth century photograph. No dwellings are present in the area and the cottonwoods, cut out earlier for firewood have not grown back. By contrast, from the same vantage as the historic photograph the study area is now almost entirely obscured by large cottonwoods.



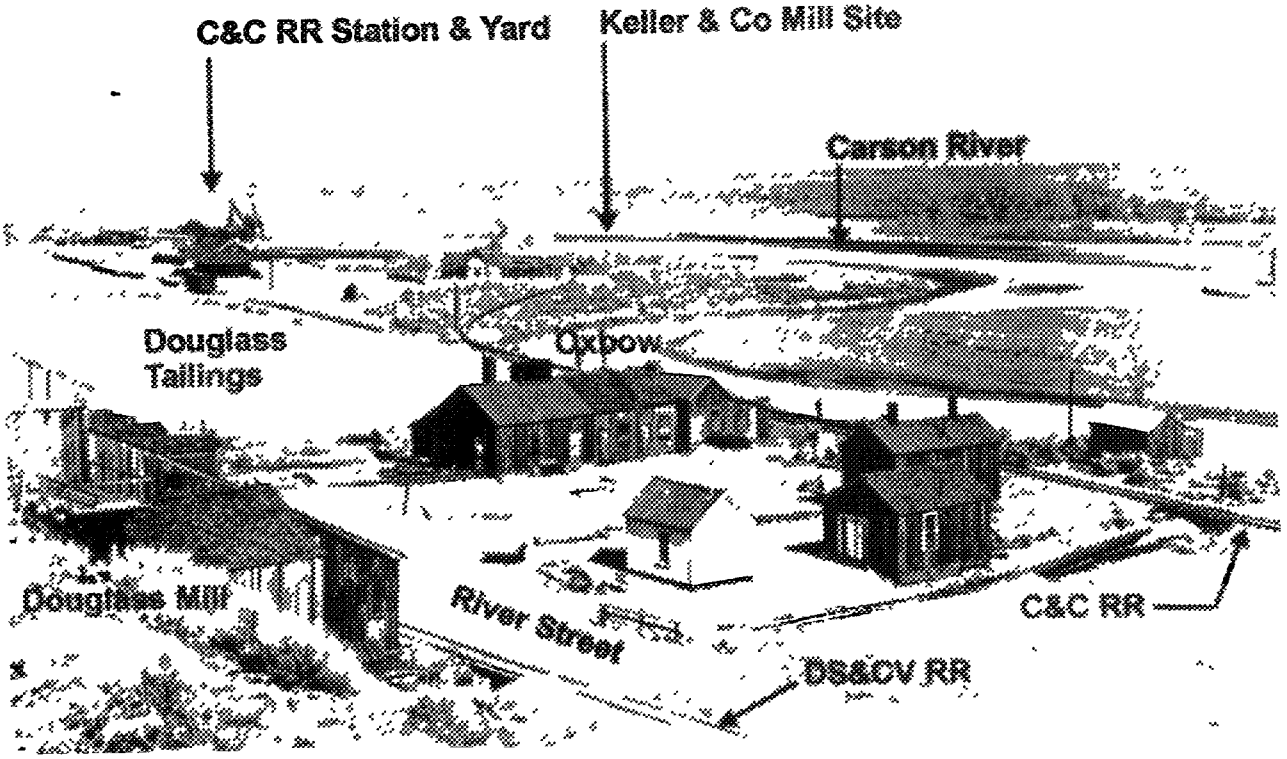


Figure 3 1-2 Dayton shortly after the turn of the century taken from the Rose Ditch and the same view today (Photo courtesy of Nevada Historical Society)

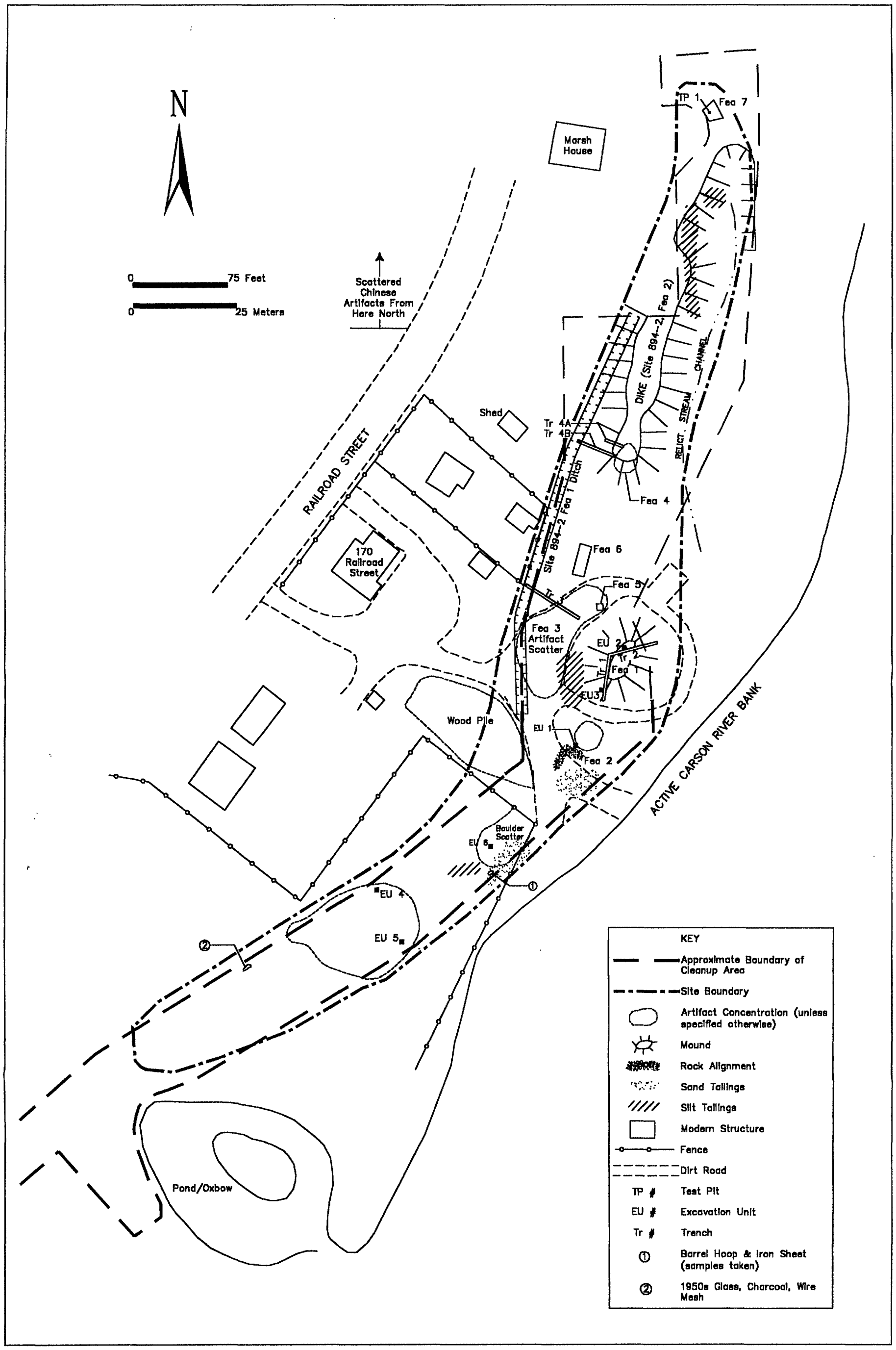


Figure 3.1–3. Site map for the Keller and Company Mill and other features at MS001.

3.2 THE MAIN MILL AREA

No definite surface remains of the mill were evident, but a mound on site (Fea 1) with many boulders and cobbles appeared likely to be part of a structure (Figure 3.1-3). A low possible rock alignment on the southwest side of the mound was identified as Fea 2. Fea 3 is a concentration of extremely fragmented artifacts including a mix of boom-period items (black glass bottles, extremely patinated brown and aqua glass), more generic nineteenth century markers such as applied and tooled finishes on bottles, cut nails, and undecorated white improved earthenware (wie). Late nineteenth to early twentieth century glass is present, including a purple picnic flask. Modern debris is also present throughout the area. Overall, ground visibility is extremely poor. Where the dense growth of weeds has been scraped off fragmentary artifacts are exposed. Fea 4 is a concentration of nineteenth century domestic artifact fragments exposed by partial excavation of the ditch berm of Site 894-2 for use as a borrow pit. These surface artifacts are not particularly mill-related, suggesting instead generic domestic discard and architecture that has accumulated through time since the mill was abandoned. This pattern of artifacts extends into the southern end of the site within MS001 South discussed below.

Two backhoe trenches (Tr 1 and Tr 2) and three excavation units (EU 1-3) were placed within a mound thought by Piedmont Engineering to correspond to the historically mapped location of the historic Keller & Co. Mill (Figure 3.1-3). The 1862 survey map (Figure 3.1-1) suggests that a single rectangular building with long axis oriented roughly northeast-southwest comprised the quartz mill. Tr 1 extends for 12 m at 10 degrees along the length of the mound from a central apex to an apparent lower edge to the south. EU 3 was excavated in the west wall of this trench at a location where an area of charred debris looked like possible in situ structural remains. Tr 2 begins at the north end of Tr 1 extending at a 75 degree bearing for 11.5 m and exposing the river side of the mound. Within Tr 2, one area of structural debris was chosen for excavation (EU 2). EU 1 was placed in an area located on a slight rise off the southern edge of the mound in an area with several rock alignments on the surface (Fea 2). Location of units and trenches with regard to the mapped millsite in 1862 would place Tr 1 extending from somewhere in the center towards the southeastern wall; Tr 2 would extend from the apex through the northeast wall to the Tail Race. EU 1 would be near the juncture of the southwest and southeast edges of the mill. However, it should be noted that an overlay of the 1862 plat places most of the mill in the present river and places the mound immediately southwest of the building.

Depositional history of the mound (Fea 1) is illustrated and described in detail on Figure 3.2-1. Briefly, and working from the past to present within the context of 4-ft-deep maximum exposures, major strata and stratigraphic breaks suggest the following scenario. An existing or human-made terrace rising to a maximum of about 1.5 m above the surrounding floodplain and comprised of Str 14, 14A, 14B, and Str 4 in EU 1 formed a flat topped surface (Int 13) for use by local millers. These strata are primarily devoid of cultural artifacts although some artifacts have mixed into the upper levels of the softer alluvial sediments. All of these strata represent either overbank or active alluvial channel deposits as expected along the edge of the Carson River.

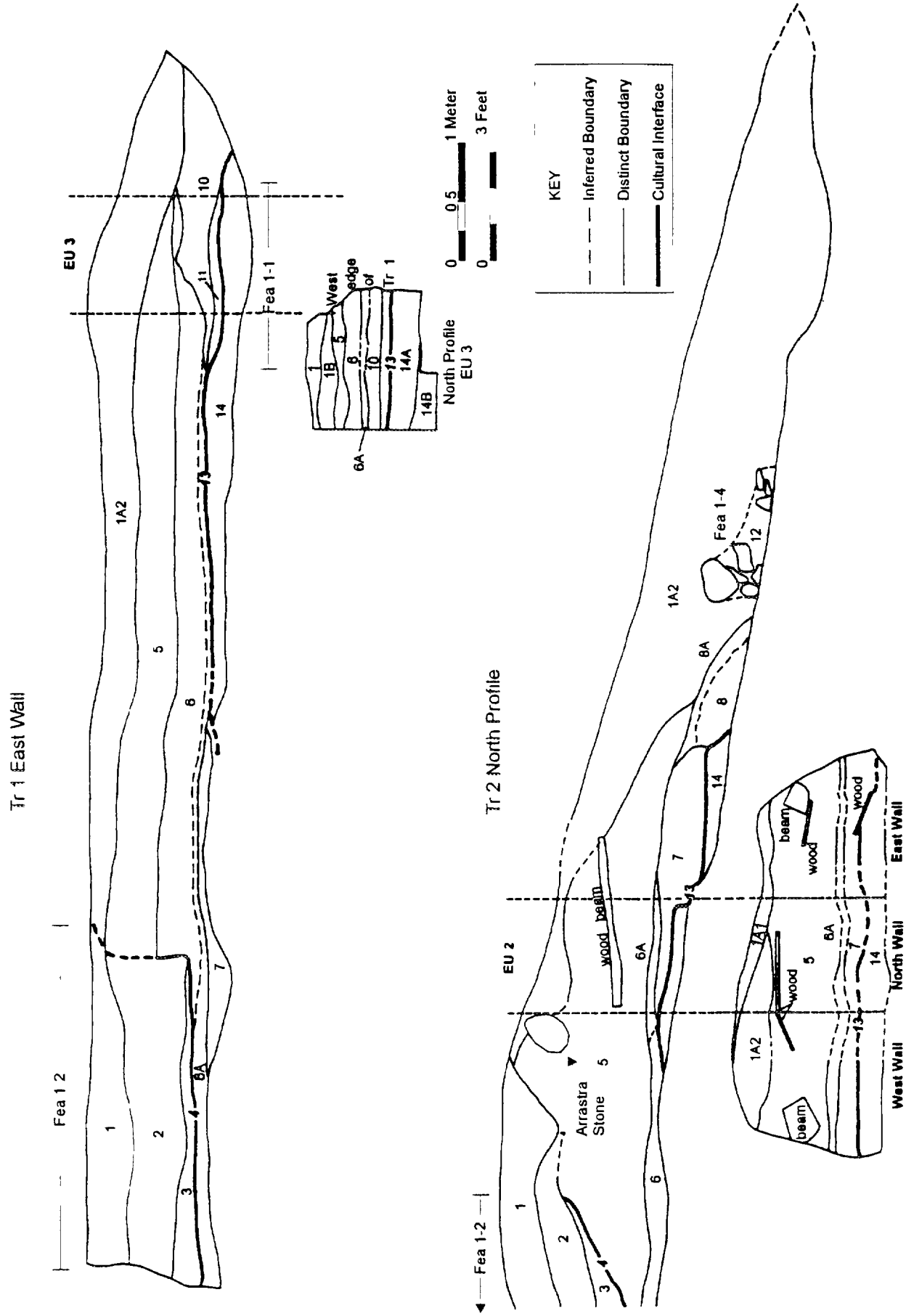


Figure 3.2-1. Stratigraphic profiles in Fea 1, Keller & Company Mill, NMS001 North.

Cultural Fill in Fea 1-2 Depression

1 10YR4/3 brown (dry) 10YR3/3 dark brown (moist). very poorly sorted gravelly sandy loam texture; massive structure non-plastic, dry loose to soft consistency; inclusions of aqua and olive glass, brick, modern hoses and debris in upper 10 cm, grass, brush and cottonwood roots; no reaction to HCl; gradual smooth boundary. Surface fill on top of Fea 1 mound from nearby Carson River bouldery alluvium, may have purposely buried the mill site.

2 10YR6/3 pale brown (dry), 10YR5/3 brown (moist), mottles 10YR5/6 yellowish brown, 10YR8/2 very pale brown, 10YR5/6 yellow, 10YR8/4 very pale brown (dry): mostly fine sand to small boulders to silt: massive; non-sticky, non-plastic, dry soft; brick, aqua glass, charcoal, common medium to coarse roots; no reaction to HCl; abrupt smooth boundary/irregular and gradual locally. Fill with ca. 50% very, fine sand; the various colors are probably mill tailings; bulldozed push pile of material from nearby silt clasts hold their subhorizontally stratified integrity and thus have probably not been moved far from their place.

3 10YR5/2 grayish brown (dry), 10YR4/2 dark grayish brown (moist); poorly sorted fine to very fine loamy sand; non-plastic, dry soft; charcoal, cut nails, aqua and olive glass, brick, copper triangles, large metal pieces, glass carboy fragments, fine sand tailings concretions, roots; no reaction to HCl; clear smooth boundary. Possible debris lens filling the base of a large pit or hole, partially burned; Fea 1-2 fill.

4 Interface or cut that was filled with debris; Fea 1-2 cut.

Cultural Fill Outside of Fea 1-2 on Fea 1 Mound

1A1 10YR6/3 pale brown (dry). 10YR5/3 brown (moist); poorly sorted fine sand; massive to platy parallel to slope; non-sticky, non-plastic, dry loose to soft; roots. rootlets; no reaction on top to weak reaction to HCl near base; abrupt boundary; surficial slopewash and or wind reworking.

1A2 10YR6/3 pale brown (dry), 10YR5/3 brown (moist); moderately well sorted fine sand, 5% boulders; massive; non-sticky, non-plastic, dry soft to loose; rare tailings blobs, wood, duff, roots and rootlets; no reaction to HCl; wavy clear boundary. Possible mechanical disturbance.

1B 10YR6/4 light yellowish brown (dry), 10YR5/4 yellowish brown (moist); moderately well sorted very fine sandy loam; massive with local silt blebs; non-sticky, non-plastic, dry soft; silt blebs, roots. rootlets; no reaction to HCl; abrupt smooth boundary. Tailings mixed in upper strata on site; possible mechanical disturbance.

5 10YR6/3 pale brown (dry), 10YR5/3 brown (moist), with dry mottles of 10YR8/3 very pale brown, 10YR6/2 light brownish gray, 10YR6/6 brownish yellow; moderatedly well sorted fine sand; massive; non-sticky, non-plastic, dry soft; wood, arrastra stones, barrel parts, white earthenware, bricks, metal, roots, tailings blebs; no reaction to HCl, except very fine sand/silt blobs have moderate reaction; clear smooth boundary. Mill site rubble, possible mechanical disturbance.

6 10YR7/2 light gray (dry), 10YR6/2 light brownish gray (moist); very poorly sorted medium sands to well sorted pebbles to granules; massive, subhorizontally bedded, depressed under rocks, course beds 6 cm thick, fine beds greater than 1mm thick, generally fining upward through stratum; charcoal, brick, rootlets, roots; weak reaction to HCl near base of stratum; abrupt smooth boundary. In situ, water laid tailings and few pebbles and other clasts near surface of stratum. One boulder appears to have been thrown on west stratum and deformed underlying laminae.

6A 10YR6/2 light brownish gray to 10YR6/3 pale brown (dry), 10YR5/2 grayish brown to 10YR5/3 brown (moist); moderately well sorted coarse silt loam to well sorted very fine sand; massive with subhorizontal stratification; non-sticky non-plastic, dry soft; charcoal, nails, wood fragments, few colored tailings blebs. roots. rootlets, krotovina; moderate reaction to HCl locally; abrupt smooth boundary. Mill tailings, ponding episode at the base of Str 6.

7 10YR5/3 brown (dry), 10YR4/3 brown (moist); moderately sorted very fine sandy loam; massive; non-sticky, non-plastic, dry slightly hard; wood, charcoal, metal, roots, rootlets; moderate reaction to HCl; clear smooth boundary. Basal level cultural material.

8 10YR5/3 brown (dry), 10YR4/3 brown (moist), mottles 10YR5/4 very pale brown (dry); darker color is poorly sorted medium sand, lighter color is well sorted fine sand and silt, 10% pebbles: massive, locally light and dark colored areas interbedded; plastic, dry soft; brick fragment, roots; no reaction to HCl; clear smooth to wavy boundary. Colluvial action or mechanical deformation to get this mix of tailings and gravels on the edge of the Str 10 possible terrace.

10 10YR5/2 grayish brown (dry), 10YR3/2 very dark grayish brown (moist); poorly sorted sand, pebbles to silt, medium mode; massive; non-sticky non-plastic, dry soft; nails, metal, rootlets, roots; no reaction to weak reaction to HCl; abrupt irregular boundary. Fill on south edge of the Fea 1- 1 berm, possibly to hold Str 6 and a small mill tailings pond.

11 10YR8/1 white (dry) mottles 10YR2/1 black (dry): poorly sorted very fine sand; massive; non-sticky, non-plastic dry hard; metal fragments, charcoal, spruce glass, copper sheet, slag/clinker pebbles to 2 cm diameter, rootlets; strong reaction to HCl; abrupt smooth boundary. Possibly primary or secondary deposit of hotly burned material the white may be lime, mortar or ash.

12 10YR6/3 pale brown (dry), 10YR5/3 brown (moist); bouldery sandy loam, ca. 50% boulders; massive; non-sticky, non-plastic, dry soft; roots. krotovina; moderate reaction to HCl; gradual irregular boundary. Appears to be a collapsed 4-coarse or higher rock wall or berm, possibly rip-rap on the east side of the Fea 1 mound.

13 Interface between natural and cultural strata, on Fea 1 mound.

14 10YR4/2 dark grayish brown (moist); poorly sorted sand, medium gravels to medium sand; massive, possibly fining upward sequence where exposed; non-sticky, non-plastic, dry loose; charcoal, olive and aqua glass, brick, nails, wood, unknown metal, roots; no reaction to HCl; boundary not exposed. Primary or secondary Carson River deposits.

14A 10YR5/3 brown (dry), 10YR4/3 brown (moist); very poorly sorted gravelly fine sand, gravels rounded to subrounded to 18 cm dia; massive; non-sticky, non-plastic, dry loose to soft; few glass and nails, roots, rootlets; clear smooth boundary. Gravel bar deposits of the Carson River.

14B 10YR5/3 brown (dry), 10YR4/3 brown (moist); moderately sorted fine sand; massive; non-sticky, non-plastic, dry soft to moist; one nail, few roots at upper contact; boundary not exposed. Sand bar deposits of the Carson River.

Figure 3.2-1. Stratigraphic descriptions for Tr 1 and Tr 2 in Fea 1 at Keller & Co. Mill, MS001.

These strata are encountered near or below the base of Tr 1 and Tr 2, and in the lower levels of EU 1.

It appears that the lower edges of this flat-topped terrace may have been stabilized against the Carson River floodwaters by placement of boulder riprap such as that found in EU 1 (resting on Str 3) and in Fea 1-4 (Str 12) near the center of Tr 2 as well as on the south side of the mound as noted during monitoring of that area. Conversely, these boulders could have been deposited during very high energy floods along the flanks of a high terrace remnant. Just inside the riprap zone and above the terrace top are several notable strata. In the southern part of Tr 1, Str 11 represents a mangle of intensely burned metal, glass, and cut nail fragments in a white ash, charcoal, and clinker/cinder/slag matrix, ranging from indurated to soft consistency. Lack of fire-reddening, oxidation, or hardening of sediments above or below this deposit suggests that the stratum was not burned in situ but moved to this location after its encounter with an intensely hot conflagration elsewhere. A bottle fragment in Str 12 pre-dates the 1870s. Mill-related artifacts include quartz ore fragments, copper plate fragments (normally used for amalgamation plates), and fragments of a carboy (used for industrial reagents such as nitric acid). The carboy fragments crossmend with other fragments on the underlying surface of Str 13. A complete inventory of artifacts from the testing phase is provided in Reno and Clay (1996).

In Tr 2, Str 7, 8, and 8A appear to contain fragments of wood and debris that may be related to early millsite use and all directly rest on the apparent flanks of the underlying terrace. The nature of the sediment matrix in these strata closely resembles that of the underlying fine-grained overbank deposits in Str 14 with the addition of cultural material. Only Str 8 and 8A have evidence of light-colored, fine-grained mill tailings. Interestingly, in these strata and along their underlying interface with culturally sterile deposits there is no evidence for millsite foundations within the trenches and units excavated, as one would expect if the mill was actually located here.

Next are several strata that appear deposited in place and to be relatively undisturbed by floodwater or cultural demolition processes. Str 10 appears to be a human-made berm on the south edge of Tr 1 above Str 11; this stratum is similar in character to the fine-grained overbank deposits, although cultural material similar to that of Str 11 is present. This berm appears to contain Str 6 and 6A, both water lain, horizontally bedded, fine grain silt and sand deposits suspected to be mill tailings. Str 6A extends across most of the Tr 1 and Tr 2 exposures averaging 10 cm in thickness, while Str 6 averages 25 cm thick but occurs only on the central portion of Tr 1, being cut on the north by Fea 1-2, an apparent hole or pit cross-cutting this stratum. Artifact cross-mends and morphology indicate that both Str 6 and 6A are about coterminous with Str 11. This is not surprising since all rest on different portions of the Str 13 interface.

Above the stratified deposits, a thick (averaging 50 cm) massive jumble (Str 5) of boulders, wood (up to 12x12 inch section), brick, and mortar structural debris; millsite (arrastra

boulders, amalgamation pan muller) and domestic artifacts; barrel fragments; and disoriented clasts of mill tailings similar to those in underlying Str 6 and 6A cover most of the flat-topped terrace except within the Fea 1-2 area where a similar stratum, 2, occurs. This deposit may be the result of one or more processes including mechanical redeposition of primarily millsite debris and rubble from somewhere off the mound with subsequent floodwater reworking of deposits; or in situ mechanical demolition and floodwater reworking of a millsite built above stratified mill tailings (which may be unlikely given the soft nature of these deposits).

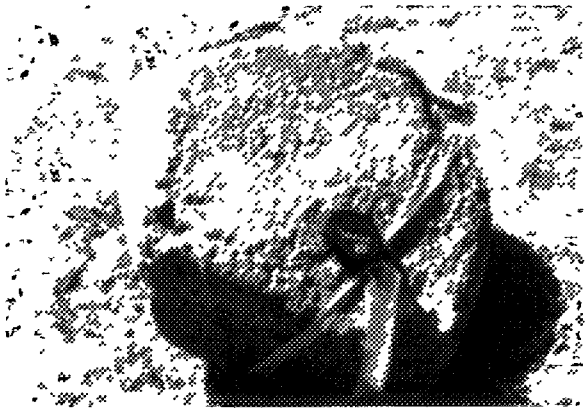
During testing, a detailed analysis was done of the arcs scored in the upper surface of the two boulders that were from the pavements of one or two of the arrastras. One of the stones indicates a minimum diameter of about 8½ ft while the other suggests a minimum diameter of 7½ ft. Three additional arrastra stones (Figure 3.2-2) were located during monitoring of the Fea 1 removal; arcs from two of these stones indicate minimum diameters of 7 ft 10 inches and 10½ ft while the third stone was not distinct enough to measure. The arrastras may have been larger, since it is unlikely that we have the outermost stones. By comparison, an intact arrastra from Arizona was about 11 ft in diameter (Kelly and Kelly 1983).

Str 2 in Fea 1-2 is identical in nature to Str 5 but may have more tailings inclusions in near horizontal context. Fea 1-2 appears to be a man-made cut and fill feature near the apex of the mound. The base of this feature slopes up to the east along Tr 2 and has a vertical cut about 3 m south of the Tr 1-Tr 2 juncture. Lowermost fill is Str 3, an artifact and charcoal laden deposit that may represent primary burning of a structural feature; however, since no evidence of foundations or in situ burning was identified, this is more likely a secondary waste or debris disposal area subsequently buried by Str 2 rubble.

Several variations of surface Str 1 are present. Str1 tops the Fea 1-2 area with relatively culturally clean bouldery loam. South of Fea 1-2, Str 1A2 contains fewer boulders than Str 1 and has a fine sandy nature. East of Fea 1-2 in Tr 2, Str 1A2 contains common boulders and is also sandy in nature. All of these surface strata could represent floodwater deposits or reworking of sediments previously covering the mound. Str 1 could also be mechanical fill from an area generally lacking in cultural artifacts.

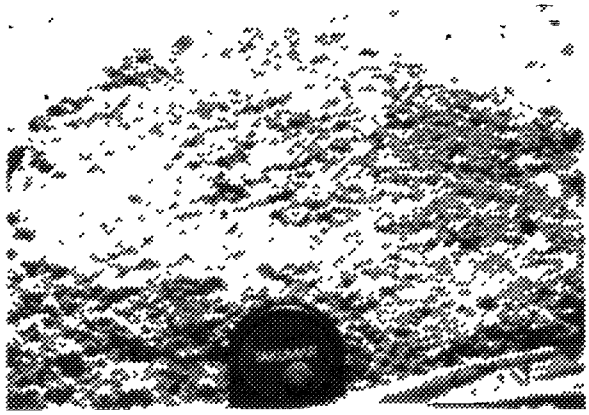
During removal of the northwestern flank of the Fea 1 mound, monitoring efforts located additional deposits similar to those described above in TP 3 and a historic household dump (Fea 5) resting stratigraphically above jumbled silt and fine sand tailings, and brick and mortar rubble (Figures 3.2-3, 3.2-4). One historic trench was noted through the demolished mill and tailings strata; this trench apparently started/ended in TP 3 and extended to the north an unknown distance. The trench is approximately 2 ft wide and 2-3 ft deep and contains water lain silt and brick rubble fill. Stratigraphically, the trench is below the Fea 5 dump and within the mill deposits. The Harris Matrix in Figure 3.2-4 illustrates the stratigraphic relationships of the lower mill-related deposits (Str 3-9) to the overlying household dump (Str 2). Fea 5 characteristics, including artifact descriptions, are presented in Chapter 6.0, The Community of Dayton.

959-3, fr. 7



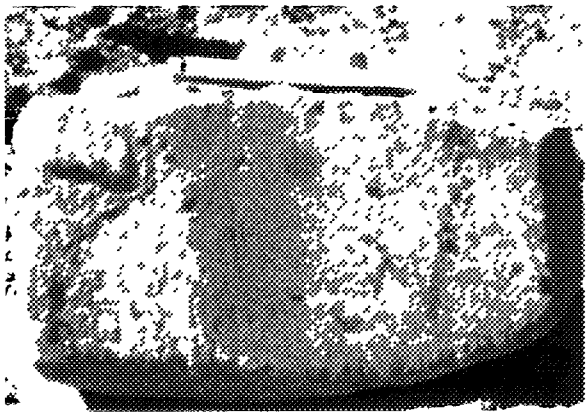
Arrastra stone #1

959-3, fr. 6



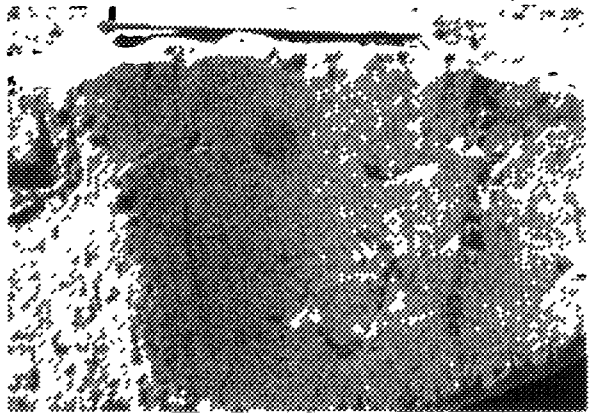
Detail of arrastra stone #1

959-3, fr. 9



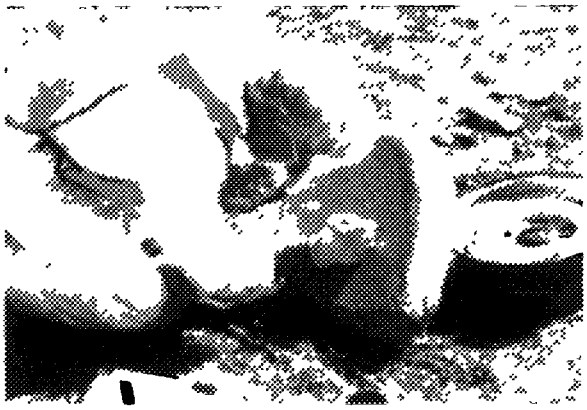
Arrastra stone #2

959-3, fr. 8



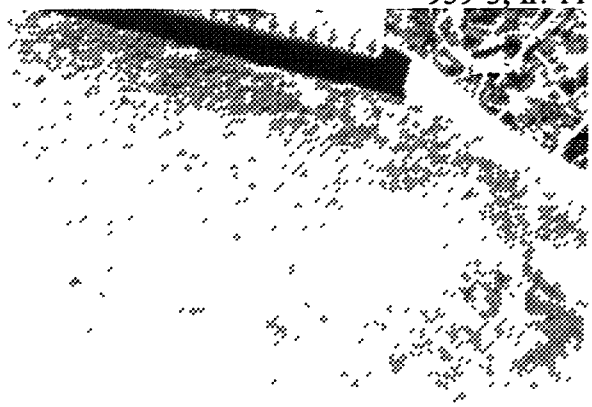
Detail of arrastra stone #2

959-3, fr. 12



Arrastra stone #3, computing stone arc

959-3, fr. 11



Detail of arrastra stone #3

Figure 3.2-2. Photographs of arrastra stones at Keller & Co. Mill, MS001.

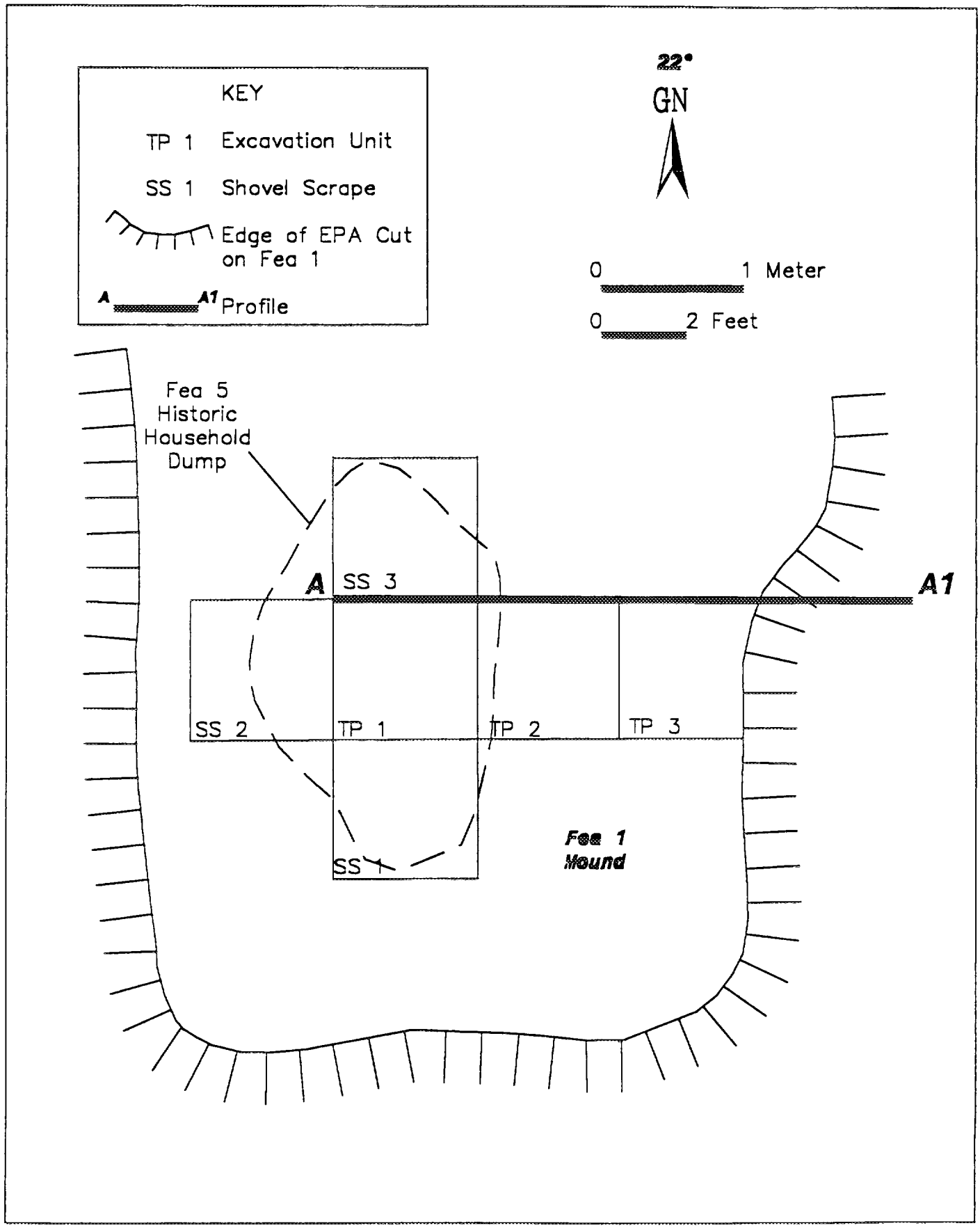
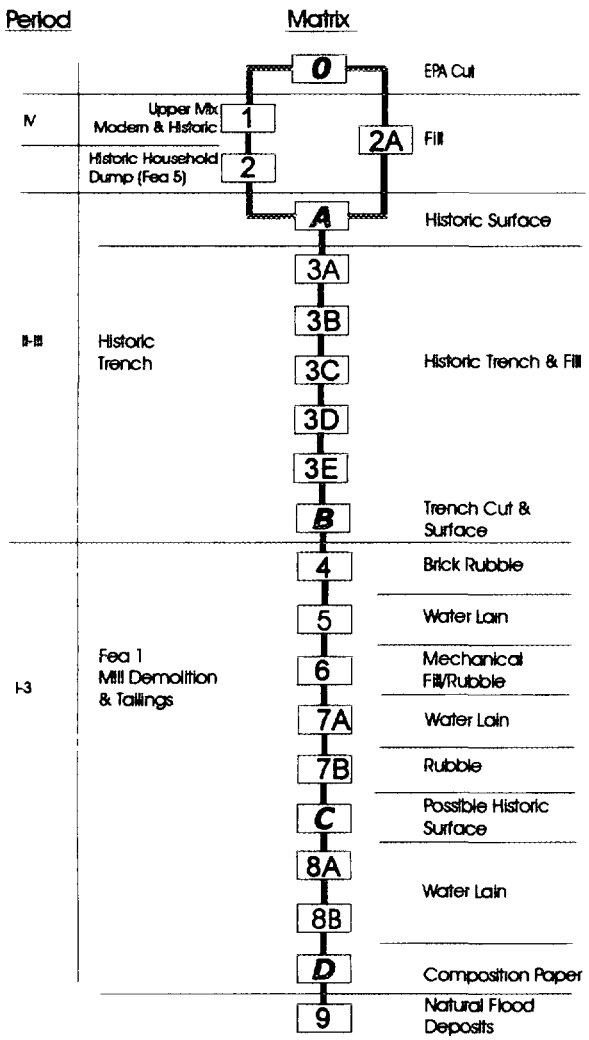
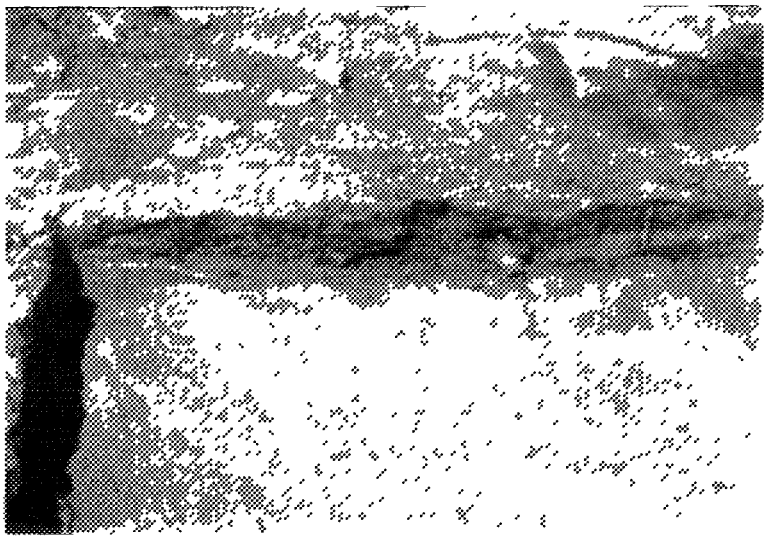


Figure 3.2–3. Plan view of Fea 5 and excavation layout on the northwest flank of the Fea 1 mound at the Keller & Co. Mill, MS001.



Harris matrix for Fea 1 and Fea 5



Photograph of Fea 5 in TP 1 (Roll 959-3, fr. 2)

Photograph of Fea 1 mill deposits in TP 3 (Roll 959-3, fr 4)

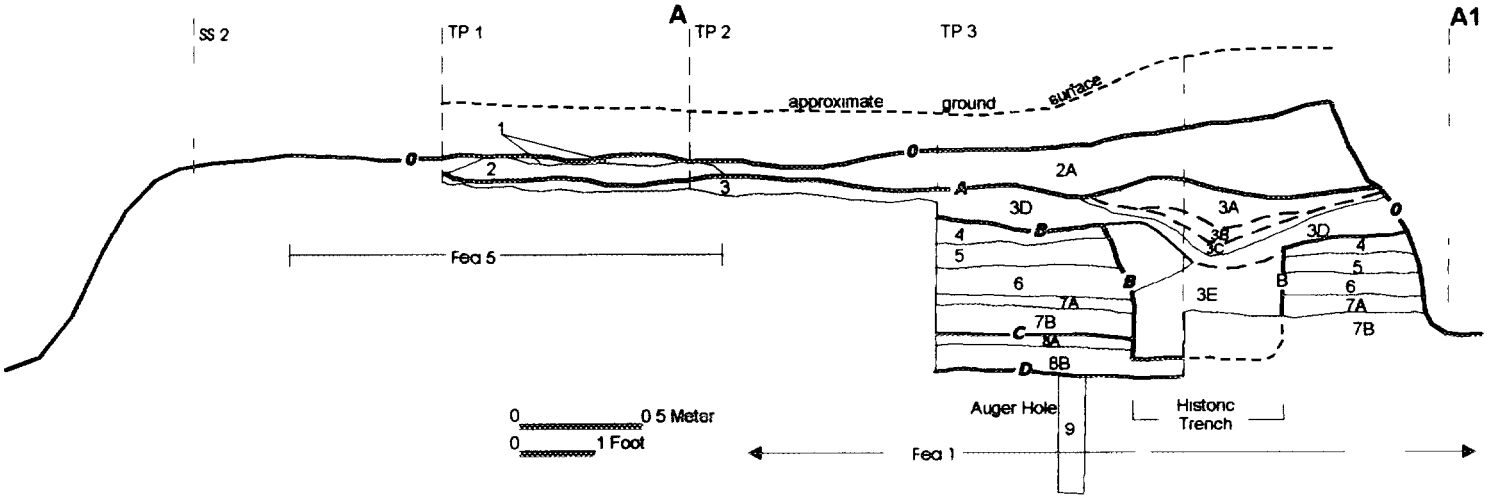


Figure 3 2-4 Harris matrix, photographs, and stratigraphic profile of the north wall of TP 1, TP 2, and TP 3 at the Keller & Co Mill, MS001

Stratigraphic descriptions:

0	EPA dozer cut.
1	10YR6/3(dry);loam; massive; non-sticky, non-plastic, dry soft; gradual to smooth boundary to tails; modern and historic trash present; same as Str 2A, cut away by bulldozer 10-40 cm deep.
2	10YR4/2(dry); ashy loam; massive; non-sticky, non-plastic, dry soft; abrupt smooth boundary; violent HCl reaction; Fea 5 historic household dump.
2A	10YR6/3(dry); fine sandy loam; massive; non-sticky, non-plastic, dry soft; roots, rodent bone common; abrupt smooth boundary; slight HCl reaction; fill stratum.
A	Interface; historic surface that Fea 5 was dumped on.
3A	10YR6/6(dry); silt to fine sand; massive; non-sticky, non-plastic, dry soft; few roots, strong FeO stain; no reaction to HCl; gradual boundary to Str 3B.
3B	10YR6/1(dry); silt; massive; non-sticky, non-plastic, dry soft; FeO stain; no reaction to HCl; abrupt smooth boundary.
3C	10YR4/2(dry); clay, slightly sticky, slightly plastic, dry hard; few roots and angular tailing chunks; abrupt smooth boundary; silt tails.
3D	10YR6/3 (dry);silt loam; massive; non-sticky, non-plastic, dry slightly hard; abrupt smooth boundary; reworked tailings.
3E	mottled 7.5YR5/8 (dry), 10YR6/8 (moist), 10YR8/1 (dry); silt; non-sticky, non-plastic dry slightly hard; roots, krotovina, FeO stain, slight HCl reaction; abrupt smooth boundary.
B	Interface; trench cut and surface that trench was excavated into.
4	10YR6/3(dry); poorly sorted sandy loam; massive; non-sticky, non-plastic, dry slightly hard; 25% brick and mortar inclusions; no HCl reaction; abrupt smooth boundary; brick rubble.
5	2.5Y7/2(dry); silt loam; massive; non-sticky, non-plastic, dry slightly hard; yellow stain, krotovina; no HCl reaction; abrupt smooth boundary; reworked tailings.
6	10YR6/4(dry); sand to clay loam; massive; slightly sticky, slightly plastic, dry hard; pipe at contact with Str 7 in two places; abrupt smooth boundary; mill rubble.
7A	10YR4/3(dry); fine sandy; massive; non-sticky, non-plastic, dry slightly hard; few krotovina; abrupt smooth boundary; reworked tailings.
7B	10YR4/2(dry); loam mixed silts on top of mill rubble; massive; slightly sticky, slightly plastic, dry slightly hard; wood common; slight HCl reaction; abrupt smooth boundary; mill rubble.
C	Interface; possible historic surface.
8A	10YR5/2(dry); silt loam; massive; non-sticky, non-plastic, dry slightly hard; roots and krotovina common; abrupt smooth to composit boundary; reworked tailings.
8B	10YR5/2(dry); silt loam; massive; non-sticky, non-plastic, dry slightly hard; roots, paper at base; abrupt smooth boundary; reworked tailings.
D	Interface; composition paper.
9	10YR5/2(dry); fine sandy loam to gravels at base; massive; non-sticky, non-plastic, dry soft; no HCl reaction; abrupt boundary; possible natural overbank deposits.

Figure 3.2-4. Stratigraphic descriptions for Fea 5, TP1, TP2, TP3

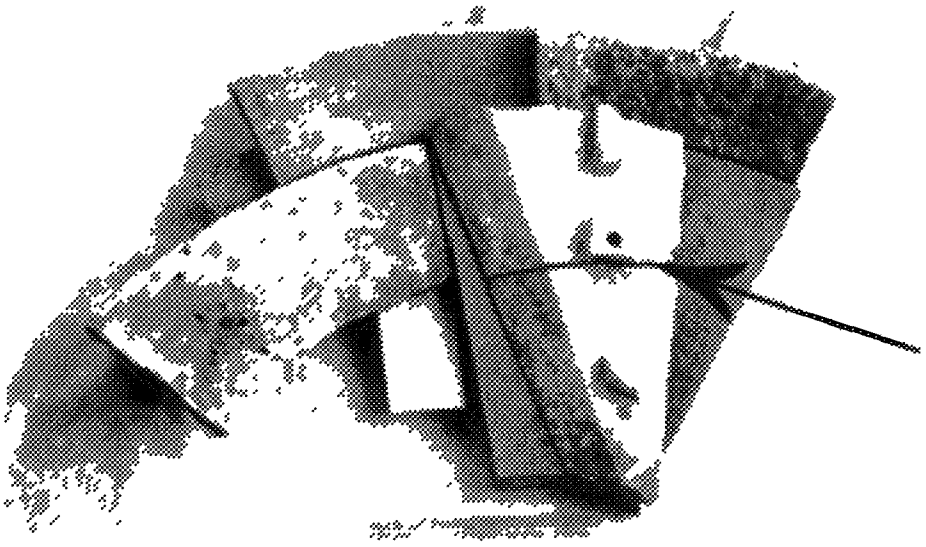
Lack of in situ structural footings and foundations on the Fea 1 mound and presence of in situ mill tailings here suggest either this is not the actual millsite, but merely a portion of a tailings pond, or if this is the millsite location, the energies of the Carson River floodwaters have stripped away any visible basal ramifications of the mill and left only a jumble of mill parts. Additionally, some of the depositional processes may have been misinterpreted, and no doubt their complexities. However, even if this is not the exact mill location, the artifact assemblage of the mound is entirely consistent with a mill of the proper vintage. Key diagnostic artifacts have survived the two periods of mill use, i.e. the arrastra stones from the Keller & Co. mill and a boss from a Washoe pan muller shoe (Figure 3.2-5) from the reconstruction by Lindauer & Co. This shoe was originally a disposable iron wear plate attached to the lower surface of the muller as it turned above the array of fixed dies (also disposable wear plates). The combination of solid bosses on the upper surface and the one hollow one preserved at the mill enabled the miller to replace a worn shoe by removing a single bolt, the head of which resided in the boss safe from grinding action taking place on the lower surface of the shoe.

MILL AREA ARTIFACTS (Fea 1) by C. Lynn Furnis

Within the mound area, several mill-related features were identified during the archaeological testing phase, including the largest overall Fea 1, then Fea 1-1, Fea 1-2, and Fea 1-4. Fea 1-1 is a deposit of intensely-burned artifacts, slag, ash, and charcoal. Fea 1-2 is a filled pit in the top of the mound, and Fea 1-4 is a collapsed stone wall or berm located along the east side of the mound. Artifacts were associated with each feature. During the later, monitoring phase at the Keller Mill site, many more artifacts were collected and analyzed from the surface of the mound. All of the artifacts from the Fea 1 mound complex are briefly discussed in this section.

Fea 1-1 consists of a single stratum (Str 11) within Trench 1, in which four artifacts were encountered. These consist of a green glass carboy sherd, a lump of slag embedded in mortar and ash, a length of half round wooden molding with two embedded screws, and a partial copper plate 10.5 inches long and 0.03 inches thick. As noted above in the feature descriptions, the carboy, slag, and copper plate are all considered mill-related artifacts.

Three strata comprised Fea 1-2, but artifacts were observed only in the bottom stratum – Str 3. There were a minimum number of items (MNI) totaling 15 artifacts, including fragments from three different glass carboys, in green, olive green, and aqua, a charred wie tableware vessel, lamp chimney fragments, large charred animal bone, a 10d machine-cut iron nail with attached wood, thin sheet iron, four copper plates, and four fused lumps of iron, earth, ash, and charcoal. The green carboy sherds crossmend with the carboy fragment recovered from Fea 1-1, located 6 m to the south in Tr 1. As with Fea 1-1, the carboys, copper plates, slag, and possibly the sheet iron and nail relate to mill activities, while the remaining three artifacts (20% of assemblage) are domestic, non-industrial types of objects.



Location of boss on a complete shoe from the Nevada Butte Mill

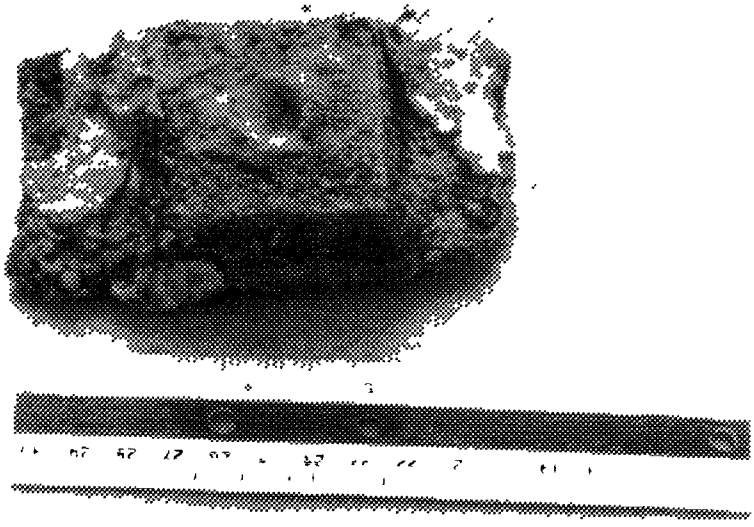


Figure 3 2-5 Attachment boss from a Washoe pan muller shoe at the Keller & Co. Mill

Fea 1-4 yielded a single artifact – a dark green glass bottle of cylindrical shape with hand-drawn manufacture. This bottle is thought to pre-date 1870 based on its construction technique and was probably for liquor, wine, or champagne (Reno and Clay 1996:7).

During the testing phase, artifacts from Fea 1 were noted in Tr 2, EU 2, and EU 3 strata. There were 381 MNI mill artifacts and these are summarized in Table 3.2-1. The additional 407 domestic artifacts found are discussed in Chapter 6. As might be expected, small building fasteners and mill byproducts such as nails, quartz fragments, and slag lumps are common, as they tend to move easily horizontally and vertically within a site. The architectural artifacts are thought to be remnants of mill structures at the site. As noted above, copper plates comprised amalgamation plates in the milling process. The copper rivet may have held thick cloth belts or leather straps together. One crossmend was noted among the mill artifacts, consisting of carboy glass fragments between Str 11 and Str 13/14A.

The artifacts in Table 3.2-1 offer few manufacture dates to provide a chronology for the strata within Fea 1. Only the machine-cut nails, that occur in nearly every stratum, provide a date range of ca. 1830 to 1920 (Fontana and Greenleaf 1962:56-58). Non-industrial, sun-purpled glass artifacts within this same assemblage provide a more restricted time range of 1880 to ca. 1920 (Munsey 1970:55). Such glass occurs in Str 1, in Str 6A, and in Str 11, suggesting either that most of the deposits were laid down after 1880 or that the lower deposits have been disturbed since their initial deposition, mixing in more recent artifacts with older ones. A few modern artifacts were observed in Str 1, the stratum that comprised ground surface in 1996.

In 1998 monitoring and data recovery work was conducted at Fea 1. The work consisted of collection of artifacts from the recently bladed ground surface and excavation of TP 3 located at the northwest perimeter of the Fea 1 mound and just 1 m east of Fea 5, a household debris dump. The surface-collected artifacts originated in strata that probably lay beneath the 1996 ground surface. These artifacts were collected after they were exposed by means of bulldozer scrapes. They are out of context, but include 144 MNI, only four of which relate to milling. These include two used, bone ash cupels, one copper plate fragment, and one board fragment.

Within the 1x1 m unit (TP 3), 14 strata were encountered, 13 of which yielded artifacts. The 13 field-identified strata, however, have been since lumped into seven strata, so that the TP 3 artifacts are organized into seven units as well. Altogether, they yielded 181 MNI, and 70 of these (39%) are mill-related artifacts, summarized in Table 3.2-2. The artifacts are scattered through five of the seven stratigraphic units, with milling byproducts, such as tailings blebs (chunks of displaced material) and quartz ore chunks, being the most numerous. Brick fragments encountered in TP 3 strata were all red, common brick rather than fire brick. The non-industrial artifacts from Fea 1 are discussed in Chapter 6.

Table 3.2-1. Mill-related Artifacts from Fea 1, Testing Phase at the Keller & Co. Mill Site, MS001.

Artifact Group	Artifact Type	Stratum											
		1	1A	1A/5	5	6	6A	7	10	11	13/14A	14B	Total MNI
Architecture	Brick, red	1	-	1	-	1	1	-	1	1	-	-	**6**
	Mortar	-	1	1	-	-	-	1	2	-	1	-	**6**
	Nail, cut	1	1	10	-	2	15	46	34	80	11	1	**201**
	Spike, cut	-	-	5	1	-	-	-	-	-	-	-	**6**
	Wood, milled	-	-	-	-	-	1	-	1	-	-	-	**2**
Industry (Milling)	Boss, Washoe Pan	-	-	1	-	-	-	-	-	-	-	-	**1**
	Carboy	-	-	-	-	-	-	-	-	-	1	-	**1**
	Cinder/slag	3	1	-	-	2	2	1	12	93	4	-	**118**
	Hose, rubber and cloth	-	1	-	-	-	-	-	-	-	-	-	**1**
	Ore, quartz	1	8	-	1	1	2	2	4	5	-	2	**26**
	Part, machine	-	-	-	-	-	-	-	-	1	-	-	**1**
	Plate, copper	-	-	-	-	-	-	1	-	3	-	-	**4**
	Plate, iron	-	-	-	-	-	-	-	-	1	-	-	**1**
	Rivet, copper	-	-	-	-	-	-	-	1	-	-	-	**1**
	Screen, perforated	-	-	-	-	-	-	-	-	1	-	-	**1**
	Sheet, iron	-	-	-	-	1	1	1	1	-	1	-	**5**
Total MNI		**6**	**12**	**18**	**2**	**7**	**22**	**52**	**56**	**185**	**18**	**3**	**381**

Table 3.2-2. Mill-related Artifacts from Fea 1, TP 3, at the Keller & Co. Mill Site, MS001.

Artifact	Stratum					
	2A	3ABCD	6	7A/7B	8A/8B	Total MNI
Bleb, tailings	-	-	-	-	40	40
Board	-	-	1	-	-	1
Brick, red	1	1	1	1	-	4
Mortar, brick	1	1	-	-	-	2
Nail, cut	-	9	-	-	-	9
Ore, quartz	4	-	2	5	2	13
Plate, copper	-	-	-	1	-	1
Total MNI	6	11	4	7	42	70

In regard to chronology, TP 3 artifacts offer few manufacture dates. One glass saucer from Str 2A dates from the Great Depression years and later – ca. 1930 to ca. 1945. From Str 3ABCD, which is the fill from a historic-period trench, there are two moldblown food and beverage bottles that date between ca. 1850 and ca. 1920. And from further down in the unit, Str 6 provided one Prosser porcelain button, dating between 1840 and ca. 1910 (Albert and Adams 1970:4-15).

3.3 ASSAY AREA (Fea 6)

Fea 6 is a concentration of brick and mortar, assaying artifacts, and domestic glass and ceramics; domestic artifacts are discussed in Chapter 6 while those related to milling and assaying are discussed here. This feature does not appear to be part of the 1860s mill or Fea 1 mill-related mound, although it lies only a short distance to the northwest of that feature (Figure 3.1-3). A 0.5 m deep bulldozer cut along the east side of Fea 6 illustrates a complex array of brick rubble (Str 7), burned (Str 4A, 8, 9, 7A) and unburned (Str 1, 1A, 2) debris, and redeposited tailings throughout (Figures 3.3-1, 3.3-2, and 3.3-3). Surface extent (roughly 9 m N-S x 7 m E-W) of the feature was suggested by a combination of machine blading and hand clearing during monitoring.

Seven 1x1 m excavation units were stratigraphically removed to a basal depth of 50 cm below the bladed surface (Int 0) in Fea 6 to discern if intact architectural remains such as foundations, brick walls, or other cultural features could be located in the apparent rubble. In most units, 50 cm depth did not extend to the base of cultural deposits, thus the basal strata of

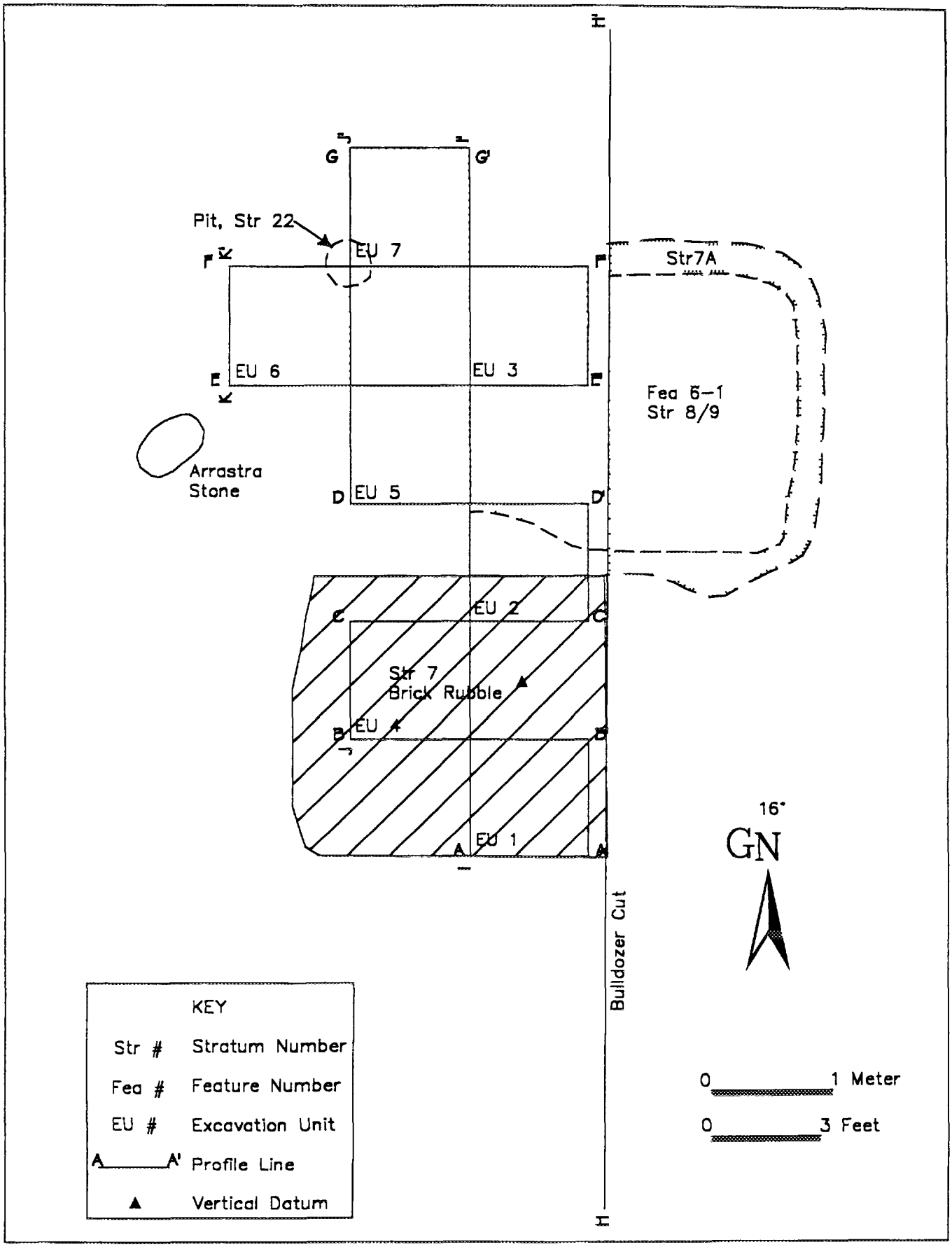
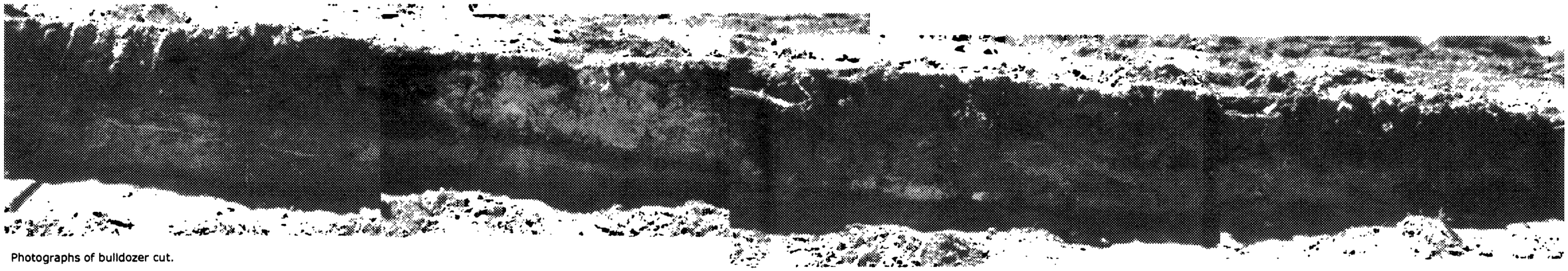


Figure 3.3-1. Plan view and profile locations in Fea 6 possible assay area at Keller & Co. Mill, MS001.



Photographs of bulldozer cut.

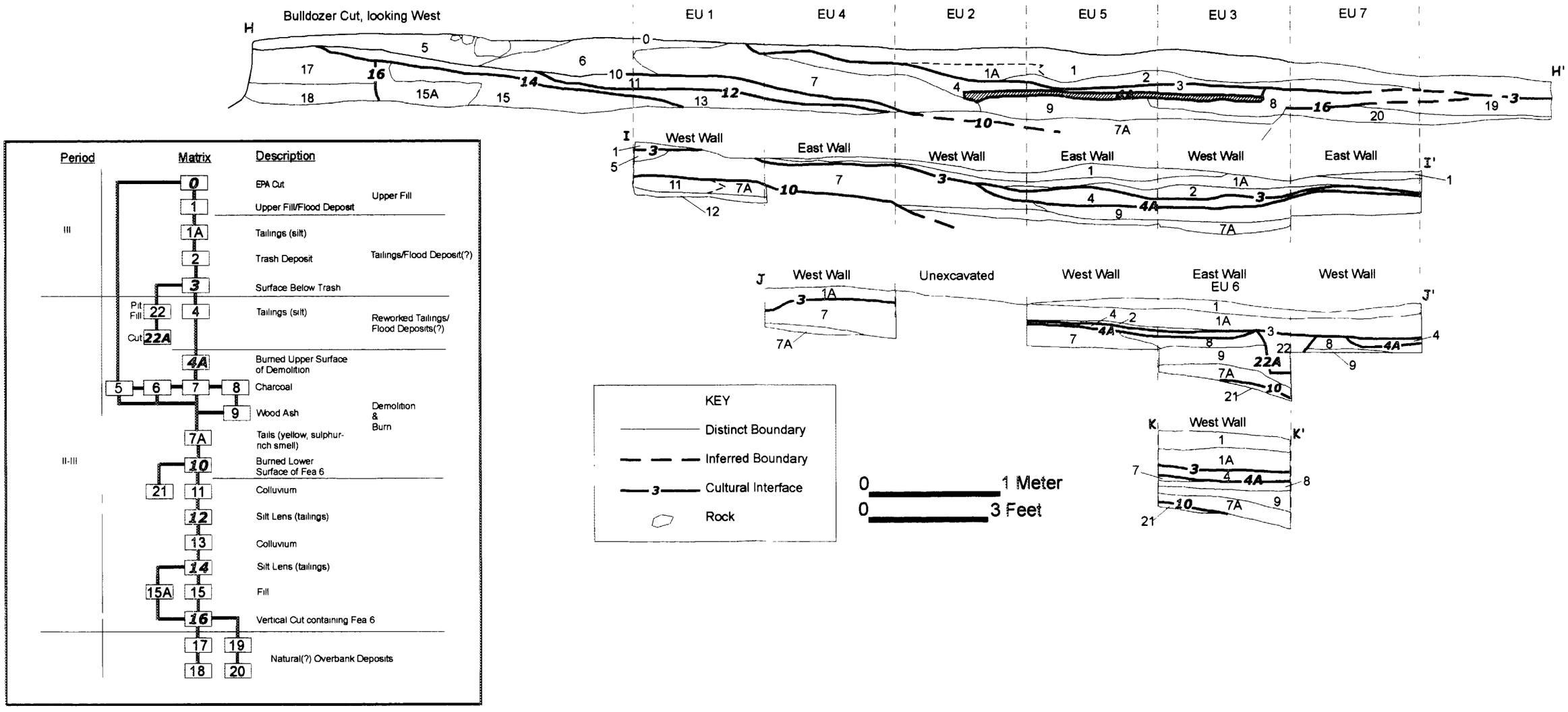


Figure 3.3-2. Photograph and stratigraphic profiles of grid east and west walls of the bulldozer cut and excavation units in Fea 6 at Keller and Co. Mill, MS001.

0 Interface; EPA cut, about 10-30 cm removed prior to profile.

1 10YR5/3 (dry), 10YR3/4 (moist); poorly sorted sandy loam texture; massive structure; non-sticky, non-plastic dry slightly hard consistency; inclusions of 15% rounded pebbles, krotovina, no HCl reaction; gradual smooth boundary; Interpretation: surface fill or flood deposit.

1A 10YR6/3 (dry), 10YR4/6 (mottles); fine sand to silt beds, graded horizontal beds 1-10cm thick; platey; non-sticky, non-plastic dry soft to slightly hard; few roots, krotovina, artifacts, no HCl reaction; abrupt smooth boundary to Str 2 or Str 4; washed tails.

2 10YR4/2 (dry), 10YR2/2 (moist); gravelly sandy loam; massive lens; non-sticky, non-plastic, dry soft; common roots, roolets, krotovina, glass, metal, no to strong HCl reaction; abrupt discontinuous boundary; trash deposit.

3 Interface; surface below trash deposit and upper wash. Pit feature with Str 22 and Str 22A excavated into this surface.

4 10YR7/3 (dry), 10YR6/4 (moist); well sorted silt to fine sand; crenulated laminae; non-sticky, non-plastic, dry slightly hard; few rootlets, krotovina, few artifacts, no HCl reaction; abrupt smooth to irregular to ash and charcoal and brick stratum; appears to be fine tails with some metal or pipe inclusions.

4A Interface; burned upper surface of demolition.

5 10YR5/3 (dry), 10YR3/3 (moist); poorly sorted pebbly sandy loam; massive and platey; non-sticky, non-plastic, dry slightly hard; few roots, krotovina, few artifacts, slight HCl reaction; abrupt smooth boundary; cultural fill.

6 10YR2/1 (dry), 10YR4/1 (moist); charcoal & loam supported matrix; massive; non-sticky, non-plastic, dry loose; krotovina, common roots and roolets, 50% wood charcoal ash, burned mortar, oxidized zone below, strong HCl reaction; abrupt smooth boundary; structural burn.

7 10YR3/2 (dry-mortar), 2.5YR4/4 (dry-brick), 10YR7/3 (dry-dirt); gravelly loam; massive; non-sticky, non-plastic, dry soft to slightly hard; few roots, krotovina, bricks, mortar, no HCl reaction; gradual smooth to Str 10 and oxidized zone in Str 11; collapsed brick and mortar structural material, likely burned.

7A 2.5Y7/4 (dry) with sorted silt, massive gray and yellow mottles, some sulphur smell; massive; non-sticky, non-plastic, dry soft; few roots, krotovina, no to slight HCl reaction; abrupt smooth boundary, sloping to Str 21; tailings(?).

8 10YR5/1 (dry), 10YR2/1 (moist); charcoal supported loam; massive; non-sticky, non-plastic, dry soft; few rootlets, krotovina, oxidized stain above & below stratum, no HCl reaction; abrupt smooth boundary; likely burned in place with oxidation.

9 10YR7/1 (dry), 10YR5/1 (moist); fine silt to sand, well sorted ashy loam; massive powder; non-sticky, non-plastic, dry soft; few rootlets in krotovina, burned artifacts, slight HCl reaction; abrupt smooth boundary in places; highly burned deposit leaving primarily wood ash, oxidation below suggests it was burned in place.

Figure 3.3-2 and 3 3-3. Stratigraphic descriptions for Fea 6, MS001 (page 1 of 1).

10 Interface; surface on which Str 6, 7, 7A, 8 & 9 burned and collapsed.

11 10YR5/4 (dry), 10YR3/4 (moist); sandy loam; massive lens dipping to north; non-sticky, non-plastic dry soft; organic rich with lots of rootlets, krotonina, few charcoal chunks, oxidized from burning above, no HCl reaction; abrupt smooth boundary; fill below most cultural deposits.

12 Interface; silt lens upper 0.2-0.5 cm thick; white 10YR8/1 (dry) discontinuous washed in lens at Str 11/Str 13 interface.

13 10YR6/3 (dry), 10YR5/3 (moist); silt loam to loam; massive; non-sticky, non-plastic, dry slightly hard; krotovina, few rootlets, some FeO staining, north of 3m, more silt, south of 3m, mixed silt and sand, no HCl reaction; looks mushed.

14 Interface; 10YR8/3 (dry) 1-2cm thick silt lens, abrupt discontinuous contact; result of ponding on basined surface or mechanical cut.

15 10YR5/2 (dry), 10YR1/2 (moist); loam; massive lens dips north; non-sticky, non-plastic, dry slightly hard; few rootlets, krotovina, white silt, no HCl reaction; unknown boundary; appears to be fill.

15A 10YR5/2 (dry), 10YR4/2 (moist); fine sandy loam; massive with few lenses of silt; non-sticky, non-plastic, dry loose; abrupt smooth boundary; krotovina fill.

16 Interface; possible cut or krotovina on south edge of assay area.

17 10YR5/3 (dry), 10YR4/3 (moist); poorly sorted loam; massive; non-sticky, non-plastic, dry slightly hard; few rootlets, krotovina; gradual smooth boundary; overbank deposit.

18 10YR5/2 (dry), 10YR3/2 (moist); fine sandy loam; massive; non-sticky, non-plastic, dry slightly hard; few rootlets, krotovina, few charcoal flecks; overbank deposit.

19 10YR5/3 (dry), 10YR4/3 (moist); sandy loam; massive; non-sticky, non-plastic, dry soft; common roots, rootlets, krotovina; gradual smooth boundary.

20 10YR6/3 (dry), 10YR5/3 (moist); sandy loam; massive; non-sticky, non-plastic, dry slightly hard; common roots, rootlets, krotovina; boundary unknown.

21 10YR5/3 (dry); sandy loam; massive to single grain; non-sticky, non-plastic, dry soft; white mottles, few crushed ore rocks in upper 5cm; boundary unknown.

22 10YR5/3 (dry); loam; massive; common roots and krotovina, charcoal; abrupt steep side, flat bottom; pit fill.

22A Interface; pit cut.

Figure 3.3-2 and 3.3-3. Stratigraphic descriptions for Fea 6, MS001 (page 2 of 2).

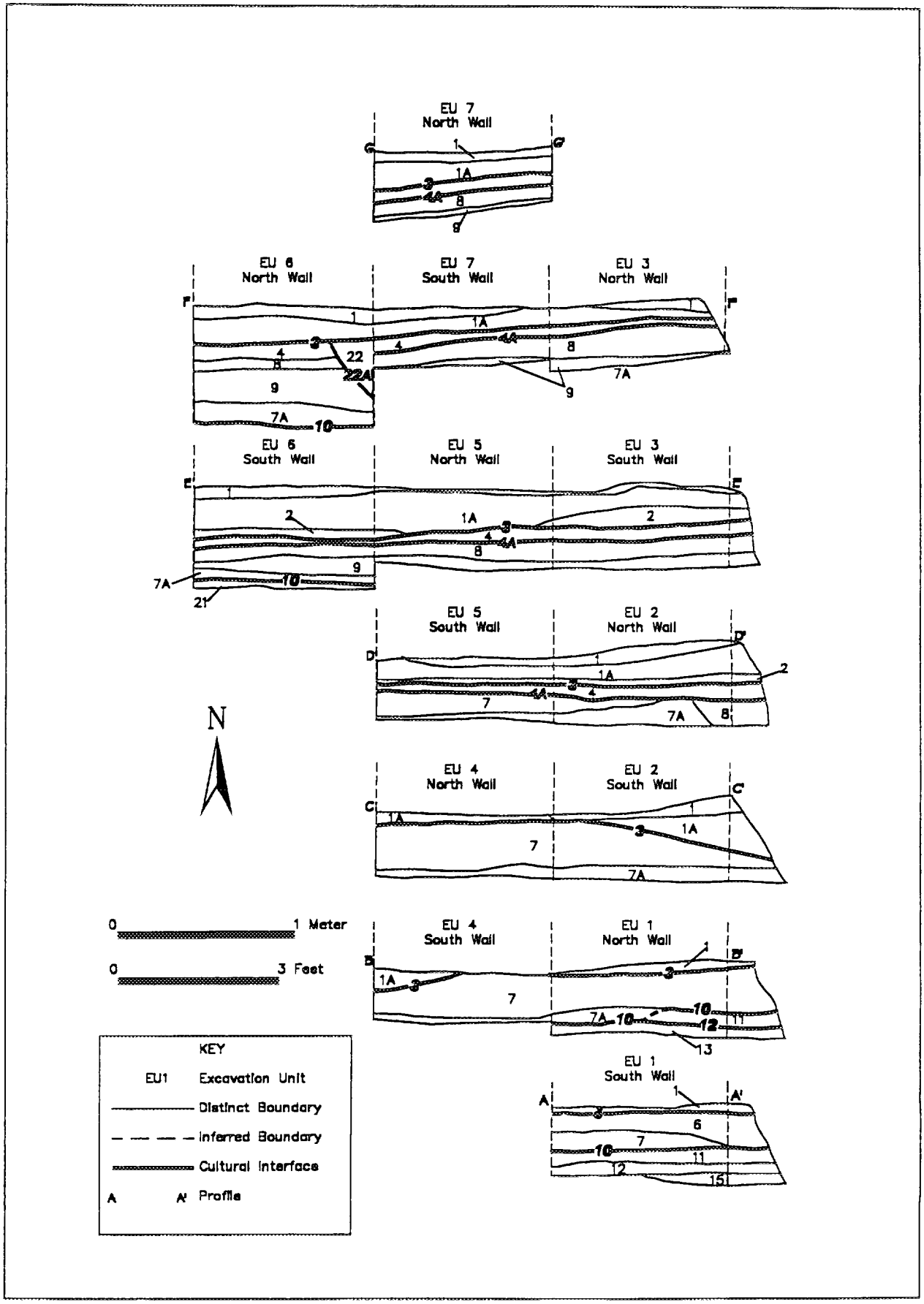


Figure 3.3–3. Stratigraphic profiles of the north and south walls of excavation units in Feo 6 at Keller & Co. Mill, MS001.

Fea 6 were not located other than on the margins. The units were distributed in checkerboard fashion (Figure 3.3-1) to expose as much of the area as possible and develop a feature-wide stratigraphic framework (Figures 3.3-2 and 3.3-3). Major strata are briefly discussed with detailed description in Figure 3.3-2. In the following section artifacts related to the assaying and milling industry are discussed by strata.

During monitoring of the MS001 North removal by EPA, approximately 10-30 cm of Str 1, a modern-historic mixed fill and flood deposit, was removed prior to locating the Fea 6 area. This feature was delimited by a wealth of brick rubble initially suspected to be a brick wall or foundation alignment, and a concentration of assay-related artifacts including crucibles and cupels. Below this deposit a discontinuous bed of likely floodwater redeposited silt tailings (Str 1A) covered an unburned domestic trash deposit in Str 2. The Str 2 dump as exposed in units is approximately 3x3.5 m (N-S x E-W) with the eastern extent bladed away. Non-milling/assaying artifacts are described later in Chapter 6. Str 1, 1A, and 2 appear to fill a shallow basined area (Int 3) that may represent the collapse of an earlier underlying feature, channel scouring during a flood, or the base of the uppermost in a series of fill episodes. A small (0.4x0.5 m) pit (Str 22, Int 22A) appears to have been excavated into Int 3 at the EU 6-EU 7 juncture.

Str 4 represents another episode of redeposited silt tailings covering what appears to be burned and demolished structural remains. These include demolished brick and mortar wall fragments (Str 6, 7), a fire-reddened and blackened zone (Int 4A), charcoal-rich loam (Str 8), ashy-loam with abundant artifacts (Str 9), ashy-loam with few artifacts (Str 7A), and a fire-reddened lower interface (Int 10). The burned strata tend to be sub-horizontal in nature suggesting an architectural feature may have been present as outlined in Figure 3.3-1 using Str 7, and Str 7A, 8, and 9 as indicators of the bricked and burned area, respectively. Interbedded silt tailings (Str 12, 14, 21) and colluvial fill (Str 11, 13, 15, 15A) occur below the burned deposits and appear to fill a cut (Int 16), although the base of this cut was not uncovered. Possible flood deposits unrelated to Fea 6 include Str 17-20. Thus, although no in situ brick walls or foundations were located, burned subhorizontal strata and a stratigraphic cut on the south edge of Fea 6 suggest there may have been a brick and wood structure within this cut. Brick and mortar rubble (Str 6, 7) occurs only along the south edge of the feature in a general east-west orientation, while wood charcoal is common in Str 4A, 7A, 8, and 9 suggesting the remainder of the feature may have been wooden. Conversely, this material may represent the pit burial and burning of demolished mill, assay, and domestic debris strata removed from their original locations (probably nearby) and buried here prior to reuse of this location for other purposes.

ASSAY AREA ARTIFACTS (Fea 6) by C. Lynn Furnis

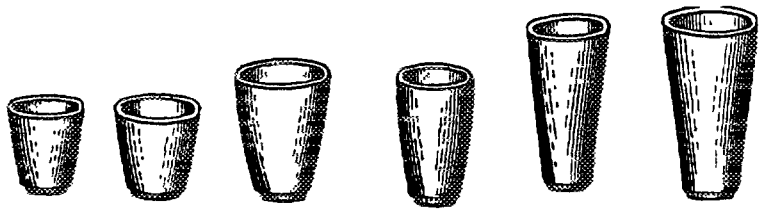
Over 3000 MNI were recovered from the 28 strata and interfaces identified within Fea 6 (Figure 3.3-2). Only 13 of these yielded artifacts; 41 percent of the artifact assemblage is associated with mill assay activities and possibly with assay buildings. The assay-related artifacts are summarized in Table 3.3-1, where a distinction is made between upper and lower

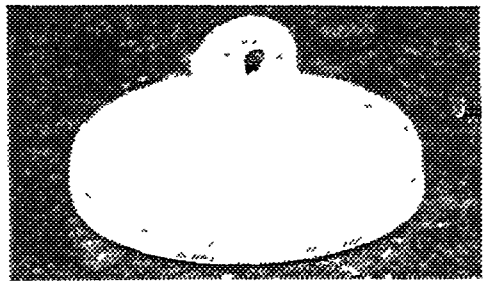
strata. The assaying and structural artifacts were distributed throughout upper and lower strata though Str 9 was most heavily laden with assay articles such as crucibles, cupels, chemical bottles, and parting cup lids, as well as milling by-products such as quartz ore fragments, slag, and tailings blebs.

The way typical artifacts functioned in the context of an assay office is presented in Chapter 2. In Figure 3.3-4, artifacts common to an assay office are depicted. Examples of all of them were recovered from Fea 6 including stoneware crucibles, graphite crucibles, parting cup covers (lids), bone ash cupels, and graphite-stoneware furnace liner tiles (shown in the cross-section of the furnace). Other specialized items were collected such as the base and body from a colorless glass beaker, two colorless glass bottle necks with internally-ground surfaces, a porcelain mortar fragment, a copper amalgamating plate, and part of a pan or box composed of sheet copper. Additional artifacts are included in Table 3.3-1 that are less obvious mill/assay artifacts. For example, two bits of fine metal wool were recovered, perhaps used in precipitation, cleaning or filtering operations. There is sheet lead that may have been used to line mill tanks containing acidic solutions. Also present is lead foil that may have been used during cupellation. Five large copper rivets with heads of 0.63 inch diameter and nine copper rivet burrs of 0.5 inch diameter may have fastened leather straps or woven cloth conveyor belts. All of these were found in Str 9. Str 1, 4, 7, and 9 yielded larger numbers of assay and mill artifacts than the others.

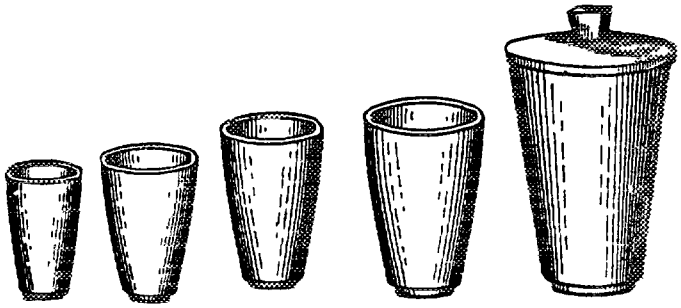
There are 11 stoneware or "fire-clay" crucibles with impressed makers' marks. Ten of the vessels are from Str 9, while one is from Str 7. Nine crucibles have the same mark, consisting of: ANC^{RE} M^{ON}M. ... \DEHUELLE SE PARIS\J. TAYLOR & CIE\SAN FRANCISCO\6. The only marked crucible from Str 7 carries this mark, while the remaining eight were from Str 9. The other two marked crucibles are from England. Both are impressed with an oval within which the following partial lettering is discerned: PAR ... \BAT...\WORKS ...\LONDON\CRUCIBLE COMPANY. This is a product of the Battersea Works.

Dating of Fea 6 strata was accomplished by considering the entire assemblage from each layer, not just the assay and mill artifacts. The deepest stratum with artifacts is Str 21, but has no datable artifacts. The next deepest stratum – Str 9 – is rich in datable artifacts. The *terminus post quem* (tpq) for Str 9 is very late, ca. 1950, and derived from two modern pieces of plastic found in EU 7. Their presence here does not fit with the remainder of the assemblage and suggests recent disturbance of Str 9 within EU 7. There is a vertical-sided stratum in EU 7 known as Str 22. This may be a modern-era pit dug into Str 9 and Str 8, though Str 22 contains no artifacts. The next artifact manufacture date in Str 9 is 1880, based on sun-purpled glass fragments (Munsey 1970:55). Several bottles have relatively restricted time periods, including one J.T. DALY CLUBHOUSE GIN case bottle (1850s to 1870) (Wilson and Wilson 1968:59,60) and several bottles with CODE, ELFELT & CO. catsup labels that date between 1874 and 1898 (Zumwalt 1980:86).

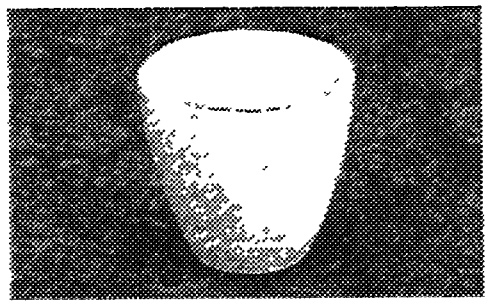




Coors crucible cover



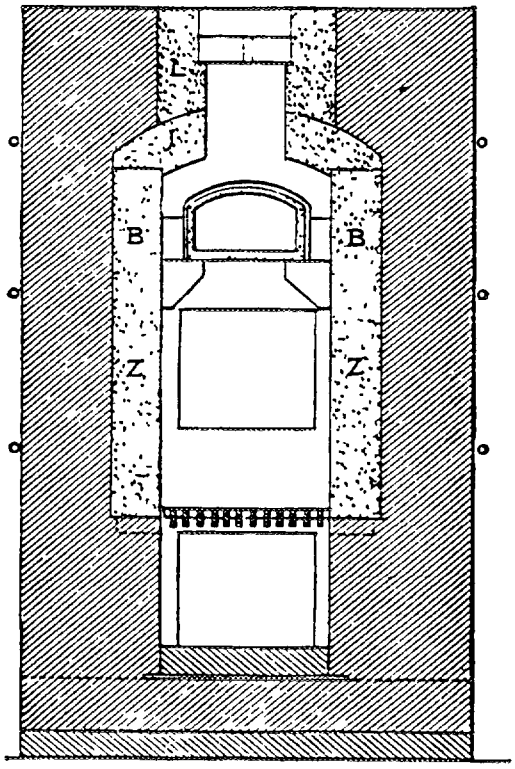
Fire-clay crucibles



Coors high form crucible

Scorifiers

Bone ash cupels



Wood-burning muffle furnace (cross-section)

Graphite crucible

Figure 3 3-4 Typical assay office artifacts (Fulton and Sharwood 1929·11, 34, Lab Safety Supply 2000 108, Legend 1997·53, 56).

Table 3.3-1. Mill-related Artifacts from the Keller & Co. Mill Site Assay Office, Fea 6, MS001.

Artifact Group	Artifact Type	Upper Strata				Lower Strata								Total MNI
		1	1A	2	5	4	7	7A	11	13	8	9	21	
Architecture	Board	1	-	2	-	1	-	-	-	-	-	2	1	7
	Brick, red	3	2	1	-	1	3	1	1	1	1	1	1	16
	Brick, fire	-	-	-	-	-	-	-	-	-	-	1	-	1
	Mortar, brick	5	-	-	-	-	1	-	-	-	-	-	-	6
	Nail, cut	6	3	-	-	5	3	-	-	-	-	1	-	18
	Nail, wire	2	-	-	-	-	-	-	-	-	-	-	-	2
	Nail, unknown	-	2	-	-	-	15	-	-	-	-	7	-	24
	Pull, door	-	-	-	-	-	-	-	-	-	-	1	-	1
	Slate	-	-	1	-	-	-	-	-	1	-	-	-	2
	Window glass	3	2	3	-	1	3	-	1	-	1	2	-	16
Industry	Beaker	-	-	-	-	-	1	-	-	-	-	-	-	1
	Bleb, tailings	-	-	-	-	-	-	-	-	-	-	46	-	46
	Bottle, chemical or lab (grounded necks)	-	-	-	-	-	-	-	-	-	-	2	-	2
	Burr, copper rivet	-	-	-	-	-	-	-	-	-	-	9	-	9
	Crucible, graphite	-	-	-	-	2	-	-	-	-	-	3	1	6
	Crucible, stoneware	2	2	2	1	2	1	-	-	-	1	19	-	30
	Cupel, bone ash	12	1	1	-	4	5	-	-	-	-	84	-	107

Table 3.3-1. Mill-related Artifacts from the Keller & Co. Mill Site Assay Office, Fea 6, MS001.

Artifact Group	Artifact Type	Upper Strata				Lower Strata								Total MNI
		1	1A	2	5	4	7	7A	11	13	8	9	21	
Industry (cont.)	Filter, metal mesh	-	-	1	-	-	-	-	-	-	-	1	-	2
	Hose, rubber and cloth	-	-	-	-	1	1	-	-	-	-	-	-	2
	Lid, parting cup	-	-	-	-	1	-	-	-	-	-	2	-	3
	Liner, fire brick	-	-	-	-	1	-	-	-	-	-	2	-	3
	Liner, graphite kiln	-	-	-	-	-	-	-	-	-	-	3	-	3
	Mortar, porcelain	1	-	-	-	-	-	-	-	-	-	-	-	1
	Ore, quartz	4	2	3	-	5	13	10	-	-	16	639	5	697
	Pan, copper	-	-	-	-	-	-	-	-	-	-	1	-	1
	Plate, copper amalgamating	-	-	-	-	1	-	-	-	-	-	-	-	1
	Rivet, copper	-	-	-	-	-	-	-	-	-	-	5	-	5
	Sheet, lead	-	-	-	-	-	1	-	-	-	-	1	-	2
	Shovel, iron	-	-	-	-	-	-	-	-	-	-	1	-	1
	Slag	22	4	1	2	323	31	-	-	1	-	27	-	411
	Sulphur	-	-	-	-	-	1	-	-	-	-	-	-	1
Total MNI		61	18	15	3	348	79	11	2	3	19	846	8	1427

Only one datable artifact came from Str 8 – a sherd from a German stoneware mineral water bottle, dating between ca. 1850 and ca. 1900 (Leavitt 1999). Int 7A yielded no datable artifacts, though Str 7 has a tpq of 1880, again based upon the presence of sun-tinted colorless glass. No datable artifacts were recovered from Str 11, 13, or 5. The Str 4 tpq is 1880, based on purpled glass. Str 2 has a tpq of 1903, based on the presence of a machine-made crown finish from a pale green glass bottle (Miller and Sullivan 1984:91). The tpq for Int 1A is also 1880, while a single fragment of modern plastic film (ca. 1950 to present) provides a late tpq for Str 1. The next manufacture date from Str 1 is 1880, yet again based on sun-purpled glass fragments. The deposits between and including Str 9 and Str 4 seem to post-date 1880, while Str 2 and those above it post-date 1903. The plastic fragments found in Str 9 are regarded as intrusive, having been introduced by means of rodent or root disturbance or by excavation (Str 22).

3.4 TAILINGS

Tailings were nearly ubiquitous throughout MS001 once surface sediments were removed. Most of these tailings are in the slimes category but some at the lower terminus of remediation removal were heavily oxidized sand. The latter are rare, since they represent quartz mill tailings that had somehow escaped reprocessing through the years.

MS001 NORTH TAILINGS

Tailings were encountered in the Fea 1 mound area and in the northern part of MS001 North in most trenches and excavation units. Many of the silt tails appear to be reworked by either floodwaters (horizontal and often graded bedding) or mechanical (brecciated) deformation. Redeposited silt tailings of both types were commonplace throughout the Fea 1 stratigraphy (Figure 3.2-1) while fine sand tailings that may have been in situ were noted in areas on the south margin of Fea 1 during monitoring. Fea 6 also contained reworked silt tailings (Figure 3.3-2). Intact tailings deposits including fine sands and silts were noted during trenching in Tr 4A and Tr 4B in a possible pond or reservoir setting (Figure 3.4-1); these appear to be the only undisturbed tailings in the MS001 North area.

MS001 SOUTH TAILINGS

Three excavation units (EU 4, 5, and 6) were placed in this area with similar stratigraphic results. Strata from these units were correlated into one series of descriptions (Figure 3.4-2). All upper strata (1, 1A, 1B, 1C, and 1D) are moderately well sorted beds of silt, fine and very fine sand with horizontal bedding. These strata contain historic, and in the uppermost level, modern artifacts and closely resemble remnants of mill tailings found in other parts of the project area. Upper strata are thickest on the northern part of the area at 30 cm in EU 6, and thinnest at 5 cm in EU 4. Below this stratum is a tailings-overbank deposit interface (2) thought to be the natural-cultural boundary, although in all cases cultural material was found below this interface, possibly

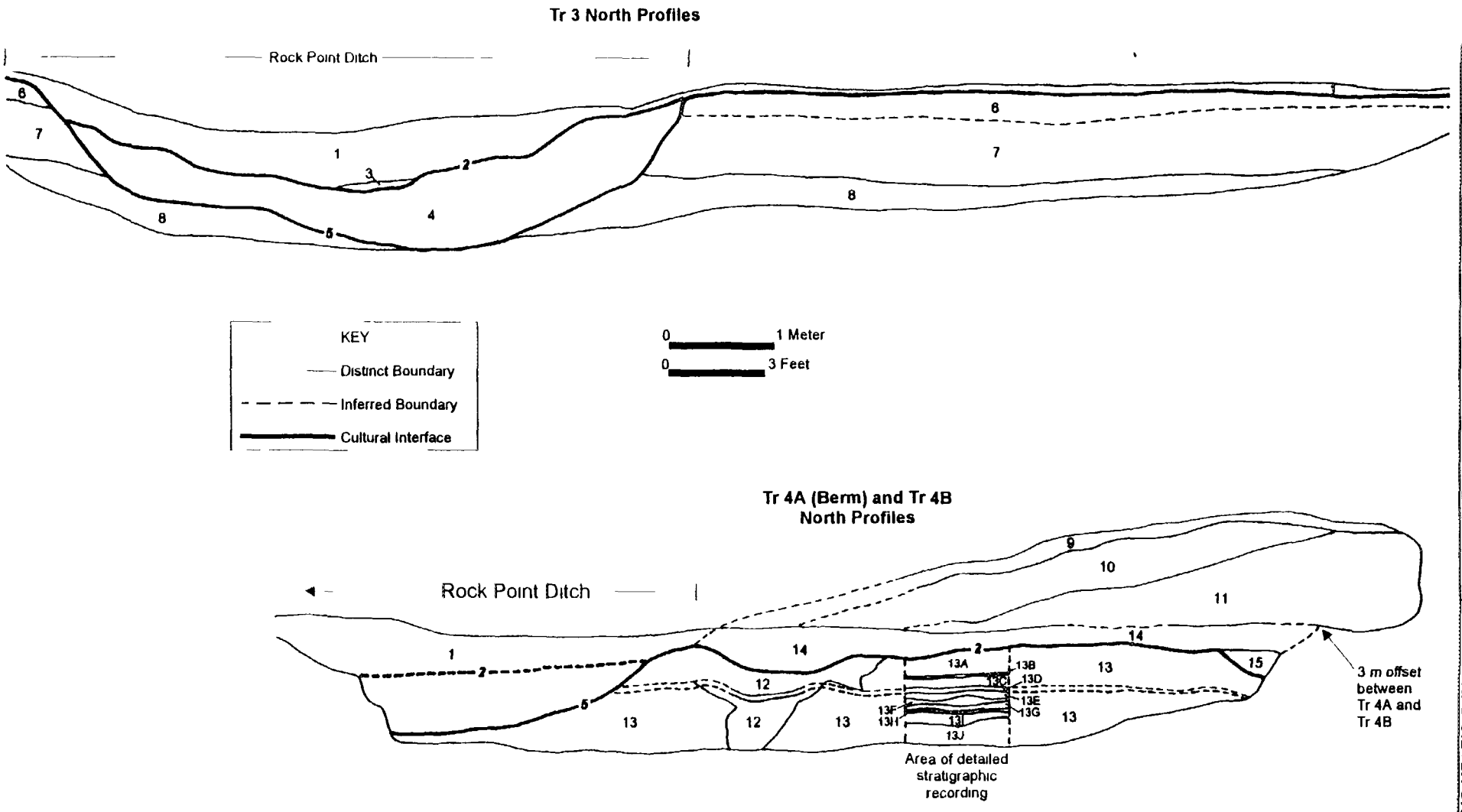


Figure 3 4-1. Stratigraphic profiles for Tr 3, Tr 4A , and Tr 4B at Keller and Co. Mill, MS001

Rock Point Ditch Strata Descriptions

1 10YR6/3 pale brown (dry), 10YR4/3 brown (moist), white-gray mottles,' poorly sorted sandy loam texture, massive to weak subangular blocky structure, non-sticky, non-plastic, dry soft consistency; inclusions of wire nails plastic screen mesh, aluminum beer cans, brick fragment, 1979 news paper, aluminum pull-tops, charcoal bed spring wood fragments, roots weak to moderate reaction to HCl, abrupt wavy boundary, Burial of modern domestic debris mixed with dirt, appears to have been bulldozed into the existing depression or ditch to level the area

2 Interface, a mechanical cut removing the A soil horizon east of the ditch

3 10YR6/4 light yellowish brown (dry), 10YR4/4 dark yellowish brown (moist), moderately well sorted fine sand; massive to single grain, non-sticky, non-plastic, dry soft, rootlets, very weak reaction to HC1, abrupt wavy boundary Possibly originated dumping of a bit of sand near the lowest spot in the depression or ditch.

4 10YR6/3 pale brown (drv), 10YR4/3 brown (moist), poorly sorted sandy loam with 10% cobbles and pebbles, massive non-plastic, dry soft, clear brown and amethyst glass, butchered bone, rusted sheet metal, wood coal boot parts, cut nail roots and rootlets, weak reaction to HCl, clear to smooth wavy boundary Ditch/depression fill late 19th, early 20th century domestic debris appears mixed with sediment to level area.

5 Interface, major ditch cut may represent one or more episodes of cutting and cleanout activity

Natural Strata

6 10YR3/3 brown (dry), 10YR4/3 brown (moist), poorly sorted fine sandy loam, massive to coarse platey in upper 3 cm, slightlv sticky, slightly plastic, dry hard, rootlets, fine bits of charcoal, moderate reaction to HC1, gradual smooth boundary Natural Bk horizon developed in overbank deposits of Carson River

7 10YR6/2 light brownish gray (dry) 10YR5/2 grayish brown (moist) with white carbonates, poorly sorted very fine sandy loam, massive, non-stickv non-plastic, dry hard, rootlets, carbonate blebs to 2 mm, strong reaction to HCl, clear smooth boundary Ck soil horizon developed in Carson River overbank deposits

8 10YR3/3 brown (dry), 10YR4/3 brown (moist) with iron staining 10YR5/4 yellowish brown (dry), 10YR3/4 dark yellowish brown (moist), moderately well sorted fine sand, massive, non-stick>, non-plastic, dry soft, few rootlets no reaction to weak reaction at Str 7/8 boundary to HCl, boundary not exposed. C2 soil horizon, splay or fining upward channel or overbank deposits, iron staining from water table flow through sands at base of Str 7

Cultural Ditch Berm Strata

9 10YR5/3/3 brown (dry), 10YR4/3 brown (moist), moderately well sorted very fine sand, massive, non-sticky, non-plastic, dry loose, grass rootlets, roots, weak reaction to HC1, abrupt irregular boundary Possible duff accumulation or ditch clean-out sediments piled on top of berm.

10 10YR6/3 pale brown (dry), 10YR5/3 brown (moist), mottles 10YR8/2 very pale brown (drv) and 10YR5/6 yellowish brown (dry), poorlv sorted very fine sandv loam, massive-mechanically deformed, non-sticky, non-plastic, dry soft to slightly hard, tailings blobs, rusted iron, charcoal, olive glass roots, rootlets; moderate reaction to HC1, abrupt to clear wavv boundary Mechanically redeposited mix of Str 13 tailings

11 10YR5/3 brown (dry), 10YR4/3 brown (moist), poorly sorted fine sandy loam (pebbles to silt), massive, non-sticky, non-plastic, dry slightly hard, bolt, charcoal, olive and aqua glass, roots, krotovina, moderate reaction to HCl, clear smooth boundary Push pile from east to west, artifact rich (19th century) A soil horizon/overbank deposit pushed into a berm/dike just east of Rock Point.

Mill Pond Tailings

12 10YR6/3 pale brown (drv) 10YR4/3 brown (moist), mottles 10YR6/6 brot~nish yellow (drv), moderately well sorted very fine sand to very well sorted fine sand, massive to mechanically disturbed, non-stick», non-plastic, drv soft and friable, few roots and rootlets, moderate reaction to HCl, abrupt smooth irregular boundary Mechanically deformed stratified deposits (industrial tailings in probable pond)

13 10YR8/2 very pale brown to 10YR7/2 light gray (dry), 10YR6/2 light brownish grav to 10YR5/2 grayish brown (moist), silt, very fine sand to fine sand, massive, subhorizontal bedding, non-sticky, slightly to non-plastic, dry loose, moderately friable, laminae and color of this stratum suggest industrial anthrosol, some charcoal, weak to moderate reaction to HCl, boundary not exposed. Stratified mill tailings of fine to very fine sand and silt, individual beds described below

13A very fine sand with low angle cross beds
B orange grav silt, iron staining on top
C jumbled fine sand to silt as if dried and disturbed
D iron stain above and below gray, massive silt bed that crosses most of Tr 4B
E well sorted fine sand.
F five laminae or beds ranging from silt to very, fine and to fine sand to silt to very fine sand
6 massive silt bed with iron staining above and below-,
H thin dark gray silt bed
I jumbled fine sand to silt as if dried and disturbed
J horizontal fine sand bed

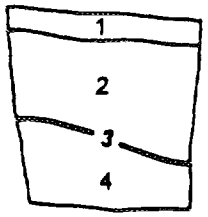
Upper Fills

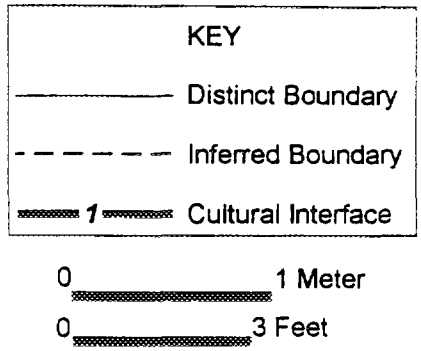
14 10YR6/4 light yellowish brown (dry), 10YR5/4 yellowish brown (moist), poorlv sorted gravelly fine sandy loam with 12% rounded cobbles and pebbles, massive to weak platey, non-sticky; non-plastic, dry loose to soft, common roots and rootlets cobbles and pebbles, weak reaction to HCl, clear wavy boundary Fill originating from closer to Carson River with abundant rounded river gravels

15 10YR5/3 brown (drv) 10YR4/3 brown (moist), poorly sorted sandy loam, massive, non-sticky, non-plastic, dry slightly hard, few roots and rootlets weak to moderate reaction to HCl, abrupt smooth boundary Channel or small ditch fill

Figure 3 4-1 Stratigraphic descriptions for Tr 3, Tr 4A, and Tr 4B at Keller and Co Mill, MS001

EU 1
East Profile





Stratigraphic descriptions for EU 1
Cultural Strata:

1 10YR6/3 pale brown (dry), 10YR4/3 brown (moist); moderately well sorted fine sand, massive; non-sticky, non-plastic, dry soft; roots, rootlets, carbonate blebs, weak reaction to HCl; abrupt to clear and smooth boundary. Fill.

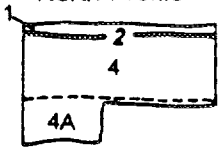
2 10YR6/3 pale brown (dry), 10YR4/3 brown (moist); moderately well sorted fine sand; massive, non-sticky, non-plastic, dry soft; brick fragments, cobbles and pebbles (possible manuports), roots, rootlets, abrupt to clear smooth boundary. Fill/originally overbank deposit.

3 10YR7/2 light gray (dry), 10YR5/2 grayish brown (moist); silt; massive, 2 mm thick lens; non-sticky, non-plastic, dry soft; no inclusions; moderate reaction to HCl; distinct smooth boundary. Interface; silt flowing over a southeast sloping surface.

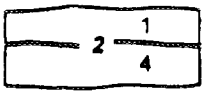
Natural Strata:

4 10YR5/3 brown (dry), 10YR4/3 brown (moist); moderately well sorted fine sand; massive to single grain; non-sticky, non-plastic, dry soft to slightly hard; roots, rootlets; moderate to strong reaction to HCl; boundary not exposed. Possible sand bar deposit on the Carson River prior to fill episodes.

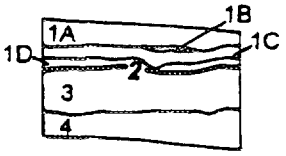
EU 4
North Profile



EU 5
East Profile



EU 6
East Profile



Stratigraphic descriptions for EU 4, EU 5, and EU 6
Cultural Strata:

1 10YR5/3 brown (dry), 10YR4/3 brown (moist); moderately well sorted fine sand texture; massive with subhorizontal bedding structure; non-sticky, non-plastic, dry soft to slightly hard consistency; inclusions of a few can and glass fragments, silt tailing blebs, rootlets, roots; weak reaction to HCl at trop to moderate reaction at base; abrupt smooth boundary. Tailings.

1A 10YR5/3 brown (dry), 10YR 4/3 brown (moist); moderately sorted fine sand; massive; non-sticky, non-plastic, dry soft; smooth boundary. Possible fill, plow zone or tailings.

1B 10YR5/3 brown (dry), 10YR4/3 brown (moist); silt loam; massive; non-sticky, non-plastic, dry soft; rootlets; wreak reaction to HCl; abrupt discontinuous wavy boundary. Possible tailings, krotovina disturbance or root cavity filled with silt.

1C 10YR6/3 pale brown (dry), 10YR5/3 brown (moist); moderately sorted fine sand; massive to single grain; non-sticky, non-plastic, dry soft; a few can and red pot fragments, some Str 4 blebs, rootles, no reaction to HCl; abrupt smooth to wavy boundary. Possibly tailings.

1D 10YR6/3 pale brown (dry), 10YR5/3 brown (moist); coarse silt; massive; non-sticky, non-plastic, dry soft; rootlets, weak reaction to HCl; abrupt smooth to wavy boundary. Probably mill tailings.

2 Interface between natural and cultural strata

Natural Strata:

3 10YR4/3 brown (dry), 10YR3/3 dark brown (moist); poorly sorted sand, ca. 5% round to subrounded pebbles; massive to single grain; non-sticky, non-plastic, dry soft; rootlets; weak reaction to HCl; abrupt smooth boundary. Stream deposits.

4 10YR5/2 grayish brown (dry), 10YR4/2 dark grayish brown (moist); loam; massive to weak subangular blocky; non-sticky, non-plastic, dry slightly hard; few roots and rootlets; moderate reaction to HCl; boundary

Figure 3.4-2. Stratigraphic profiles for EU 1, EU 4, EU 5, and EU 6 at Keller and Co. Mill, MS001.

as a result of mixing by roots or rodents. Conversely, the uppermost levels of the overbank deposits formed a cultural surface prior to the tailings deposition. Loamy overbank deposits (Str 4) were present immediately below this transition in EU 4 and EU 5; however, a channel deposit of sandy and gravelly alluvium was present below this interface and above loamy overbank deposits in EU 6. Strata present on this part of the project area reflect alluvial floodwater and channel deposits overlain by a relatively thin veneer of tailings possibly deposited within a ponded or reservoir setting. Features were not located within any of these units, albeit a very small portion of this area was exposed.

3.5 OTHER MILL FEATURES AND ARTIFACTS

MS001 South includes an old oxbow of the Carson River that was reused as a reservoir for the Keller & Co. Mill. The oxbow is prominent in Figure 3.1-2. This area was tested with the three units (EU 4-6) described in the section on tailings. Monitoring showed that the entire area was covered by tailings, as mentioned above.

Site content consists of a continuation of the scatter of highly fragmented surface artifacts noted above in MS001 North. Like the rest of the scatter, surface indications do not appear to be significant. The three test pits in this portion of the site support the notion that artifacts have been spread through this area as part of grading episodes through time. Although nineteenth century artifacts were found, the geological context suggests they are not in their original place of deposition. Therefore, this portion of the study area was not considered significant as a result of testing. Monitoring throughout this area revealed a sparse scatter of artifacts, including bottle fragments, barrel hoops and two light railroad car axles.

ROCK POINT DITCH

Historic Context

The Rock Point Mill is the same vintage as the Keller & Co. mill, dating to 1861 and operating through several reconstructions into the 1930s (SAIC 1993(1):105-110). Some evidence exists that the pan mill was preceded by an 1859 arrastra mill and associated water rights (Dangberg 1975:342-346). Water rights for the Rock Point Ditch (Locus 894-2) were claimed by R. M. Hotaling in 1860. Despite the fact that this diversion was located upstream of the study area in the SE1/4 SW1/4 SE1/4 Sec. 23, the ditch is not shown on the 1865 survey plat, suggesting that during the early years of its use a diversion at the Rock Point dam near the bridge downstream of the study area may have been used (United States vs. Alpine Land & Reservoir Co. n.d.:129). Similarly, the Rock Point Ditch is not shown on any of the three detailed maps of the Keller & Co. Mill site during the 1860s and 1880s. Instead, the dam for the Rock Point Ditch is always shown downstream of the bridge north of the study area. All of this evidence suggests that the portion of the Rock Point Ditch in the study area post-dates 1885 and was no longer in

use by the early 1940s. The ditch is shown on the early twentieth century view in Figure 3.1-2. In this photograph the ditch is wood-lined and appears to be built largely or entirely above-grade.

Dangberg (1975:347) quotes L.H. Taylor (from 520, Plaintiff's [3]:190) as follows:

> The Rock Point mill ditch takes water from the left fork of the Carson River just below the town of Dayton.
>
> The upper portion of this ditch consists of a channel in earth, while for a considerable distance at its lower end the water flows through a box flume eight feet wide at its head and having a depth of 3.83 feet toward the upper end, and 4.10 feet near the penstock at the mill. A section measured just above the mill 387 feet in length has a grade in this distance of 0.04 of a foot, taking the level of high water mark for hydraulic grade, and a mean depth of 3.625 feet. On the inside of this flume are four 1x4 inch battings nailed over cracks, which reduce the sectional area to 28.89 square feet, with a mean radius of 1.8147 feet.
>
> The carrying capacity, with coefficient for roughness 0.012 is 52.73 cubic feet per second, or 2635.5 miner's inches.
>
> The maximum capacity of this flume at the place where measured, taking the grade of the bottom which is 0.295 of a foot in 387 feet, and assuming the flume to have a free discharge, is 150.0 cubic feet per second, or 7500 inches.

Additional details about the original construction of the ditch are provided in a deposition by R. M. Hotaling for case No. 6166 filed on June 10, 1920 with the State Engineer. A pumping plant is in existence and was installed before 1908. The diversion upstream of MS001 was in use since at least 1892 for cyaniding operations. Destruction of the Rock Point Dam in the 1907 flood required extending the Rock Point Ditch upstream through MS001 to the new diversion point in 1908.

Physical Remains

Aside from an informal driving tour, no attempt was made to revisit the entire ditch. Detailed description is limited to the study area. On the ground surface the ditch is manifested as a linear depression (Site 894-2, Fea 1) running along much of MS001 North and disappearing just north of MS001 South.

Trenches 3 and 4 were used to look at the subsurface manifestations of the suspected location of one alignment of the Rock Point Ditch or mill race. Tr 3 is 14 m long and oriented 116 degrees, while Tr 4 is 10 m long at 104 degrees divided into two segments, one crossing the ditch and one cutting through the adjacent berm. Both trenches were placed perpendicular to an

existing linear depression thought to be the ditch remnant. Tr 3 is just west of the mound discussed above and Tr 4 is downstream from the mound.

Three strata and two interfaces were noted in trench exposures of the Rock Point Ditch (894-2). Str1 consists of overbank deposits of loam with inclusions of primarily modern domestic household debris such as plastic bread wrappers, aluminum beer cans, and 1979 newspaper fragments. This stratum could represent recent (1986) floodwaters mixing with modern Dayton debris, or mechanical filling of the ditch low spot with surrounding overbank deposits and burial of backyard garbage. Int 2 appears to be a mechanical cut on the burned surface outside of the ditch and a ditch surface prior to the deposition of Str1. Str 3 is a clean sandy deposit at the base of the Int 2 ditch. Str 4 appears to be the oldest visible ditch fill and contains artifacts over 50 years old mixed with overbank flood deposits. One bottle base exhibits a sand pontil dating it to before about 1870. Int 5 is the ditch cut or the interface between the ditch and outside strata. This cut suggests the lowest part of the ditch is about 5 m wide, while the top of the ditch is approximately 6 m wide. Maximum depth of the ditch is 1.4 m as seen in Tr 3.

A berm (exposed in Tr 4A) just east of the ditch appears to be related and is built of sediment containing artifacts from the nineteenth century in three strata. Str 9 is a thin surficial layer that may represent the final episode of berm building, an episode of ditch clean out and piling on the berm, or natural accumulation of organic rich duff. Str 10 is a mechanically redeposited mixture of natural overbank deposits mixed with small wavy clasts of mill tailings and probably represents an episode of ditch clean out in Tr 4B with redeposition on the berm. Str 11 may be the original berm comprised of overbank deposits with cultural material but lacking the silt and fine sand mill tailing clasts common in the overlying stratum. An interface (2) is at the base of the berm and immediately above a massive, horizontally-bedded deposit of mill tailings (Str 12 where mechanically disturbed and Str13 where undisturbed). These very fine sand, fine sand, and silt beds with iron oxide crusts paralleling many of the graded beds presumably were deposited in a pond near the millsite.

Natural strata were found east of the ditch in Tr 3 and these include only overbank deposits (Str 6, 7, and 8) of the Carson River. Artifacts were not noticed in the profiles of any of these loamy and sandy alluvial deposits.

In summary, allowing for slumping side walls, the Rock Point Ditch was unlined at this point, was about 5 m wide, and 1.45 m deep. At least for some of its length it had a substantial berm on the Carson River side of the ditch, formed at least partly of ditch cleanout debris.

Although the Rock Point Ditch went through this area, it has been entirely obliterated by subsequent grading. Regardless of the significance of the entire ditch, this could not be considered a significant portion and it was not selected for further study during monitoring. In

the course of monitoring efforts, no additional features were found that could be associated with this ditch.

Ditch Summary

The Ditch provided water for the Rock Point Mill at the north end of Dayton; the mill proper is outside the study area. The Rock Point Mill (CrNV-03-1606) exhibits extensive foundations relating to the different phases of site use and appears to be a NRHP significant site. The main mill area and closely related features have been recommended significant both by Elston (1978) and Seldomridge (1987). It is currently incorporated in interpretive programs at the Dayton State Park. The reservoir adjacent to the mill is in excellent condition and comprises by far the largest feature on the site.

The Rock Point Ditch is more problematic. Since its course lies directly through the town of Dayton, most of it has been covered or bladed away by subsequent land users. The remnants offer little interpretive potential in relation to the main mill complex. The segment crossing US Hwy 50 was judged non-significant by Seldomridge (1987). Due to the existence of many other mill and mining-related ditches in less improved areas (particularly Rose's Ditch), there is no reason to consider this ditch a particularly good example of this class of feature. Although remnants of the ditch were sectioned during our testing program, they were heavily damaged by subsequent filling, and do not show engineering features of any particular interest. None of these segments can be considered eligible for the NRHP.

3.6 SUMMARY

The Comstock (including the Carson River and Washoe Valley mills) is renowned as the birthplace of the "Washoe Pan Process" of milling. This process was not developed solely in any single mill and was characterized by a lengthy period of experimentation in details of the process. For these reasons, any intact mill remains from the Comstock have the potential to provide information relating to this significant theme. During the nineteenth century there was a proliferation of pan mills. For example, in 1866 there were 77 mills processing ore for the Comstock alone (State Mineralogist 1867). However, this first generation of mills did not survive as intact mills, and few are reasonably intact even in the archaeological record. Some pan mills in outlying districts retain fairly good preservation of the spatial distribution of all mill features. An example is the Nevada Butte Mining Company Mill in the Battle Mountain District (Reno et al. 1999), but most only have preservation of some portion of the entire mill area at best. On the Comstock, where the process was first developed, mills have not survived well due to extensive later modifications of the landscape. Hence, any Comstock mill that retains any intact features has the potential to contribute to our presently limited knowledge of how details of the process were expressed in actual workplaces. Intact mills could easily be significant under criteria A, C, and D. Only mills associated with key developers of the process such as Almarin

Paul would be significant under Criterion B. Although the original builders of the mill in the study area were of local importance, their merchandise business rather than the mill has the closest association with their local significance.

On the surface, this mill seat retains no integrity and is not eligible. Based on subsurface testing and monitoring, we now know that there is at least some integrity of location since artifacts diagnostic of both milling episodes were found in the mound area of the site. However, these deposits have been moved about before reaching their current resting places. Only one possible wall remnant (likely to simply be some riprap) was found in place. No other intact features were found and the artifact-rich strata are jumbles of poorly preserved redeposited items.

The assay area at Fea 6 provided a less illuminating picture than was thought likely when it was selected for additional data recovery during the course of monitoring. The seemingly intact brick walls turned out to be portions of walls that were deposited in sections, but not in place as the initial exposure suggested. The dating clearly indicates that the abundant assay artifacts and associated building remnants were not part of the 1860s mill. With a probable early date close to 1880 for deposition of the lower strata this corresponds closely with the third period of site use when the C&CRR was constructed (Table 3.1-1). Burial of any kind of material as fill between the railroad facilities and the river makes a great deal of sense at this time. Presence of an active assay shop here is less likely given the distance between it and any active milling operation and the barrier of the railroad between it and the town road system. Hence, it seems more likely that this feature represents secondary deposition of most or all of a dismantled assay office along with some mixing of domestic items.

The artifact assemblage of the assay area is dominated by items that would have been intentionally or accidentally broken during normal operations. Lacking are major parts of a furnace, an extensive collection of laboratory glassware, and the various metal implements necessary for handling hot or acidic specimens. This characteristic of the assemblage rules out any possibility that a functioning assay office burned down on this spot. If an office was here, all functional equipment was thoroughly removed before demolition, and the same applies to the possibility that this material was brought from elsewhere.

4.0 BIRDSALL AND CARPENTER MILL

by Ronald L. Reno, Vickie L. Clay, and C. Lynn Furnis

The Birdsall and Carpenter Mill is an extensive industrial complex in use through much of the latter half of the nineteenth century. This mill once occupied most of the hillside west of River Street, much of which is in the APE (Figures 4.0-1 and 4.0-2). The complex of buildings and mill yard extended east across River Street to the location of modern US Hwy 50. In addition to the mill and refinery ruins within the project area at MS004, there are the Bluestone building on Main Street that served as the main office and sales location for bluestone produced at the mill site, an assay office on Main Street, sulphuric acid works and a bluestone works that are only partly in the study area, a small railroad, tailings ponds, and a mill yard with shops and an engine house.

This chapter is named after the first phase of milling at the site, but the story here is much more complex than that, with a long series of restructuring events under different ownership. Discussion is arranged by starting with historical accounts of the mill. This is followed by a documentary and comparative model of the three major episodes of use as the Birdsall & Carpenter Quartz Mill, the Lyon Tailings Mill, and the Peck Concentration Mill. Each of these phases is then discussed from an archaeological perspective. Tailings deposits, chemical and sediment analyses, and reconstructions of milling processes are examined separately before the chapter ends with a brief summary.

4.1 HISTORICAL ACCOUNTS

The Birdsall and Carpenter Mill was built in 1865. It was designed to use the Washoe Process of pan amalgamation to extract gold and silver from Comstock ore. The mill underwent a long series of modifications to enlarge its capacity and, importantly, to accommodate a shift to reworking tailings rather than pristine ore. During this period it also manufactured bluestone and sulphuric acid for use at other mills. In 1897 the mill was restructured yet again to utilize a new concentration process. The mill never made the transition to cyanide leaching. Until its abandonment around 1900 the mill went by a variety of names, including Birdsall & Carpenter Mill, Douglass Mill, and Lyon Mill (Reno 1996:3-4). At times it was even referred to by the name of the current mill superintendent. The mill was minimally recorded on the Historic American Engineering Record (HAER), on file at the Comstock Historic District Commission, Virginia City. After its final abandonment the mill yard and related features are shown in Figure 3.1-2. Three other views of the mill are an overview from the southeast (Figure 4.1-1), a detailed view from slightly farther south (Figure 4.1-2), and a view east from the mill yard (Figure 4.1-3).

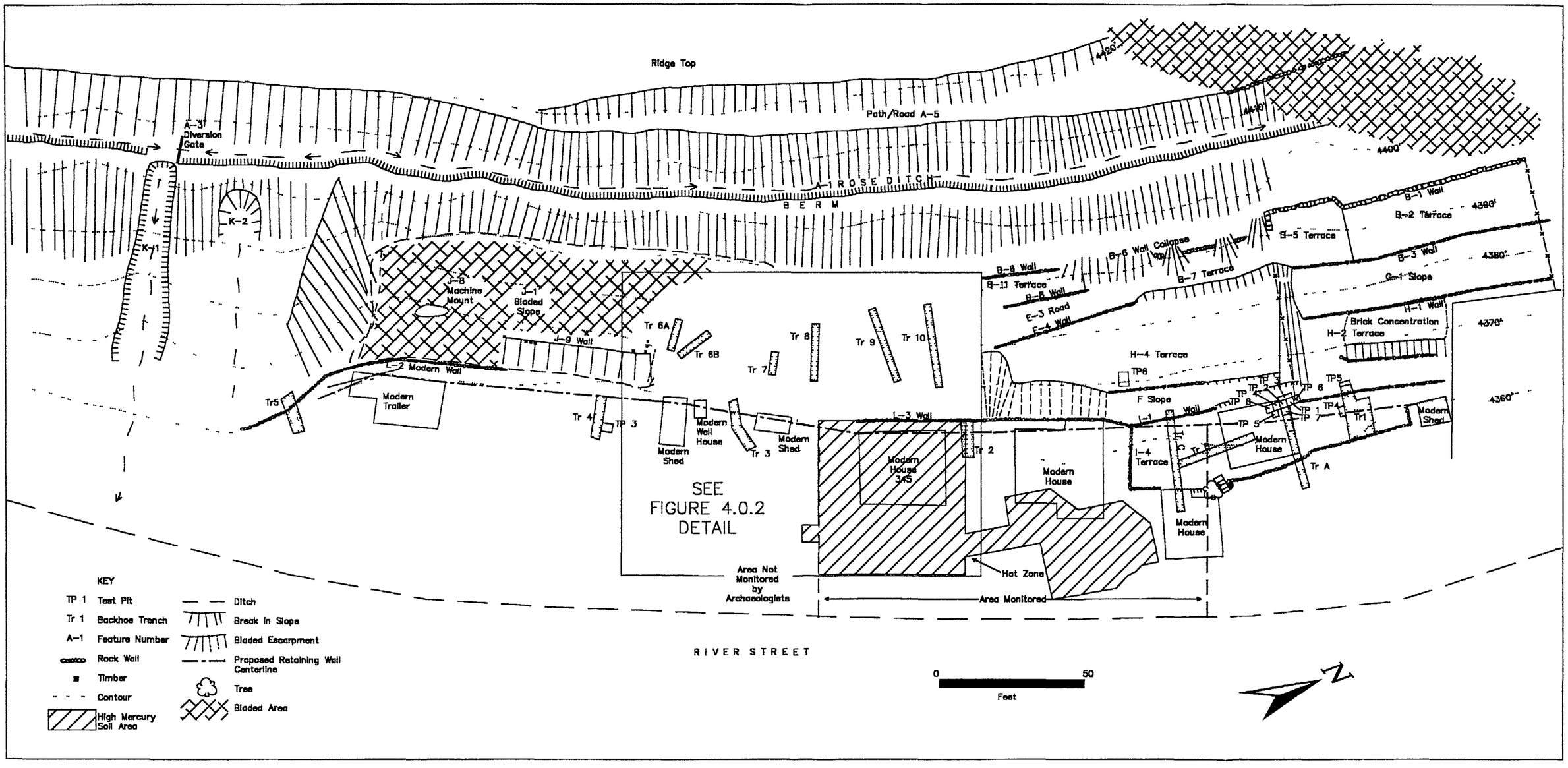


Figure 4.0-1. Base map of the Carson River Mercury Site, MS004 showing modern features and archaeological excavations.

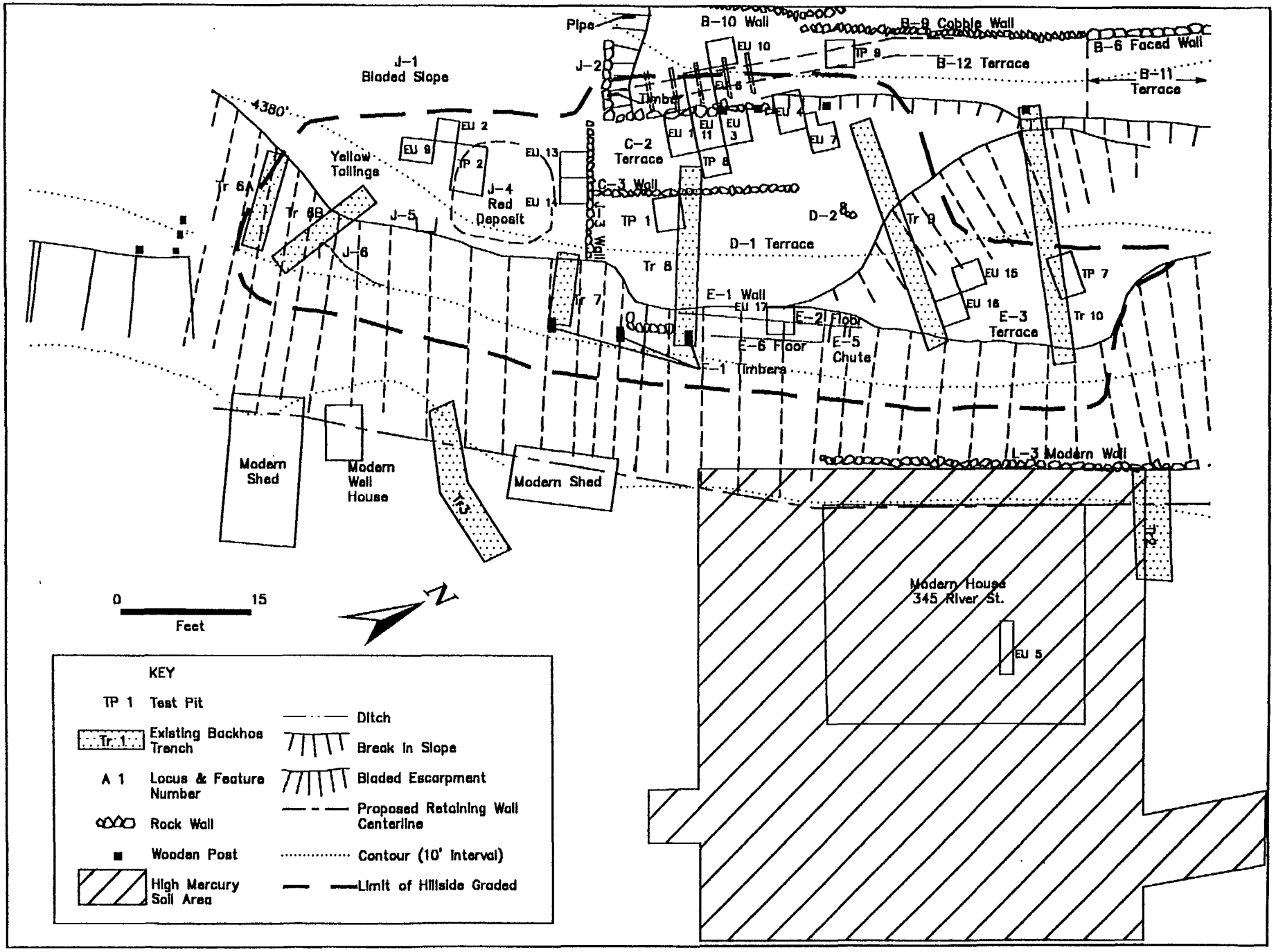


Figure 4.0-2. Detail of portion of the Figure 4.0-1 base map.

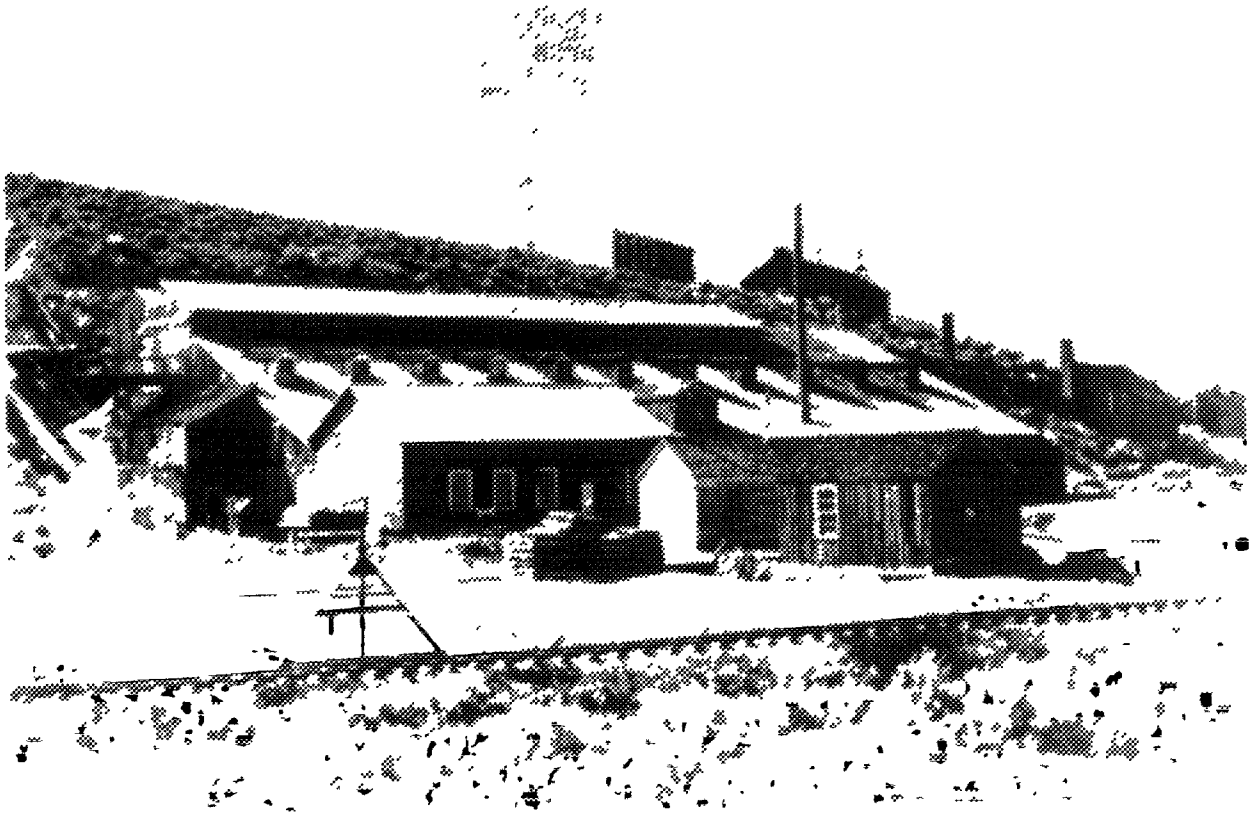


Figure 4 1-1 Overview of the Douglass Mill from the southeast early in the twentieth century (Courtesy of Nevada Historical Society)

Figure 4 1-2 Close-up of the Douglass Mill from the southeast early in the twentieth century (Courtesy of Nevada Historical Society)

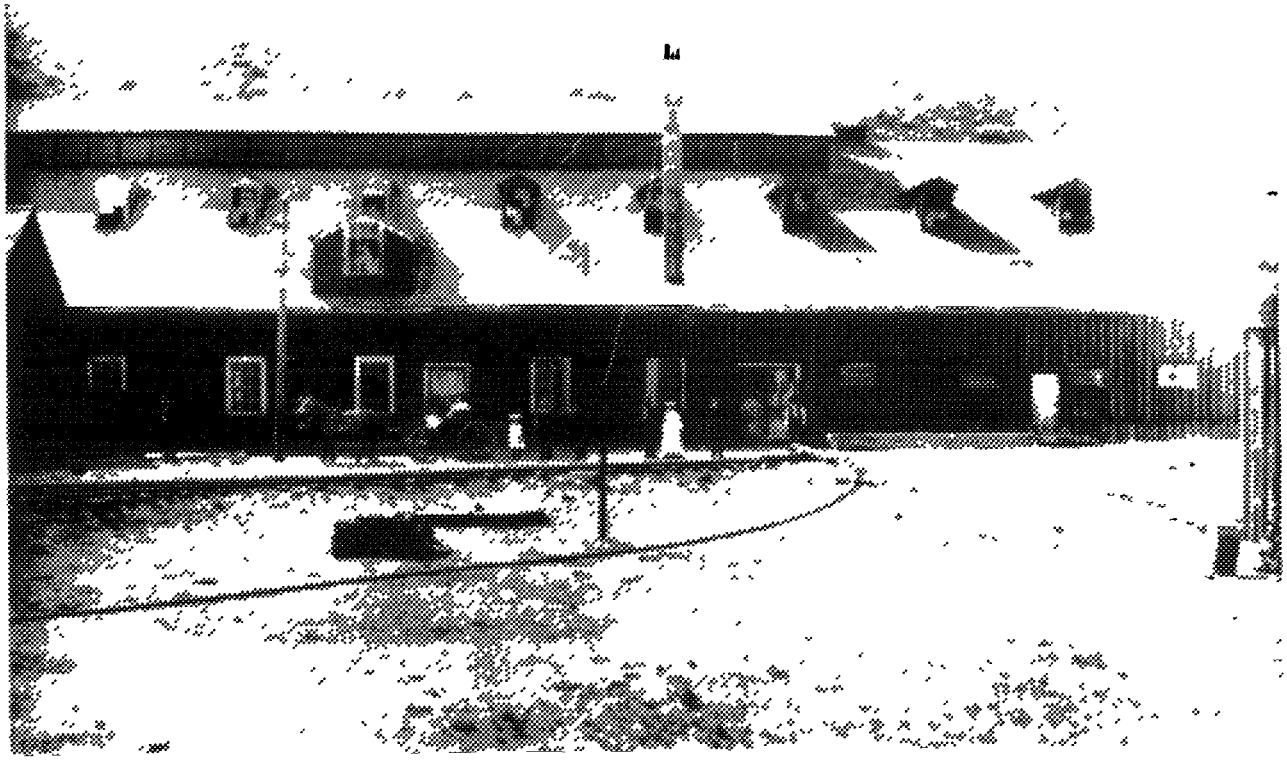


Figure 4 1-3 The Douglass Mill from the east early in the twentieth century (Courtesy of Nevada Historical Society)

4.2 A PREDICTIVE MODEL

In this section as many details as possible are gathered for the successive periods of mill construction and use. These periods are summarized in Table 4.2-1. The details provide not only a mill history, but also form a predictive model of the kinds of archaeological remains to be expected for each period and where on the property they are likely to be located. To facilitate understanding the entire mill process, flow charts are reconstructed for the pan mill and the tailings mill. In addition, enough information is available to recreate a fairly accurate floor plan of the original quartz mill, most of which is no longer present in the archaeological record.

WASHOE PAN MILL

Ground was broken for the Birdsall and Carpenter Mill early in April 1865 (Gold Hill News April 4, 1865). The mill was completed in August 1865 and the event was celebrated with a party for all "to witness the interesting and to us very welcome performance of starting up a magnificent new quartz mill." The mill was described briefly by the *Gold Hill News* (5 June 1865):

> *Birdsall & Carpenter M.* – Birdsall & Carpenter, proprietors; J. R. King, Superintendent; water power, twenty stamps, ten pans; ten men employed; one cord wood used per day; thirty tons quartz crushed per day.

The mill was not competed at this date, but expansion (never fully completed) was contemplated to as many as 40 stamps. A much more detailed description both of the party and the mill was recorded by the *Gold Hill Union* (26 August 1865):

> About 250 yards up the river from Birdsall's corner, on Main street ... is the location. The site is peculiarly advantageous, being dug in the side of the hill, just below the race or ditch, formerly known as Rose's Ditch. This ditch has been purchased by Birdsall & Carpenter for the use of the mill. This ditch conveys water from Carson the river, at a point about four miles above; and at the point where the mill stands it attains an elevation of 50 feet above the plain below, so that a small amount water furnishes an immense power. The water is carried entirely over the mill, so that in case of fire the whole building can be flooded in a few moments.
>
> The main building, when completed, will be 58 by 91 feet, excepting the wheel house, which is 14 by 54 feet. The water wheel is very strongly built, and is 50 feet in diameter with 7 feet face. The segment, or rag wheel, is 30 feet in diameter, and 10 inch face. This works in a pinion 30 inches in diameter. The main pulleys are 6 feet in diameter.

Table 4.2-1. Periods at the Birdsall Mill and Vicinity of MS004.

Period	Phase	Date	Mill	Ditch	Railroad	Road
I	1	1849-1855	NA	NA	NA	Emigrant trail and local route from Dayton to Carson.
II	1	1855-1858	NA	Construction by Chinese.	NA	Same.
	2	1858-1865	NA	Used for gold placers and Dayton settlement.	NA	Same.
III	1	1865-	Birdsall & Carpenter Pan Mill. Construction. 20 stamps, 10 pans, 30 tons/day.	Purchased by B&C Mill; diversion and water wheel.	NA	Same.
	2	1865-1869	B&C Mill operation on raw ore from Comstock & Como. 1866 upgraded to 30 stamps, 20 Wheeler pans, 55 tons/day. 1868 Carpenter leaves. By 1869-70 had 30 stamps and 40 pans.	In use for mill.	1869 horse-powered railroad constructed	Same.
IV	1	1869	Birdsall Mill converts to tailings.	Same.	Horse-powered railroad used	Same.
	2	1869-1882	Lyon Mill in use for tailings. 1872 max average capacity 142 tons/day. Bluestone plant and acid works constructed.	Same.	Same.	Same.
V	1	1881-1882	Tailings mill enlarged, purchased by Douglass.	Same.	DS&CV RR built; access to upper lower mill terraces	Same.
	2	1882-1896	Douglass mill in use for tailings.	Same.	Tailings railroad in operation.	Same.
VI	1	1897	Converted to process tailings with cyanide by Peck Brothers.	Widened for use at mill.	Repaired.	Same.
	2	1897-c1900	Abandoned except for brief trial run in 1898.	In use for Dayton settlement.	Abandoned.	Same.
	3	ca. 1900-ca. 1914	Demolished	Same.	Demolished.	Same.
VII	1	ca. 1914-ca. 1941	No activity.	Same	NA	Conversion to automobile road; by 1935 part of Lincoln Hwy.
VIII	NA	ca. 1941-present	Graded, house construction, retaining wall construction, underground utilities.	Abandoned in 1970s. Partly demolished at highway in 1980s; partly demolished at mill in 1990s.	NA	Service station construction, paved, US 50 in 19??; Service station abandoned.

> The machinery is placed on four distinct levels, the belting and gearing of each level being underneath its own floor and entirely out of the way. On the first level is a flue boiler, 30 inches in diameter and 15 feet in length, for a heater. Also, three agitators 6 feet in diameter and two feet in depth. These are placed on a grade so the water and tailings will run from one to the other, from the highest to the lowest, and then pass off.
>
> Eight feet above, on the second floor or level, are 5 settlers, 7 feet in diameter and 30 inches deep.
>
> Five feet above, on the third level are 10 of Wheeler's latest improved pans and 10 pulp tanks, 5 by 8½ feet and 3 feet deep: also 4 slum tanks, 4 by 8 feet and 3 feet deep.
>
> Ten feet above, on the fourth level, are 2 batteries of 10 612-pound stamps each. These are self-feeders, set and arranged on the latest and most improved plan for saving labor and doing good execution.
>
> In the rear of the batteries on the same level, and under the platform on which the wagons are driven to dump the ore, is a large ore room, 20 by 91 feet, which will hold many tons of ore.
>
> An additional battery of ten more stamps, with pans, settlers and agitators to match, will be added in five or six weeks, when the whole will be complete. The foundation for it is all graded and the lumber on the ground, with as many men at work on it as can be employed.
>
> On the front of one of the batteries is a very handsome card, on which may be seen the name of "Chas. Morgan, Builder," and we think all will agree with us that he may well be proud of his work. ... The convenience of its construction is such that with its present capacity Mr. R. King, the Superintendent, expects to run it with five men on a shift.

This was a classic early Washoe pan mill. The detailed description, along with comparative information about the structure and use of similar mills allows reconstruction of the internal layout of the mill in Figure 4.2-1 and of the milling flow sheet in Figure 4.2-2. The primary owner of the mill had a variety of interests, but the most stable one was his store in the "Bluestone Building" on Main Street in Dayton that still stands. During this period the mill owners did the first hillside terracing and leveled the terrace along River Street. Browne (1868:352-357) provides many details about the mill in 1866. The estimated cost of construction was $110,000, making it one of the more expensive mills on the Comstock. Only the ridiculously overbuilt Gould & Curry ($380,000), the Mexican ($300,000), and the Imperial or

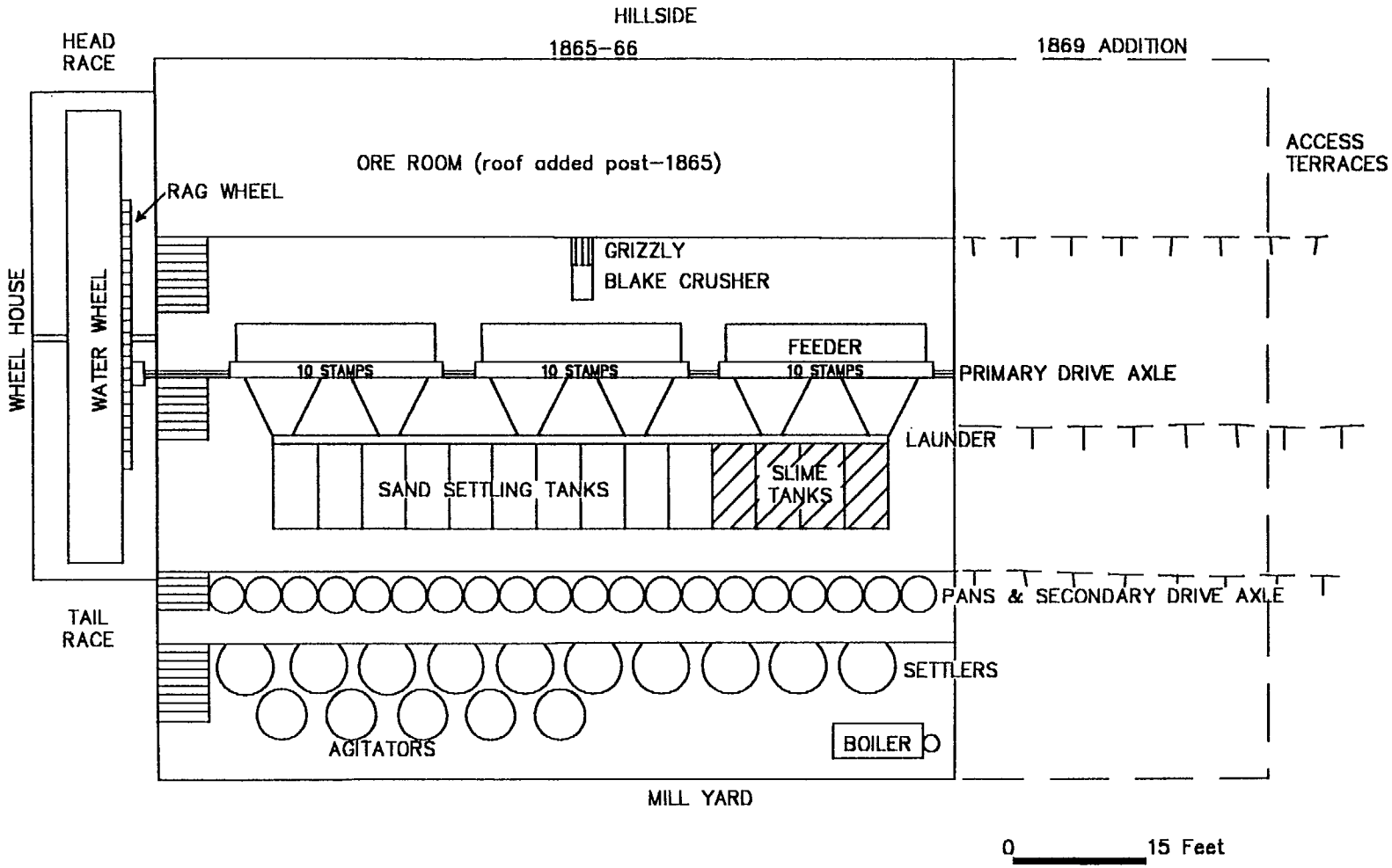


Figure 4.2–1. Reconstructed layout of Birdsall and Carpenter's Washoe Process quartz mill in 1865–1866.

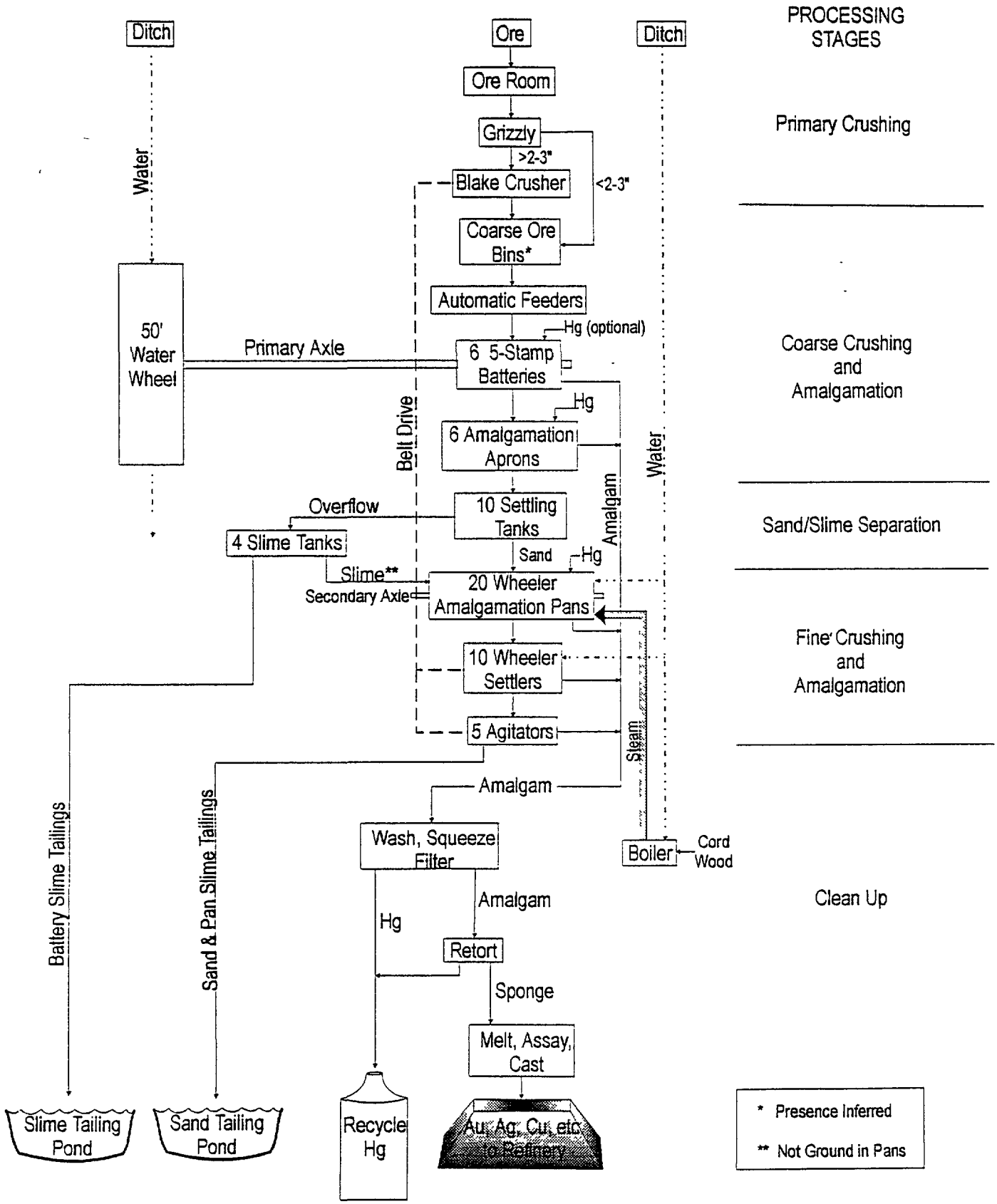


Figure 4.2-2. Reconstructed flow sheet for the Washoe Pan Process as used at the Birdsall and Carpenter quartz mill in 1865-1866.

Rock Point mills ($250,000) cost significantly more to build. Motive power was primarily from the 50 ft diameter overshot water wheel. The mill used only a modest cord of wood daily, most likely to provide steam to heat the pans. The 30 stamps weighed in at 613 lbs each, had a nine-inch drop, and cycled at an ear-shattering 85 drops per minute – faster than any other mill associated with the Comstock at the time . The mill was rated at 75 tons per day or 1,900 tons per month, exceeded only by the Gould & Curry, Yellow Jacket, and Imperial. The ore sources were 7.5 mi away. The mill employed 21 men and haulage cost $3.00 per ton. The mill was equipped with 20 Wheeler pans, 10 large-sized Wheeler settlers, 5 agitators, a Blake rock breaker, and a grinder. The mill was assessed at $110,000 and the ditch $40,000. A summary in the report of the Nevada Surveyor General for 1867 agrees with these details except for giving the stamps weights of 650 lbs and estimating wood consumption at two cords. It also specifies that the mill had a right to 700 inches of water, which is about half that available for most of the other water-powered mills on the Comstock.

Como ore selected from old dumps was sent to Dayton, likely at the Birdsall Mill, in 1867, where it yielded over $20 per ton (MSP 1867:15:311). By 1868 the mill was reported to have 30 stamps and a reduction to12 pans. Water power was still used and the mill was assessed at $120,000 (Surveyor General 1869:137; *Territorial Enterprise* 8,21 January).

This was a *custom mill* that processed ore from a variety of sources. It was not built to process ore from a particular mine. This implies constant alterations of the process at the mill to accommodate variations in the ores. For example, the mill processed 100 tons of selected ore with a yield of over $20 per ton from Como in 1867 and 2,000 tons from the Old St. John's Mine on the Occidental Lode in 1868 (MSP 1867 15:247, 311; 1868 16:263).

At least some ore (as opposed to tailings) may have been processed as late as July 1874, when a worker, Camill Daganyott, severely injured his hand in the stamp battery (LCT July 30, 1874). The coarse crushing portion of the mill would have been idle had it converted strictly to tailings operations, unless he had his injury in the small stamp battery used at the refinery which will be discussed in more detail later.

TAILINGS MILL

Birdsall & Co. constructed blanket concentrators in Gold Canyon in the summer of either 1867 or 1868. These concentrators, also called sulphuret tables, were 1,800 ft long and 30 ft wide (Surveyor General 1869:135). This date places the blanket sluices among the earliest used in the district. Regarding processing of tailings at the Birdsall Mill:

> The most successful operator was George Langtry, who persuaded Birdsall to turn the Lyon mill into a tailings plant. This mill was operated and yielded large dividends until 1880, but after this date and until the introduction of the cyanide process there was nothing more than desultory work. [Young 1913:335-336]

The mill is reported to have had 40 pans in 1869. This is a major restructuring event requiring either extensive addition, which seems most likely, or cramming far more machinery in the same space since very little could be removed. This doubling of the pans while not increasing the numbers of stamps heralds the changeover to processing tailings concentrates from blanket sluices, although raw ore could also be worked as the need arose. By 1871, it continued to have 30 stamps and 40 pans (State Mineralogist 1871:14). The actual workings of the mill are documented in some detail for the first three-quarters of 1872. In that year F. Birdsall & Co. processed 3,222 tons of ore worth $16,133.00 the first quarter, 6,000 tons worth $25,848.06 the second quarter, and 12,880 tons worth $45,791.57 the third quarter for a total of 22,102 tons valued at $87,772.65 (State Mineralogist 1873:176-177). At peak capacity during the third quarter this averages out to about 142 tons per day. By 1872 the mill was focusing so much on tailings that the stamps were inactive and the mill was identified as a tailings mill by the State Mineralogist (1873:100). The 1873 business directory specifically identifies the mill as "Birdsall & Co.'s Tailings Mill, G. C. Langtry, Sup't" (Uhlhorn 1873).

Reorganization as a tailings mill was completed with the formation of the Lyon Mill and Mining Company. Frederick Birdsall, Henry Merwin, Constant Birdsall, and George C. Langtry granted their holdings in the mill and tailings reservoirs to this company, which they controlled, on December 29, 1873 (SAIC 1993:47). The Lyon Mill was the most successful of the tailings mills, operating largely under superintendent Langtry (Shinn 1980:88). The superintendent was so important in these operations that the mill was sometimes called Langtry's mill.

Hague (1870:262) describes the Birdsall mill, working tailings from reservoirs as follows:

> The largest of all the mills thus engaged is that of Mr. Birdsall, at Dayton. This mill was formerly a crushing mill, provided with 30 stamps and 20 Wheeler pans. It has lately been refitted and devoted to the working of tailings. The stamps, of course, are useless for this purpose. A number of large Horn pans have been added to the machinery of the mill, making 30 or 35 pans in all, with capacity for working between 250 and 300 tons of tailings per day. The mill has an excellent water-power, derived from the Carson River, ample for all its needs. As it is conveniently placed with reference to the supply of material, it should be able to do its work very economically. It is said that the business of this mill is exceedingly profitable, but the writer is not in possession of definite information concerning the yield of the tailings or the costs of working them.

The mill was processing up to 300 tons of tailings by 1876. This is over twice the capacity of any other tailings or stamp mill operating in either Lyon or Ormsby counties at the time (Powell 1876:67). The tailings industry was a major endeavor in Lyon County. For the year ending September 30, 1876, the mills were reported to " have been exceedingly busy" – working 70,274 tons of material, yielding bullion valued at $385,675.93 (State Mineralogist 1877). Documentation about the mill in this period is sparse but with an annual output of about 50,000

tons during the following decade it was the major producer in Dayton. In the second half of 1877 the Lyon Mill processed 19,158 tons of tailings with a gross value of $75,681.54 (State Mineralogist 1879:188-189).

Joe M. Douglass bought the mill in 1882 and proceeded to enlarge it yet again. He extended the tracks of the railroad to Sutro and named it the Dayton, Sutro, and Carson Valley Railroad (Myrick 1962:211; SAIC 1993). Curiously, the Surveyor General (1885:50) in the report for 1883-1884 only credits the "Douglass tailings mill; [with] water power; twelve pans; capacity 160 tons per twenty-four hours." This was a difficult time for the tailings industry. The Surveyor General (1885:50) concisely identified the problem:

> The amount of bullion produced from tailings is about the same as last year, but the expense of reducing them is so great that very little revenue is obtained from this source. Taking into consideration the low grade of all the tailings worked in Lyon county and the heavy discount on fine bullion it is surprising that they are worked at all.

The year 1887 marked a radical innovation in the tailings plant. Late in the spring of that year Dr. Rae's process of using electrolysis to reduce losses of mercury and amalgam was introduced to the mill following a period of failed experiments elsewhere. The dynamo not only charged the anodes, but operated seven settlers. A dynamo was needed since community-wide electrical service was not extended to Dayton until after the mill's closure early in the twentieth century. All of the machinery was made by the Pacific Iron Works. Rae claimed the anodes in the bottoms of the settlers had the benefits of both saving more bullion and of keeping mercury from becoming "floured" and unable to amalgamate. During the experiment, 135 tons of ore were worked daily resulting in a 4 to 10 percent increase in bullion yield and much better mercury recovery providing an additional savings of $5,000 a month (Bailey 1996:50-51).

Rae's process failed to save the mill at this time. De Quille (1889) did not even bother to include a mention of this mill, formerly one of the two most important mills in Dayton, in his description of Comstock mills.

TAILINGS

A peculiarity of tailings mills is that the waste from other mills is their "ore." Of the various tailings sources used at this mill through time, the most extensively used was what came to be called the Douglass Tailings impounded in a reservoir on the Carson Plains below Sutro. These tailings included materials from many plants in Sixmile and Sevenmile canyons. As the most distant major tailings source for the mill, this deposit was the endpoint of the mill railroad.

An estimated 400,000 to 500,000 tons of these tailings were still present in 1897 with an average assay of $7 to $8 per ton. The values are mainly silver due to more efficient removal of gold through the old processes (LCT 27 February 1897). As of early 1896 local millers

generally believed that what was left in the Douglass tailings was of too low a grade to work profitably (LCT 22 February 1896). Despite this belief, these tailings were integral to the revival of the mill in 1897 by the Peck Brothers. The railroad to the Douglass tailings was repaired and the old Carson Valley Mill boarding house was refurbished to house workers at this location (LCT 18 September 1897). Tailings were removed at a rate of 200 tons daily starting on October 4, 1897, when a crew of 10 Chinese and an overseer loaded railroad cars at the reservoir (LCT 9 October 1897). Operations did not last beyond October when the mill shut down (LCT 8 January 1898). A subsequent test of the Peck process showed that returns were not enough to meet expenses and that the whole operation was a fraud.

Shortly thereafter the Douglass tailings were again sampled to determine if they could be cyanided. The tests were not good enough to result in a sale of the tailings – the paper disgustedly noted that "any item about these tailings for a year or so past has been a regular Jonah" (LCT 28 May, 20 August 1898).

Despite such discouragement, interest in the tailings continued. A corporation including W. J. Douglass and several others held an option on the property and were convinced they had found a method to work it and ore from other sources using cyanide at a plant they proposed constructing (LCT 9 December 1899). In 1901, numerous tests were made of it by Woodbury, representing the Eureka Cyanide Plant, to see if the still-large deposit could be worked at a profit, with no success at that time (LCT 25 May 1901).

In a summary report on the re-treatment of Comstock tailings, Leaver and Woolf noted that all attempts to treat the Douglass tailings by cyanide had failed due to loss of too much cyanide caused by cyanide-soluble copper:

> Practically all of the free gold and a high percentage of the silver minerals have been removed by the former milling methods. Much of the heavier sulphide material has been removed as concentrates [in blanket sluices]. The remaining sulphides, mostly from the slime portion, are partly oxidized by weathering.
>
> Re-treatment is most important for the recovery of mercury lost in the amalgamation process and of copper introduced as sulphate to assist the amalgamation. Part of the mercury remaining in the tailings has united with base metals, part has formed sulphides, and the remainder is mostly oxidized. Most of the copper introduced as sulphate was precipitated by the iron parts of the treatment equipment. This metallic copper is now partly amalgamated and sulphidized.
>
> The metal content of the Douglass tailings approximates 2.8 ounces silver, 0.055 ounce gold, 0.5 pound mercury, and 0.12 per cent copper. [Leaver and Woolf 1928:2-3]

This summary indicates the materials entering the tailings mills, though somewhat varied depending on tailings source, were massively different from the original Comstock ores treated by the quartz mills. These differences did not occur all at once, but were created by several re-treatment episodes, effects caused by movement by water over long distances, and exposure to the atmosphere for varying periods. All this in addition to the mechanical and chemical changes made in the quartz mills themselves.

Ultimately, about half the values in the Douglass tailings were recovered at a flotation plant (Leaver and Woolf 1928:3-4). Additional efforts have been made to recover precious metals and mercury from the tailings by a succession of companies into the 1980s, generally with marginal success (John Gomes personal communication 2000).

Tailings from the Douglass Mill itself were not exempt from investigation for possible reworking. One test of these tailings was in 1892, to determine if they could be worked with the new cyanide process (LCT 20 August, 24 September 1892). Tailings from the Rock Point Mill were also worked at the Douglass Mill in 1897, and fully cleaned out by late October (LCT 23,30 October 1897).

REFINERY AND BLUESTONE PLANT

In large measure, the long-term success of the mill was due to the extent to which it controlled all aspects of the milling operation. Its handling of one of the critical reagents of the Washoe process, bluestone, and construction and operation of a refinery for the product on site illustrates this point well. The *Lyon County Times* provides a glimpse of the importance of these portions of the operation (LCT 6 September 1874):

> The Lyon Mill and Mining Co. are working to their full capacity. They have the most extensive bluestone and acid works in the State, and have the contract of furnishing the Carson Mint with acid.

Copper ore for the plant was provided by several sources. Birdsall owned a small copper mine on the east side of the river and a 3 mi south of Dayton. A considerable amount of good grade copper ore was taken out for the bluestone works (LCT 1 July, 16 September 1899). In addition, copper ore was milled from the Dobbins Mine in Mason Valley. This ore had as much as 45 percent copper yielding $90 per ton with copper prices at 10 cents (LCT 20 March 1897).

After working as an assayer for the Lyon Mill for several years, in 1886 A. D. Hodges wrote a detailed treatise about the refining process used at the mill, along with its critical linkage to the handling of bluestone. This process was pioneered at the mill and subsequently spread to other tailings mills. The complete text and figures are included as Appendix D, but since much of the archaeological work at the mill was in the refinery and bluestone production area, salient points will be summarized. Although direct quotations are not used here, the paraphrasing often

uses Hodges' own words. A reconstructed flow chart for the mill, refinery, and bluestone works is in Figure 4.2-3.

Tailings were amalgamated in combination (wood and iron) pans. Salt and bluestone were added. Correcting the failing observed by Hague (1870), that most plants on the Comstock failed to use sufficient quantities of reagents, this mill used bluestone in sufficient quantity to make the bullion rich in copper. Clearly, the copper brought the precious metals out of the pulp during amalgamation. Bullion from this mill was kept at 150-150 parts per thousand of precious metal, most of the remainder being deliberately introduced copper.

Amalgam was taken from canvas strainers and retorted in cylindrical iron retorts. Retorting produced two residues. White bullion is compact and partly fused while base bullion is reddish-brown, porous, and brittle. Base bullion was easily refined by crushing, roasting, and treating it with sulphuric acid. White bullion, comprised of about half silver and half copper, was much more difficult to refine and had in fact proved beyond the capabilities of local refineries. This was a serious problem, since shipping costs were greatly increased by the base copper content and, surprisingly, no compensation was provided for the copper portion of bullion sent out of the district for refining.

The method for refining white bullion at the mill was developed in 1873. Facilities for refining included sulphuric acid chambers, a bluestone factory, small old 5-stamp battery for crushing the base bullion wet, small roasting furnace, dissolving tubs, crystallizers, and an old refining kettle. A Chili mill was later substituted for the stamps. This mill was made specifically for the refinery and its plan is in Appendix D. In contrast to the interrupted vertical motion of the stamps, the Chili mill crushed pulp beneath 3-ft diameter iron wheels rolling around a vertical axle set in the middle of a flat stationary iron bed. When the old furnace burned out, it was rebuilt elsewhere on the site in its own room. Additions were two silver precipitation vats made of old settlers lined with lead, two or three filter tubs, and a precipitating room. All of these features are discussed in greater detail below or in Appendix D. The basic process used for retorted bullion was as follows, beginning with heat-treatment at the furnace room:

> The base bullion is crushed and roasted dead in a reverberatory furnace to form oxide of copper and metallic silver (and gold).
>
> The white bullion is treated with sulphur in a closed vessel at a low heat, forming sulphide of silver and of copper. This is crushed and roasted to form oxide of copper and sulphate of silver (Ziervogel-process).

From the furnace room the bullion was trammed through the retort house and continued farther north to the bluestone works for leaching and precipitation:

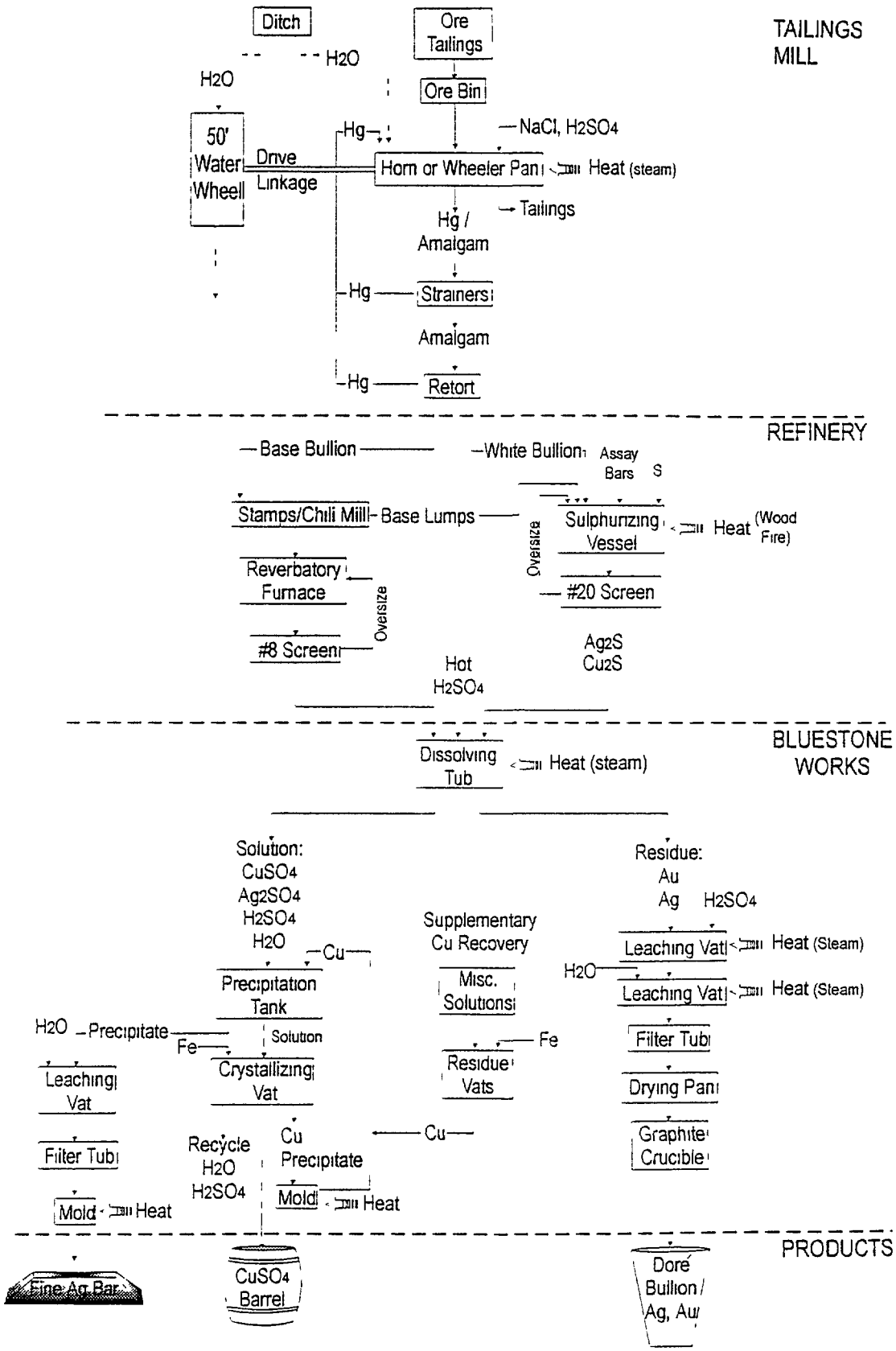


Figure 4.2-3 Flow chart for the Lyon Mill constructed from data by Hodges (1886).

> The roasted products are treated (separately as a rule) with hot dilute sulphuric acid (chamber acid). All of the copper (oxide) is thus converted into soluble sulphate. The silver sulphate also goes into solution. Moreover as dilute nitrogenous sulphuric acid dissolves metallic silver to a considerable extent, an additional amount of silver sulphate is obtained in solution. Some of the silver apparently remains oxidized after roasting, and dissolves in common sulphuric acid; that is, acid which has been concentrated. The Omega Refinery used such acid (diluted), but the amount of silver sulphate obtained from the base bullion was much less than at Dayton, where chamber acid was used. A large part of the silver in the roasted products and all of the gold are left as residues in the dissolving tubs, and (after leaching, drying, etc.) are melted in black-lead crucibles to refined doré bullion.
>
> All the sulphate solutions are removed to tanks containing metallic copper, where metallic silver is precipitated. This product melted gives fine-silver bars.
>
> The copper-sulphate solutions, after being freed from silver, when of sufficient strength, as was almost always the case, are drawn into crystallizing vats whence is obtained a fine quality of merchantable bluestone. Weaker solutions are first concentrated and then crystallized. Very weak solutions (wash-waters, etc.), are run into vats holding iron, to recover the copper which is melted into bars and used to precipitate silver. The mother-liquor from the crystallizers is concentrated and rechrystallized, the acid second mother-liquor being utilized in the dissolving tubs.

For further details on the way tailings were processed at the Lyon Mill there is no substitute for reading all of Appendix D, which is already an immensely dense-packed document that defies further summary. Much of that work will be revisited in the detailed analyses of archaeological features below. However, in three areas Hodge's work would benefit from further context. These areas are general descriptions of the process for making chamber sulphuric acid, the bluestone production process, and some additional background on the Ziervogel process.

Sulphuric Acid Works

DeQuille (1889:104) notes that the acid works produced two tons of sulphuric acid daily. The sulphur used for this was from a mine in Humboldt County, Nevada, and cost $40 per ton. The sulphur mentioned by DeQuille was from the Rabbit Hole (Sulphur) District, by far the largest producer in the county at that time and the only district in the county where sulphur was mined in marketable quantities (Lincoln 1923:103; Willden 1964:107). This sulphur was largely elemental, derived from hot springs.

The raw sulphur ore brought to the mill had to be purified in some way. It is most likely that this was done by distillation in closed retorts similar to those used for mercury. However, other methods using melting or other types of furnaces may have been used (Crookes & Rohrig 1868:710-722). It is possible that archaeological evidence from the northern end of the mill complex could help discern the method chosen here.

Similarly, the physical plant using enclosed chambers to convert sulphur into sulphuric acid were located at the northern end of the mill site. Buildings and an ore bin related to both the sulphuric acid and bluestone works are visible at the upper right corners of Figures 4.1-1 and 4.1-3.

Hodges mentions that the acid produced at this plant was *chamber acid*. This acid has specific properties resulting from the way it was made. The state of the art regarding sulphuric acid production in the late nineteenth century was summarized by Armstrong, Meldola, and Butler (1875:503-504). The following discussion of the process is based entirely on that source:

> The method employed consists essentially in oxidizing sulphurous acid by atmospheric oxygen, which is accomplished with the aid of nitric oxide gas in the following manner. Sulphur dioxide gas is prepared by burning sulphur, or iron pyrites, FeS_2, in a properly constructed furnace, sulphur being always employed when the purest qualities of acid are required, and this gas is conveyed into a large leaden chamber, into which steam and air are also continuously admitted. At the back of the furnace in which the sulphur is burnt, a small vessel is placed containing sodium nitrate and sulphuric acid, which continue to generate nitric acid for some time...

This initial process yields nitric acid and sodium hydrogen sulphate. Through a complex series of chemical changes that were "imperfectly understood" but that worked just fine in practice, the oxygen, water in the steam, nitric acid, and sulphur combining to form the dual end products of nitric oxide and sulphuric acid.

To prevent loss of acid in stack gas, scrubbers were normally used. These were simple devices, consisting of stacks filled with coke [or charcoal] kept moist with either water or sulphuric acid.

> The acid from the leaden chambers has generally a specific gravity of about 1.55; by concentration in shallow leaden pans this is raised to above 1.7. The further concentration is effected in glass or platinum retorts. The commercial acid, known as oil of vitriol, has a specific gravity of about 1.84; it is frequently of a more or less brown color from the presence of organic matter, and always contains lead. Other impurities, such as arsenic and nitrous or nitric acid, are not infrequently present [Armstrong et al. 1875].

Bluestone Works

In addition to the bluestone produced as a byproduct of the Ziervogel Process, large amounts were made for the other mills in the region. This bluestone was made from copper mined specifically for the purpose. This implies the existence of another complete small mill on the property with an incoming ore bin and the capability to crush the copper ore in preparation for the rest of the process. Making bluestone or blue vitriol by the vitriolization process is simple. Copper is converted into copper sulphate by oxidization in the presence of hot sulphuric acid from the acid works and atmospheric air. The reagents are mixed in vats. From the bottom of the vats the liquor is directed through a series of cooling launders. The copper sulphate crystallizes out of suspension in the launders and is available for harvesting. The acid solution is then recycled to the copper dissolution vats. The final step in the process of making marketable bluestone is re-dissolving the launder scrapings and re-crystallizing the copper sulphate into larger and purer crystals in a vat (Percy 1880:494-495). An important characteristic of all vats and launders in both the sulphuric acid works and bluestone works is that they had to be covered with sheet lead to protect the wood and iron from the violent oxidization that would have taken place should the sulphuric acid be allowed to come in contact with these materials. Hodges provides details about the procedure used at the Lyon Mill for making these linings. Certainly an archaeological expectation of these areas is a combination of lead-enriched sediments and fragments of the lead linings discarded during repair or demolition.

Ziervogel Process

The Ziervogel Process is a method of extracting silver with warm water and sulphuric acid. According to Crookes and Röhrig (1868:378):

> This is the simplest and cheapest of all the different known processes for extracting silver, and is based upon the transformation of the silver contained in the substance under treatment into sulphate of silver, which is then lixiviated [separation of the soluble from insoluble materials by washing with a solvent] by hot water containing some sulphuric acid, and precipitated from this solution by means of copper. The formation of sulphate of silver is effected in the roasting process by the evolution of sulphuric acid in a gaseous form from sulphates which have been generated from other sulphides associated with the sulphide of silver.
>
> The perfection of the desilvering depends solely on the result of the preliminary roasting, which is one of the most delicate operations in the metallurgy of silver.

There had been little success in using this process to work silver ores since so many of them contained antimony, arsenic, lead, or zinc in large enough quantities to disrupt the chemical process, or did not contain an adequate amount of copper sulphide or copper sulphate. The tailings processed at the Lyon Mill did not have this problem with minor elements and addition of large quantities of copper sulphate corrected the last deficiency.

THE PECK CONCENTRATOR

As the Comstock fell deeper into depression and silver prices declined to less than 90 cents the mill gradually fell into disuse. By mid-1895 the mill had been unused for some years and had fallen into disrepair (LCT 6 July 1895; 25 January 1896; 27 February 1897). A hope that the Hale & Norcross would lease the mill, put stamps in it (suggesting that the stamps had been removed as part of restructuring as a tailings plant), and haul ore to the mill via the Sutro Tunnel proved false (LCT 28 March 1896).

The mill entered its final phase of operations in February 1897 when the Peck brothers leased the mill and all related rights and equipment, including the railroad, engine, water rights, and so on. In addition, they purchased the Douglass tailings below Sutro. The railroad was repaired and the mill was partially converted to continue working tailings. At first the cost was estimated at some $25,000, but ultimately the project took nearly twice as much capital. Several men began work on the conversion early in March. At the same time, the ditch was enlarged to provide more power (LCT 27 February, 6,13 March 1897).

The core of the facility was based on Charles V. Peck's pulverizing and concentrating process, the patent of which was held by the Peck Title Company (LCT 23 April 1898). Most of the machinery for the mill arrived early in May. Perfection water wheels were installed by June 5 to supplement or replace the old wheel (LCT 8 May, 5 June 1897). Although specifics on these wheels were not located, they are likely to be similar in design to Pelton wheels.

The first tailings worked at the new concentrator were from the Rock Point Mill. Milling operations started on June 7, 1897, and despite delays due to problems with the penstock, the first two carloads of concentrates were shipped to Salt Lake City for smelting on June 26 (LCT 22 May, 5,12,26 June 1897). Subsequent shipments of sulphurets were sent to the Selby works in California instead (LCT 3 July 1897). This suggests the concentration process did not involve any chloridizing pretreatment but simple separation by specific gravity.

In addition to tailings, plans were afoot to attempt treating ore from the Logan and Hully Mine and the Mayday Mine at Como but it appears that nothing came of this scheme (LCT 24 April, 23 October 1897).

After a run of less than two months the mill shut down on July 28, 1897. During this time the mill processed nearly 200 tons daily, working through most of the Rock Point tailings. The reason offered for this shutdown was lack of water (LCT 31 July 1897). The mill started up again on Birdsall tailings on October 4, processing about 200 tons daily. The mill force was 20-25 men while 10 Chinese supervised by George Rammelkamp loaded tailings into the railroad cars at the reservoir (LCT 9 Oct. 1897).

The optimistic series of news items about the Peck operation came to a shocking halt in the January 8, 1898 issue of the *Lyon County Times* under the headline "A Heavy Attachment:"

> Joseph Douglass, of Virginia City, placed an attachment on the Peck concentrating machinery in the Douglass mill at this place, last Wednesday. The attachment is for $44,185.35, alleged to be due Mr. Douglass for money loaned C. V. Peck to repair the mill and put machines to work the Douglass and other tailings. C. V. Peck left here about two months ago, and the mill has been idle since, ostensibly on account of a broken wheel, which rumor says was broken on purpose. It was reported that the mill would be started up this week, but instead orders came to send certain parts of the machinery below. When this was learned Douglass probably thought it was time to try to get some of his money back or something for it. The property is now in the hands of the Sheriff....

Alas, it was far past time for Douglass to recover his losses; Charles V. Peck and W. H. Peck were never heard from again. A list of equipment and other assets offered at the sale are provided in Table 4.2-2. These assets include about 300,000 tons of tailings at the Birdsall tailings reservoir, a Peck concentrating machine, two dynamos, two agitating tanks, three Perfection water wheels, and a miscellany of tools, spare parts, and smaller pieces of equipment. The paucity of major equipment indicates how little alteration was made in the existing mill complex.

Douglass retained the equipment and proceeded to test the machinery and process on Douglass tailings. Preparatory to this, the mill, ditch and flume were again cleaned out and repaired (LCT 23,30 April 1898). Ominously, the test of Peck process started on Friday, May 13 with a full crew. As expected by this time, the test ended four days later as "a rank failure" unable to cover milling expenses (LCT 14,21 May 1898).

No indication could be found in the documents that the Peck process included conversion to a cyanide plant. If it was, it is surprising that the documents would not point this out, since descriptions of other plants using the new leaching process were normally described as cyanide plants. Sampling of the Douglass tailings by the Pecks, with the intent of possibly using a cyanide process, is further evidence that this reagent was not used at the mill (LCT 28 May 1898). The matter of possible cyanide use from the evidence of soil chemistry is revisited in Section 4.7.

The first notice that the Peck Brothers were considering working tailings at various sources and mills along the Carson River was heralded as "Good News for Dayton." After they left, in a cloud of debt and ruined chances to work tailings in a proper manner, the verdict was somewhat different in retrospect when the paper noted the time when "the celebrated Peck Brothers cleaned up the tailings and people hereabouts some years ago" (LCT 4 January 1896; 18 August 1900).

Table 4.2-2. Items at Sheriff's Sale of Peck's Improvements to the Douglass Mill (LCT 9 April 1898).

TAILINGS
300,000 tons of tailings (more or less)
AT MILL [inferred]
One [Peck] concentrating machine, Type 11, No. 9, with attachments.
Three pair of deferential chain-blocks.
Two thousand ore sacks (more or less).
Two oil pumps.
Two sizers and attachments.
Two clamps for hoisting machine.
Two pair chain tongs.
Three Stillson wrenches.
One 20-inch monkey wrench.
One 10-inch monkey-wrench.
One pipe vice.
Two pipe cutters, No's. 1 and 2.
One set Green River machine taps and dies, (two taps missing).
Two sets pipe dies and stocks.
Two new iron pulleys.
One roll new 12-inch 4-ply belting.
Five patent wooden pulleys.
Five centrifugal pumps.
One pair tin snips.
One dynamo engine.
One Whitcomb dynamo.
Two large water tanks.
Two agitating tanks at rear of mill.
One small lathe and attachments.
One emery wheel.
Three Perfection water wheels.
One box machine plugs.
One pair counter scales.
Five boxes of copper rivets.
LUMBER
Four timbers 12x12x20.
Three timbers 10x10x24.
Two timbers 4x4x28.

Table 4.2-2. Items at Sheriff's Sale of Peck's Improvements to the Douglass Mill (LCT 9 April 1898).

Six timbers 2x4x16.
Two timbers 4x6x16.
Two timbers 1x12x16.
Five piles railroad ties.
Five large drying tanks.
One sampling tank at south end.
AT RESERVOIR
Nine square-pointed shovels.
Ten round-pointed shovels.
One railroad-spike puller.
Four crowbars.
Two picks.
One grubbing pick.
One sledge-hammer.
IN TOOL HOUSE
Five new square-pointed shovels.
One and one-half boxes window panes.
One box machine plugs.
One-half box fish-plate bolts.
Ten pounds railroad spikes.
Eleven machine fittings for sizer.
Twenty round-pointed old shovels.
Eleven picks.
Miscellaneous lot of pipe fittings and check valves.
One new 2-inch globe valve.
IN OFFICE AT MILL
Two rolls brass wire screen.
IN ASSAY OFFICE
Four gasoline furnaces.
One gasoline tank.
One air-pump.
369 assay crucibles.
One box soda.
Six sacks litharge [lead monoxide].
Three sacks charcoal.

The mill machinery was sold in the early 1900s and the mill itself was torn down shortly after the photographs in Figures 4.1-1 through 4.1-3 were taken. The mill building was still standing as of May 25, 1901 when it was under consideration by Oscar Woodbury and McCone of the Eureka Cyanide Plant for conversion to a cyanide plant to work the Douglass Tailings (LCT 25 May 1901). It was no longer in existence for some years before the 1932 highway reconstruction was planned through Dayton.

4.3 ARCHAEOLOGY OF THE BIRDSALL AND CARPENTER QUARTZ MILL (1865-1869)

Archaeological remnants of the original Birdsall and Carpenter Quartz Mill proved to be nearly invisible. Following demolition it was excavated to a great degree in an effort to expand the size of the River Street terrace, probably by local landowners in the 1940s to 1950s. Most of the existing mill remains are north of the EPA area of disturbance. Figure 4.3-1 shows how an overlay of the 1865 mill dimensions likely fit on the MS004 landscape and delineates features we recorded that likely relate to the original mill construction on the gravelly hillside between the Rose Ditch and the Carson River floodplain. Archaeological features are discussed below. As few archaeological excavations (Tr 4, TP 3) were made in this area, no portable artifacts can be directly related to this early mill episode.

Features in existence prior to original mill construction and fundamental to its working include the Rose Ditch (A-1) and those ditch-related features commensurate with ones discussed in Chapter 8 related to its construction. This includes a downslope retaining wall of five or more courses of boulders aiding berm stability on the steep hill slope. Immediately northwest of the mill building, a simple cut and fill haulage roadway at the level of the B-2 terrace must have provided access for ore wagons bringing quartz ore to the upper portions of the mill from the Comstock via Gold Canyon wagon roads. No evidence of this roadway was identified, since it likely has been erased by the subsequent system of hillside terracing. Access to the top of the mill south of the J-1 embayment was minimal, confined to the maintenance road on top of the Rose Ditch berm. Other access from the south was restricted by the mill wheel and its associated head and tail races (Figure 4.2-1). Thus all incoming ore would have entered on the north side.

Within the area that was likely encompassed by the early mill walls, only a few features remain. These include a large bay area with an extremely steep slope (J-1), and a bank of two upright bolts likely machine mounts that may have held part of the axle and gear system attached to the water wheel (J-8). Fea J-9 is an alignment of 11 palisaded burned timbers up to 14x14 inches that may have served as the foundation under a bank of stamps as well as two similarly burned 12x12 inch timbers about 30 ft west of the palisade at what may have been the north wall of the original building (Figure 4.3-2). Most of the J-1 bay was removed by mechanical excavation in the 1940s supplying local landowners material for building terraces to house small dwellings above the floodplain. The J-8 mounts are substantial, ¾ inch diameter king bolts with iron washer and nut, situated side by side in the location where the water wheel would have been; a large iron bearing bushing is laying in slopewash just below the bolts. The J-9 palisade of

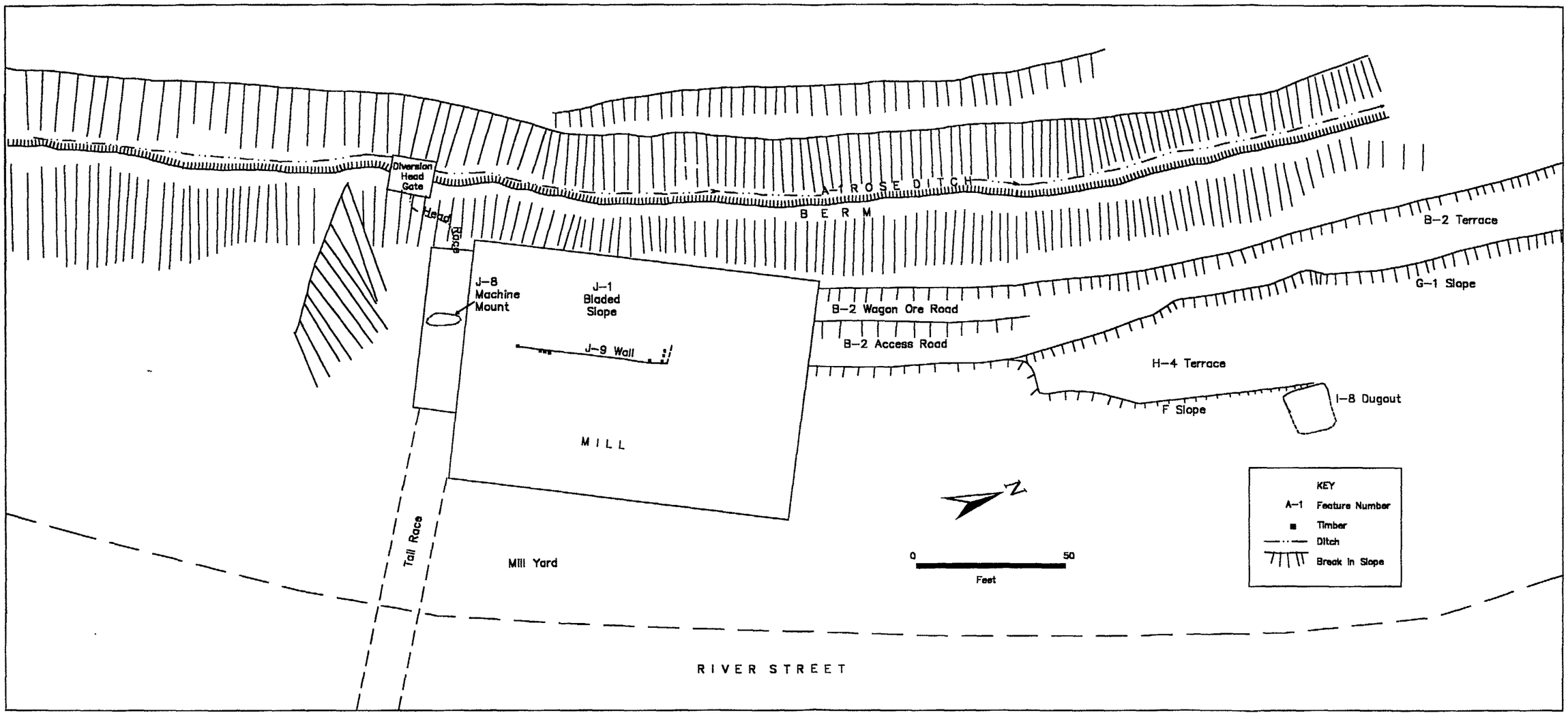
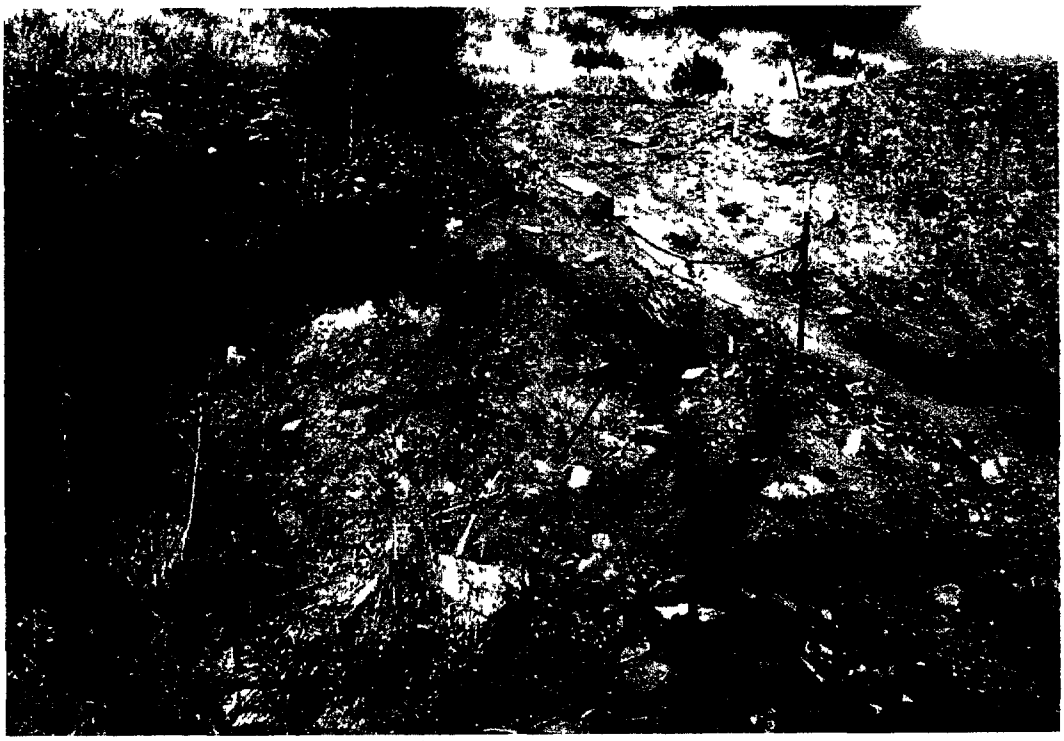


Figure 4.3–1. Birdsall & Carpenter Quartz Mill (1865–1869) archaeology.

View southwest (Roll 970-6, fr.16).



View west-northwest (Roll 970-6, fr.15).

Figure 4 3-2 Fea J-9 palisade stamp area foundation (top) and possible north wall timbers of the Birdsall & Carpenter Mill

upright burned timbers ranges in height from 0.5 to 3.5 ft and appears to provide a barrier for tailings on the west side of the palisade including copper blue, and gray and white sandy loams; one horizontal 7/8 inch bolt with a 2 inch nut may have helped anchor the palisade to the hillside. In any event the substantial nature of this configuration may have supported the stamps in the upper level of the early mill. The presence of sandy white to gray tails just north of this area may also substantiate this idea. Sand-sized tailings are the hallmark of crushing by stamps and these tailings were often called *stamp sands*. Crushed quartz-rich ore fragments were found in excavations of Loc J. Although Loc J was likely added on with the expansion and conversion to a tailings mill, these ore fragments may have been left from the earliest mill use or from custom ore milling during the tailings mill operation.

Excavations in the area of this mill were limited to Tr 4 and TP 3 where no artifacts dating to either the quartz mill or tailings mill episodes were found. These units are discussed in section 4.5 below. ARS was not present during the removal of contaminated sediment at the base of the mill building on MS004, therefore, the footprint of the original mill race below the water wheel or any other features that may have been in this area were removed and covered with clean sediment. Evidence from TR 4 and TP 3 indicates that at least part of this area was excavated away after mill demolition, much reducing the chances of finding intact mill foundations in this part of the site.

Although most of the quartz mill has been destroyed, we were fortunate in finding enough archaeological and documentary information to reconstruct both the placement and internal layout of the mill onto the composite site maps where it can be linked to the much better preserved archaeological remains north of the old mill. In addition to the unusually detailed mill descriptions from the documentary record, the 1932 highway map accurately locates the position of the tail race. A cluster of reinforcing rods in the Rose Ditch identifies the position of the diversion box for the head race, and equipment mounts indicate the approximate north edge of the mill wheel. The alignment of the stamp batteries are indicated by wood foundations, and wall segments indicate the overall orientation of the building.

4.4 ARCHAEOLOGY OF THE LYON TAILINGS MILL AND ASSOCIATED FACILITIES (1869-1896)

Most of the archaeological features excavated during this project are related to the Lyon Mill period wherein a large amount of data were collected warranting further subdivision of this section using spatial locations corresponding with different functions of the various areas within the site. Subdivisions include the mill building and upper access corridors, the furnace house and bullion/ore/tailings bins, the mill yard, and miscellaneous ancillary features not discussed elsewhere. Figure 4.4-1 represents the plan map of archaeological deposits and features related to the construction and use of the mill during this period. In addition, Figure 4.4-2 represents a reconstructed cross-section through the area just north of the mill building and includes the Rose Ditch (Loc A), access terraces in Loc B, the furnace house (Loc C and D), the bin areas (Loc D

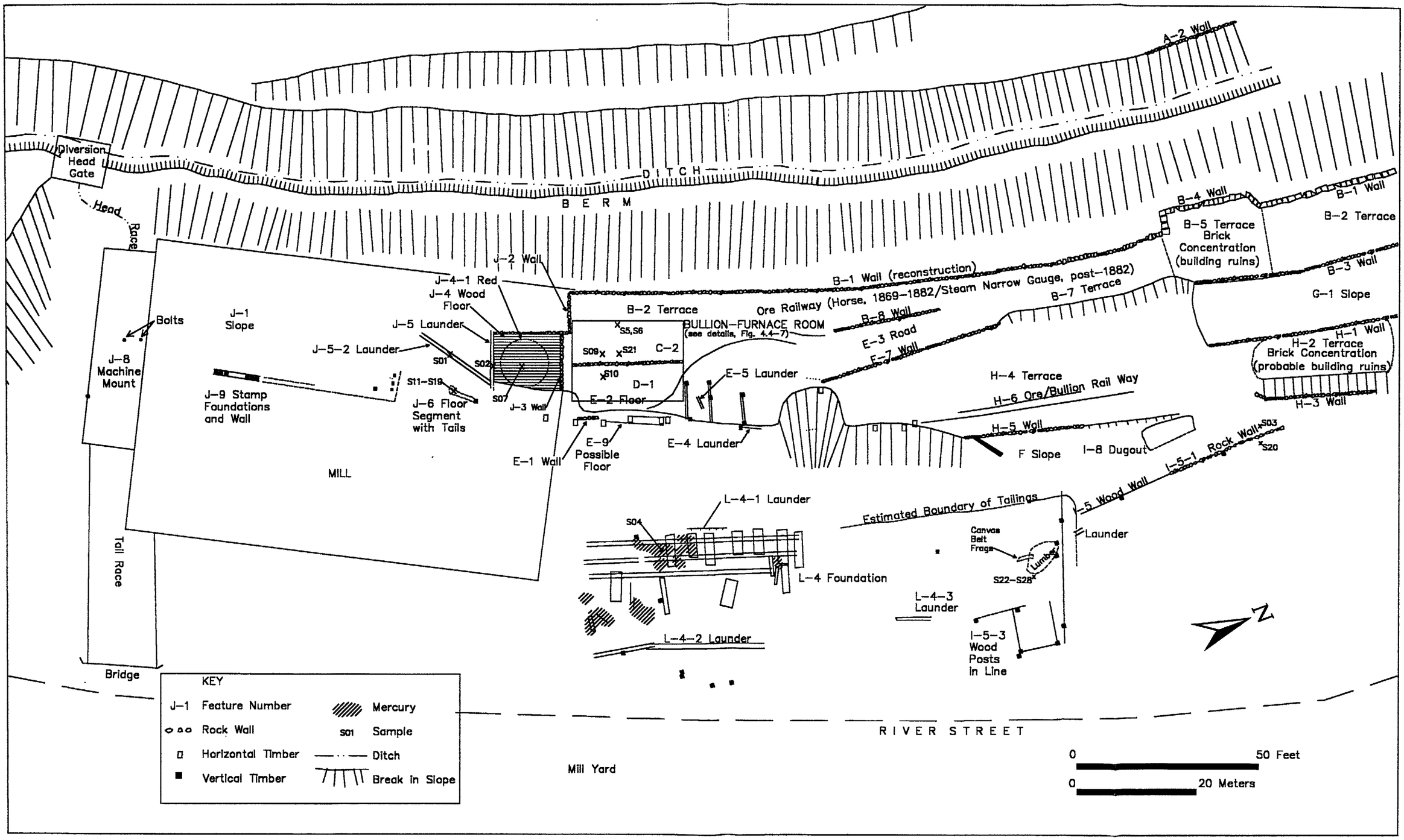


Figure 4.4-1. Lyon Tailings Mill (1869-1897) feature map.

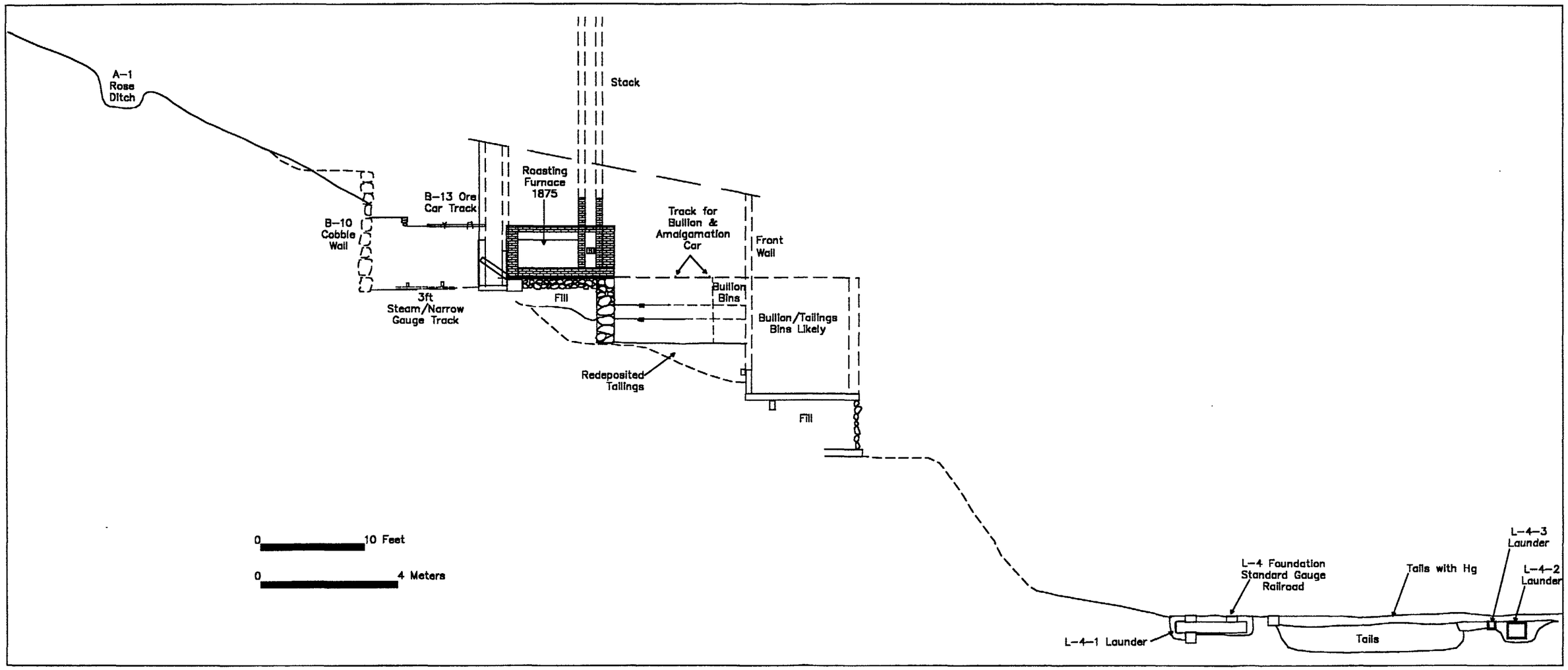


Figure 4.4-2. Lyon Tailings Mill cross-section with archaeological and reconstructed data.

and E), and the mill yard (Loc L). This cross-section is through the complex at the refinery immediately north of the main mill building, which continued to look much like the section in Figure 2.2-1.

INSIDE THE MILL BUILDING AND ACCESS ROUTES

As detailed in the mill history section and Appendix D, the heyday of the Lyon Mill began when it converted to a tailings facility, complemented by a bullion roasting facility, a bluestone works, and a sulphuric acid works. Producing fine quality bluestone marketed on the Comstock as coming from Great Britain (a marketing ploy also used by pottery manufacturers elsewhere) and pure sulphuric acid stronger than one would care to handle, this mill began roasting its bullion and producing some of the finest grade silver ever seen on the Comstock (Hodges 1886, Appendix D). These ancillary features coupled with a highly successful tailings operation and a distinctive corporate culture based on thrift, pride, and quality made this mill flourish for almost three decades. Expansion of the mill building by about 35 ft to the north to startup the tailings operation left a new footprint on the landscape. In addition to foundation and stamp supports described in the previous section, certain of the Loc J features appear to be upper remnants of the 1869 mill building addition.

Excavations in the northwest corner of Loc J encountered primary floor deposits, wooden floors, floor drains, and launders. Many Loc J features were sampled for chemical analysis as this was one of the few locations within the MS004 site area that contained primary deposits related directly to mill processes. Excavations in Loc J included TP 2, EU 2, 9, 13, and 14, and TR 6A, 6B, and 7. These excavations coupled with surface feature recording give a glimpse into operations in this area of the tailings mill. Features other than those described in the Birdsall and Carpenter Quartz Mill section are detailed below.

Fea J-2 is an indistinct rock wall alignment trending east-west at the south end of the B-12 terrace. It appears to be about 10 ft long and is of unknown height. Rocks appear to be local subrounded cobbles up to 1 ft diameter with a massive corner noted at the east end of the wall. This corner appears to represent a conjunction of a north-south buried rock wall, and a 1 ft inset to the Fea J-3 rock wall. A 2⅜ inch diameter iron pipe extends into Loc J through or over the top of this rock wall from the B-12 area. The area below the J-2 wall likely was the northern extent of the incoming ore or tailings room at the top of the mill.

Fea J-3 is a cobble wall immediately south of Loc C and D, at least 6 ½ ft long,1 ft wide, and 3 ft 10 inches high (Figure 4.4-3). This wall sits on top of the J-4 wood floor and may have supported the north mill wall superstructure. Mortar has been laid between rows of stone that are presently eight courses high and roughly faced into the J-4 area.

Fea J-4 is the cut terrace with tightly fitted 1 inch thick wood floors covering an area about 18 ft north-south and 16 ft east-west south of J-3 and north of the J-5 launder that may have been fitted with tongue and grove flooring of 6 or 12 inch width. The terrace is cut into

View north (Roll 978-6, fr.3)

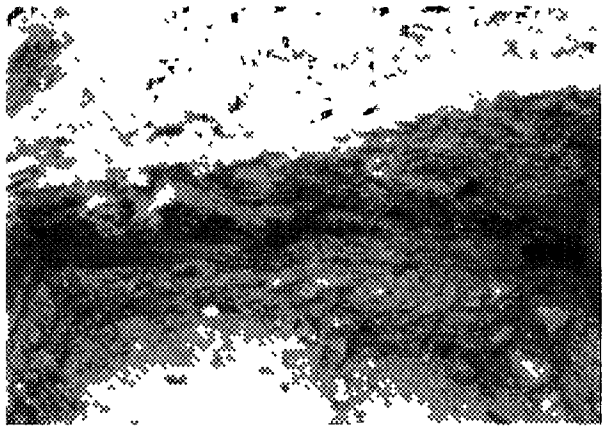
View down (Roll 978-6, fr.1).

Figure 4 4-3 Photographs of the J-3 cobble wall and J-4 wood floor with subfloor joist or drain exposed in EU 13 and EU 14, Lyon Tailings Mill, MS004

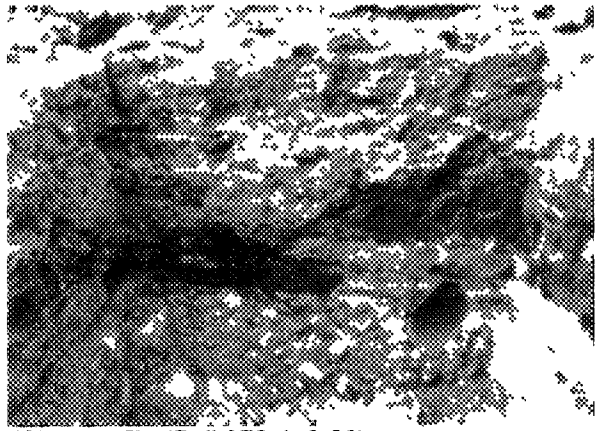
natural Quaternary alluvium and a series of east-west floor joists appear to be in place under the planks; the cut is clearly visible in Figure 4.4-4. An interesting series of deposits is present on top of the flooring throughout the J-4 area. These include a bright yellow sulphur-rich water laid deposit (2-3 inches thick) laying directly on the wood flooring and illustrated in both the Figure 4.4-3 and 4.4-4 photographs, and a brick red magnetite deposit (up to 2 ft thick) resting directly on top of the sulphur deposit. The red deposit (Fea J-4-1) was assessed for chemical values (S07) and found to have extreme iron and high sulphur content and was also slightly acidic. These deposits are clearly part of the chemical bath added to the incoming tailings to extract values. More precisely, the sulphur layer is a residue from the production of sulphuric acid while the red deposit is a waste byproduct of adding iron to the sulphuric acid and dissolved bullion solution to precipitate out the copper content (Figure 4.2-3). It is likely that these residues were stored here following abandonment of this portion of the mill. This was not designed primarily as a place for processing these materials since the wood floor and launder system are unprotected wood that has not been shielded from acid attack by lead linings.

Fewer than 200 artifacts (MNI) were recovered from Loc J. There are 59 MNI from Fea J-4, 65 from Fea J-5, and 69 MNI from non-feature areas of Loc J. Fea J-4 artifacts are all from one stratum and include primarily architectural, industrial, and unknown function artifacts. The architectural assemblage consists of at least four wooden boards, fragments from one red brick (collected sample, many others observed), 14 very corroded iron nails, and two glass windowpanes. The industrial artifacts are comprised of a thick piece of flat glass, perhaps from the front of a furnace or stove, one large wooden and bristle paintbrush, three pieces of heavy canvas for machinery belts, and 15 pieces of quartz ore and other rock thought to be by-products of the milling process. One olive green glass wine bottle body fragment was collected, the only representative of food-related artifacts from Fea J-4. One aqua glass panel bottle was found, possibly a medicine bottle. The "unknown" category includes 15 MNI, with fragments of glass, ceramic, iron, lead, paper, rubber, and unknown materials present, as well as iron wire, a 6.5 inch long iron handle, a small circular metal part, an iron triangular scrap, and a lead strip.

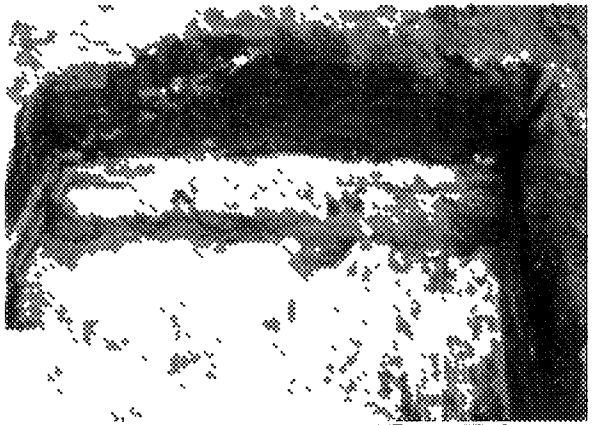
Fea J-5 is one of a series of launders or subfloor ditches and drains found in EU 2 and 9 (Figure 4.4-5). As a group (Fea J-5, J-5-1, J-5-2, J-7), these features appear to be wood encased drainages ranging in size from 3-12 inches wide and 3-6 inches deep that facilitated the flow of water, tailings, solutions, and slimes from one processing area to another throughout the mill system. Details of the J-5 launder are illustrated in Figure 4.4-5. This launder appears to extend from the small north-south rock wall between J-2 and J-3 to the east for a distance of 18 ft before entering demolished space. One chemical sample (S02) was taken in primary tailings just below the base of this launder. Sample chemistry contained a mix of many of the elements used to process tailings with distinctly less copper and sulphur than in the adjoining J-5-2 launder. A chemical sample (S01) from the J-5-2 launder of the same size and shape as the J-5 and intersecting the J-5 below the sample locations, yielded twice the values for gold and silver as J-5 as well as three times the sulphur and 18 times the amount of copper, suggesting a solution of copper sulphate was running in the J-5-2 ditch (see Section 4.7 for details). The series of drains and launders in Loc J attest to an area of the mill where valuable and highly chemical processes



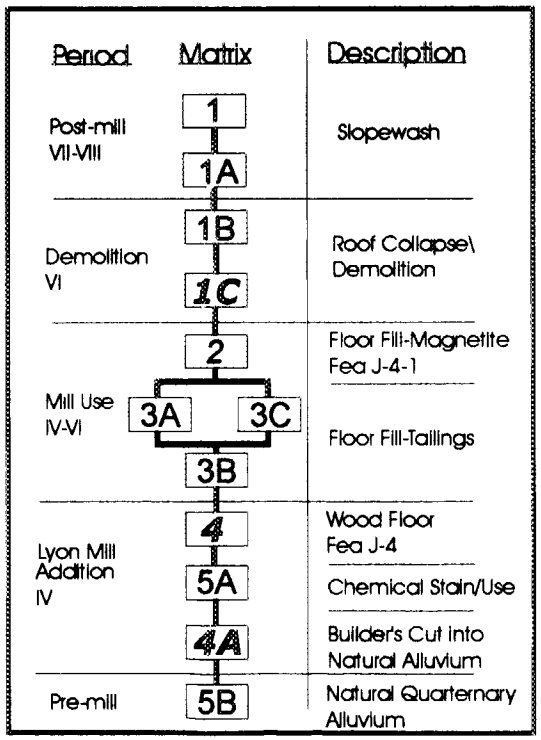
South profile (Roll 970-1, fr.24).



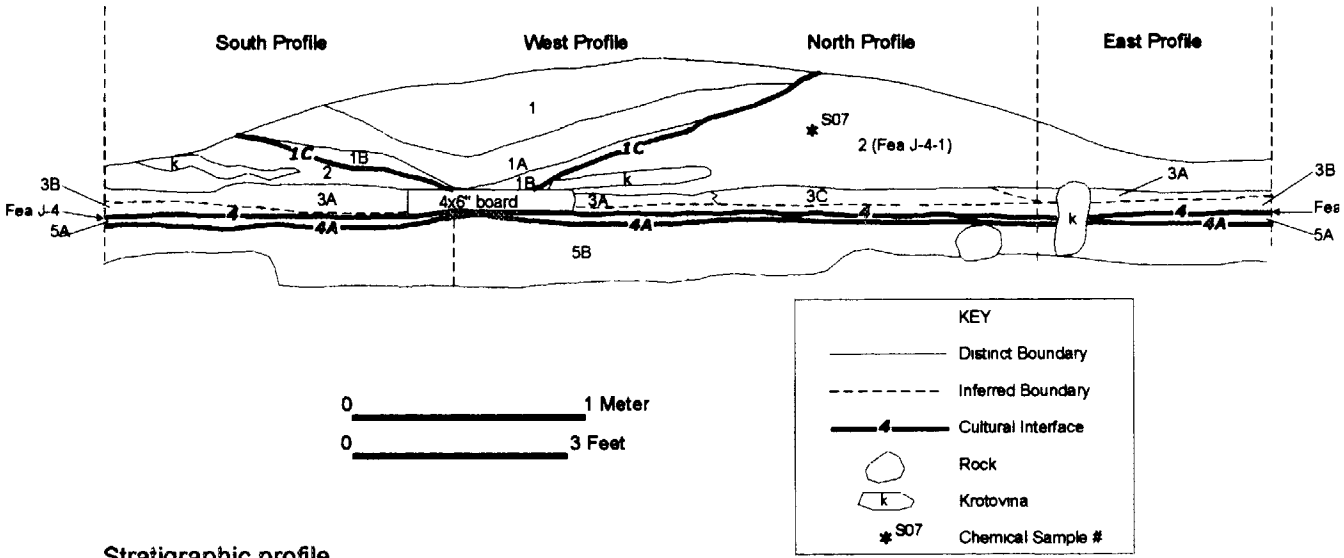
West profile (Roll 970-1, fr.22).



North profile and Fea J-4 Wood Floor TP 2 (Roll 970-1, fr.11)



Harris matrix.



Stratigraphic profile

Figure 4 4-4 Photographs, Harris matrix and stratigraphic profile of TP 2, Fea J-4, MS004

Stratigraphic descriptions:

1 10YR6/6 (dry) brownish yellow, 10YR4/4 (moist) dark yellowish brown; poorly sorted sandy loam texture; massive lenticular structure; non-sticky, non-plastic, dry soft consistency; inclusions of 20% pebbles and small gravels, krotovina, few roots, rootlets, milled wood, charcoal, ash, brick fragments; no HCl reaction, pH=5; gradual smooth boundary; colluvial deposit/structural collapse to the southwest part of unit, on top of and to west of magnetite pile (Str 2) floor fill, upper collapse mixed with slopewash.

1A 10YR6/3 (dry) pale brown, 10YR5/3 (moist) brown, 2.5YR4/4 (mottles) dusky red; poorly sorted sandy loam; massive; non-sticky, non-plastic, dry soft; 10% small pebbles, few rootlets, krotovina, milled wood, charcoal, limonite/sulphur stain; no HCl reaction, pH=5; colluvium immediately above collapsed and mashed wood, possibly part of collapse from upslope, roof fall deposit or wall deposit fallen over floor deposits and strata.

1B 10YR3/1 (dry) very dark gray, 10YR2/1 (moist) black; organic loam; massive; non-sticky, non-plastic, dry soft; some inclusions of Str 2 and 1A; large crushed wood fragments; no HCl reaction, pH=4; abrupt irregular boundary; structural collapse of wall or roof over Str 4 horizon wood flooring, lowest part of structural collapse over floor fill sediments, base of Str 1B=1C.

1C Interface; roof collapse zone.

2 2.5YR5/4 (dry) very dusky red, 2.5YR2.5/4 (moist) very dusky red; well sorted fine sandy loam; massive; non-sticky, non-plastic, dry soft to slightly hard; krotovina; few glass, metal, and cloth fragments, some crushed quartz-rich ore (ca. 1" dia); no HCl reaction, pH=5; pile magnetite on top of floor slimes and under structural collapse, appears to be localized to north of unit with tip of pile in the north central wall.

3A 10YR5/6 (dry) yellowish brown, 10YR3/6 (moist) dark yellowish brown, 10YR4/4 dark yellowish brown, 10YR6/3 (mottles) pale brown; silty to sandy loam; massive lens; non-sticky, non-plastic, dry soft to slightly hard; krotovina; brick fragments; no HCl reaction, pH=5; abrupt smooth and horizontal boundary; upper floor slimes, some colluvial chunks, 5-10 cm thick on the east and south walls.

3B 5YR4/3 (dry) reddish brown, 10YR3/4 (lenses) dark yellowish brown; well sorted sands and silts in water laid beds 1-5 mm thick; single grain; non-sticky, non-plastic, dry soft to loose; few rootlets; no HCl reaction, pH-4.5; abrupt smooth to wood floor; water lain sandy tails on top of wooden floor in most of unit, thickest in southeast corner.

3C 10YR6/8 (dry) brownish yellow, 10YR5/8 (moist) yellowish brown; silt to silt loam; massive; non-sticky, non-plastic, dry slightly hard; krotovina; milled wood fragments; no HCl reaction, pH=5.5; abrupt smooth boundary; water land silt slimes on mill floor under largest and deepest part of Str 2 magnetite.

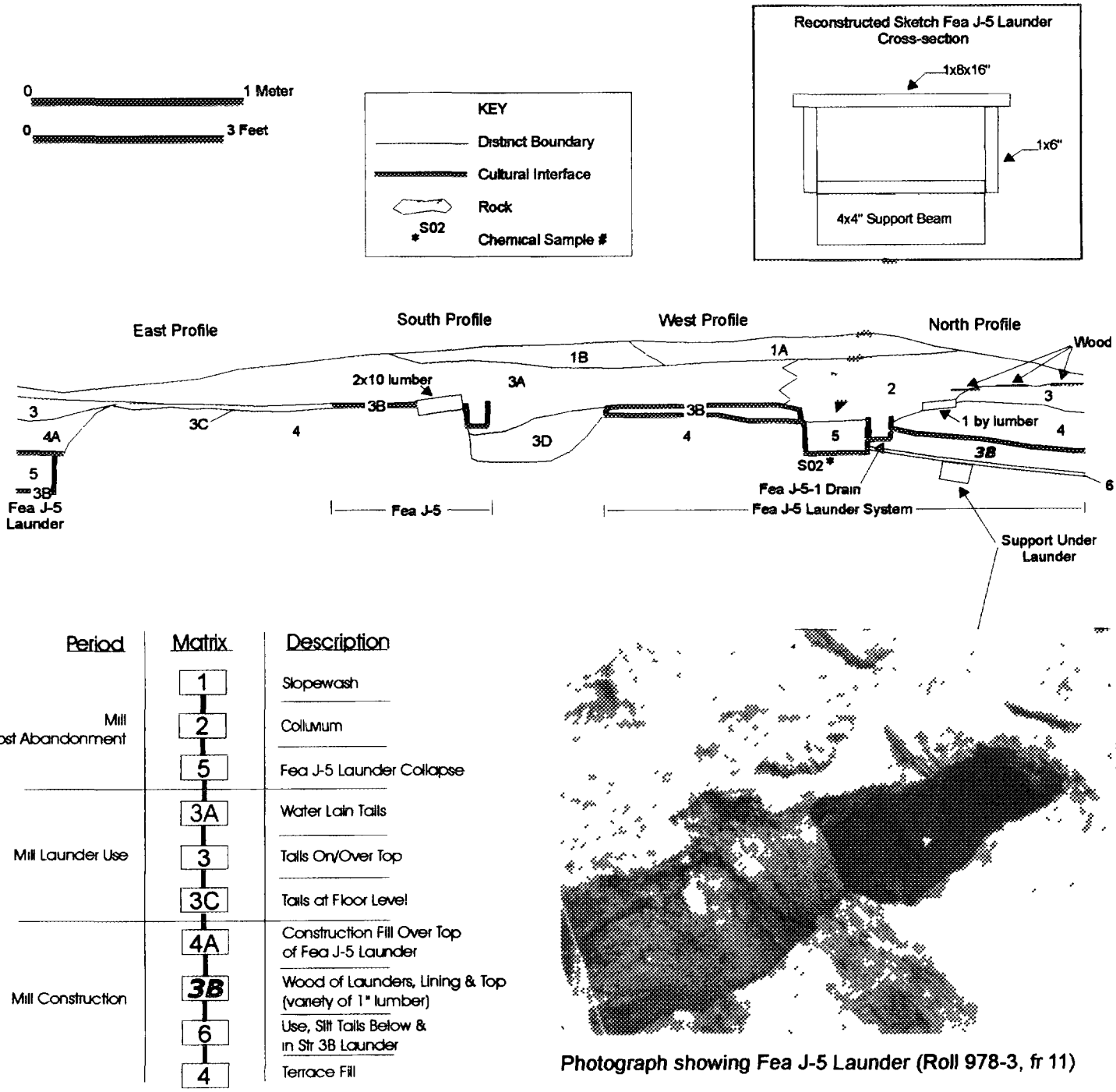
4 10YR3/4 (dry) dark yellowish brown, 10YR3/4 (moist) dark yellowish brown; organic wood remains; lenticular; non-sticky, non-plastic, dry soft; few sands, krotovina; 1x6" milled lumber planks; no HCl reaction, pH=4; abrupt smooth boundary; wood floor, floor boards extend approximately north-south, slightly northwest-southeast with no obvious subfloor fill or supports.

4A Interface; terrace construction cut for Fea J-4.

5A 10YR6/2 (dry) light brownish gray, 10YR5/2 (moist) grayish brown, 10YR7/6 (mottles) yellow; gravelly sandy loam; massive; non-sticky, non-plastic, dry slightly hard; non inclusions; no HCl reaction, pH=5.5; gradual smooth boundary; subfloor fill possible or staining from above floor activities, seems slightly finer grain than 5B gravels thus fine material may have been used to fill and level area immediately below the floor.

5B 10YR7/4 (dry) very pale brown, 10YR6/4 (moist) light yellowish brown; poorly sorted gravelly loam; massive; slightly sticky, slightly plastic, dry hard; 25% rounded to subrounded pebbles, cobbles and boulders; no HCl reaction, pH=6; boundary unknown; possibly a natural Quaternary-age terrace with yellow acid staining from mill processing; either sulphur or FeO limonite colored stains.

Figure 4.4-4. Stratigraphic descriptions for TP 2, Fea J-4, MS004.



Photograph showing Fea J-5 Launder (Roll 978-3, fr 11)

Figure 4 4-5 Stratigraphic profile, photograph and Harris Matrix for EU 9 in Loc J, MS004

Stratigraphic descriptions:

1 10YR6/6 (dry) brownish yellow, 10YR4/4 (moist) dark yellowish brown; poorly sorted sandy loam texture; massive lenticular structure; non-sticky, non-plastic, dry soft consistency; inclusions of 20% pebbles and small gravels, krotovina, few roots, rootlets, milled wood, charcoal, ash, brick fragments; no HCl reaction, pH=5; gradual smooth boundary; colluvial deposit/structural collapse to the southwest part of unit, on top of and to west of magnetite pile (Str 2) floor fill, upper collapse mixed with slopewash.

1A 10YR6/3 (dry) pale brown, 10YR5/3 (moist) brown, 2.5YR4/4 (mottles) dusky red; poorly sorted sandy loam; massive; non-sticky, non-plastic, dry soft; 10% small pebbles, few rootlets, krotovina, milled wood, charcoal, limonite/sulphur stain; no HCl reaction, pH=5; colluvium immediately above collapsed and mashed wood, possibly part of collapse from upslope, roof fall deposit or wall deposit fallen over floor deposits and strata.

1B 10YR3/1 (dry) very dark gray, 10YR2/1 (moist) black; organic loam; massive; non-sticky, non-plastic, dry soft; some inclusions of Str 2 and 1A; large crushed wood fragments; no HCl reaction, pH=4; abrupt irregular boundary; structural collapse of wall or roof over Str 4 horizon wood flooring, lowest part of structural collapse over floor fill sediments, base of Str 1B=1C.

1C Interface; roof collapse zone.

2 2.5YR5/4 (dry) very dusky red, 2.5YR2.5/4 (moist) very dusky red; well sorted fine sandy loam; massive; non-sticky, non-plastic, dry soft to slightly hard; krotovina; few glass, metal, and cloth fragments, some crushed quartz-rich ore (ca. 1" dia); no HCl reaction, pH=5; pile magnetite on top of floor slimes and under structural collapse, appears to be localized to north of unit with tip of pile in the north central wall.

3A 10YR5/6 (dry) yellowish brown, 10YR3/6 (moist) dark yellowish brown, 10YR4/4 dark yellowish brown, 10YR6/3 (mottles) pale brown; silty to sandy loam; massive lens; non-sticky, non-plastic, dry soft to slightly hard; krotovina; brick fragments; no HCl reaction, pH=5; abrupt smooth and horizontal boundary; upper floor slimes, some colluvial chunks, 5-10 cm thick on the east and south walls.

3B 5YR4/3 (dry) reddish brown, 10YR3/4 (lenses) dark yellowish brown; well sorted sands and silts in water laid beds 1-5 mm thick; single grain; non-sticky, non-plastic, dry soft to loose; few rootlets; no HCl reaction, pH-4.5; abrupt smooth to wood floor; water lain sandy tails on top of wooden floor in most of unit, thickest in southeast corner.

3C 10YR6/8 (dry) brownish yellow, 10YR5/8 (moist) yellowish brown; silt to silt loam; massive; non-sticky, non-plastic, dry slightly hard; krotovina; milled wood fragments; no HCl reaction, pH=5.5; abrupt smooth boundary; water land silt slimes on mill floor under largest and deepest part of Str 2 magnetite.

4 10YR3/4 (dry) dark yellowish brown, 10YR3/4 (moist) dark yellowish brown; organic wood remains; lenticular; non-sticky, non-plastic, dry soft; few sands, krotovina; 1x6" milled lumber planks; no HCl reaction, pH=4; abrupt smooth boundary; wood floor, floor boards extend approximately north-south, slightly northwest-southeast with no obvious subfloor fill or supports.

4A Interface; terrace construction cut for Fea J-4.

5A 10YR6/2 (dry) light brownish gray, 10YR5/2 (moist) grayish brown, 10YR7/6 (mottles) yellow; gravelly sandy loam; massive; non-sticky, non-plastic, dry slightly hard; non inclusions; no HCl reaction, pH=5.5; gradual smooth boundary; subfloor fill possible or staining from above floor activities, seems slightly finer grain than 5B gravels thus fine material may have been used to fill and level area immediately below the floor.

5B 10YR7/4 (dry) very pale brown, 10YR6/4 (moist) light yellowish brown; poorly sorted gravelly loam; massive; slightly sticky, slightly plastic, dry hard; 25% rounded to subrounded pebbles, cobbles and boulders; no HCl reaction, pH=6; boundary unknown; possibly a natural Quaternary-age terrace with yellow acid staining from mill processing; either sulphur or FeO limonite colored stains.

Figure 4.4-4. Stratigraphic descriptions for TP 2, Fea J-4, MS004.

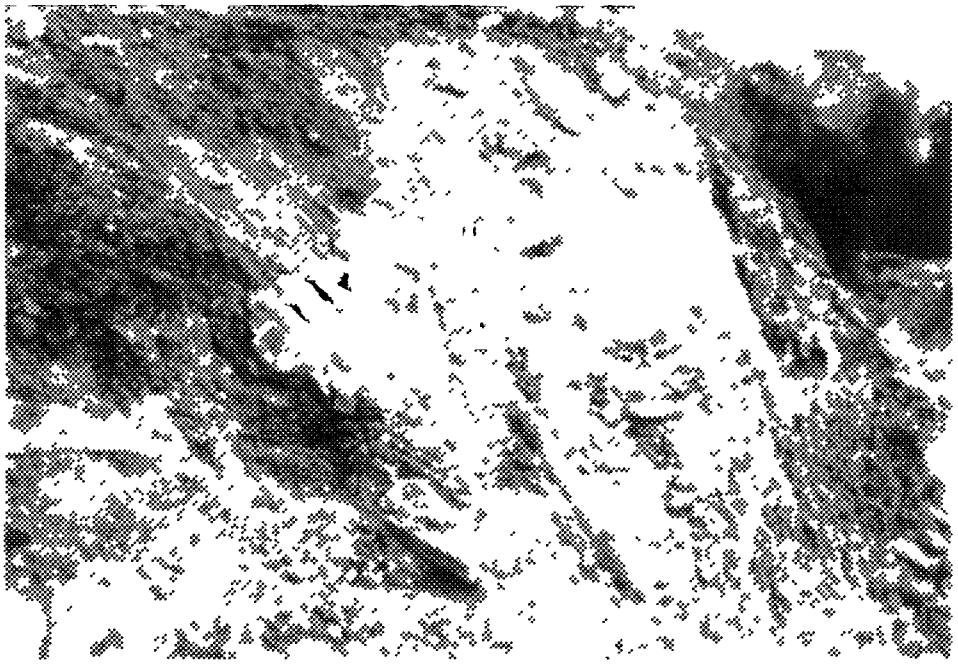
were taking place. The chemical signature for this entire area agrees with expectations for the tailings mill operations rather than for a standard Washoe Process quartz mill.

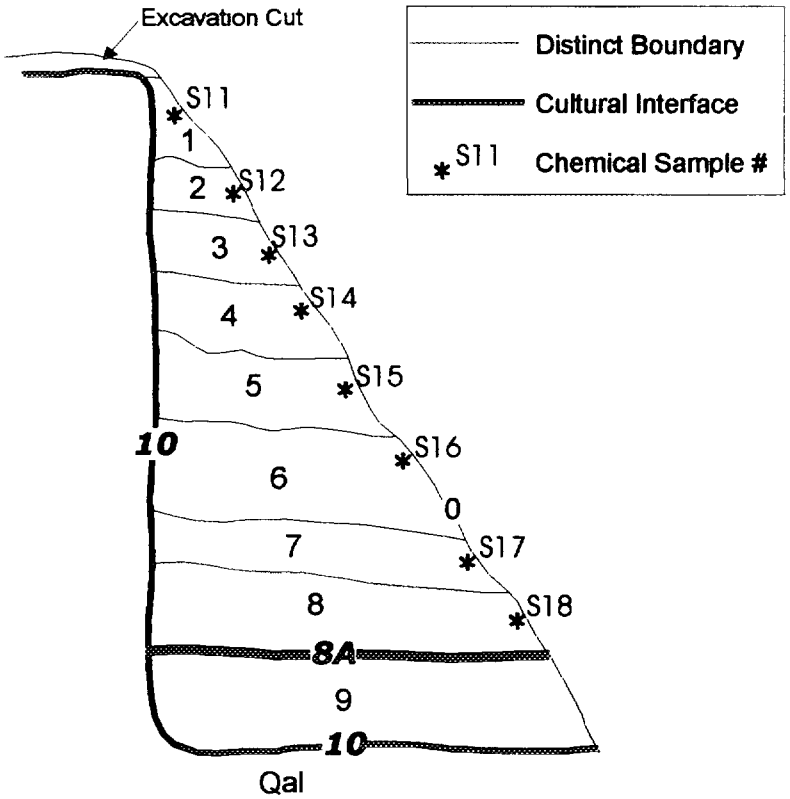
The 67 artifacts recovered from Fea J-5 were found within four contexts – Str 1, 3A, 4, and surface. Str 4 yielded one natural wood fragment and one chunk of ore. In Str 3A, one piece of wood, possibly unmilled, was collected as well as two iron fragments – one thought to be a very corroded nail. Str 1 provided 37 MNI, with architectural artifacts consisting of nine iron nails, one fragmentary red brick, and part of one windowpane. Mill-related artifacts include 13 ore fragments and one copper rivet, perhaps used on a canvas belt, and lead and copper sheet fragments. Additional items such as a wooden stake, part of an aqua glass bottle, four iron fragments, wood fragments, and one wie sherd. The 25 surface artifacts are composed of architectural items (nine iron nails, lamp chimney glass, two large boards, one red brick, window glass), industrial artifacts (a rubber and canvas hose and seven pieces of ore), and miscellaneous bits (aqua bottle glass, a zinc cap, an iron fragment, and one wie sherd).

Artifacts from non-feature areas of Loc J reflect a composition very similar to those from Fea J-4 and Fea J-5, except that more food-related and personal artifacts were recovered from the general locus area. Architectural artifacts include 13 MNI of cut nails (1), unidentified nails (5), wooden boards (2), bricks (1), and windowpanes (4). A rubber hose fragment, paintbrush, and 11 ore chunks comprise the industrial group, while six peach pits, one cut mammal bone, and fragments of a glass liquor bottle, a soda water bottle, and a wine bottle compose the food artifact group. Three personal artifacts were found, including two medicine bottles and one ball clay tobacco pipe bowl fragment. One of the medicine bottles is believed to be a moldblown Drake's Plantation Bitters bottle (1862-1920), while the second is a machine-made brown glass bottle embossed: W[within a circle]\.5. This was made by the T.C. Wheaton Co, of Millville, New Jersey between 1946 and the present (Toulouse 1971:527). The pipe bowl is decorated with a molded "T" on one side of its body and probably had "D" on the other side. TD pipes were very popular in the nineteenth century. Nearly every British maker of inexpensive clay pipes produced TD pipes in several styles (Walker 1977).

Fea J-5-1 is a small wood-lined subfloor drain (3x3 inches) that connects to J-5 after running for about 3 ft across the EU 2 floor. A flattened can or thin metal sheet appears to lie over the wooden flooring to initially collect the drain material. Fea J-5-2 is identical in size and shape to the J-5 launder and appears to intersect it in an area beyond the existing J-4 terrace edge. The J-5-2 launder originates somewhere in the southwestern edge of Loc J and proceeds for over 20 ft in a northeasterly direction to a probable intersection with J-5 in the demolished space. In EU 13, 14, and TR 7 another small, 3x3 inch, floor drain appeared to cross northeast-southwest this area of flooring. Again these floor drains directed toward the larger launders suggest an interest in collecting all materials accumulating on the floor in this part of the mill.

Fea J-6 appears to be the mere remnant of a back, cut wall and wooden floor for a lower terrace within the Loc J mill interior (Figure 4.4-6). This feature contained eight primary tailings strata that were identified to color and texture and sampled for chemical content (refer to section





Period	Matrix	Description
Post Mill Erosion VII-VIII	0	Erosion
Lyon Tailings Mill Use Primary Tails IV-VI	1	Orange Silt
	2	Pink Silt
	3	Gray Silt
	4	Pink Silt Tails
	5	White Silt
	6	Tan Sand
	7	Pink Silt
	8	Gray Black Silt
	8A	Possible Fea J-6 Floor
	9	Subfloor Tails, Orange Silt
Feature Construction IV	10	Fea J-6 Cut
	Qal	Quaternary Alluvium

Figure 4 4-6 Photograph, stratigraphic profile and Harris matrix for Tr 6, Fea J-6, MS004

4.7 for details). Chemistry suggests the pink silt tails contained the greatest gold and silver values and generally the greater iron values, while other colors contain various amounts of the other chemicals. This stacked deposit undoubtedly suggests that at least a somewhat repetitive color series, i.e., orange-pink-gray, may represent the repeated nature of ore processing in this part of the mill.

In summary, Loc J is suspected to have housed important and valuable chemical processing facilities requiring tight wood floors, mortared stone walls, and a series of floor and room drains and launders to collect the solutions and slimes being produced therein. This is evidenced in the wall and floor construction as well as in the formalized wood lined and covered launder system. This area appears to contain residues from both milling and refining, as is appropriate since it is on the interface between these two feature systems. Based on the poor fit between overlying sediments and the floor and subfloor feature systems, it seems likely that this area was originally designed as part of the expanded mill but was later shifted to use as a repository for wastes generated at the refinery.

Access to the top of the mill during the Lyon phase was probably at the base of the B-12 terrace on a level with the C-2 terrace. Excavations never reached the base of fill in B-12, so the presence of a narrow gauge line was not encountered. The formalized block walls comprising Fea B-1, B-4, and B-6 are thought to be the retaining walls for the rail line delivering tails to the Lyon Mill between ca. 1869 (horse powered railroad) and 1897 (DS&CV RR from 1882). The series of terraces (B-2, B-5, B-7, B-11, and B-12 lower) below these walls also provided the access surface for the various narrow-gauge tailings delivery railways, baby-gauge mill yard tramming railways, and maintenance roads.

THE FURNACE HOUSE AND BULLION/TAILINGS BINS

Hodges has related in detail the fine milling processes developed and used in the Lyon Tailings Mill (Appendix D). Within this 1886 conference paper, construction plans for the Lyon Mill bullion-furnace room or furnace house built in 1875 were drawn to scale with building materials and labor costs finely itemized. Figure 4.4-7 illustrates how the bullion-furnace room plans fit within the archaeological features identified during a wealth of excavation in the Loc C, D, and E areas of MS004. Figure 4.4-2 relies on the same combination of data to reconstruct a detailed profile of the same feature system. As this area was completely within the zone scheduled for mechanical removal and contained visible terrace and wall features, ARS chose to devote a number of units to the area. Had Hodges' report been available during excavation (it was only available for study after the post-excavation literature search) additional units would have been placed in other key areas. Excavation units in Loc C include TP 8, EU 1, 3, 4, 6, 7, 8, and 11. In Loc D, TP 1 and in Loc E, EU 15, 16, and 17, and TP 7 were excavated. TR 8, 9, and 10 crosscut all three loci and identified structural relationships of subsurface timbers and terrace fills used in construction of this area immediately north of the mill building.

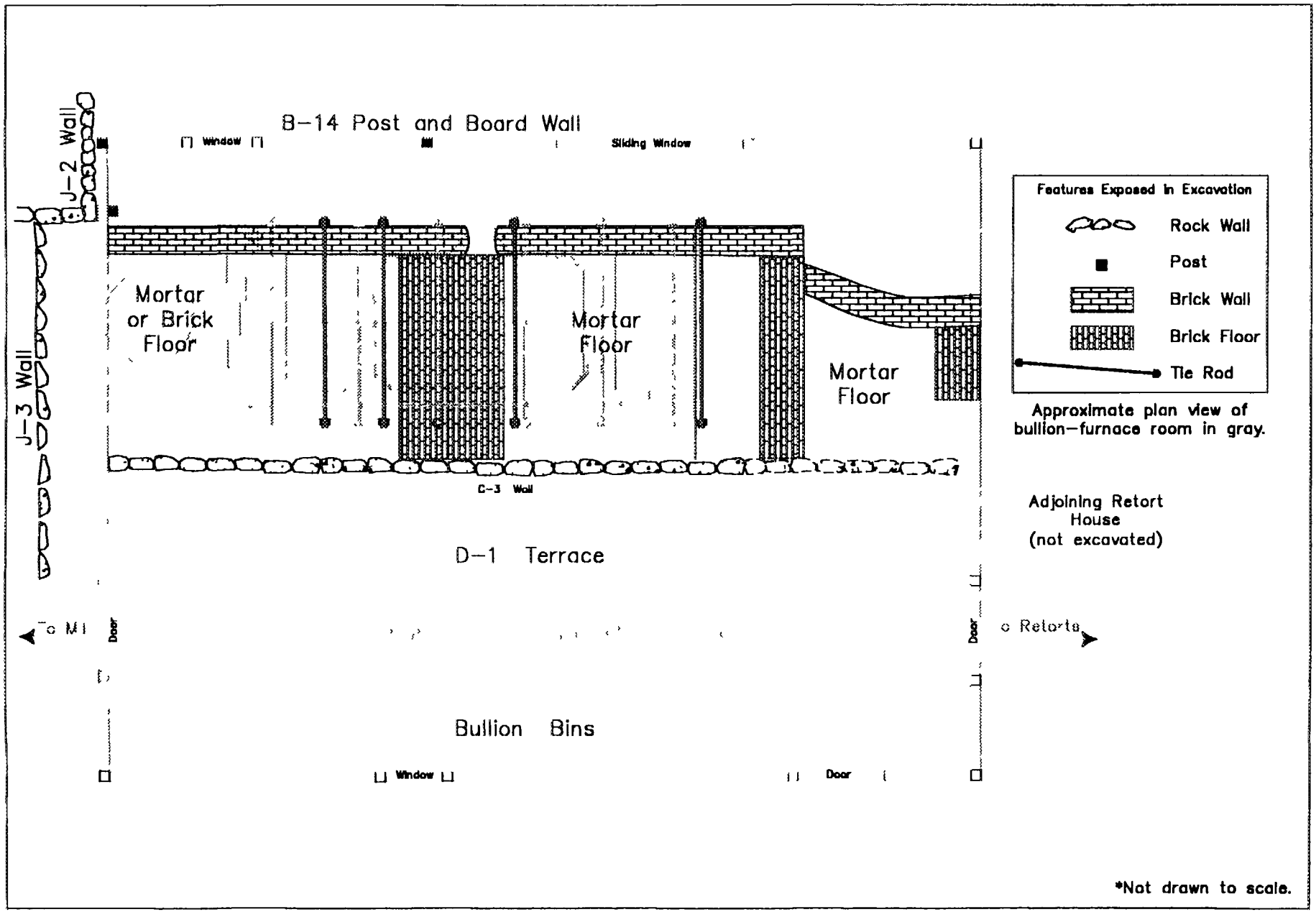


Figure 4.4-7. Archaeology of the bullion furnace room at the Lyon Mill (after Hodges 1886: Fig.5).

Working from west to east down the terrace system and referring to the furnace house footprint in Figure 4.4-7 and the section in 4.4-2, the features and strata relevant to this element of the Lyon Mill are described below. The west wall of the furnace room as designed was a 30 ft long, board and timber-supported feature with a large sliding window over the furnace and a smaller window to the south; this wall was designed to be 3 ft west of the west wall of the brick roasting furnace. Excavations found the subsurface remains of about 10 ft of this wall (B-14) which was incorporated into Peck period construction of the B-12 terrace. Excavations in EU 6 revealed an elaborate cross-bracing system that fitted this wood wall to the brick and mortar furnace (C-1, C-2) at precisely 3 ft distance as suggested in the plans (Figure 4.4-8). Board sizes are detailed in the figure, revealing that only about 4.5 ft of the lower wall, extending for only about 10 ft north remained intact.

Also specified on the furnace room plans are large tie rods and bolts holding the brick and mortar furnace foundation together. As shown on Figure 4.4-8, these bolts and rods do extend across the brick and mortar platform (C-2) and tie into a finely constructed C-3 rock and mortar wall at the front of the furnace area. Excellent examples of the rod reinforcements were noted in EU 1 (Figure 4.4-9). The rods are 1 inch diameter solid iron, while the bolt found in EU 4 is rusted to about 4 inches across. The spacing between rods appears to be about 2.5 ft rather than the 3 ft shown on the plan. The area containing rods and bolts extends from the J-2 and J-3 rock walls on the south, north for at least 25 ft and approximately 10 ft east-west covering the entire C-2 platform area rather than the 15x6.5 ft area specified on the plans. It may well have been easier to build a larger reinforced platform to hold both the roasting furnace and the sulphurizing kettle and possibly the retorts as well. In any event the entire platform appears to be reinforced with bolted rods. On top of the rods, which are seated in mortar or mortared brick, are areas comprised of one or two layers of brick or a thick layer of mortar not obviously covered with brick. These areas of floor brick may have corresponded with brick walls forming the roasting furnace superstructure (Figure 4.4-10). One area in the west edge of EU 3 suggested that the west furnace opening had been located here. The west brick furnace wall is breached in a formal looking opening; the opening containing rubble of slag-covered fire brick and burned red brick as well as crunchy man-made chemical rock, no doubt a byproduct of the roasting process. One other interesting subfeature on the northern edge of the west furnace wall is an oddly angled wing wall, flaring out from just east of the back wall to the northeast; this feature is not present on the furnace plan. Since it is near the northern limit of archaeological exposures, its function cannot be determined at this time.

Notable foundation inconsistencies from the construction plan are the bolt spacing, the size of the bolt reinforced platform, the shape of the bricked furnace area, the location of the west furnace wall opening, and the northern wing wall. Similarities are the relationship and spacing of the west wooden wall to the back of the brick furnace, the size and directions of the reinforcing bolts, presence of a back wall opening to the furnace, and the colors and types of bricks used for furnace construction. Interesting details of the furnace construction are the use of recycled red bricks for furnace foundation construction, while those in the walls appear to be complete.

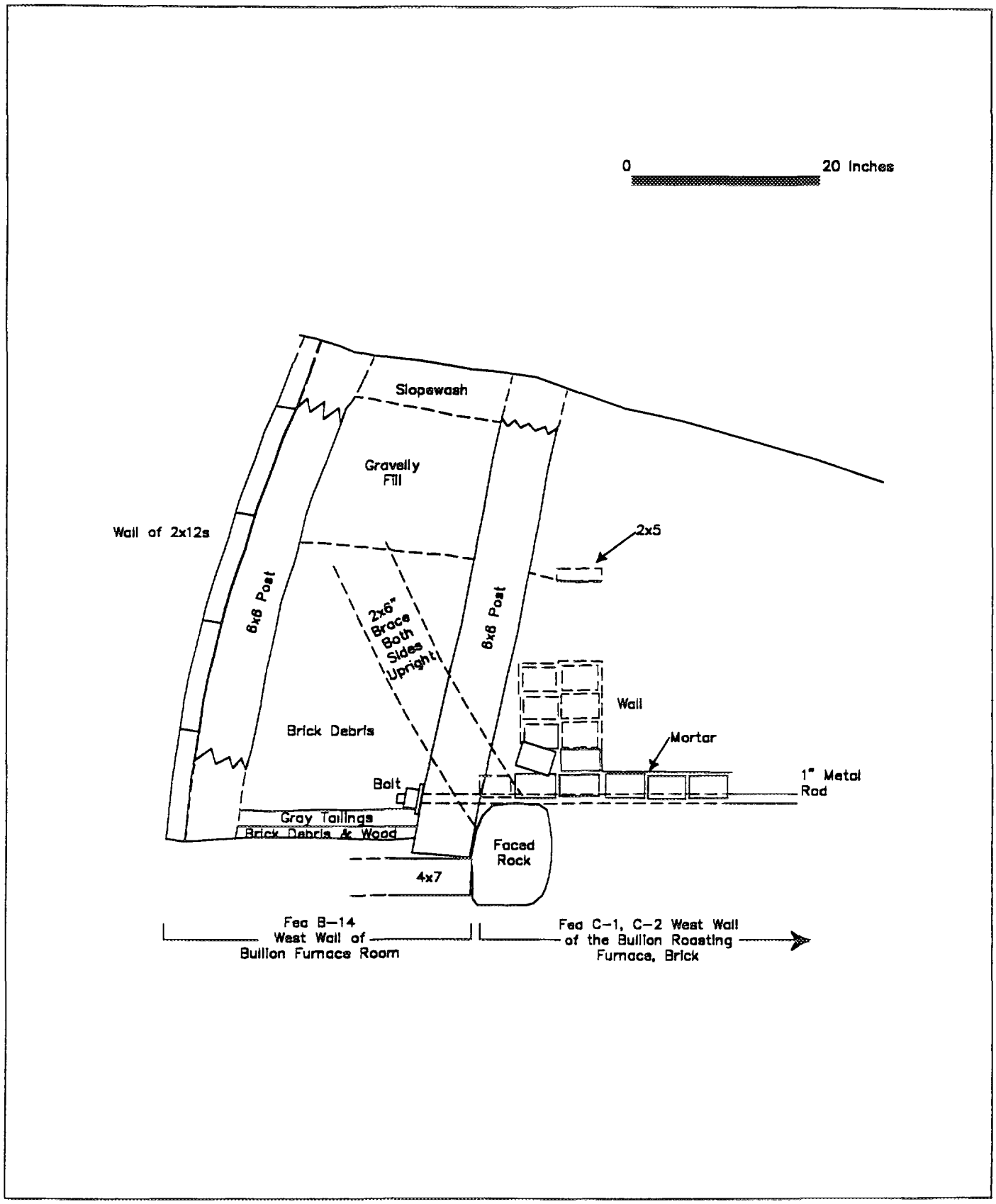
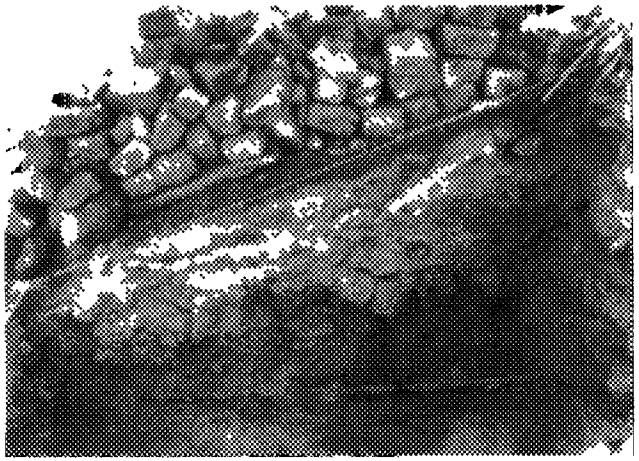
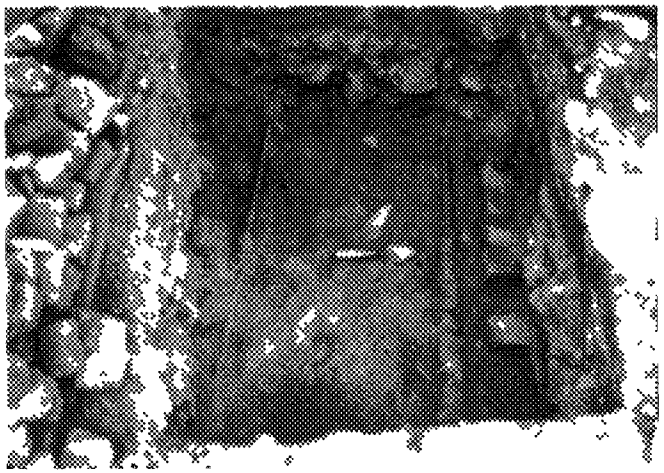


Figure 4.4-8. Archaeological evidence of the west wall of the bullion furnace room and the roasting furnace.



View of south profile (CP611, fr.3)



View of west profile (CP611, fr.21).

Period	Matrix	Description
V 1-3	1	Post-abandonment Slopewash
	1A	demolition, burned wood & ash
VI	2	Water-laid colored talls(Pink, gray, tan)
	2A	Redeposited colluvium/collapse
	3	Talls with red iron & blue cupric stains
	3A	
	3B	Latest C-1 terrace surface
V-VI	4	Demolition, brick rubble
	4A	Base of demolished brick zone/ top of intact brick & motar
Furnace Room Construction 1875 IV	5	Brick Flooring
	6	Sub-brick mortar & reinforcing bolts

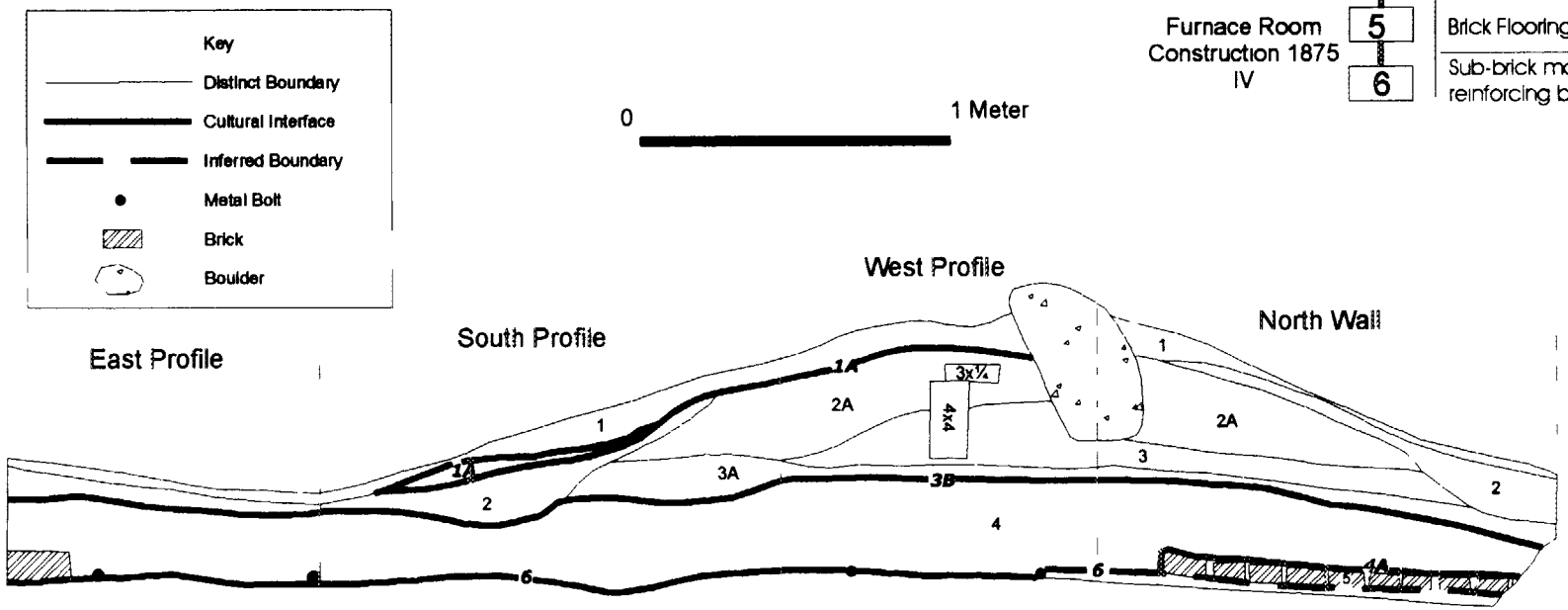


Figure 4 4-9 Photographs, Harris matrix and stratigraphic profile of EU 1, Loc C, MS004

Stratigraphic descriptions:

1 10YR4/4 (moist) dark yellowish brown, 10YR5/4 (dry) yellowish brown; loam texture with 3% gravels; subangular blocky structure; slightly sticky, slightly plastic, slightly hard consistency; no HCl reaction; root and rootlet inclusions; abrupt smooth boundary; slopewash.

1A Interface; demolition, burned wood and ash.

2 2.5YR5/6 (moist) light olive brown, 2.5YR6/6 (dry) olive brown with yellow and red mottles; silty loam; single grain to massive; non-sticky, non-plastic; slight to no HCl reaction; common roots, rootlets, wood, charcoal, ash; abrupt smooth boundary; water-lain tails.

2A 10YR5/4 (moist) yellowish brown, 10YR6/4 (dry) light yellowish brown; loam with 5% gravels; subangular blocky; slightly sticky, slightly plastic, medium hard; no HCl reaction; common rocks, pebbles, rare organics; abrupt smooth boundary; redeposited colluvium/collapse.

3 10YR5/4 (moist) yellowish brown, 10YR6/4 (dry) light yellowish brown; silt loam; single grain; slightly sticky, non-plastic; slight HCl reaction; rare roots, rootlets; abrupt smooth boundary; tails with iron and cupric stains.

3A 5Y5/3 (moist) olive, 5Y6/3 (dry) pale olive, with mottles of green, yellow, reds; silty sands with 3% gravels; inconsistent, subangular blocky; non-sticky, non-plastic, hard; no HCl reaction; plant, wood debris; abrupt smooth boundary; tails with iron and cupric stains.

3B Interface; latest Fea C-1 terrace surface.

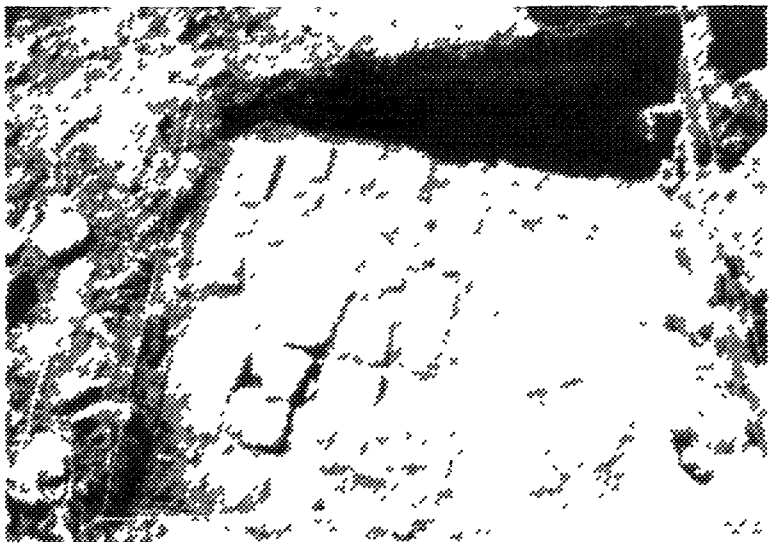
4 10YR5/4 (moist) yellow brown, 10YR6/4 (dry) light yellowish brown; sandy with 3% gravels; massive; non-sticky, non-plastic, hard; strong HCl reaction; rocks, mortar, charcoal; abrupt smooth boundary; demolition, brick rubble.

4A Interface; base of demolished brick, top of intact brick & mortar.

5 Brick flooring in furnace room.

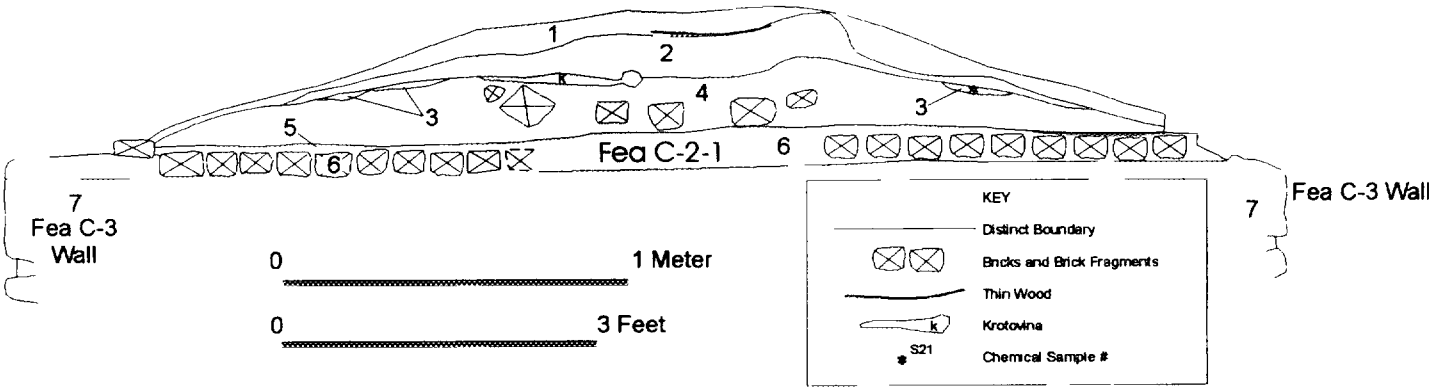
6 Sub-brick mortar and reinforcing bolts.

Figure 4.4-9. Stratigraphic descriptions for EU 1, Loc C, MS004.



Fea C-2-1 brick floor in TP 8, looking south, note the use of brick fragments to form the surface (Roll 970-3, fr.11)

South Profile West Profile North Profile



Period	Matrix	Description
Post-Mill VIII	1	Upper Slopewash
Mill Use or Redeposited Tails VI-VIII	2	Red Magnetite
	3	Tails
Partial Demolition VI	4	Demolished Mill Walls & Floor
Construction IV	5	Mortar
	6	Lower Brick Floor
	7	Fea C-3 Rock Wall

Fea C-2-1

West profile of TP 8, Fea C-3 in foreground (Roll 970-3, fr 13)

Figure 4 4-10 Harris matrix, photographs and stratigraphic profile of TP 8, Fea C-2,terrace, Fea C-2-1 brick floor and Fea C-3 retaining wall at the Birdsall Mill, MS004

Stratigraphic Profile Descriptions for Figure . TP8, MS004

1 7.5YR5/2 (dry), 7.5YR4/2 (moist); gravelly loam texture; weak platey to massive structure; non-sticky, non-plastic, dry soft consistency; inclusions of few roots, rootlets, krotovina, no HCl reaction, pH=7.0; abrupt irregular boundary; uppermost slopewash on steep slope above rock wall.

2 2.5YR2.5/4 (dry); fine sandy loam; single grain; non-sticky, non-plastic, dry loose; some krotovina, rootlets, no HCl reaction, pH=4; abrupt smooth boundary; magnetite used in milling process.

3 5Y7/6 (dry), 5Y8/2 (mottles); silt loam; massive; non-sticky, non-plastic, dry slightly hard; no inclusions, no HCl reaction, pH=5; discontinuous abrupt boundary; may represent geochemical addition of a sulphur compound, sulfuric acid, copper sulphate or cyanide or tails of such a process. Appears to have run downslope from the West to cover brick demolition layer.

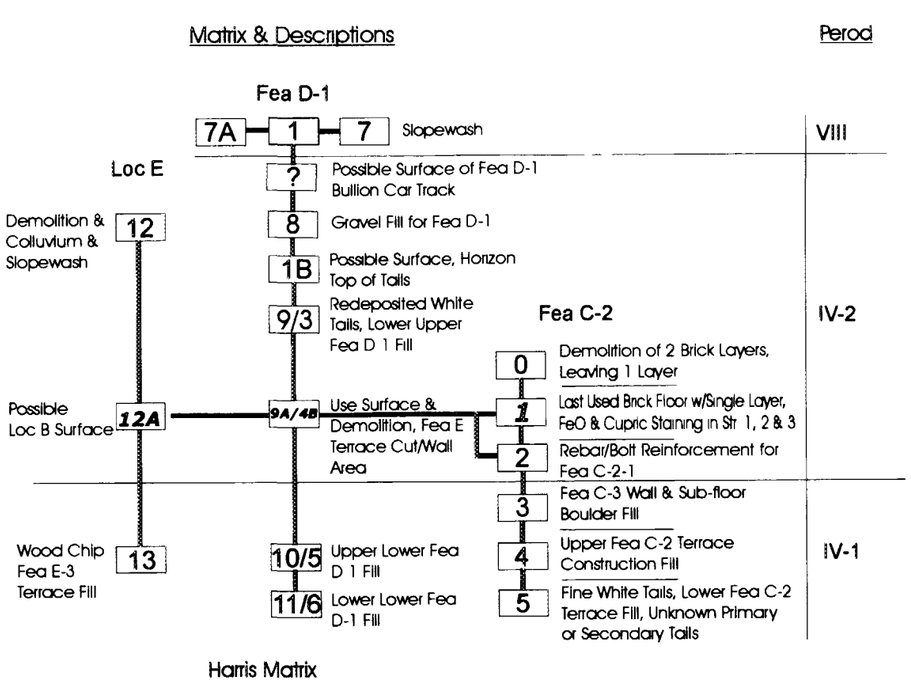
4 7.5YR6/4 (dry), 7.5YR4/4 (moist), 7.5YR5/8-7.5YR8/4 (mottles); loam to sandy loam; massive; non-sticky, non-plastic; few rootlets, 25% brick fragments and mortar, 10-15% gravels, no HCl reaction, pH=5.5; abrupt smooth boundary to mortar. Floor fill with brick, mortar, unburned shingle or box wood just above the mortared floor.

5 7.5YR8/6 (dry), 7.5YR7/6 (moist), mottles of blue, red, orange and yellow; sandstone, pisted; massive lense; non-sticky, non-plastic; brick, mortar, slag inclusions, no HCl reaction, pH=4 (unaltered), 5.5 (blue altered); abrupt smooth boundary; 1 to 3 cm thick mortar puddled across all the bricks. The mortar in TP8 is not as burned as the bricks/mortar above the floor.

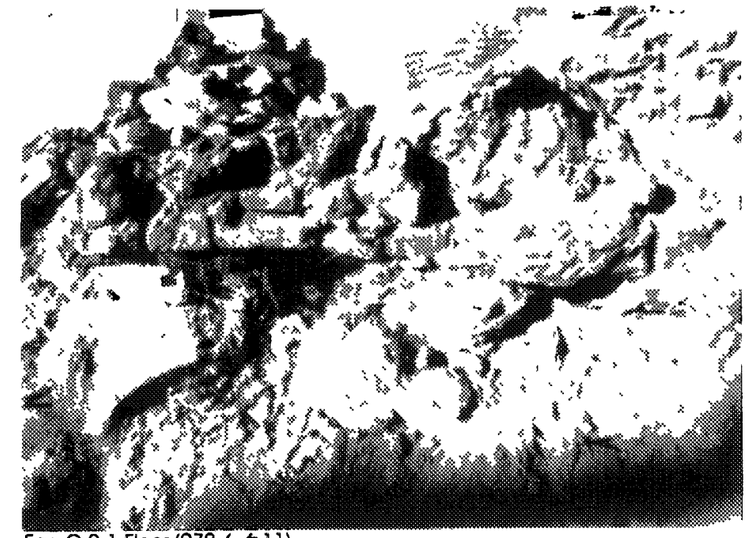
6 10YR5/6 (dry); brick, mortar, flagstone; massive; non-sticky, non-plastic, dry very hard; no HCl reaction, pH=5; abrupt smooth boundary; brick floor, primarily pieced fragments running north-south behind lower mortared wall, some tabular stone was also used, 2-4 cm between bricks and 2-4 cm mortar below bricks. Makes a substantial floor and attaches to top of mortared stone wall to east.

Stratigraphic details both below the furnace room, i.e., the terrace construction, the D-1 terrace bullion bins, and the destruction/demolition of the room are detailed in a variety of excavation unit profiles (Appendix E). A series of trench profiles from south to north, TR 8, 9, and 10, cut through the C-2 terrace, the C-3 retaining wall, the D-1 terrace, and Loc E surfaces and launders give a three dimensional view of the terracing systems within the furnace room (TR 8 and 9) and the area just north of this room (TR 10). Views of these three trenches are included as Figures 4.4-11, 4.4-12, and 4.4-13. Following the plan of the furnace room, a bullion and amalgam car track should be located from 6-9 ft east of the brick furnace, likely at or near grade with that furnace floor. As such, all of the D-1 strata (Figure 4.4-11) may have provided fill for this car track which left no archaeological trace as the surface has slipped away. Interestingly, this D-1 fill contains little to no brick rubble, which would support the supposition that it was constructed for use at the time the furnace room was built (1875), six years after the mill started processing tailings. This suggests the C-3 wall, the 9A interface, and the Str 9/3 tails were built or in use from 1869-1875 – prior to addition of the furnace room construction gravel fill (Str 8). Just east of the bullion car track a series of 3 ft wide bullion bins extended to the east wooden wall of the structure. Evidence of wooden bins may be present in the appearance of another terrace, Loc E just below the D-1 terrace. The width of the furnace room (22 ft) would have extended to the E-1 stone wall and the timbered substructure members illustrated in TR 9 and TR 10 (Figures 4.4-12 and -13) may well have provided foundation members to support various bins on the side of this rather steep slope. Large wooden bins are also noted below the furnace terrace in the photograph of the abandoned mill, thus their presence may have persisted from construction of the furnace room until mill abandonment.

Several strata suggesting a variety of terrace activities are of interest in this series of trenches. In TR 8 and TR 9, on the Loc E terrace notable amounts of pine bark were present suggesting that cordwood to feed the furnace, retorts or other fires was stacked at least at times on the Loc E terraces (E-2, E-3). In addition, bark was noted on several of the timbers used to construct the Loc E terrace foundations/terraces. Further, one wood-lined box launder (Fea E-4) was located in an area of tailings deposits in the outer edge of the E-3 terrace suggesting that launder features continued not only throughout the mill building interior but extended throughout the local terrace system to the various workings such as the outer Loc E terrace. This launder is 1 ½ ft by 6 inches and completely lined with wood; tailings seeping through the baseboard were collected for analysis (S19) yielding relatively high contents of sodium, chloride, and mercury and good values of gold and silver. This launder appears to be within an area that may have contained bins filled with tailings. Chemical samples in TR 8 tailings deposits used for terrace fill or deposited on the terrace surface prior to processing, two samples one from Str 5 (S09) and one from Str 9 (S10) yielded interesting values. Str 5 used in the construction of the C-2 terrace contained high values of copper and sulphur while Str 9 had negligible amounts, both had good presence of mercury and similar gold and silver values. This suggests that the C-2 terrace fill had been run through a process with copper sulphate while that on the outside in Str 9 had been only processed with mercury.



TP 1 (in North Profile) (970-2, fr.5)



Fea C-2-1 Floor (978-6, fr 11).

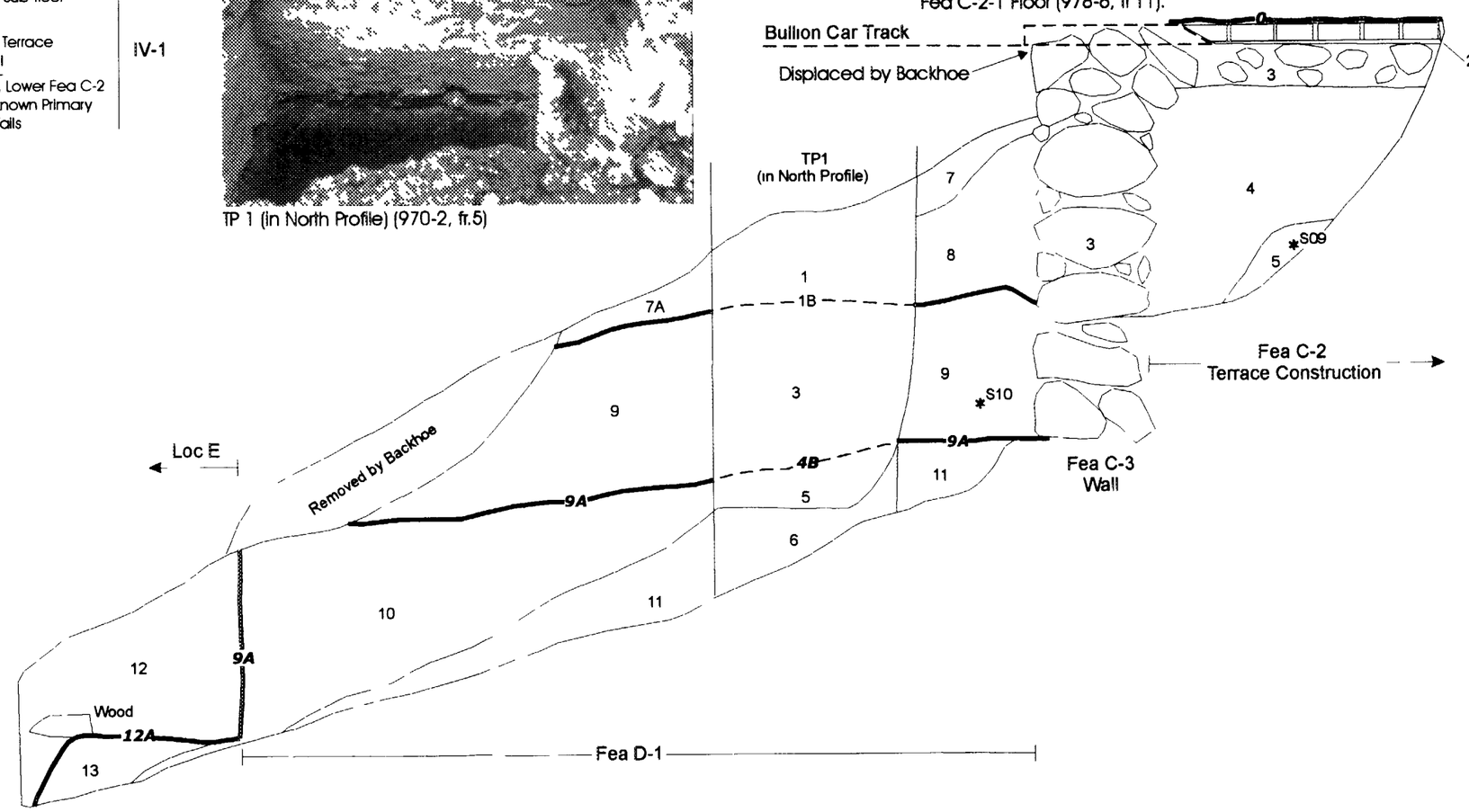


Figure 4 4-11 Harris matrix, photographs and stratigraphic profile for Tr 8, MS004

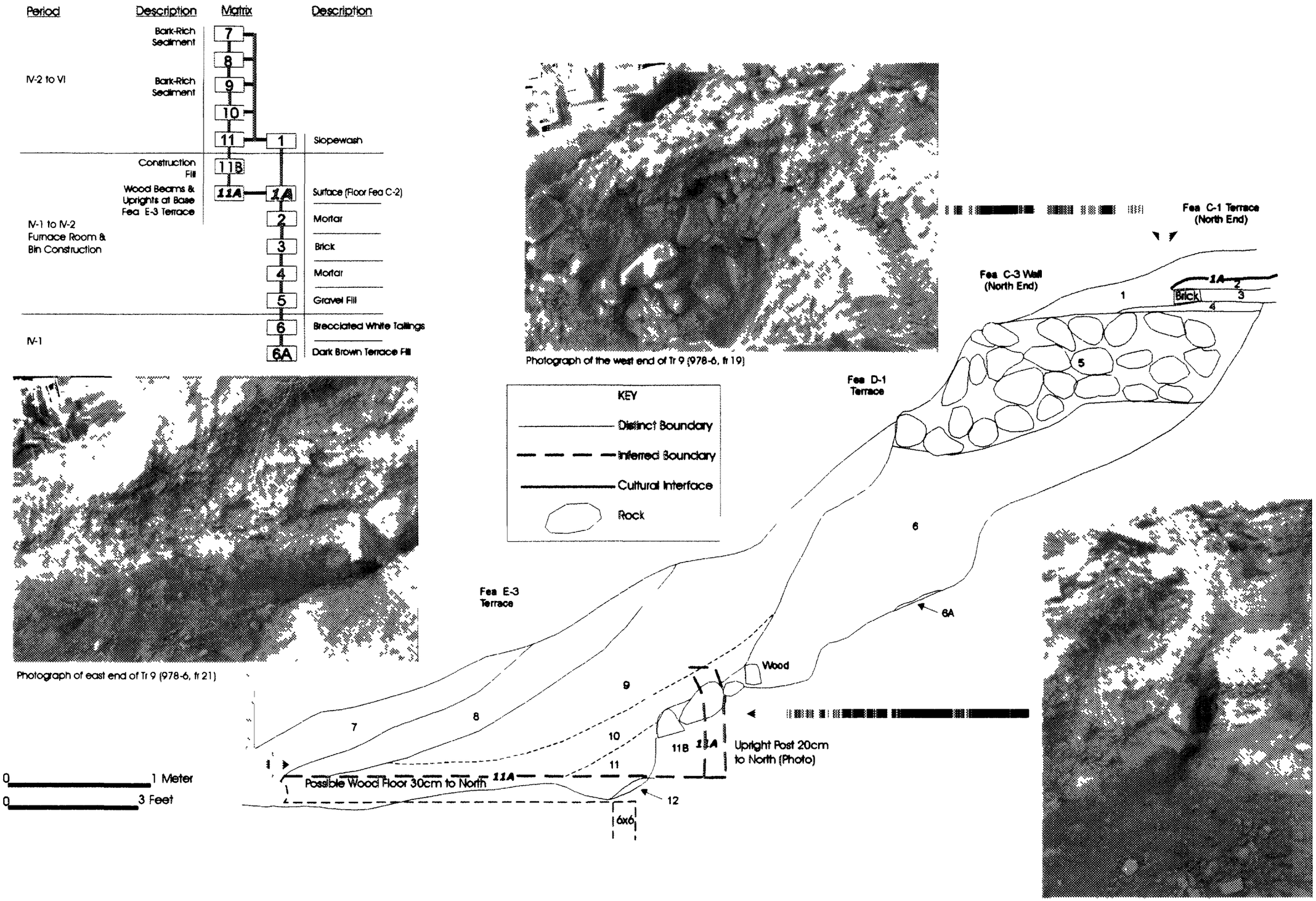
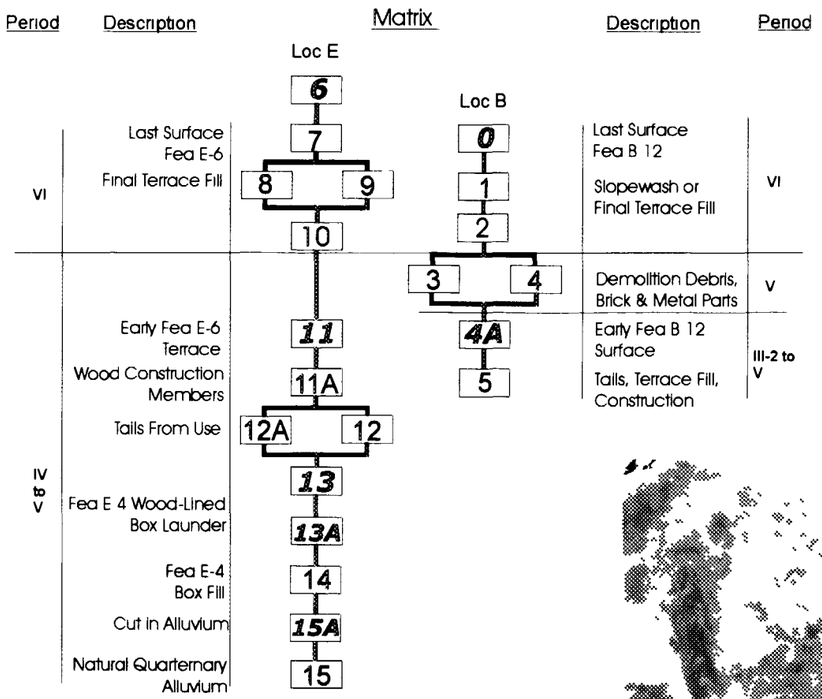
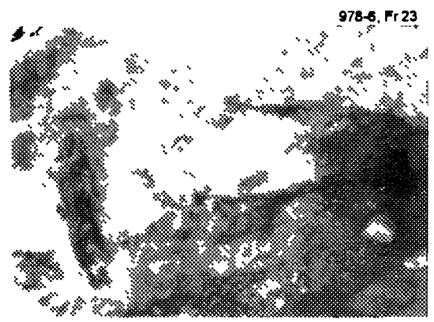
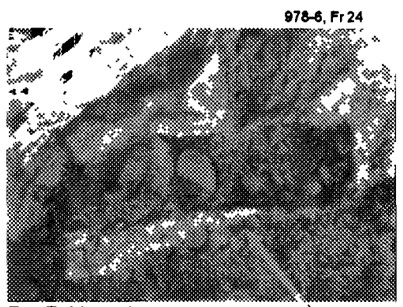


Figure 4 4-12 Photographs, Harris matrix and stratigraphic profile of Tr 9, MS004

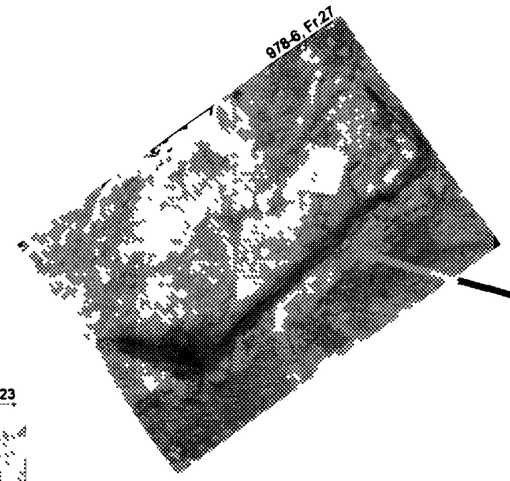


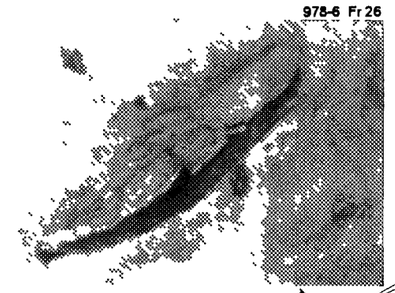


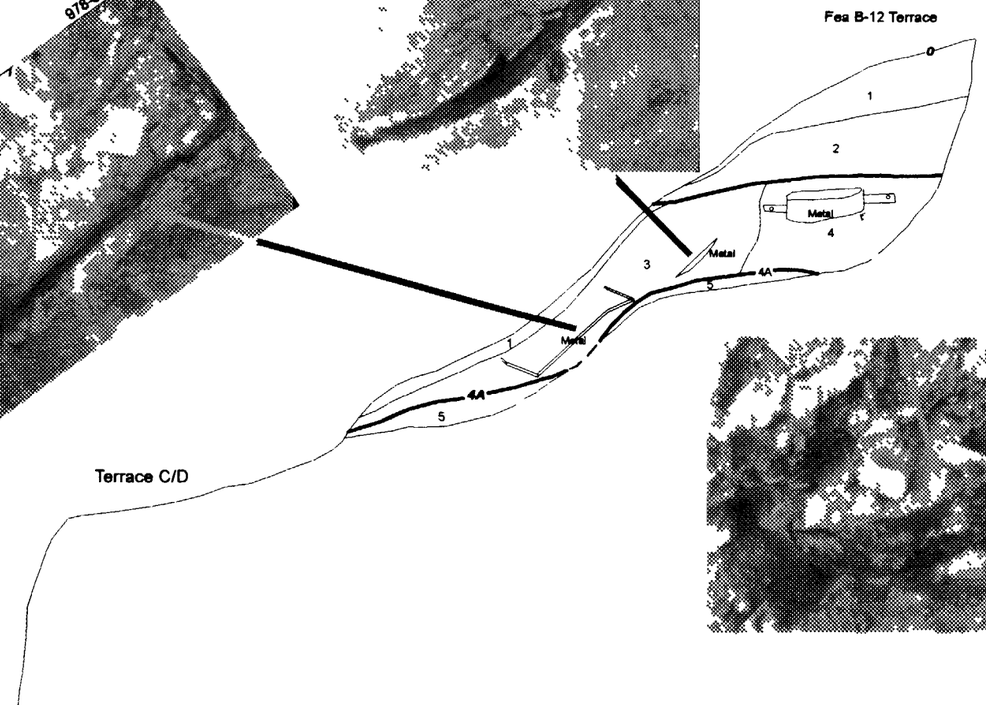
Detail of wood post

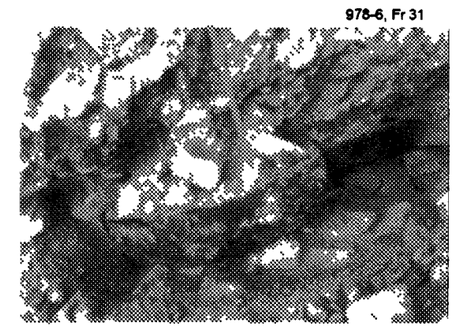


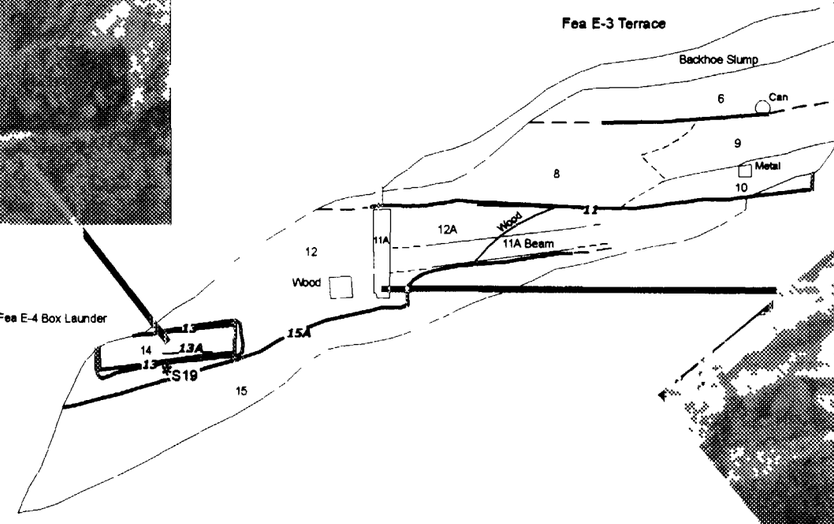
Fea E-4 Launder

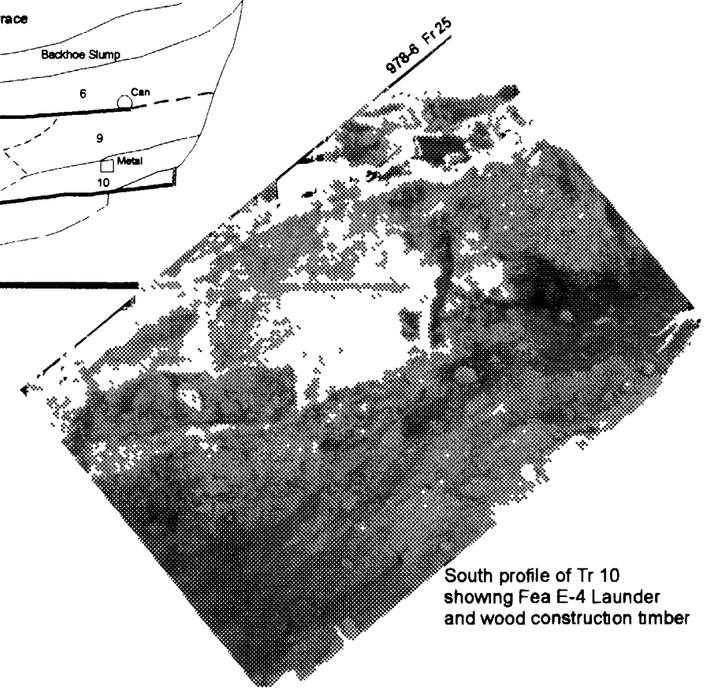












South profile of Tr 10 showing Fea E-4 Launder and wood construction timber

0 1 Meter

0 3 Feet

KEY

Distinct Boundary

Inferred Boundary

Cultural Interface

* S19 Chemical Sample #

Figure 4 4-13 Photographs, stratigraphic profile and Harris matrix for Tr 10, MS004

Temporal period correlation within the Loc B, C, D, and E areas suggest certain very late Peck Mill features and modifications (B-12, B-13, upper C-1, upper C-2), a variety of Lyon Mill features and demolition/remodeling episodes (construction of terraces using mill tailings as fill), and very little to nothing related to the original Birdsall & Carpenter Mill period.

Over 400 artifacts from loci C, D, and E were recovered. In each locus, architectural and unknown function artifacts were the most numerous groups, with industrial artifacts as abundant at Loc C and Loc D. Architectural artifacts from all three loci are summarized and compared in Table 4.4-1. Only Loc C yielded fire bricks. Parts of two were found there and each has lettering molded into it: 1) HEAT ... \I ... , 2) ... HERY ... \ ... PLATE ... \ GLAS ... . As for industrial artifacts, those from Loc C consist of an iron ore cart wheel, a copper rivet probably from a canvas machinery belt, rubber and canvas hose fragment, two complete round-nose shovel blades, lead sheet fragments, 34 quartz and other ore fragments, and 11 slag fragments. Those 42 industrial items from Loc D are one dark green glass carboy for chemicals, a tan stoneware "foot" perhaps for use in a kiln or furnace (Figure 4.4-14), and quartz and other ore fragments. Loc E artifacts consist of a green glass carboy, one canvas machinery belt fragment, part of a paperboard file folder, four fragments of ore, and a narrow-gauge railroad spike.

Table 4.4-1. Architectural Artifacts from Loc C, Loc D, and Loc E at the Lyon Mill site, MS004.

Artifact Type	Locus C	Locus D	Locus E	Total MNI
Board, wooden	16	2	4	22
Brick, red	14	1	2	17
Brick, fire	2			2
Concrete	1		1	2
Mortar, brick	3			3
Nail, cut	1		6	7
Nail, untyped	40	8	38	86
Roofing, composition	1			1
Spindle, wooden			1	1
Windowpane	1	1	3	5
Total MNI	79	12	55	146

At Loc C, other kinds of artifacts were found including food artifacts such as eggshell (1), a brown, moldblown glass beverage bottle (ca. 1850-1920), a complete glass soda water bottle, the kick-up base from a freeblown wine bottle, and sherds from three wie vessels, forms unknown. The soda water bottle is a faceted cylindrical bottle of aqua glass, with blob top and is

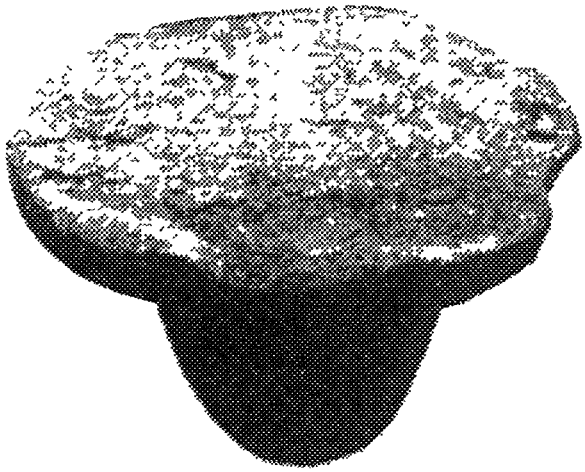


Figure 4 4-14a. Buff stoneware kiln foot from Loc D, MS004

Figure 4 4-14b McEwin soda water bottle from San Francisco, Loc C, MS004

embossed vertically on the body: McEwin\San Francisco (Figure 4.4-14). James McEwin was in the San Francisco mineral water and soda water business from 1856 until at least the mid-1870s, often in partnership with others. It was in 1871 that he ran a business by himself – the Bay City Soda Water Company (Markota and Markota 1971:56). Since his is the only name on the bottle from Loc C and since it has a blob top, this indicates a date of 1871 to ca. 1885.

From the group services functional group, Loc C yielded fragments of a 1939 newspaper, which are obvious later intrusions in the deposits. Two artifacts of a personal nature were collected, including one aqua glass medicine bottle with applied bead finish and one clothing button with four sew holes that appears to be made of a ceramic material. The button is white with a bluish tinge that appears to have been severely charred or chemically altered.

There are 70 MNI in the unknown function category. Many are here because they are so fragmentary that their form and function cannot be determined. Included are fragments of glass, iron, lead, burlap, wood, leather, and unidentified materials, as well as iron sheet, a metal disc, two metal rods, and two fragmentary glass bottles.

The Loc D material is less plentiful than the 223 artifacts from Loc C. Only 74 MNI came from Loc D, and 12 of these are architectural, another 40 are mill-related. Food-related artifacts were found, including one peach pit, fragments from one green glass beverage bottle, and from one black glass beverage bottle (ca. 1850-1890), one wine bottle, and one undecorated wie vessel. There are 14 MNI in the unknown category, including sheet iron, miscellaneous fragments of iron, glass, lead, rubber, wood, glass bottles, a bolt, two metal rods, and a wie vessel.

Industrial and architectural artifacts for Loc E are discussed above (Table 4.4-1). A total of 142 artifacts was collected from Loc E and those few items not architectural (n=55), industrial (n=8), or unknown (n=55) are spread over five other functional categories. First, there are food artifacts that include five unidentified mammal bones, a machine-made brown glass beer bottle, one olive green wine bottle, a sanitary food can, a wie platter, and two metal canning jar lid liners. This group of artifacts is firmly dated to the early to mid-twentieth century. The beer bottle post-dates 1903, the can post-dates 1904, and the lid liners date from 1915 to the present (Miller and Sullivan 1984:85, 93-94; Rock 1984:101, 105; Toulouse 1969:169). A crown finish characterizes the beer bottle. The collected food can is cylindrical but is much wider than it is tall, measuring 1.25 inches tall by 4 inches in dia. The end that is still attached is stamped with large letters or a design, but the symbols cannot be read. It may have held a meat or fish product. The partial platter found is large, footless, and adorned with molded rim design as well as teal-colored floral transferprint on rim and inner sides. The base is oval in shape, but the rim is angular, with sections or panels breaking its contour. Part of an impressed mark exists on the base, but is not legible.

Fragments of a newspaper were recovered, the only "group services" artifact. Munitions are represented by two brass rimfire .22 Long caliber casings with the headstamp "H." They post-date 1860 (Barnes 1969:296).

Three personal artifacts were found, including one SCA glass prescription medicine bottle (1880 to ca. 1920), a wooden pencil with metal ferrule and rubber eraser, and a small sherd of unglazed porcelain from a doll's face. The porcelain sherd is painted pink on the exterior and includes a raised rim and part of a hole.

Multiple use artifacts from Fea E include two large, square-head iron bolts, three square iron nuts of 1.31 inch size, a large and heavy iron ring of 4.25 inch dia, two iron sheets, an iron washer, two lengths of iron wire, a piece of string, and one iron shovel blade. The unknown function group consists of many fragments of iron, bottle glass, burlap, glass, leather, and wood.

The Loc E non-industrial artifacts definitely post-date the years when milling took place on the site. Most may simply be domestic debris that has been tossed here by nearby residents after the last mill had been abandoned. They are few in number but reflect consumption of goods and foods by adults, by adult women, and by a little girl. The origins of the domestic artifacts are not known, though most porcelain dolls from the 1800s were imported from Germany. The Loc E doll may date from the nineteenth century and be of German make.

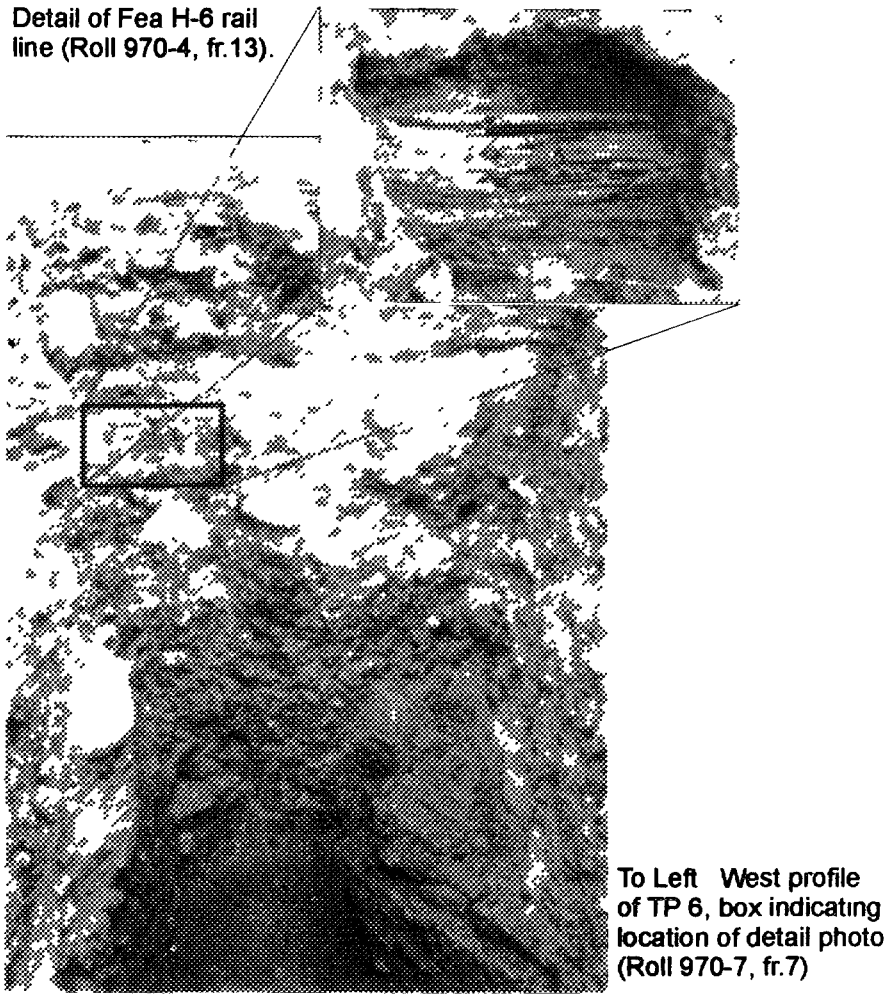
MISCELLANEOUS HILLSIDE FEATURES

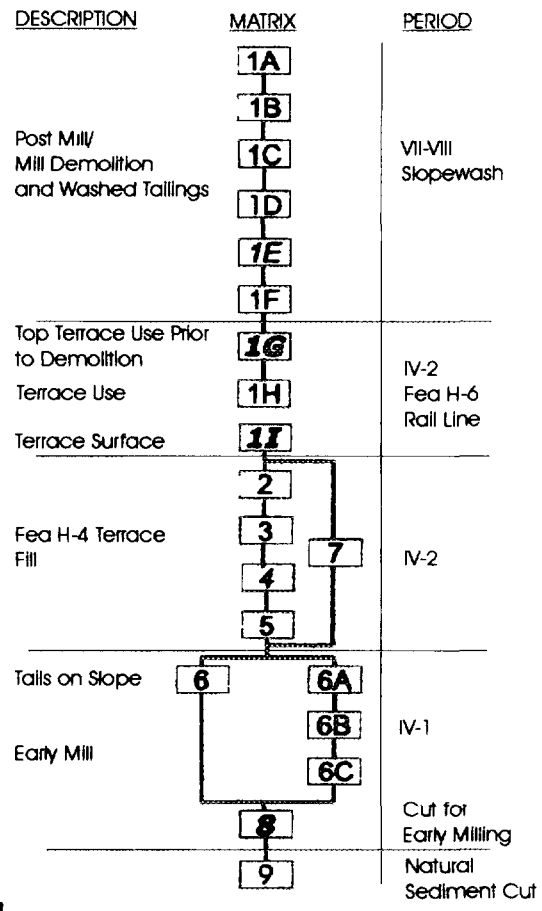
Numerous terrace and retaining wall systems are present on the area north of MS004 (Figure 4.0-1).

Several features were excavated on the northern terraced reaches of MS004 during initial site testing and monitoring of sediment removal. In TP 6, another ore or bullion cart rail line (H-6) consisting of ½ inch thick metal strap affixed to the top of milled timbers occurs on the H-4 terrace (Figure 4.4-15). This line extends in a north-south direction for 20 ft or more. This may well be a segment of the bullion and amalgam car track noted in the furnace room plans, as it seems much lighter in weight than the ore car track found on B-12. Below the line is evidence of a major demolition and a previous use episode.

Further north, TR 1 and TP 5 encountered a wooden box launder (I-2) filled with tailings on the eastern edge of the H-2 terrace (Figure 4.4-16). This covered box was very similar to others found throughout the terrace system, it just appeared to be well north of many mill activities, but below a series of constructed terraces. As little was done in this area with regard to excavation in the higher terraces, little context can be discussed for this particular feature.

A small assemblage of artifacts was recovered from TP 5, numbering 124 MNI. Over half of these are architectural artifacts, especially nails. Only two standard, red bricks provide evidence of building materials. But architectural hardware from Loc F includes 13 machine-cut





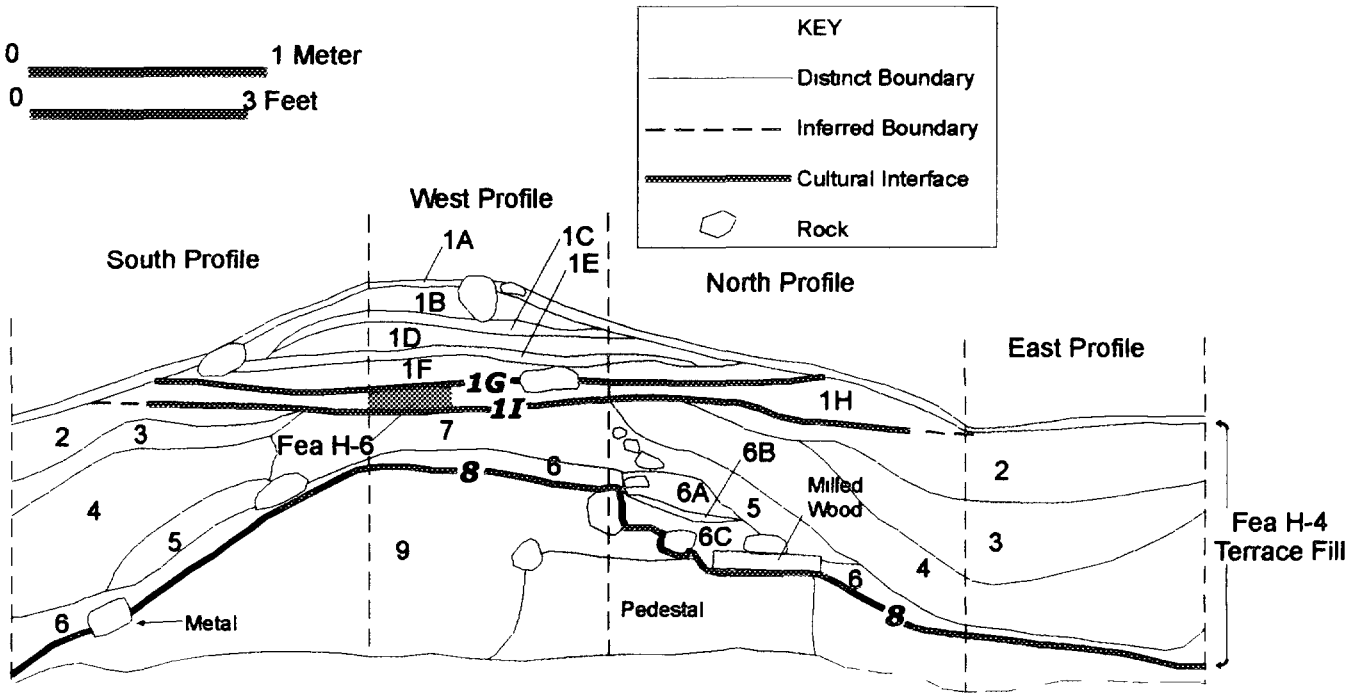


Figure 4 4-15 Photographs, Harris matrix and stratigraphic profile for TP 6, Fea H-4 terrace and Fea H-6 rail line, MS004

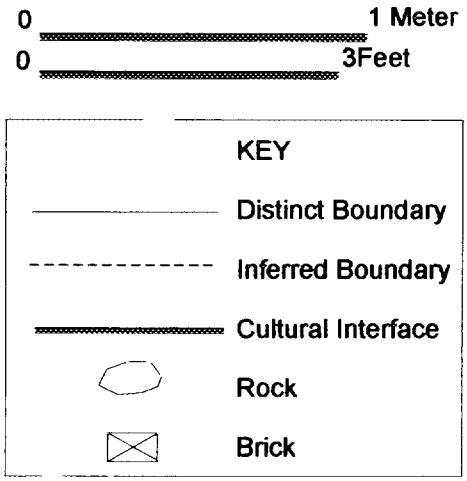
Stratigraphic descriptions

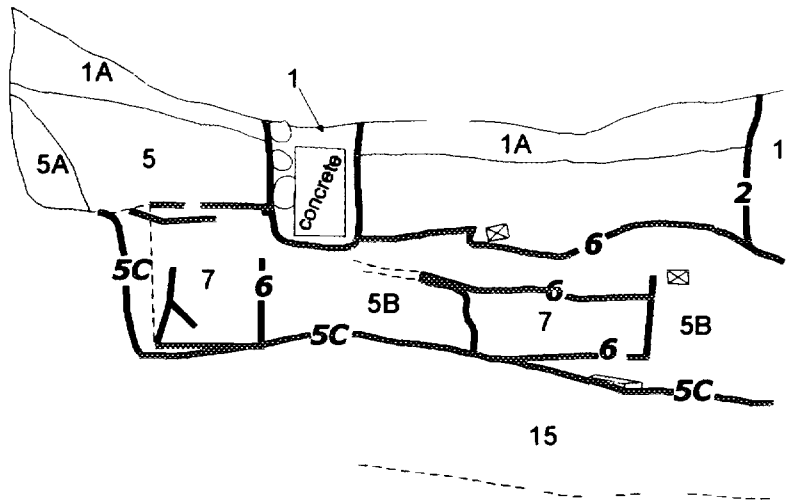
1A=1C=1E	10YR3/3 (dry), 10YR2/2 (moist); organic rich loam texture; massive to weak platey structure; non-sticky, non-plastic, dry loose consistency; inclusions of roots, rootlets, sagebrush duff, strong HCl reaction, pH=6, few cultural artifacts; abrupt smooth, discontinuous; organic duff surfaces with sagebrush holding strata and providing duff, up to 5 separate surfaces with duff were noted (3 mapped) large sagebrush grew in this area.
1B=1D=1F	10YR5.5/4 (dry), 10YR4/4 (moist); silt to sandy loam; massive horizontal beds; non-sticky, non-plastic, dry slightly hard to soft; 15% angular and subrounded cobbles to small boulders, roots, krotovina, strong HCl reation, pH=7 to 7.5, few artifacts; abrupt smooth boundary; slopewash between duff layers, redeposited tan tails with high carbonate concentrations covering a horizontal surface, water lain, Str 1F may be primary tails on horizontal wood floor surface which appears preserved west of TP6 with 4x4" runner in southwest wall of unit.
1G	Cultural Interface
1H	7.5YR5/4 (dry), 10YR4/4 (moist); loam to fine sandy; massive; non-sticky, non-plastic, dry slightly hard; krotovina, roots, very weak HCl reaction, pH=7, wood; abrupt smooth; 4x4" wood in southwest corner of unit in this massive pink deposit appears to be a single water lain deposit ca. 6cm thick of pink tails in tack wood does not continue to east.
1I	Cultural Interface
2	2.5YR5/2 (dry), 2.5YR3/2 (moist), 10YR7/6 and 10YR5/4 (mottles); silt to fine sandy loam; massive with angular chunks; non-sticky, non-plastic, dry soft; tails, roots, rootlets, krotovina, no HCl reaction, pH=7.5, few milled wood fragments; abrupt irregular boundary; secondary upper fill deposit representing a mix of red sediments, yellow silts, green coppers in a colluvial jumble just below the building surface, thickest to east, thins to west. Red fine sands are magnetite (strongly attracted to magnet), yellow silts are brecciated slimes, copper colors appear to be stained pebbles and silts in localized areas.
3	10YR5/3 (dry), 10YR3/3 (moist); loam; massive to angular blocky; slightly sticky, slightly plastic, dry hard; 10% rounded to subrounded cobbles and pebbles, krotovina, no to weak HCl reaction, pH=5, milled wood; abrupt gradual irregular boundary; appears to be middle terrace fill camprised of redeposited Str 9, a natural Bt soil horizon,.thickest to east and thinning to west and south.
4	10YR5/3 (dry), 10YR3/3 (moist), 2.5YR3/4 (mottles); gravelly loam (clast supported); massive to single grain; non-sticky, non-plastic, dry soft; 50% round to angular pebbles and cobbles; massive to single grain; non-sticky, non-plastic, dry soft; roots, krotovina, no HCl reaction, pH=5, milled wood; abrupt irregular boundary; middle terrace fill of gravelly loam with some pink (FeO?) staining. Gravels appear to be redeposited alluvial gravels generally not larger than 10 cm.
5	10YR6/3.5 (dry), 10YR4/3 (moist); poorly sorted sandy loam; massive; non-sticky, non-plastic, dry soft; no reaction to locally weak reaction, pH=7, few cultural artifacts; gradual smooth discontinuous boundary; water lain coarse (possible tails) deposits below colluvium and above Str 6 fine water lain slimes and sands.
6	10YR5/3 (dry), 10YR3/3 (moist); fine sandy loam; massive; non-sticky, non-plastic, dry soft to slightly hard; 10% subrounded cobbles and small boulders, rootlets, krotovina, strong HCl reaction, pH=7, few milled wood fragments and slag; gradual to abrupt smooth boundary; water lain fine sandy tailings on natural (in south wall) or cut slope (in north wall).

Figure 4.4-15. Stratigraphic descriptions for TP 6, MS004.

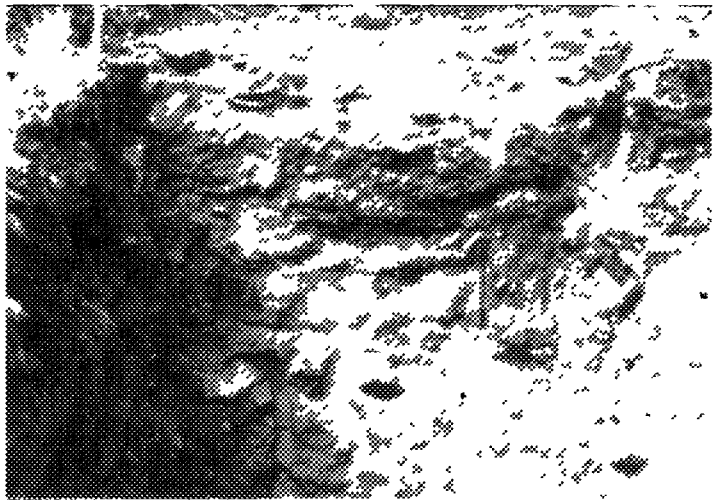
6A	10YR5/3 (dry), 10YR3/3 (moist); fine sandy loam; massive; non-sticky, non-plastic, dry slightly hard; rootlets, krotovina, weak to locally strong HCl reaction, pH=7, few cultural artifacts; gradual smooth boundary; wedge of sandy tails filling an older cut surface on northwest part of unit.
6B	10YR7/3 (dry), 10YR5/3 (moist); well sorted fine sandy loam; single grain; non-sticky, non-plastic, dry soft; strong HCl reaction, pH=7; abrupt smooth boudnary; clean water lain lens of fine sand tails.
6C	10YR5/3 (dry), 10YR3/3 (moist); bouldery loam; massive; slightly sticky, slightly plastic, dry slightly hard; rootlets, slight HCl reaction, pH=5, large horizontal wood piece in 1'7" (L) x 1' (W) x 1.5" (Th), cut on both ends, oriented northeast-southwest, had one metal square 7" north of south end in top center of board; possible horizontal surface extending from north half of unit to north. Wood and bouldery colluvium above wood mark this zone, 1 cm thick fine sandy loam (Str 6) is under wood and bove a horizontal cut (Int 8) in the Str 9 natural stratum.
7	10YR5/3 (dry), 10YR3/3 (moist); loam; massive to angular blocky; slightly sticky, slightly plastic, dry hard; rootlets, krotovina, strong HCl reaction, pH=7, few slag, milled wood; gradual smooth boundary; colluvial terrace fill, smooth to Str 3 and 4, possibly redeposited Str 9 from upslope cutting.
8	Cultural interface.
9	10YR5/3 (dry), 10YR3/3 (moist); gravelly loam; massive to angular blocky; slightly sticky, slightly plastic, dry hard; 30% subrounded cobbles, small boulders, roots, krotovina, no to weak at upper contact, pH=6.5, no cultural artifacts; unknown boundary; possibly natural Bt soil horizon in old alluvium.

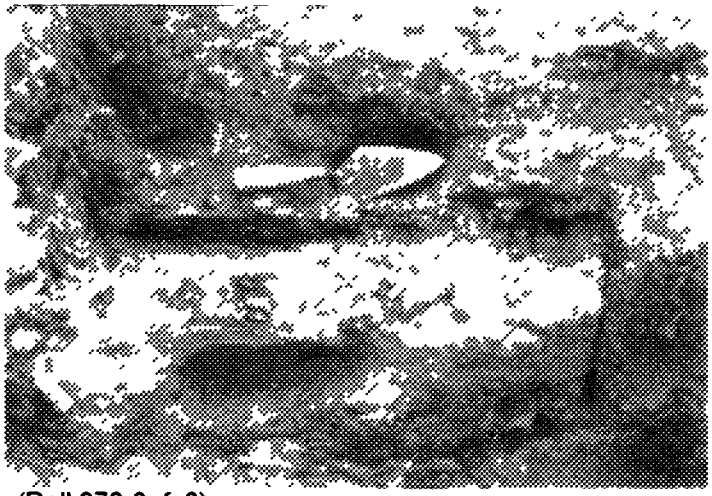
Figure 4.4-15. Stratigraphic descriptions for TP 6, MS004.





Period	Matrix	Description
Modern VIII	1A	Slopewash
	1	Fea I 2 Retaining Wall
	2	Cut for Fea I-2
Post Mill VII	5	Slopewash
Mill Operation IV - V - VI	6	Top & Sides of Fea F-2 Box Launder
	7	Tailings in Fea F 2
	6	Base of Fea F-2
Mill Construction IV V	5B	Fill in Builders Trench
	5C	Builders Trench
Pre-Mill	15	Natural Sediment


(Roll 970-1, fr 1)


(Roll 970-3, fr.3)

(Roll 970-3, fr.6)

Figure 4 4-16 Stratigraphic profile, Harris matrix and photographs of Fea F-2 in TP 5, MS004

nails, three wire nails (1883 to present), and 52 unidentified iron nails. Two mill-related artifacts were found – sherds from two glass carboys, but one of these may already have been counted as part of the Loc E assemblage. Mill by-products are represented by 22 quartz and other ore fragments and by one piece of slag. Five food-related items were collected, consisting of one eggshell, one apricot pit, one mammal bone, and fragments from one olive green glass wine bottle and a brown glass liquor bottle. Multiple use artifacts were found and include one bolt with 1.25-inch square head, one iron nut of 1.13-inch size, one slot-head wood screw of 2.5-inch length, and two iron sheets. The remainder are fragments of glass bottles, iron, a lead strip, plastic, and wood. Only the wire nails from TP 5 provide reliable dates. None of the glass vessel fragments include temporally-diagnostic attributes.

This northern area is extremely important precisely because it has not been heavily disturbed by development through time. Hidden in this area are the archaeological remains of the acid works and portions of the refinery and bluestone works. Particularly intriguing is the series of features concentrated at the extreme northern end of the mill complex. As shown on the map in Figure 4.4-1, these features step down the hillside in the form expected of a separate mineral-processing operation. This is most likely the sulphur works, with the bluestone plant in the more disturbed ground just north of the bullion-furnace room.

Feature A-2 is a faced dry-laid stone wall situated near the top of the ridge. It is likely the downhill support for the ore bin in the upper right corners of the photographs in Figures 4.1-1 and 4.1-3. This bin most likely held sulphur ore. The wall presently has a maximum height of 2 ft 6 inches and extends for 37 ft along the contour of the slope. It has about five irregular courses of subrounded cobbles available in the surrounding alluvium. The ore bin would have stood on the uphill side of the wall.

The next feature downhill is B-5, a distinctive terrace backed by an inset (wall B-4) in the massive B-1 retaining wall, the dominant remaining visual feature at the mill site. Wall B-4 is carefully faced and stood at least 6 ft high when constructed. The terrace itself is 20x25 ft. It is flat and covered with red sediment and red clay brick fragments. It is not known whether these are remnants of a floor or of furnaces. Large cut nails are common on the terrace suggesting former presence of a wooden structure. A single carriage bolt was also observed here. The downhill edge of the terrace is supported by a low retaining wall, Fea B-3.

The slope (Fea G-1) below Fea B-5 does not appear to have structural remains in it based on surface indications. Downslope of this there is another sloping terrace (Fea H-2) has a red brick concentration that is likely the remains of another mill-related structure. Some fire brick is present here as well. Terracing limits the total size of this structure to a maximum width of 16 ft and an undetermined length. The stone retaining walls above and below this terrace barely extend above ground level, but there is no way to know how tall they are without excavation. Artifacts on the terrace include cut nails, fragments of thick iron plates, thin milled wood, and body fragments from an olive green bottle. Nodules of copper sulphate are also present on the ground surface.

THE MILL YARD

Modern Loc I terraces cover the Loc L mill yard. As Loc I was removed, and during trenching (TR 1, A, B, and C) and contaminant removal, several interesting features were discovered in both Loc I and L. Very little formal excavation (EU 5 and EU 12) was carried out in this area. Rather, archaeologists monitored excavations by heavy machinery to trace wood, timber, artifacts, colorful tailings, bins, and possibly a railroad foundation on maps (Figure 4.4-1) prior to the removal of highly contaminated mercury-rich sediments. For convenience, this area of high mercury was called the "hot zone." One domestic dugout (Fea I-8) contemporary with the Birdsall & Carpenter period is described in the chapter on the Dayton community. From older to more recent uses of the mill yard examined (only that portion northeast of the mill building location), the following is a general temporal-stratigraphic assessment.

The Fea I-8 dugout is the oldest recognizable feature in the yard area and it is cut away leaving only about one third of the hillside-hugging feature intact. This feature is covered with a series of tailings and a launder may have extended across the demolished structure prior to the construction of a board, post and rock retaining wall (I-5 and I-5-1) extending northwest from a technicolor tailings or slime pond (for at least 60 ft) to the area of TR 1. Purpose of this retaining wall is unknown unless it is holding tails washing off the hillside. Several similar board and post retaining walls are found just south of I-5. One, I-5-2 extends east west for over 40 ft and appears to be within the technicolor slime pond (I-6). These retaining walls appear to be at least 3-4 ft high. Slimes of maroon, bright yellow, copper blue, and gray to black color cover each other in a ponded basin up to 3-4 ft deep as seen in the TR C profile (Figure 4.4-17). Chemical samples S22-S28 were taken from the various colored strata in this pond. These samples indicate that all chemicals tested for were present in some quantity except cyanide. This strongly implies creation during the Lyon Mill period. The I-6 pond may be up to 60 ft north-south by 40 ft wide, bounded on the west by a cut, on the north by a post and board retaining wall (I-5-2) and on the east by a similar wood and post wall (Fea I-5-3) and possibly by a cut into natural alluvium as well. Slimes/tails within the pond appear to be primary wet laid deposits. At least one and possibly four launders extend roughly north-south across this pond area and may be the conduits for bringing these materials to this location from the base of the main mill building. In any event, the launders are again tightly fitted and usually covered wood-lined ditches. Other than the launders and slime pond, a heavily built foundation (Fea L-4) that has the fingerprint of a standard gauge railroad track, albeit without spikes or rails, crosses the area in a north-south direction aimed toward the northwest corner of the mill building (Figures 4.4-1, 4.4-18). This 40 ft long by 5-10 ft wide foundation contained the first liquid mercury found on the project, adhering to the massive timbers, some larger than 12x12 inches. This L-4 feature, if a standard gauge track, may be heavy reinforcement where it crosses a slime pond. Otherwise is appears to be a support for something massive that is outside of the mill building outline. Artifacts found primarily during monitoring of contaminant removal are discussed below.

Over 500 MNI were recorded from combined Loc I and Loc L. As with other loci assemblages from MS004, the artifacts from Loc I and Loc L are mostly architectural, multiple

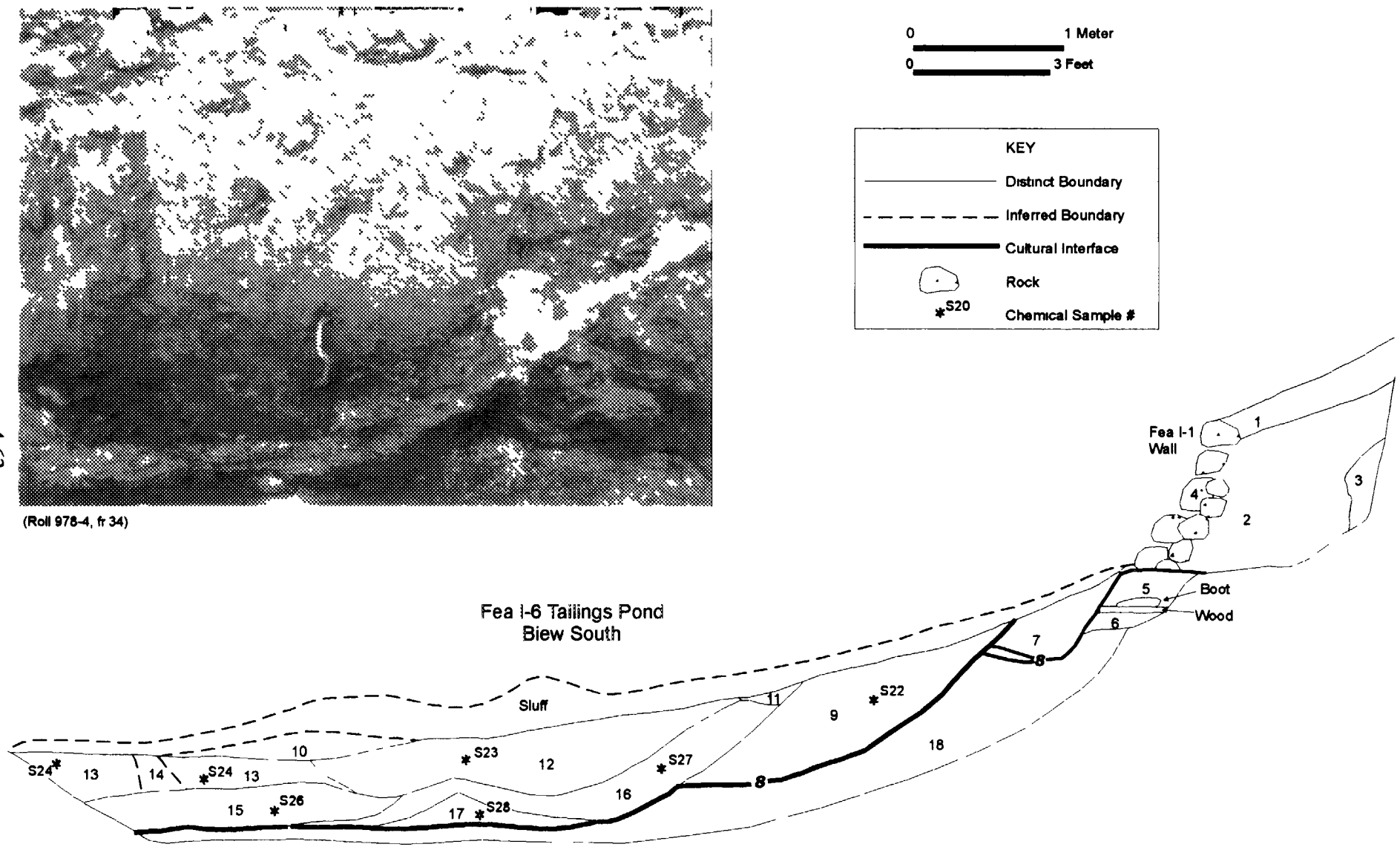


Figure 4 4-17 Photograph and stratigraphic profile for Tr C in Loc I, MS004

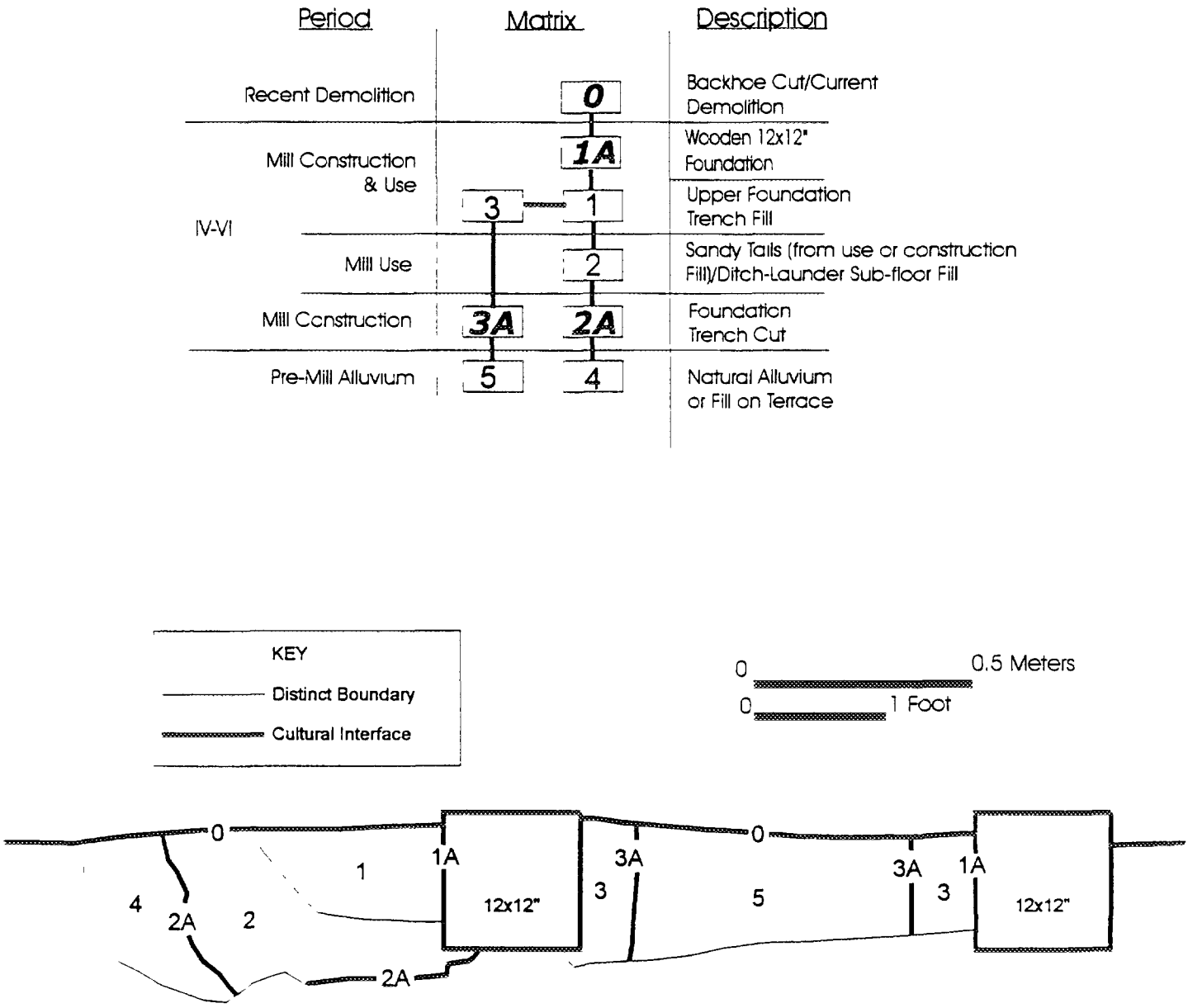


Figure 4.4-18. Harris Matrix and stratigraphic profile for EU 5 in Loc L, MS004.

use, and unknown function artifacts, with the exception of Fea 8 in Loc I. Fea 8 is a dugout used for non-industrial, non-mill purposes and its assemblage (137 MNI) is discussed in Chapter 6. The artifacts from other contexts within Loc I and all of them from Loc L are briefly discussed here.

In Loc I, the largest functional group of artifacts is the industrial one, but its 54 components are five railroad spikes, fragments of a glass carboy, one marked fire brick, and 47 quartz and other ore fragments. The fire brick has lettering molded onto it: HEATHERY ... \PATE ... \GLASG ... . This and other fire bricks from MS004 with the same mark must have been imported from Glasgow, Scotland. Many multiple function artifacts may well relate to the mill use of the Loc I, such as a 5 inch long iron bar, two shovel blades, five carriage and other bolts some of which are 12 inches long, iron pipe, a heavy iron ring of 7.5 inch diameter, an iron pick, an iron washer, a large wood screw, a metal tube, and two pieces of lead sheet.

The architectural components consist of one board of 3.75 inch length and 0.5 inch thickness, five standard red bricks (all fragmentary) and six machine-cut nails, one wire nail, and 41 nails too corroded for identification. Two pieces of window putty were found, as well as pieces from at least two glass windowpanes.

Domestic artifacts are represented by a single wooden table or chair leg, an SCA lamp chimney, and a paintbrush. Food-related artifacts are present and consist of nine mammal bones, seven peach pits, and one apricot or cherry pit. Beyond actual food remains, food containers, serving vessels, and cooking ware were observed. These include three glass beer bottles, three beverage bottles, one brown glass liquor bottle, six olive green wine bottles, one plain wie cup or sugar bowl, and an iron Dutch oven.

As for group services, two glass insulators were recovered from Loc I, thought to be modern examples. Personal artifacts were encountered, consisting of one white Prosser porcelain four-hole shirt button (0.44 inch dia), a complete large, black rubber boot, one leather shoe or boot, and parts of four glass patent medicine bottles. Among the last are fragments from a Hostetter's Stomach Bitters bottle and from a second large bitters bottle. One animal transportation artifact came from Loc I – a complete horseshoe.

The architectural components consist of one board of 3.75 inch length and 0.5 inch thickness, five standard red bricks – all fragmentary – and six machine-cut nails, one wire nail, and 41 nails too corroded for identification. Two pieces of window putty were found, as well as pieces from at least two glass windowpanes.

Few of the Loc I artifacts provide date ranges, but those that do include wire nails (1883 to present), SCA glass (1880 to ca. 1920), moldblown wine bottles (pre-1920), and the porcelain button that dates between 1840 and 1910 (Albert and Adams 1970: 4-10). A number of modern artifacts were mixed in with the Loc I assemblage that have not been discussed above. There remains a core assemblage there that does date to the mill years.

Loc L artifacts comprise a total assemblage of 123 MNI, 59 of which are architectural items and another 44 of which are multiple use and unknown function artifacts. The architectural artifacts are composed of four partial boards, one standard red brick, two cut nails, one wire nail, 49 nails unidentified as to type, one white ceramic tile, and pieces of a windowpane. The few domestic artifacts include sherds from two glass lamp globes – one pale blue and one SCA glass – and a brass lantern part. Food remains and food vessels came from Loc L in small number. They include three cut mammal bones, three glass beverage bottles, one colorless glass liquor bottle, and one wie vessel. Two of the bottles are machine-made, with externally-threaded finishes; they may be modern refuse from the recent inhabitants of the site.

A few industrial artifacts were collected from Loc L; these are two pieces of quartz ore, one blue green tailings chunk, and a copper burr, probably used with a rivet on a canvas machine belt at the mill.

Personal artifacts from the site consist of a Prosser porcelain sew-through button of 0.31-inch dia (1840-1910), and two SCA glass medicine bottles, one square and one cylindrical. The square bottle is embossed with a mark: W. T. & CO. This is the mark of Whitall, Tatum & Co, of New Jersey that dates from 1857 to 1938 (Toulouse 1971:544). The SCA glass from which the bottle is made further limits its period of manufacture to 1857 to ca. 1920 (Munsey 1970:55).

One mule shoe was collected from Loc L. It is a winter shoe as it is fitted with heel and toe calks. The unknown function group includes parts of 12 glass bottles, miscellaneous iron, rubber, leather, glass, and cloth fragments, as well as a domed, hexagonal metal nut, a 2-inch wide square nut, iron wire, a metal spike or stake fragment, two heavy iron bars, of 17- and 11-inch lengths, a metal strip, and an iron disc.

The best temporal indicators within the Loc L assemblage are the SCA glass (1880-1920) and the Prosser button (1840-1910).

4.5 ARCHAEOLOGY OF THE PECK MILL (1897) AND POST-MILL USE (1897-2000)

The final mill modification and use of the MS004 area came from 1897-1900 with the Peck Mill, followed by a steady array of post-mill modifications, demolition, terracing, and other industrial and domestic construction for the past century. The major modifications and features attributed to the Peck period are illustrated in Figure 4.5-1. These features include: the B-13 ore car track; the B-12 terrace and associated B-9 and B-10 cobble walls; the upper C-1 boulder and post wall related to the final modification and likely demolition of the furnace house while keeping the furnace chimney (and maybe a smaller furnace) and the bullion bins on the outside of the furnace house, as noted in a turn of the century photograph (Figure 4.1-1). This photograph also illustrates structures covering the main mill, a small shed roof over the bullion roasting furnace, wooden bins along the D-1 terrace, and rather large structures with brick

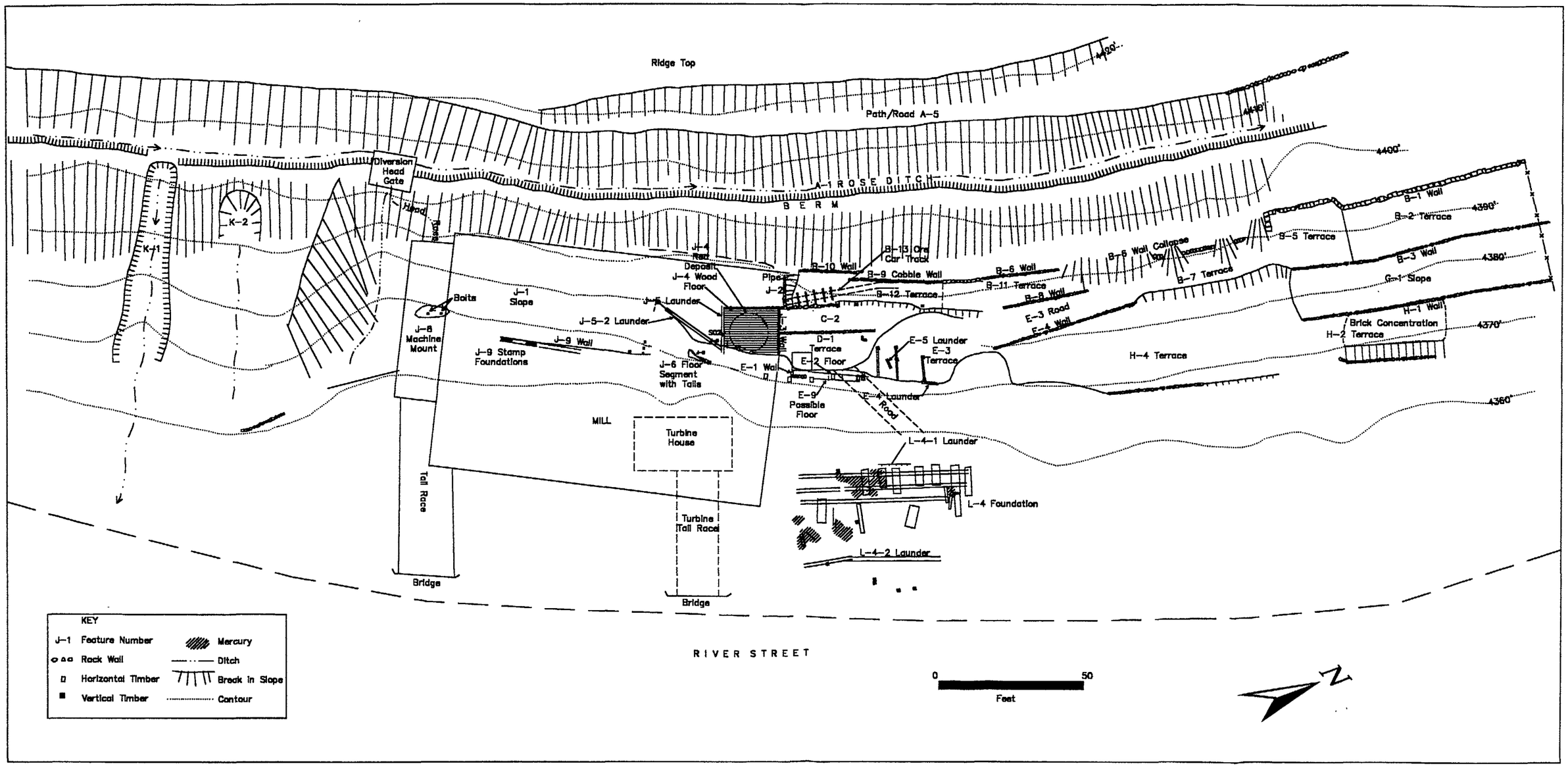


Figure 4.5-1. Peck Mill (1897) and post-mill feature map.

chimney in the E-3 and stovepipe chimney on the H-4 terrace as well as a road from Loc L ascending the hill to the middle level of the north mill wall, below the furnace and bins. It also shows a rail track of some sort continuing from the northeast corner of the mill building to the north; this may be the Fea L-4 foundation which may be a standard gauge segment of track crossing a colorful chemical-ridden Lyon phase tailings pond.

Excavations within the mill structure were limited to Tr 4 and TP 3 (Figure 4.5-2). The trench profile yielded a cut and fill feature (L-5) of post-demolition (ca.1903-1920) age with a limited mix of debris and no obvious tailings although copper staining was present in the upper strata. This feature may relate to a turbine/electrical generation feature built sometime between 1910 and 1932. There were no archaeological remains of the turbine house, which likely contained machinery recycled from the Peck Mill; however, the turbine house and tail race locations on Figure 4.5-1 are probably quite accurate.

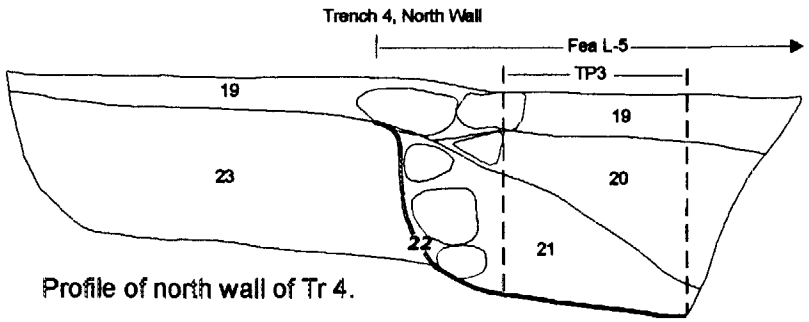
Excavations revealing the B-13 ore car track and the B-12 terrace include EU 6, EU 10, and TP 9. The modified wall(s) holding up the B-12 terrace are the B-14 wooden structure (formerly the west wall of the furnace house) and the upper C-1 boulder, board, and post wall fabrication built on top of the demolished west furnace brick wall (lower C-1). B-14 and C-1 are visible in EUs 1, 3, 4, 6, and 8. Figure 4.5-3 is a three-sided stratigraphic profile of EU 6 clearly illustrating the relationships between these features and the demolition of early features (i.e, the furnace house west wall (B-14), the brick furnace (lower C-1), and a faced boulder block wall (B-6)). Features in this area thought to relate to the Peck Mill period are described from uppermost hillside to floodplain in a generally west to east transect.

Artifacts from Loc B, Fea 12 are few, numbering 50 MNI. The architectural objects consist of six red bricks, one piece of concrete, one cut nail, and six unidentified iron nails. One glass insulator was recovered, probably relating to post-mill power lines. Artifacts relating to mill activities were found including 10 quartz ore fragments, and one lump of slag. A few multiple use artifacts such as iron wire, a 1.56-inch wide nut, sheet iron, a large square-head bolt, and fragments of coarse cloth (possibly machine belt pieces) may also be mill artifacts.

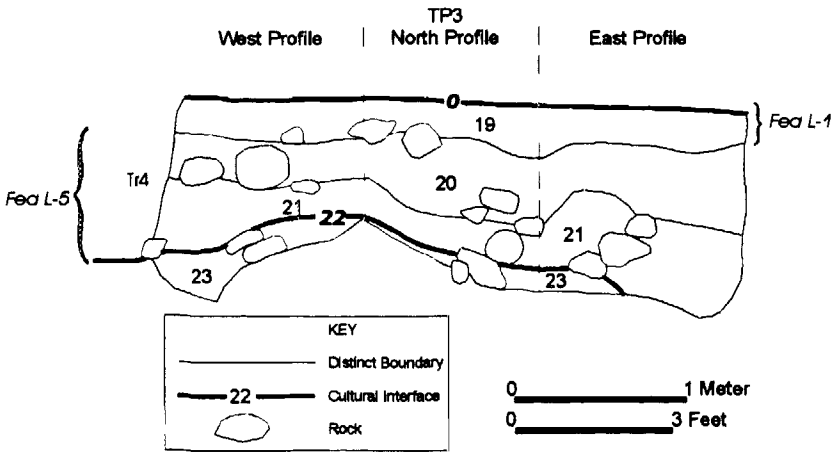
Food-related artifacts collected consisted of two plain wie vessels of uncertain form. A slate pencil fragment was found. As with all the other loci assemblages, a number of fragments of miscellaneous materials were collected, most too small for function identification.

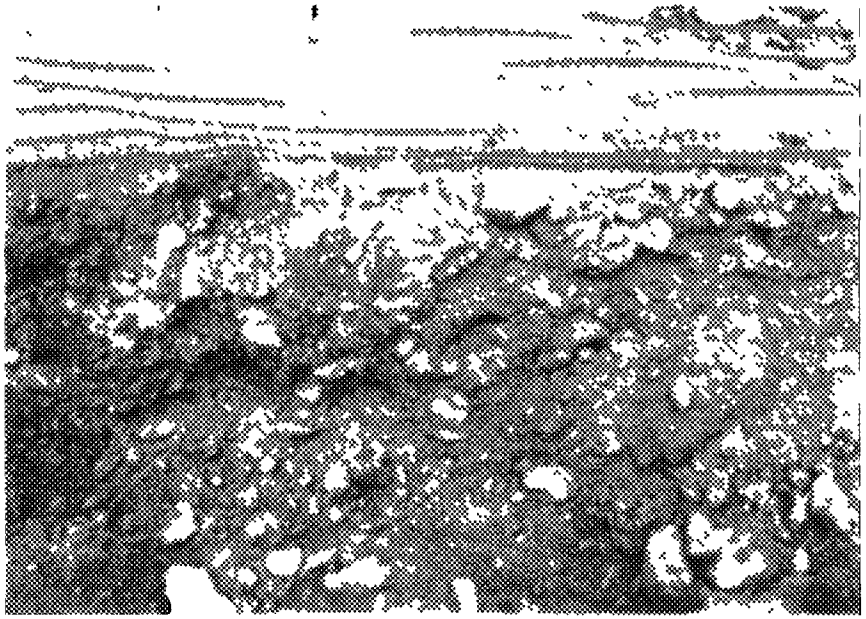
From the area within Loc B but outside Fea 12, 19 artifacts were collected. There are seven cut nails, two railroad spikes, three quartz crystal fragments (from ore), one iron eyelet from a shoe or garment, window glass from one pane, a plain wie vessel, and four miscellaneous fragments of unknown function. None of the artifacts from Loc B have provided date ranges other than the machine-cut nails, dating from 1830 to ca. 1920 (Fontana and Greenleaf 1962:58-59).

Period	Matrix	Description
1940s	0	Modern Feature L-1 Surface
	19	Feature L-1 Upper Fill
Post-1900	20	Feature L-5 Middle Fill
	21	Feature L-5 Lower Fill Demolition Episode
	22	Cut Surface for Feature L-5 Pit
Pre-Mill	23	Natural Alluvium

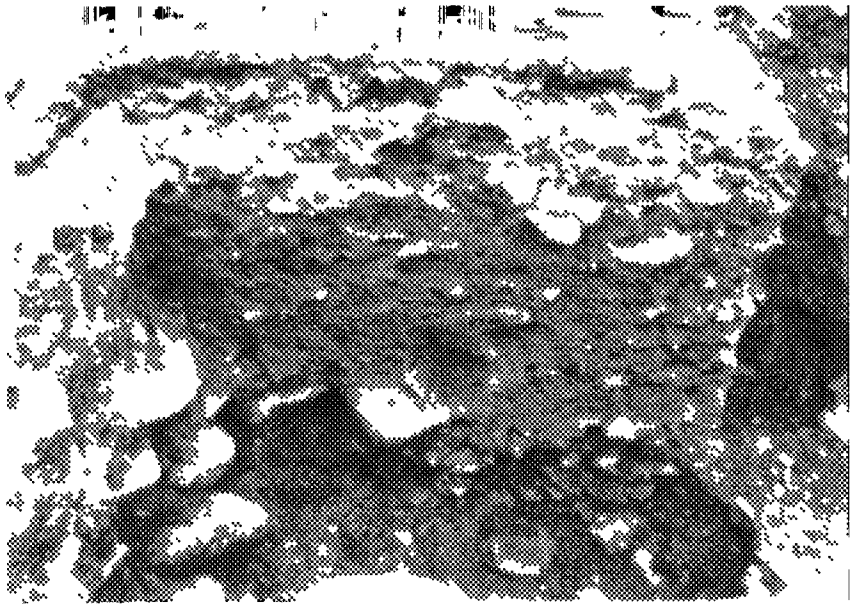


Profile of north wall of Tr 4.





North profile of Tr 4.



East profile of TP 3 (Roll 970-2, fr.19)

Figure 4 5-2 Harris matrix, photograph and stratigraphic profiles for TP 3 and Tr 4 at the Birdsall & Carpenter Mill

Stratigraphic descriptions:

0 Interface; modern Fea L-1 surface.

19 10YR6/4 (dry) dark yellowish brown, 10YR3/3 (moist) dark brown; very poorly sorted gravelly loam; massive slightly sticky, slightly plastic, dry slightly hard; few roots, modern toys and debris on surface, weak HCl reaction in matrix, moderate HCl reaction on carbs on cobbles; gradual smooth boundary with Str 23; redeposited Qal, Str 23 over existing flood plain./ground surface.

20 10YR6/3 (dry) pale brown, 10YR3/3 (moist) dark brown, mottles of $CuSO_4$; sandy loam with 8-10% rounded to subrounded gravels; massive; non-sticky, non-plastic, dry soft; few roots, krotovina, brick fragments, charcoal, milled wood fragments, metal fragments, no HCl reaction; abrupt smooth root matt at boundary.

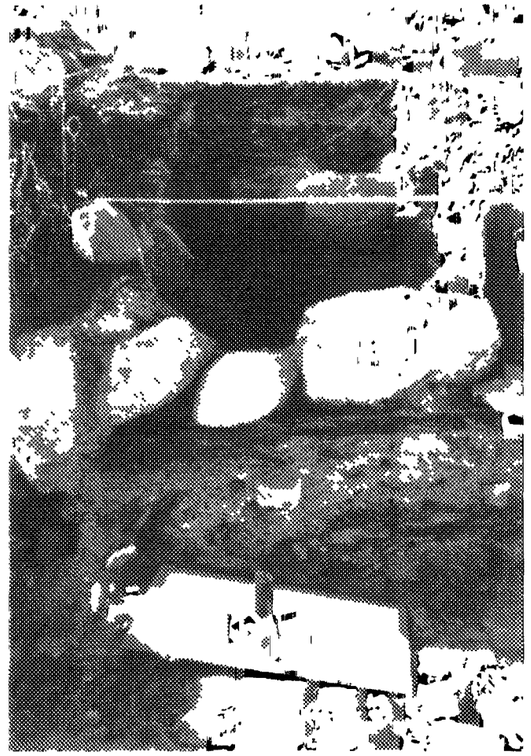
21 10YR6/3 (dry) brown, 10YR4/3 (moist) brown; gravelly loam; massive; slightly sticky, slightly plastic, dry soft to slightly hard; roots, rootlets, green grass, wood fragments, metal spikes, no HCl reaction; boundary unknown; pit fill, demolished roof of dugout, colluvium.

22 Interface; cut for Fea L-5.

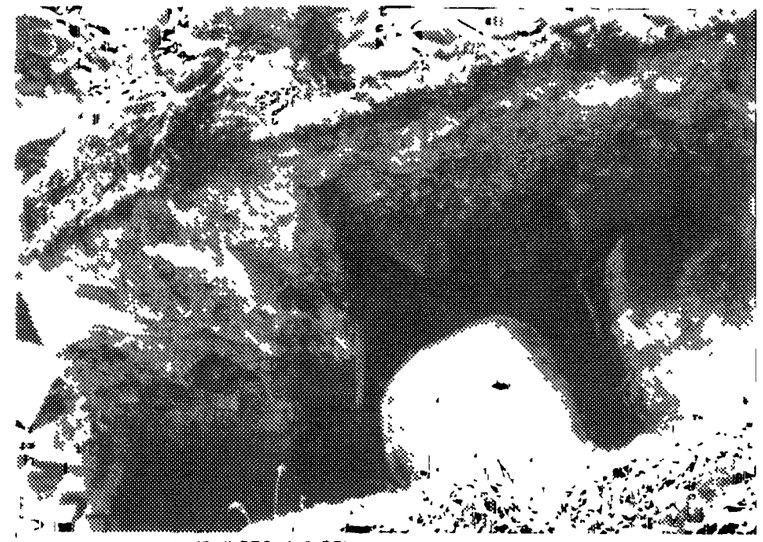
23 gravelly loam, 30%+ rounded and subrounded alluvial cobbles to boulders; massive bedding; slightly sticky, slightly plastic, dry hard; no inclusions, moderate reaction on carbs on bases of rocks; boundary unknown; Qal, active river flood/gravel bar deposits.

Figure 4.5-2. Stratigraphic descriptions for Tr 4 and TP 3 at Birdsall & Carpenter Mill.

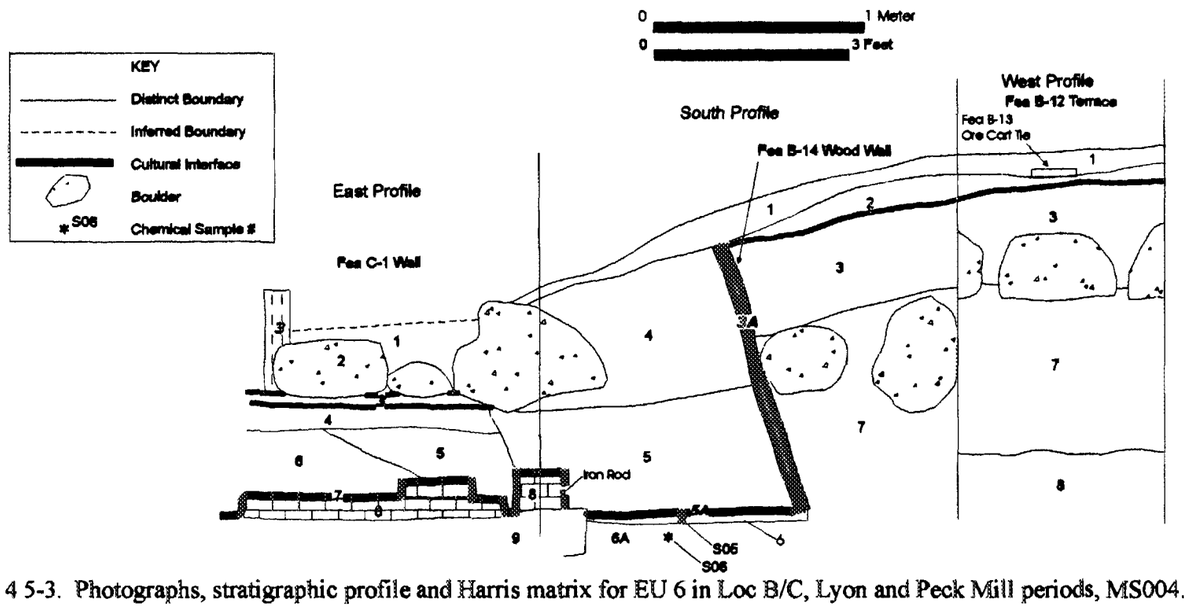
EU 6, looking west (Roll 978-4, fr 15).



EU 6, looking west (Roll 978-4, fr 31).



EU 6, looking south (Roll 978-4, fr 25).



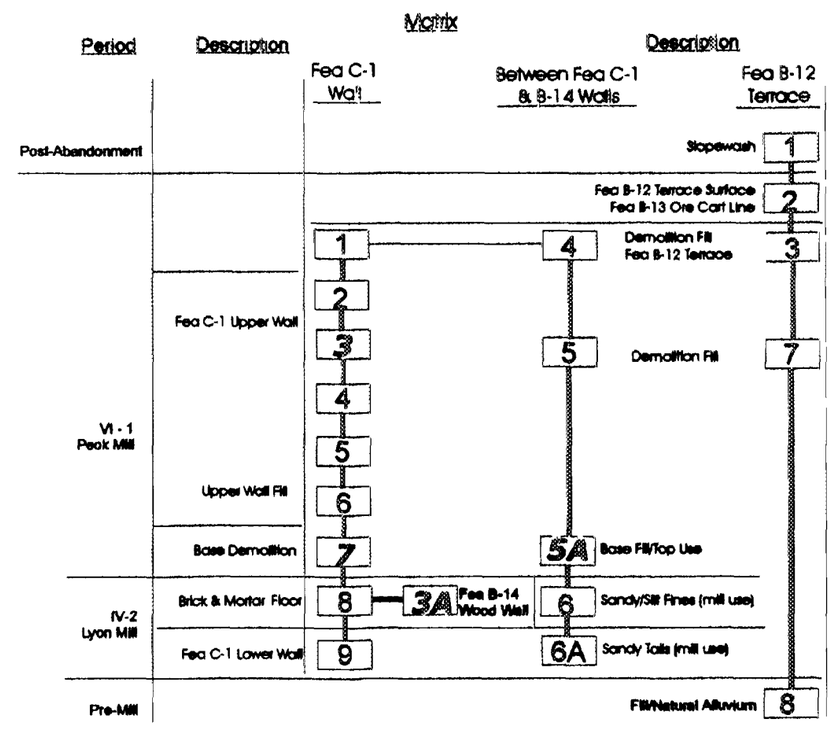


Figure 4 5-3. Photographs, stratigraphic profile and Harris matrix for EU 6 in Loc B/C, Lyon and Peck Mill periods, MS004.

Stratigraphic Descriptions:

1 10YR4/3 brown/dark brown (moist), 10YR5/3 brown (dry); silt loam texture; massive structure; non-sticky, non-plastic, dry soft; inclusions of organic matter, 5% pebbles; no HCl reaction; abrupt boundary with Str.*1A*; overlies Fea B-13 ore cart rail line.

2 10YR3/3 dark brown (moist), 10YR5/3 brown (dry); loam; massive; non-sticky, non-plastic, dry soft; common small to medium roots, 5-10% subangular to round pebbles and small cobbles, no HCl reaction; abrupt discontinuous boundary, only located behind Fea B-14 wood wall; fill for surface of Fea B-12 terrace to hold Fea B-13.

3 10YR3/4 dark yellowish brown (moist), 10YR4/4 dark yellowish brown (dry); gravelly to bouldery loam; massive; non-sticky, non-plastic, dry slightly hard; few fine rootlets, 40% rounded to subrounded pebbles and cobbles, slight HCl reaction; gradual smooth boundary; upper terrace fill behind Fea B-14 wall.

3A Cultural Interface; Fea B-14 wood wall.

4 10YR5/4 yellowish brown (moist), 10YR6/3 pale brown (dry); bouldery silt loam; subangular blocky; non-sticky, non-plastic, dry hard; rare rootlets, bouldery fill, slight HCl reaction; abrupt smooth boundary; cultural terrace fill for Fea B-12 terrace.

5 10YR5/4 yellowish brown (moist), 10YR6/4 light yellowish brown (dry); sandy loam; massive; non-sticky, non-plastic, dry slightly hard; rare rootlets, brick, charcoal, cut nail, tailings, strong HCl reaction; abrupt smooth boundary; lower terrace fill for Fea B-12 terrace.

5A Cultural Interface; base of fill, top of use surface.

6 10YR4/3 brown (moist), 10YR5/3 brown (dry), slight green mottles; silt loam; massive; non-sticky, non-plastic, dry slightly hard; 5% gravel, rare rootlets, leather, cloth, burlap, no HCl reaction; abrupt smooth boundary; water lain, top of tails.

6A 10YR4/3 brown (moist), 10YR5/3 brown (dry); sandy loam; massive; sticky, slightly plastic, dry hard; 5-10% gravels, rare roots, encrusted oxidized metal; unknown boundary; primary tails (sample for analysis).

7 10YR4/3 brown (moist), 10YR5/3 brown (dry); bouldery sandy loam; massive; non-sticky, non-plastic, dry hard; rare roots, slight HCl reaction, 5% gravels; abrupt wavy boundary; lower fill for Fea B-13 terrace.

8 10YR4/3 brown (moist), 10YR5/3 brown (dry); sandy loam; massive; sticky, slightly plastic, dry hard; rare roots, 5% gravels, no HCl reaction; unknown boundary; lowest possible natural slope.

Stratigraphic Descriptions for Fea C-1 in EU 6, Locus B/C, MS004.

1 Demolition fill.
2 Upper wall of Fea C-1
3 Cultural Interface; wood post.
4 Upper wall fill.
5 Upper wall fill.
6 Upper wall fill.
7 Cultural Interface; use surface, base of demolition.
8 Brick and mortar.
9 Cut stone wall.

Figure 4.5-3. Stratigraphic descriptions for EU 6, Peck & Lyon Mill, MS004.

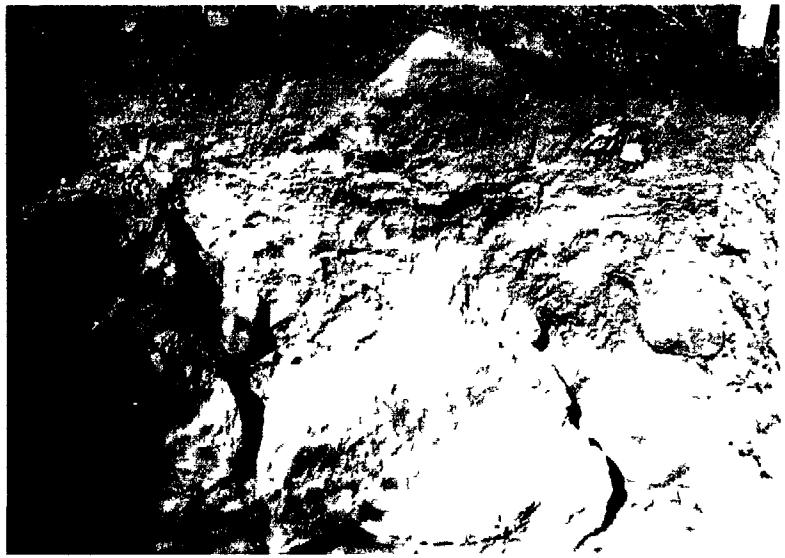
Fea B-9 is a cobble-small boulder (5-12 inch diameter) rock retaining wall south of and adjoining the B-6 faced block boulder retaining wall. This cobble wall is 30 ft long and 3 ft high at its maximum. The B-12 terrace surface is immediately east of the cobble wall and it is highly suspect that the faced B-6 wall was demolished in this area to provide fill to build the B-12 terrace to a somewhat higher (4-5 ft) level than had been used previously used.

Fea B-10 is another small cobble wall about 1.5 ft west of the south end of B-9 and is similar in construction, although 15 ft long and only one course (15 inches) high at its maximum (Figure 4.0-2). This wall is composed of small cobbles and several larger boulders. The B-12 terrace is immediately east of this wall segment. Both the B-9 and B-10 walls appear to be modifications of the B-6 alignment. Excavations in the B-12 terrace suggest that these walls came after the terrace was raised and widened somewhat to the west with the remnants of the older B-6 block wall used as terrace B-13 fill and rock for the upper C-1 boulder wall.

The B-12 terrace is the uppermost access terrace to the mill building from the north, measuring approximately 30x7 ft, it has a slight incline up to above the top of the J-2 rock wall presumed to be at or near the northwest edge of the mill building (Figure 4.5-4). This line of access to the top of the mill was likely the one used from the time of initial Birdsall Mill construction for the ore wagon access corridor, although no evidence of the wagon route was encountered it is suspected to be at the base of the boulder fill level with the C-2 terrace. One surface artifact on B-12 included a segment of iron rail (20x2x1¼ inches). Upper strata corresponding to the use and abandonment of this terrace are sitting over a massive deposit of boulder-ridden fill used to construct the terrace as shown in profile on Figure 4.5-4. This terrace appears to have been constructed solely to hold the B-13 ore car track.

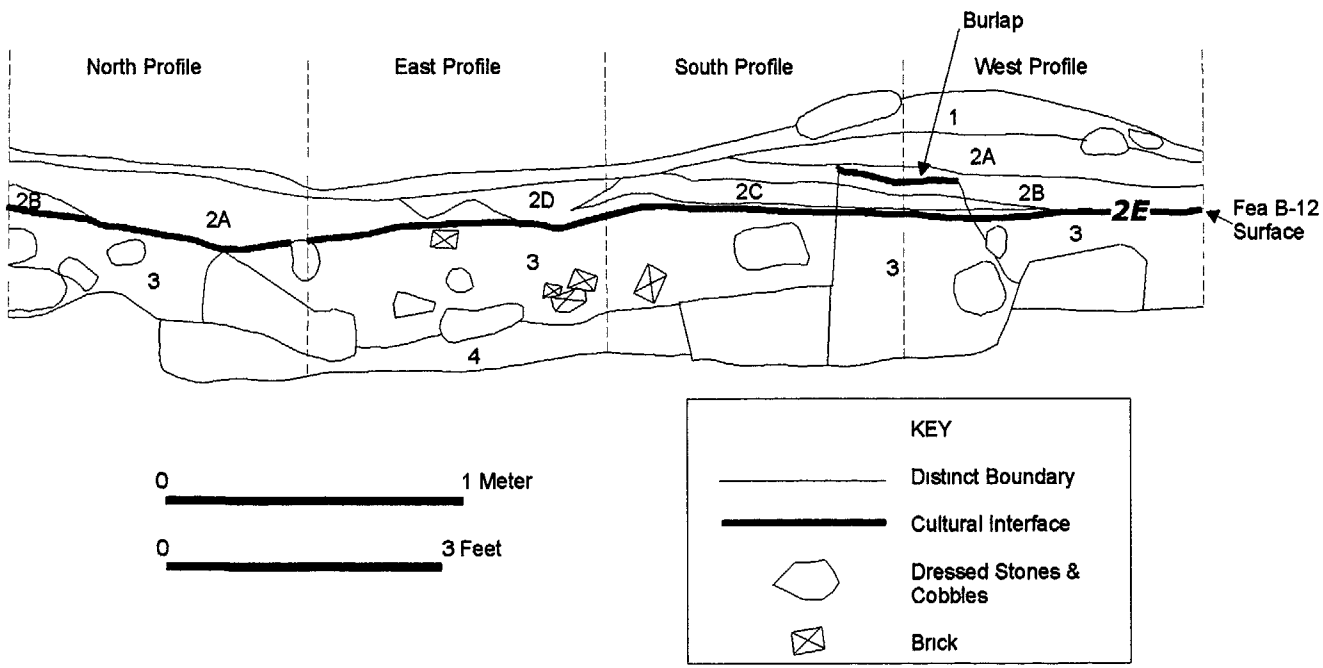
The B-13 ore car track was found during excavations of EU 6 (Figure 4.5-3) and EU 10. Remnants of this feature include portions of four board ties, three small spikes with associated shims, and the rail segment mentioned on the surface of B-12. The board ties are 68x6x1-2 inches. Width between spikes on one tie is 3 ft with a tie-to-tie spacing of 30 inches. Rails were held to the lightweight board ties by a single spike and several metal shims. Most of the rail and many of the spikes have been scavenged. The line appears to terminate at the J-2 wall where it may have dumped incoming tailings or other materials at the top of the mill in Loc J; its point of origin is unknown.

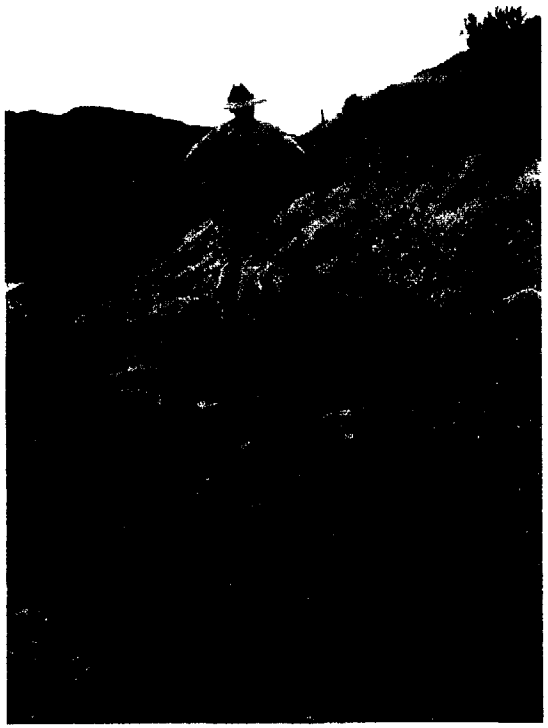
Supporting the B-12 terrace and ore car track are two series of retaining walls, the B-14 wooden retaining wall suspected to be the basal remnant of the original west wall of the furnace house described in the Lyon Mill period. B-14 is illustrated in Figure 4.5-3 and consists of a series of horizontal 2x12 boards affixed to upright posts; the B-14 remnant used to hold the B-12 terrace fill is approximately 5 ft high and 30 ft long. Three feet east of B-14 is a second retaining wall (upper C-1) also illustrated in the aforementioned figure. This wall is comprised of earthen fill over demolished brick wall, topped with a flat-lying 2x12 covered with roughly stacked boulders. This wall extends for approximately 30 ft and is about 1 ft wide and up to 3 ft high. It



West profile of TP 9 (Roll 970-3, fr.18).

Period	Matrix	Description
	1	Post-mill
VI	2A	Peck Mill Use/Demolition
	2B	
	2C	Peck Mill Use
	2D	
	2E	Surface of Fea B-12 Terrace supporting Fea B-13 rail line
	3	Terrace B-12 fill using demolished rock wall(s) and brick
	4	





Fea B-12 terrace overview, view south, note rail segment in foreground (Roll 970-4, fr.7).

Figure 4.5-4. Harris matrix, photographs and stratigraphic profile of TP 9, on the Fea B-12 terrace, during the Peck Mill period, MS004.

Stratigraphic Descriptions:

1 10YR3/3 (dry), 10YR3/2 (moist); sandy loam; massive; non-sticky, non-plastic, dry soft; 10% pebbles to cobbles, root matte, strong organic, no HCl ; abrupt smooth; organic duff, possibly burned, O horizon.

2A 10YR5/3 (dry), 10YR3/3 (most); fine sandy loam to loam; massive; non-sticky, non-plastic, dry slightly hard; roots, rootlets, krotovina, 10% angular pebbles and small cobbles, very slight HCl reaction, pH=7; gradual smooth, discontinuous boundary; possible water lain sandy tails in relatively thick bed.

2B 10YR5/3 (dry), 10YR3/3 (moist); coarse sediment to silt in horizontal beds; massive to single grain; non-sticky, non-plastic, dry soft; 10% small pebbles, roots, krotovina, very slight HCl reaction, pH=7.5; water lain deposits, possible slopewash or tails.

2C 10YR4/4 (dry), 10YR3/4 (moist), mottles of 7.5YR5/4 (dry), 7.5YR4/4 (moist); loam; massive; slightly sticky, slightly plastic, dry hard; small brick fragments, 10% cobbles, strong HCl reaction, pH=7.5; abrupt smooth boundary to Stratum 2D; horizontal beds, possibly in tails or floor fill.

2D 10YR6/4 (dry), 10YR4/4 (moist); silt loam; massive lens; non-sticky, non-plastic, dry hard; roots, krotovina, strong HCl reaction, pH=7.5; abrupt smooth boundary; first fine slimes / tails (2 to 3 cm thick) on a horizontal surface, possibly associated with stone wall to the West.

2E Interface; level surface of Fea B-12 terrace.

3 10YR6/3 (dry), 10YR4/3 (moist), mottles 7.5YR5/3 (dry); gravelly loam; massive; slightly sticky, slightly plastic, dry hard; 30% round cobbles and angular boulders, roots, krotovina, rootlets, bricks, wood, faced boulders, weak to locally strong HCl reaction, pH=7; gradual smooth boundary; episode of early demolition with construction materials in a jumble with some areas of water lain sands on the North wall, terrace Fea B-12 fill.

4 10YR5/3 (dry), 10YR3/3 (moist); gravelly loam; massive; non-sticky, non-plastic, dry slightly hard; roots, krotovina, brick, faced boulders, wood, weak HCl reaction, pH=8; wall demolition, colluvial deposit very little exposed as faced boulders cover most of pit floor, terrace Fea B-12 fill.

Figure 4.5-4. Stratigraphic descriptions for TP 9, Fea B-12 terrace, Peck Mill period, MS004.

seems roughly or quickly built and may have been fabricated as a safety measure as the B-14 wall began to collapse, or it may have been built over the B-14 collapse.

From the turn-of-the-century photograph (Figure 4.1-1), a small possible outdoor furnace and chimney extends over part of the C-2 terrace and wooden bins are visible on the D-1 terrace. Archaeological evidence for either of these uses is limited to partially demolished brick and mortar flooring on C-1 and subsurface timbers that may have formed the foundations for the bins. All of these areas were discussed in detail in the previous Lyon Mill period section.

On the floodplain in the mill yard, a possible segment of standard gauge ties cross a chemical laden tailings area. This L-4 feature was also discussed in the Lyon section, but may have been laid during the Peck or post-mill period of MS004 use. Evidence of Peck period tailings milling in the form of tails without chemical additives may be present in the D-1 area, although tailings related to this very short term use may have been the first ones removed during demolition and modification of the entire MS004 area.

In addition to the exposures made during the current project, a transect was excavated through the mill yard on the east shoulder of River Street as part of the AT&T fiber optic project. Results of this investigation are as follows:

> Archaeological materials were found along the entire 75 ft of trench through the mill area. Debris includes bricks and mortar which were not incorporated in intact structural features. Lenses of charcoal, wood, ash, and of very fine yellow loam to silt loam occur. The yellow lenses match the morphology of sediments in the tailings pond [just north of the mill yard]. The cultural strata are covered by 3-14 inches of light gray compact pebbly loam under asphalt. Profiles drawn of the west side of the trench at the southern and northern ends of the mill yard are quite similar. A 7-24 inch thick dark gray gravelly sandy loam containing scattered artifacts underlies the modern cap. ... The basal layer is decomposing brick and mortar. None of the bricks are in structures, and none are complete. In the south end of the mill yard, this layer is under a thin brown to black lens which probably represents burning [Reno 1989:33].

Artifacts along the trench included architectural materials, ceramics, glass, nails, wood fragments, and cow bone.

At the time of the AT&T project, portions of the mill yard were still fairly intact. A stone foundation and red brick are present in the area of the large wooden building shown at the north end of the yard in Figure 3.1-2. A blacksmith shop was in the building, as indicated by abundant fire brick and slag. Portions of the foundations of other mill yard buildings were also present, but were less substantial, made of river rocks (Reno 1987:35). Unfortunately, subsequent grading of this area has destroyed these building remnants.

4.6 TAILINGS

The large tailings pond associated with the Douglass Mill is prominent in Figure 3.1-2. This pond was trenched along its western edge by the AT&T fiber optic project. The fine-grained yellow tailings were intermixed with a wide variety of artifacts dating from the 1860s to present, suggesting roadside deposition into the tailings area. No detailed analyses of the tailings were made during that project.

Smaller tailings impoundments were located in the mill yard and have been described with regard to the Lyon tailings mill phase. These technicolor slimes appeared to be within wood lined bins suggesting they may have held value with regard to the many ongoing milling processes such as reclamation of iron, quicksilver, copper sulfate, and sulphur, along with gold and silver values.

4.7 CHEMICAL AND SEDIMENT ANALYSES

Out of hundreds of sediment samples taken during fieldwork, a collection of 28 samples (S1-S28) were selected for detailed analysis of a series of elements likely to provide insights into the operation of the various phases of the quartz mill, tailings mill, bluestone plant, and sulphuric acid works. Results are summarized in Table 4.7-1 and spatially located on the plan map for the Lyon Mill period (Figure 4.4-1). Original analysis reports are in Appendix B. To aid comparisons, all results are given in parts per million (ppm). Recovery of precious metals is monitored by silver (Ag) and gold (Au). Addition of chloridizing chemicals, particularly common salt, is monitored by the presence of sodium (Na) and chlorine (Cl). Sulphur (S) is more difficult to interpret, since it is integral to many of the ores as well as forming part of the bluestone additive. Bluestone is largely monitored by presence of copper (Cu), but copper was also a minor element in Comstock ores. To provide a benchmark for interpreting the results from the mill, a composite analysis of Comstock ore (Ore) and another of the Douglass tailings near Sutro (DT) are also provided in the table. Both of these comparative data sets must be used with caution due to the high range of variability both in individual ore bodies and in the various tailings deposits worked through time at the Birdsall Mill and its successors.

In addition to the samples analyzed from specific archaeological contexts, two series by E&E provide insights into the chemical environment of the millsite. The first of these is from soil characterization of the entire area of MS004 for mercury. This is discussed generally but the original data are not included here (available in the EPA site characterization files). The second set is from analyses done in the hot zone. Data from two of the many test pits (samples 18A, 18B, 20A, 20B) are particularly informative and are included in Table 4.7-1. Other samples from this series are reported in the appendix.

Feature-specific results of these chemical analyses have already been discussed above. Some more general results need to be addressed here.

Table 4.7-1. Chemical sample analyses for MS004.

SAMP	*FEA*	*UNIT*	*STR*	*Ag*	*Au*	*Na*	*Cl*	*S*	*Cu*	*Fe*	*Hg*
18A	L-4	P8		104	1.605						200
18B	L-4	P8		53	1.294						210
20A	L-4	P20		150	4.224						3500
20B	L-4	P20		74	1.830						470
DT	NA	NA		96	1.886	0	0	0	1200	0	250
Ore	NA	NA		4971	100.115	2671	0	15000	2400	10000	0
S01	J-5-2	NA		500	11.450	50	16	11000	77000	30000	150
S02	J-5	EU9	6	252	4.680	70	27	3500	4200	29000	240
S03	F-2	TP5	6	59	2.010	71	22	200	1200	20000	460
S04	L-4	NA	5								
S05	C-1/B-14	EU6	6	35	1.162	87	93	8400	49000	23000	80
S06	C-1/B-14	EU6	6	9	0.422	69	85	3700	16000	19000	37
S07	J-4-1	TP2	2	82	0.708	37	18	14000	10000	85000	21
S08	E-5	EU16	7	44	1.320	77	5	14000	260	18000	42
S09	C-2	TR8	5	314	3.375	56	17	27000	29000	12000	290
S10	D-1	TR8	9	339	5.040	0	3	3100	160	9900	390
S11	J-6	NA	1	27	0.812	22	6	26000	2300	49000	120
S12	J-6	NA	2	65	1.922	16	6	14000	2800	32000	88
S13	J-6	NA	3	53	2.028	12	3	4300	3600	20000	110
S14	J-6	NA	4	278	3.622	0	3	4100	1800	19000	40
S15	J-6	NA	5	41	2.440	12	6	22000	1900	47000	29
S16	J-6	NA	6	31	2.128	15	8	7100	1700	48000	40
S17	J-6	NA	7	349	18.547	20	10	6300	4700	18000	130
S18	J-6	NA	8	13	0.450	45	7	3900	2700	21000	33
S19	E-4	TR10	13	262	4.230	240	190	8600	1000	19000	230

All results are in parts per million. Details are in Appendix B

SAMP	*FEA*	*UNIT*	*STR*	*Ag*	*Au*	*Na*	*Cl*	*S*	*Cu*	*Fe*	*Hg*
S20	NA	TP4	12	131	5.020	61	30	4300	790	24000	930
S21	C-2	TP8	3	7073	2.103	57	47	109000	27000	74000	43
S22	I-6	TRC	9	36	1.018	36	24	2700	5000	28000	62
S23	I-6	TRC	12	38	0.951	31	16	8600	12000	80000	50
S24	I-6	TRC	13	58	2.115	26	24	3300	19000	12000	160
S25	I-6	TRC	14	43	2.194	52	36	2400	640	20000	220
S26	I-6	TRC	15	21	0.456	18	7	8700	25000	290000	19
S27	I-6	TRC	16	161	3.229	11	26	9100	17000	12000	86
S28	I-6	TRC	17	490	13.713	27	34	0	300	8400	71

Ore- Composite analysis of Comstock ore (Leaver and Woolf 1928:1)

DT- Douglass Tailings from Leaver and Woolf (1928:3). No values available for Na, Cl, S, or Fe.

S04- Liquid mercury, no further analyis.

18A-20B - Analysis provided by Ecology and Environment

All ARS and 14 EE samples were analyzed for cyanide but none was detected.

All results are in parts per million. Details are in Appendix B

An important question about the history of the mill is whether an undocumented process was introduced in the terminal phase of it use. Analysis of all of our samples from throughout the site and 14 additional E&E samples resulted in no detectable cyanide. Results of these two independent sampling programs suggest the mill may have never made the conversion to a cyanide leaching process. This supposition is complicated by the fact that cyanide breaks down through time at an unknown rate depending on the nature of depositional conditions. It is possible that no cyanide would be detected even if a large amount was originally present in the sediments (Irwin et al. 1997).

Near-surface distributions of mercury throughout MS004 are generally highest in the Douglass tailings area with concentrations of 400 to over 1050 ppm. In the area of the original quartz mill the concentrations are generally around 150 ppm. The part of the hillside where the refinery was located has concentrations from the 70s to 140s. On the River Street terrace the area below the quartz mill has concentrations in the 80s to 160s. The terrace north of the mill has many figures in the hundred range with a maximum of 230. The main area of the hot zone was not available for sampling since a house was on it but in retrospect this area of high subsurface mercury concentrations was accurately predicted by four samples with 549 ppm on the periphery of the high concentration area.

The EPA analyses within the hot zone are important since we did not wish to complicate our own sampling program with collection, analysis, and subsequent safe disposal of materials including liquid mercury. One question in this area was whether the liquid mercury was the result of a simple reagent spill. Presence of significant gold and silver values in the samples eliminates that possibility. A second question is whether the partly amalgamated mercury in this area is the result of a single metallurgical process. This would yield fairly consistent ratios of mercury to both gold and silver throughout the deposit. The ratios are presented in Table 4.7-2.

Table 4.7-2. Ratios of Mercury to Gold and Silver at the Area of High Mercury Concentration at MS004.

Location and Sample	Mercury/Gold Ratio	Mercury/Silver Ratio
0-1.5 ft Below Surface		
18A	124.6/1	1.9/1
20A	828.6/1	23.3/1
1.5-3 ft Below Surface		
18B	162.3/1	4.0/1
20B	256.8/1	6.4/1
AVERAGE	343.1/1	8.9/1

Based on sample data provided by E&E (Appendix B).

No statistical manipulation is needed to demonstrate that these ratios are highly variable both between the two test pits and between levels in the pits. Therefore it is reasonable to infer that numerous metallurgical episodes contributed to the complex chemistry of this area, a notion in accord with archaeological findings of numerous launders and ponded deposits in this area, creating a microstratigraphy far beyond the scope of this project to sort out on an individual basis. However, it should also be noted that varying soil properties such as temperature, depth, and permeability are also likely to cause variation in the ratios.

The values of gold and silver in the hot zone, which contains tailings not yet sent out of the mill area, indicate the millers may have been unwilling to send them out of the mill just yet. The extensive thickness of tailings deposits in this area indicates that they were not random spills of material in transit, but were deliberate impoundments of tailings. The average values of silver at 95.2 ppm and of gold at 2.2 ppm are nearly the same as those of tailings ore coming *into* the mill from the Douglass tailings impoundment. If this is the best this mill could do, it certainly highlights the metallurgical problem of treating those tailings with the techniques available in the late nineteenth century.

4.8 DAYTON, CARSON VALLEY & SUTRO RAILROAD

This narrow-gauge short line railroad had its origins in 1869 as a horse-drawn railroad from Gold Canyon to the Birdsall Mill. In 1881 this was upgraded to utilize a small steam locomotive. The line ran along River Street to access the lower level of the mill, where the engine house was located, and also had spurs to various upper levels at the mill. The railroad intermittently served to transport tailings from as far away as Sutro for reprocessing until 1897 (LCT July 6, 1895, April 3, 1897; Myrick 1962:210-212).

The final repair of the line to Sutro was done in April 1897 as part of Peck's lease of the mill (LCT 3 April 1897). Part of this work was described in detail by the newspaper:

> Last Saturday the little locomotive, "Joe Douglass" was run out of the house and steamed up and down the road between this place and Sutro. She is being used to haul ties, gravel, etc., in the reconstruction of the narrow gauge road over which the tailings will be hauled from the reservoir to the mill. A gang of fifteen men is employed in making repairs to the road, and it makes times look quite lively about our little town. [LCT 10 April 1897]

Part of the rebuilding included moving the old scales, formerly located in front of the Douglass corral, onto the railroad to weigh tailings (LCT 1 May 1897). The locomotive was in operation at least through October 1897. The only ore hauled during most of this period was on the short run from the Rock Point Mill tailings (LCT 24,31 July 1897). A short spur was built

into these tailings that was removed late in October when the tailings source was exhausted (LCT 30 October 1897).

The railroad started hauling 200 tons of Douglass tailings daily starting on October 4, 1897. The paper reported "It keeps the little engine hustling to keep the tailings bins full in the mill (LCT 9 October 1897). This operation did not last beyond the month as the Peck operation shut down for good.

The death knell for the little railroad was in May 1900 when switches, ore cars, and rails started to be stripped from the line and shipped to San Francisco as scrap (LCT 12 May 1900).

The locomotive *Joe Douglass* is presently on display at the Northern Nevada Railroad Museum in Carson City.

At the start of work at MS004 the intention was to produce a site form for the entire railroad based on historic sources, incorporating archaeological information from the project area. Unfortunately, other than two railroad spikes found on the hillside, no other artifacts and no features directly related to the railroad were found and for that reason, the site form was not produced.

4.10 SUMMARY

The mill either suffered or benefitted from a complex interplay of influences during its long career.

There were no surprises in the form or operation of the original Birdsall and Carpenter Quartz Mill. This is partly due to a lack of archaeological information for this area, an avenue of inquiry most likely to bring to light inconsistencies between surviving documentation and how things actually operated at a mill.

The main process used at the Lyon Tailings Mill, although document-based, is of interest as a local example of how the Ziervogel process was applied successfully in a tailings environment. Archaeological evidence comes into play here to indicate that while the overall strategy and physical plant was probably described accurately, details in actual construction and modification through time were important features of this operation. Only a partial understanding of the refinery, bluestone, and sulphuric acid areas has been obtained due to project constraints, but it has been amply demonstrated that if the opportunity arises there is abundant archaeological evidence about these processes waiting to be uncovered and analyzed at the mill site.

Extravagant waste indulged in by early Comstock miners has been glorified by Mark Twain, Dan De Quille, and even Eliot Lord (1883:125), who noted "It is evident that economy was not a popular study with the managers of a prosperous mine on the Comstock Lode in the

early years of its development at least." Operations at the Lyon Mill in particular provide a significant counterexample to this image. An important psychological aspect of the Lyon operation is the thorough emphasis on thrift and efficiency. This mill presents a rare situation where an important person at the mill describes his own feelings on this subject, and where it was shown that such thriftiness can have clear archaeological implications. Extensive use of recycled materials was identified in the archaeological record before Hodge's account was available for analysis. Its focus on a waste product of earlier milling set the tone for the operation with its emphasis on unusually careful metallurgy for the time and maximum recycling of materials, including producing its own copper-based paint from tailings of its bluestone works. Throughout most of its operation, until the introduction of electricity in the 1890s, the plant depended on cheap water power, rather than on the massively impressive steam plants used by many other mills.

Chemical analysis was important for judging the use put to various parts of the mill. The most intriguing aspect of this particular analysis was that it was possible to derive the implications of multiple processes used through time and in different parts of the mill to determine what features may have been used at various times. For example, the acidic sediments encountered at the site clearly indicated neither classic Washoe nor cyanide process residues were under consideration, since both of these processes operate in a mildly basic chemical environment. Quantities of highly oxidized iron (so concentrated that a magnet would stick to a pit wall) are certain indications here of residues of a form of copper precipitation from a sulphuric acid solution. Sediments so highly enriched in copper sulphate that they are blue in color are indications of copper enrichment far beyond that seen at a Washoe Process mill, where the bluestone was used in quantities that are detectable by chemical analysis but only visible on a very limited scale. The sediments at the Lyon Tailings Mill were literally saturated with copper sulphate solutions to the extent that the refinery area looks much more like a copper mill than a gold and silver operation. Presence of enhanced lead and zinc values are also indications of additives. Zinc was used to precipitate copper while lead was used extensively to protect machinery from sulphuric acid. The production and use of sulphuric acid is revealed not only by acidic sediments, but by concentrations of sulphur and sulphur compounds in the sediments.

Introduction of Dr. Rae's system of electrolysis represents two different threads. Use of the dynamo to power individual machines is an advance that would become the norm in most twentieth century mills, leading to major changes in how mills were arranged. The actual process taking place in the tanks is murkier. It is important to note that electricity was very new and was being used experimentally for all kinds of purposes. At the time of this experiment late in the history of the Lyon Mill, the Mining and Scientific Press reported on an entire conference devoted to the subject. Many of the presentations were visionary to say the least. On a more local scale, there was even an advertisement in the local paper for "Electric Bitters" that probably satisfied its clients as well as Dr. Rae.

Experimentation in electrolysis for processing Comstock ore was not limited to this mill. Rae's process was used with reported success at the California Mill in Virginia City (De Quille

1889:80). A similar method was tried later at the Butters cyanide plant to precipitate gold out of solution; this method failed thoroughly (Young 1913:342).

The Peck process was sufficiently novel that George H. Robinson, an experienced miller representing an English syndicate visited the plant to study its possibilities (LCT 17 July 1897). The Peck process appears to have been centered on gravity separation in a Peck Concentrator. The process was a simple one that yielded concentrates for final smelting elsewhere. The production of sulphuret concentrates indicates a lack of chloridizing pretreatment. The experiment is an anomaly at the time, since all of the other mills in the area turned to variations of cyanide leaching of low grade ores and tailings. The failure of the concentration system almost smacks of being a premeditated scam, since so much of the work was done on credit and because the process depended so throughly on a single "magic bullet" – the concentrating machine itself. Unlike introduction of a full process like cyanide leaching, this meant that very little had to be changed in the mill so a larger portion of the monies borrowed to upgrade the mill could be pocketed rather than expended on capital improvements.

Chemical analyses were also critical for identifying post-tailings mill operations. In this case, since mechanical classification appears to have been used, presence of sediments that have not been chemically enriched and that are in a stratigraphic position over the enriched Lyon sediments are clearly from that late and ephemeral phase of mill use.

In view of the flood history of the Carson River, it is apparent that long-term success lay in getting the main mill complex off the floodplain and bringing the water to the mill by means of a fairly long ditch. This approach was used by both the Birdsall Mill and the Rock Point Mill, both of the long-term milling facilities in Dayton.

A major focus on tailings in the Dayton mills from an early date was an ingenious solution to a serious transportation problem. Most of the better Comstock ores were transported to mills near the V&TRR. Only expensive wagon transportation existed to get ores to Dayton during the boom years of the nineteenth century. By the time a rail link was established, the lode had already gone into decline; however, the tailings had been transported by water as a slurry to reservoirs fairly close to Dayton. Collecting and reprocessing these materials focused on an economic niche that was not aggressively sought by the Bank Crowd and could be done with small transportation costs. Also, since there was already a large accumulation of these tailings, work could be done on a long-term basis without the periodic shutdowns common for mills depending on the vagaries of new discoveries in the mines. Focusing on tailings represented a sound and ingenious decision to attempt to turn an unpredictable mining industry with a boom mentality into a safer strategy aimed at a dependable but lower long-term income.

Birdsall's Lyon Mill operation during its heyday as a tailings plant is a splendid example of vertical industrial integration. He and the other owners gained control of most of their required resources, including ore, power, water, transportation, and marketing, while reducing costs by

production and sale of important reagents and byproducts – in this case bluestone and sulphuric acid.

The presence of an intact mill at this site may have proved a detriment for the conversion to the cyanide process at the end of the nineteenth century. Probably the best course would have been to tear it down and start over. Instead, the owner was afflicted by an unexpected cultural event. The Peck brothers came to town and expended major credit and resources on an unsuccessful technique cobbled into the existing plant. In retrospect, it was perhaps fortunate for the other large mill in Dayton, the Nevada Reduction Works, that their old plant (Rock Point Mill) burned down, clearing the way for restructuring as a cyanide-based operation as it continued into the new century.

Metallurgical milling is an area where individual expertise played a remarkably important role in the success or failure associated with any operation. Regarding the application of the Ziervogel Process in general, Eissler (1901:280) notes:

> Simple as this process may appear, it is very difficult to carry out practically, as it requires a very skillful manipulator to seize the exact moment when all the sulphates of the other metals are decomposed and none of the silver is.

This difficulty may explain part of Hodges' obvious pride in successfully using it at the Lyon Mill.

Archaeological and documentary studies at MS004 have provided a sound overall picture of the entire mill complex. This portion of the mill environment is presently in three distinct classes. The mill itself was almost entirely destroyed before the onset of this project. Although archaeological deposits from this mill are still buried on the site, these are sufficiently partial that they do not really warrant consideration for future work. The central area of the mill complex is primarily occupied by the Lyon Mill refinery. This has been extensively documented and analyzed here from an archaeological perspective and subsequently has been mostly demolished by project-related excavation and slope re-contouring. The northern part of the complex clearly retains extensive intact archaeological remains of the highly significant sulphuric acid and bluestone works. These have been recorded surficially as part of this project but since project-related effects did not extend into this area the subsurface data potential there remains untapped.

5.0 SILVER CITY MINES, MILLS, AND COMMUNITY

by Ronald L. Reno, Vickie L. Clay, and C. Lynn Furnis

The project area at MS030 is located on the outskirts of the town of Silver City (Figure 1.1-4. Silver City has a mining-related history nearly as old as Dayton, with a shared background in early placer mining and later importance as a transportation and milling center for the Comstock. Unlike Dayton, Silver City also has been worked for lode minerals nearly as long as the main Comstock mines in Gold Hill and Virginia City. Lacking bonanza level discoveries, the mineralization in and near Silver City has made it possible to conduct long-term small-scale operations. All of these endeavors have resulted in a continuously occupied town that retains at least some of its mining heritage and active miners right to the present. Particularly since the 1960s, the town has largely changed to a residential community attracted to the setting of old mining but adverse to the possibility of a resurgence of mining operations at much larger modern scales in the vicinity.

5.1 SILVER CITY: A COMMUNITY BASED ON MINES, MILLS, AND TRANSPORTATION

In the early 1850s, the area that would become Silver City was part of the extensive territory meticulously worked for placer gold by miners based mainly in Chinatown (later Dayton) and Johntown, both located farther down Gold Canyon. The vicinity of Silver City is likely where the Grosh brothers made an abortive effort to mine lode silver, but lode mining and exploration did not start in any significant way until the 1859 discovery of the Comstock Lode in what would later be Gold Hill. This discovery quickly led to mineral exploration of the surrounding area, including Silver City, for lode outcrops. These were rapidly identified in the Silver City area. Time was to show that the Silver City lodes were along an offshoot of the main Comstock Lode fault system, and that, ironically the values from this area consistently were higher in gold than silver. A community immediately began to form in Silver City due to this mineralization, and to its location about halfway up Gold Canyon between Dayton and Virginia City, because its location at the major confluence of Gold Canyon and American Canyon, and finally, the presence of sufficient water for at least moderate-scale milling operations.

By the mid-1860s Silver City had developed into a town with the same layout that still remains today as shown on the GLO township plat surveyed from 1865 to 1867 (Figure 5.1-1). The area is not congenial to easy town platting. The buildings are arrayed along the top and sides of a bedrock ridge running from northwest to southeast. The floor of Gold Canyon was devoted primarily to a series of mills, leaving the residences for over 1,000 people on the hillsides (Paher 1970:69). Charles Collins (1865) provides a vivid description of the place:

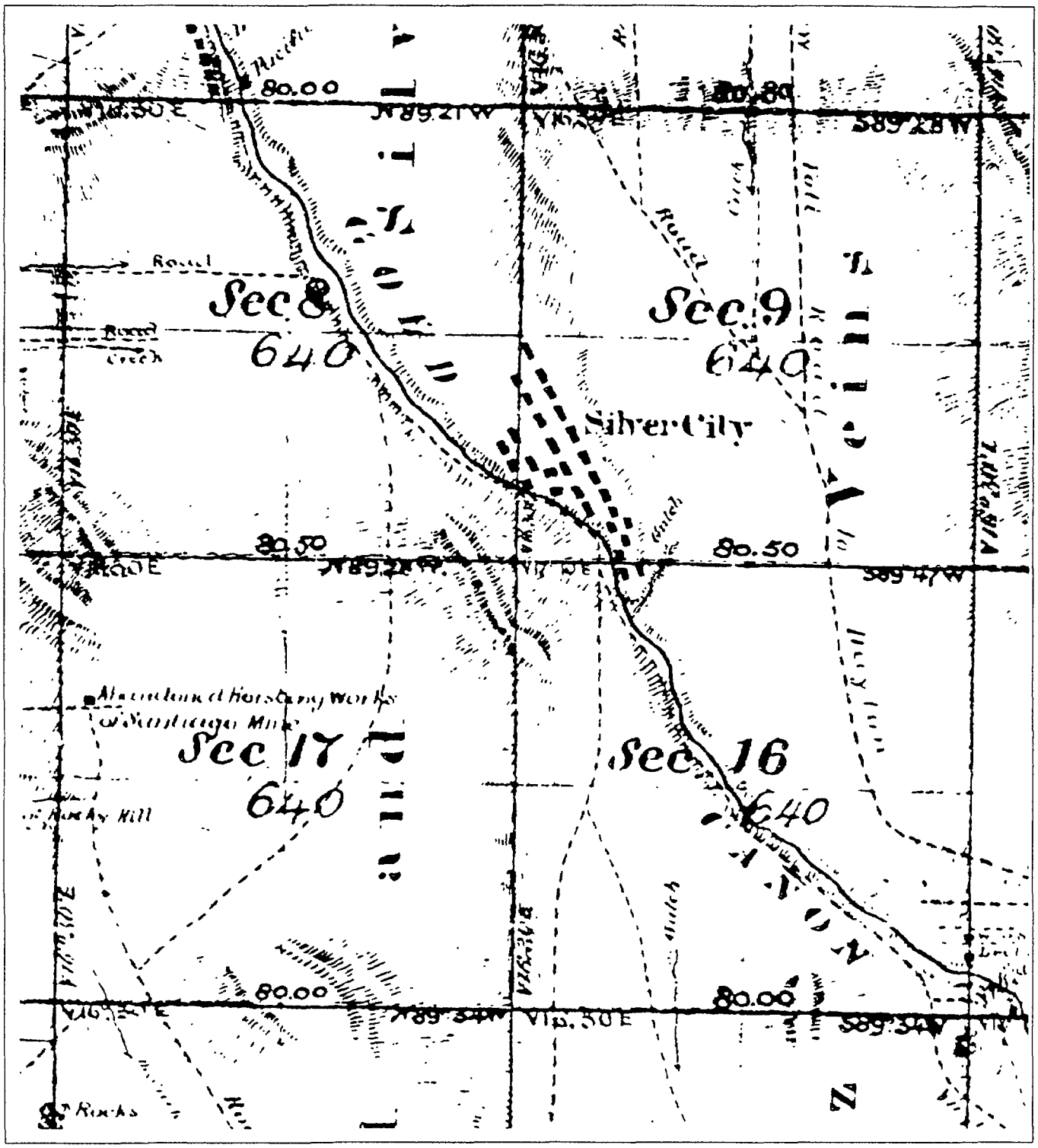


Figure 5.1-1. GLO township survey plat of Silver City, mapped in 1865-1867.

> Silver City, Lyon County, is situated about half way between Virginia City and Dayton. All of the stages running between Virginia and California, over the Placerville Route, pass through here, as well as a large proportion of the travel of the Territory. Silver City relies exclusively on the mining interests of the surrounding country for support. Some of the finest mills in the Territory, as well as the richest lodes, lay encompassed within her limits. The past year has been particularly noted for the number of private residences that have been erected and are now in course of completion. The citizens display a refined taste, as well as a confidence in the resources of the country, by the numerous gardens and other external and substantial improvements that they are constantly making. Almost every private residence is adorned by numerous trees planted around their dwellings, which has the effect of making favorable impressions on every one that either passes through or takes up a residence within its limits. Silver City is fully represented by societies, organizations and social institutions; which for numbers and unity, would be creditable to the reputation of larger cities. Having an abundance of granite and other building material contiguous to the city, the citizens have erected several blocks of buildings composed of the above material, which render them fire proof, and are substantial indications to the observing traveler, of the permanent growth and prosperity of the City.

At that time, there was only a Presbyterian church, but other denominations planned constructing churches. Education in the town was on a private basis. Masonic and Odd Fellows lodges were present, as was a militia called the Silver City Guard. Dominant in all of the directories is a long list of 15 quartz mills. Of these, the one of the most historic significance is Almarin Paul's Pioneer or Devils Gate Quartz Mill where the Washoe Pan Process was initially developed. Unfortunately, unless it is buried by fill in the vicinity of the modern state historic marker, none of this mill remains today.

Silver City was the principal town in Lyon County during the 1870s (Langley 1873). The extent of the associated town buildings, mills, and mining claims are shown on the first accurate topographic map of the area, done by the Wheeler Survey in 1877 (Figure 5.1-2).

Like the rest of the Comstock, Silver City dwindled in the 1880s to 1890s. Particularly hard hit were the milling and teaming interests. Small-scale milling and subsistence-level mining continued throughout the entire history of the district, however. A vivid description of subsistence mining in Silver City is provided by Dan DeQuille (1889:101-102):

> About the town are an immense number of small veins of gold-bearing quartz that pay from the surface down. Nearly every head of a family in the town has his own mine, and when he wants money he shoulders his pick, goes out to his mine, and digs it, as a farmer in the East digs a "mess" of potatoes. ... The people have

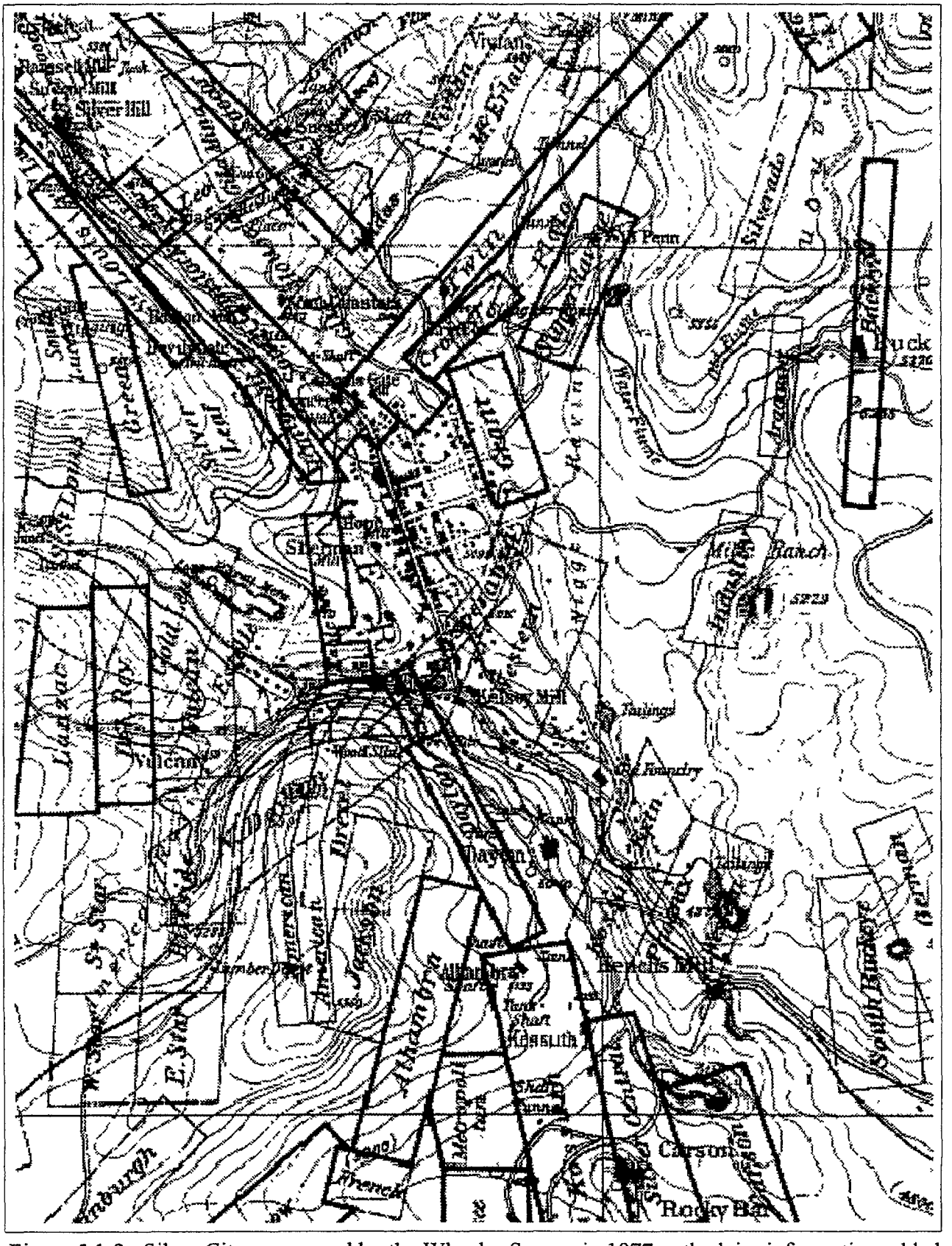


Figure 5.1-2. Silver City as mapped by the Wheeler Survey in 1877 with claim information added in 1881 (Lord 1883).

lived off their home mines for thirty years, and constitute the most thoroughly independent mining community to be found in Nevada.

Small-scale mining continued to the extent that, aside from times of booms elsewhere in the state, Silver City was one of the main producers of gold and silver, with rising production in the 1930s before the precious metals industry was put on hold by the second world war (Gianella 1936:9; Smith 1932:10). This was accomplished with the aid of power equipment, open pit techniques, and efficient cyanide mills. It did not increase the population, which was only 67 in the 1930 federal census.

5.2 DOCUMENTED ACTIVITIES NEAR MS030

The study area comprises a small terrace adjacent to a fork where the road from Silver City to the Silver City Spur on the Virginia and Truckee Railroad departs from the road up American Ravine to American Flat. This area is off the main transportation corridor that ran along Gold Canyon. The main part of Silver City has been photographed many times, but the side canyon leading up to American Flat does not appear to have been photographed a single time.

In addition to being along one of the routes from Silver City to its hinterland, connecting ultimately with American Flat and Carson City, American Ravine was the scene of early Comstock placer mining in the 1850s. The parcel is about midway between the Bacon and Trench Millsite (downstream), the Silver City Mill (upstream on the American Flat Road), and the Union Mill (upstream on the American Ravine Road). Due to recent blading, tailings are visible in the study area. These tailings could be from either of the upstream mills.

The Trench Mill (Sparrow, Trench & Co.'s Mill, French Mill) was a stamp and pan mill built in 1861 that stood until at least 1904 (Browne 1868:352; SAIC 1993[2]:69-71). The Silver City Mill (Lambert's Mill) was a small steam-powered stamp mill constructed in 1861. The mill stood at least until 1864 but is not shown on an 1874 map of Silver City (SAIC 1993[2]77,84). The Union Mill was built in 1861 and is shown on an 1874 map of Silver City (SAIC 1993[2]:83-84). All of the Silver City mills were plagued by a lack of adequate water from the seasonal streams in American Ravine and Gold Canyon while the Carson River mills were in danger from seasonal flooding. Almarin Paul's Devil's Gate Mill relied on a well for much of its water and the Bacon Mill dug a 30 ft deep shaft and started drifting east in a successful search for additional water (MSP 1867 15:55, 103).

As shown by the 1874 Ross E. Browne townsite map of Silver City, the bottom of American Ravine was lined by a scatter of small houses, much as it is today (Figure 5.2-1). In addition to the probability of roadside trash deposition, there is a likelihood of extensive domestic trash deposition from these residences.

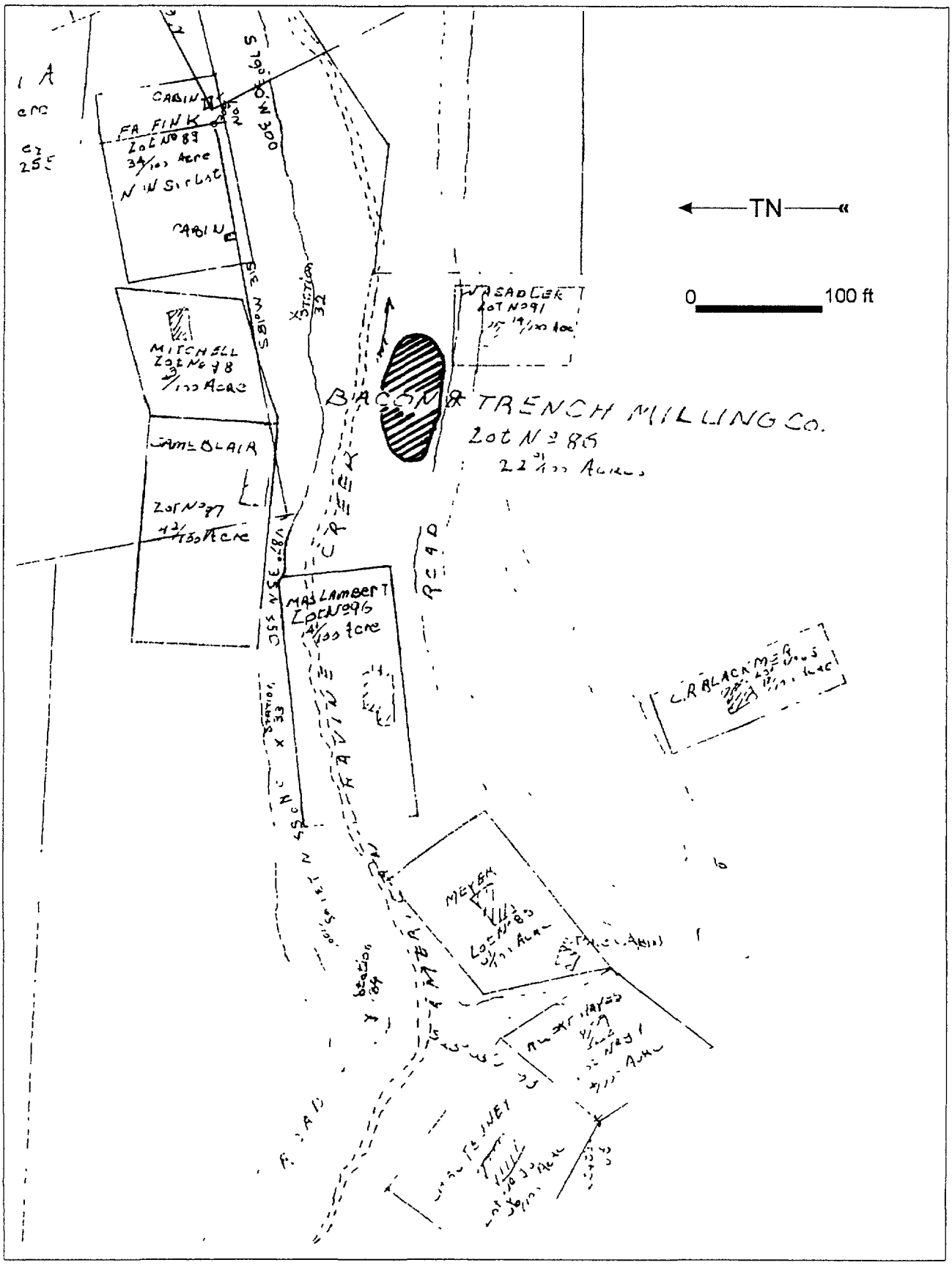


Figure 5.2-1. Portion of Silver City in American Ravine as mapped by Ross E. Browne in 1874.

The Silver City Spur of the V&TRR was constructed in about1873 (Myrick 1962:157). The spur was dismantled in 1880 (James 1998:239). This spur, which connected Silver City with the main line to the west, was a peculiar one. Due to the great difference in height between the main line and the bottom of Gold Canyon where Silver City was built, the spur did not descend to the level of the town. Instead it contoured along the north slopes of Grizzly Hill and ended there. Materials used at the mills, particularly ore and cordwood, were slid down to the floor of Gold Canyon and American Ravine by the means of an array of wooden flumes. Most of the flumes terminated in the vicinity of the confluence of these two ravines near the Trench Mill. Two of these flumes are shown terminating near MS030 on Wheeler's 1876-77 map of the Comstock. On the revised version of this map in Lord (1883), ore versus wood slides are differentiated. One of the flumes terminating by MS030 is identified as a "Wood Slide" on this map (Figure 5.1-2).

5.3 ARCHAEOLOGICAL REMAINS AT MS030

At the time of the initial visit in April 1996, the site was covered by big sagebrush and exhibited several possible pit or trench features. Secondary dump debris including domestic, milling, and architectural debris was noted. Since that visit the surface has been bladed to a depth of up to several inches, revealing thousands of artifacts (Figure 5.3-1). Mill-related artifacts were clearly not in original locations, mixed up among domestic debris. While a few nineteenth century artifacts were noted, including wine and ale/stout bottle fragments and cut nails, by far the majority of the artifacts were from the 1940s, continuing into the early 1950s. Mill tailings and mine waste rock were exposed as was additional fill material confirming that most if not all of the terrace was of human construction.

Observations during monitoring of the remediation excavations revealed a somewhat more complex set of stratigraphy at this location than indicated by the surface evidence (Figures 5.3-2 and 5.3-3). These observations related to placer mining, milling, transportation and materials storage, and the trash dump.

PLACER MINING

The lowermost cultural stratum (Str 4) exposed and partially removed during remediation of this area consisted of a deposit of rounded cobbles and boulders overlying bedrock in the drainage base (Figures 5.3-2 and 5.3-3). We interpret these size-sorted deposits as evidence of the earliest placer mining along American Ravine, likely occurring in concert with other early Comstock placering activity during the 1850s. Due to the small size of the exposure, it was not possible to determine the spatial arrangement of these placer tailings.

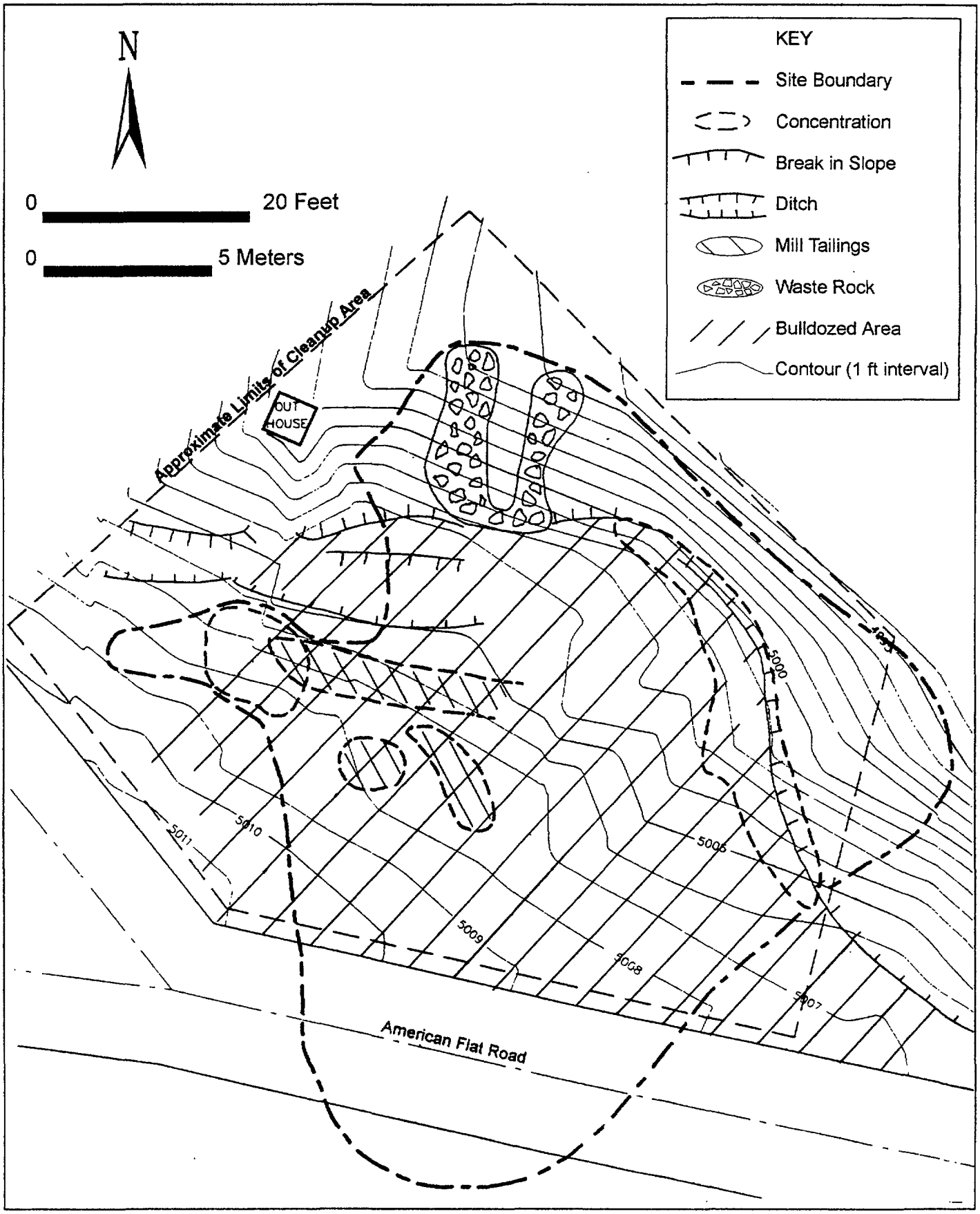


Figure 5.3-1. Surface site map of Silver City site MS030.

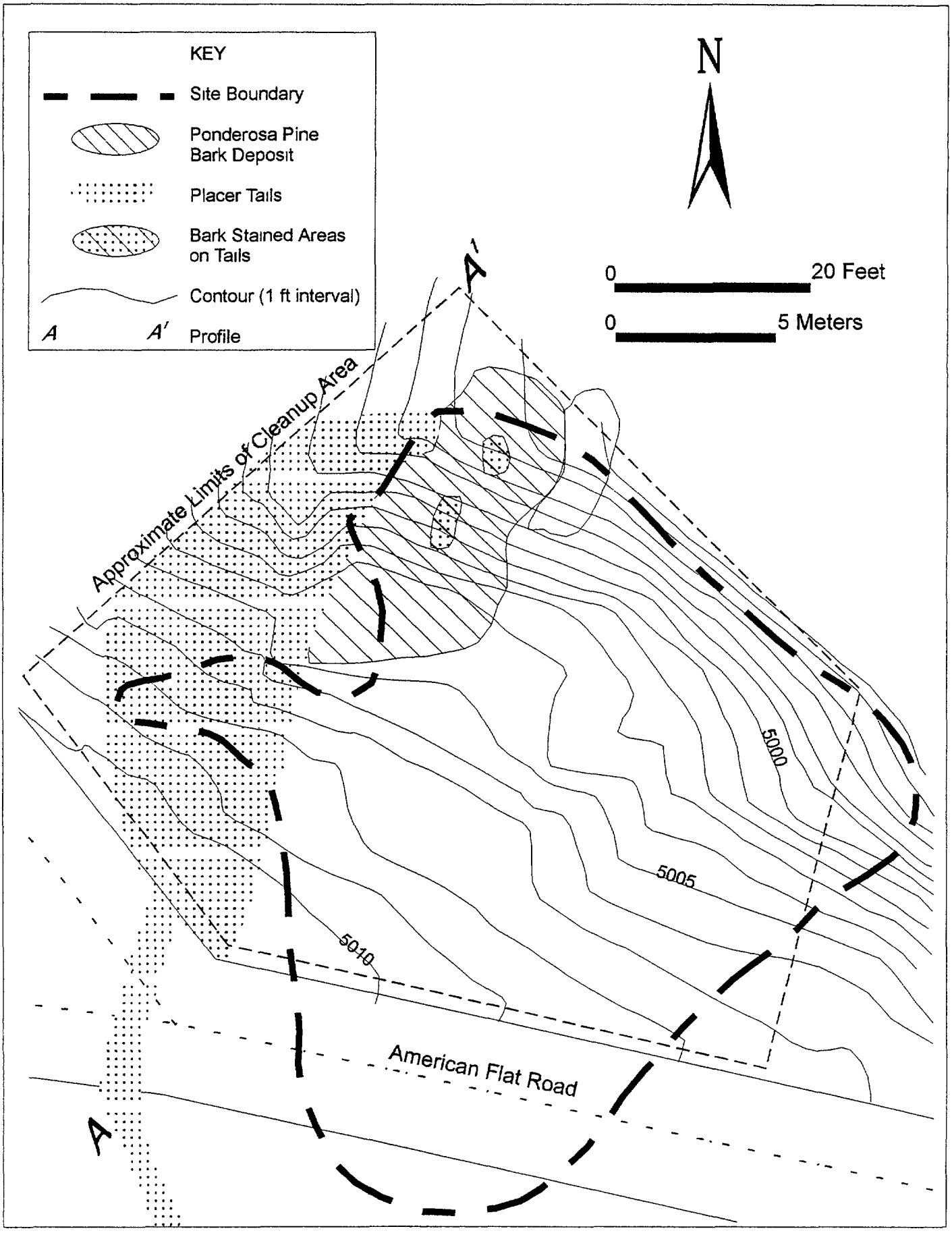
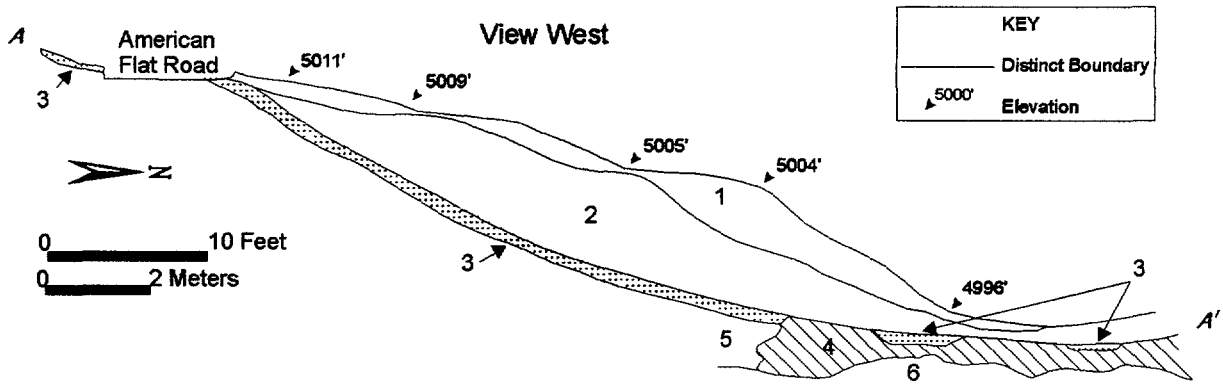


Figure 5 3-2 Subsurface deposits and cross-section location at Silver City site MS030.



General Stratigraphic Descriptions:

1 Mixed age trash deposit, covers much of site surface, up to 2 m deep in places.
2 10YR6/4 light yellowish brown (dry); silty clay loam; massive; slightly sticky, slightly plastic, dry slightly hard; common roots, krotovina; abrupt smooth boundary; tailings deposit.
3 10YR2/1 black to brown (dry); organic-rich loam; massive; non-sticky, non-plastic, dry soft; common log fragments and most common bark fragments from Ponderosa pine, some appears burned, most rotted, 15 cm thick; abrupt smooth boundary; historic wood storage area.
4 Cobbly to bouldery alluvium; massive deposit above bedrock; placer tails.
5 Colluvial slope deposit; angular cobbles in loam to clay loam; boundary unknown.
6 Local bedrock in drainage base.

Period	Matrix	Description
1860-1960s	1	Mixed Historic Trash
1861-1874	2	Mill Tailings: Silver City Mill 1861-1864; Union Mill 1861-1874
1873-1880	3	Wood Storage, V&T RR Silver City Spur
1850s	4	Placer Mining
	5	Colluvial Slope
	6	Bedrock

Figure 5.3-3. Stratigraphic profile, Harris matrix, and photograph at Silver City site MS030.

MILLING

Yellowish brown silt loams (Str 2) comprise a 2-3 m thick deposit that forms the upstream half of the site terrace while dark brown fill deposits comprise the downstream portion. The silt loam appears to be fine mill tailings likely originating at one of the two upstream mills, the Silver City and the Union, operating between ca. 1861 and 1874. It was unclear whether these tailings were in place or redeposited from their original location. Some hint of a ditch exposed on the terrace surface (see Figure 5.3-1) may provide the source for this tailings deposit. Bedding planes of these water lain deposits generally followed the sloping hill surface they covered.

Wooden tank remains on the surface of the site originated at one of the local mills, but it is clear that they had been removed from their original locations. These tanks are simply part of the mixed debris scatter rather than part of an intact mill feature system.

TRANSPORTATION AND MATERIALS STORAGE

The layer of pine bark and decayed log fragments (Str 3) at the base of the mill tailings and in a narrow path south of American Flat Road suggest that logs or unmilled cord wood with bark may have been flumed down from the V&TRR Silver City Spur to this location prior to the deposition of the silt tailings. If this is the origin of the bark layer, it dates to the period from 1873 to 1880 when the spur was in use. The bark deposit is up to 0.5 m deep in areas and covers a 15 m N-S by over 5 m E-W area. Lack of a mill in this part of the canyon would have made it an excellent place for storing large quantities of cordwood. Most of the rest of the lower end of American Ravine and the portion of Gold Canyon in Silver City were so heavily built up that space was in short supply for such purposes.

DUMP by C. Lynn Furnis

The surface was covered in mixed age debris (Str 1), 1-2 m thick on the edge of the terrace and much thinner on top. Numerous wagon or truck loads of debris had been disposed of in this location of the ravine atop tailings and adjacent a major thoroughfare for some time. Artifacts included those commonly found in community dumps and may represent debris from local businesses such as bars or restaurants as well as from local households.

All of the artifacts recorded at MS030 were part of Str 1. Those with marks were recorded in greater detail than others, though all items were literally field-recorded between bulldozer sweeps on the site. Artifacts were not collected. The observed artifacts are listed in Table 5.3-1, and organized according to functional groupings.

The date ranges from Str 1 artifacts as described above indicate that the site was an active dump during the 1940s and 1950s. The recorded, marked artifacts comprise only a small part of

Table 5.3-1. Artifacts Observed at MS030.

Artifact Group	Artifact Type	Description
Architectural Artifacts	Cut nails	a few
	Faced stone	2x2 ft
Domestic Artifacts	Ceramic tiles	
	Bed springs	
	Candy dish	green glass
	3 bleach bottles	cylindrical brown glass: MG [ligature]\PUREX/DES.PAT.APP. FOR 1682 on base, screw cap, dates from ca. 1958 (Toulouse 1971:357)
		cylindrical brown glass: 17 [illus. diamond and oval with "I"]\13\E1596 on base, Owens-Illinois Glass Company mark, dates from 1930 to ca. 1956 (Giarde 1980:80, 89-90)
		cylindrical brown glass: [illus. diamond and oval with "I"]\E1996 on base, dates from 1929 to 1956 (Giarde 1980:77, 80)
Food-Related Artifacts	Alcoholic beverage containers	cylindrical green glass bottle: SANDERSON & SON LTD\ WM LEITH SCOTLAND on body, WM. SANDERSON\6 269\ ... EITH ... on base
		colorless glass, pint size bottle: Sunny Brook Brand on paper label; Federal Law Forbids Resale or REUSE OF THIS BOTTLE on body; NATIONAL DISTILLERS [in oval]\D-1\54 50\[illus diamond and oval with "I"] on base, dates to 1950 (Giarde 1980)
		colorless glass, oval 8-ounce bottle: NATIONAL DISTILLERS [in oval]\D-1\54 50\[illus diamond and oval with "I"]\HALF PINT on base, dates to 1950 (Giarde 1980)
		brown glass oval whiskey flask: D913\66-46\[illus diamond and oval with "I"] on base, dates to 1946 (Giarde 1980:77)
		brown glass bottles (2): Federal Law Forbids Resale or Reuse of this Bottle on body; VAT 69\SCOTCH WHISKEY 2 on base, dates from 1933 to 1964 (Munsey 1970:126)
		colorless cylindrical glass bottle: 4/5 Quart on body; LP [within keystone]\390 on base, Knox Glass Bottle Company mark or Pennsylvania Bottle Company mark, dates from 1940 to 1952 (Giarde 1980:62; Toulouse 1971:333-334)
		colorless cylindrical glass bottle: 4/5 Quart on body; LM [within oval]\668 on base, Latchford-Marble Glass Company mark, dates from 1939 to 1957 (Toulouse 1971:332)
		green glass cylindrical bottle with kick-up base (wine)
	Milk containers	colorless glass milk bottle: Windmill Dairy\Minden on base

Table 5.3-1. Artifacts Observed at MS030.

Artifact Group	Artifact Type	Description
Food-Related Artifacts	Condiment containers	colorless glass, faceted catsup bottle: Duraglas[in script]\20 [illus diamond and oval with "I"] 5\6B\4064-E on base, dates from 1945-1955 (Giarde 1980:77, 95)
		colorless glass catsup bottle: 7354\HA\D 25 on base, Hazel Atlas mark that dates from 1920 to 1964 (Toulouse 1971:239)
		colorless glass mayonnaise jar: 209\NW\4 on base, Northwestern Glass Company mark, dates from 1931 to at least 1971 (Toulouse 1971:390)
		colorless glass mayonnaise jar: M805\LM on base, dates from 1939 to 1957 (Toulouse 1971:332)
		colorless glass cylindrical steak sauce bottle: 4[illus. diamond and oval with "I"] 4\Duraglas [in script]\9 on base, dates between 1944 and 1954 (Giarde 1980:77)
		colorless glass olive bottle: 20 [illus. diamond and oval with "I"] 6\3795-C on base, dates between 1946 and 1956 (Giarde 1980:77, 95)
		colorless glass cylindrical vinegar bottle: EJ802\9[illus. diamond and oval with "I"]51 on base, dates to 1951 (Giarde 1980:80)
	Fruit containers	colorless glass fruit jar: AHK[within rectangle]\639[within rectangle] on base, Alexander H. Kerr & Co. mark, dates from 1944 to at least 1971 (Toulouse 1971:44)
	Miscellaneous glass food containers	colorless glass cylindrical bottle with textured base: A[within circle]\50-28\2 on base, has externally-threaded finish, 8 oz size, American Glass Works mark, dates from 1908 to 1935 (Toulouse 1971:22-23)
		green glass square bottle: 205\3[illus diamond and oval with "I"]6\16\Duraglas [script] on base, dates between 1946 and 1956 (Giarde 1980:77)
		colorless glass cylindrical bottle: GC[intertwined] 3\3516 on base, Glass Containers Inc. mark, dates from 1945 to at least 1971 (Toulouse 1971:220-221)
		glass cylindrical bottle: Duraglas[script]\4[diamond and oval with "I"]6\14 on base, dates to 1946 or 1956 (Giarde 1980:77, 80)
		colorless glass cylindrical bottle: 20[diamond and oval with "I"]5\7-B\4064ZE on base, dates to 1945 or 1955 (Giarde 1980:77, 95)
	Sanitary metal food cans	
Food Preparation	Large enamelware pot	2 to 3 gal size
Group Services Artifacts	Ceramic sewer pipe sections	

Table 5.3-1. Artifacts Observed at MS030.

Artifact Group	Artifact Type	Description
Personal Artifacts	White glass square cosmetic jar	J&J [in script] on base, Johnson & Johnson mark?
	Colorless glass square jar	MERLE NORMAN\COSMETICS\SANTA MONICA\ CALIFORNIA on base
Transportation Artifacts	Wagon or sled part	
	Automobile door	
	Gear jack	
	Motor oil cans	one stamped Tydol
	Machine parts	
Miscellaneous Artifacts	Bulldozer parts	
	Metal cable lengths	1-inch diameter
	Metal wheelbarrow	with metal wheel
	Iron sheet	in large pieces
	Clay pigeons	
	Heavy metal pipe elbow	

the Str 1 deposit. A few nineteenth century artifacts were noted within it, but the vast majority of items is mid- to late twentieth century material. As previously noted, the very mixed nature of the artifacts and the lack of context of origins (specific households, restaurants, or other commercial establishments) renders the deposit only marginally informative.

5.4 SUMMARY

In situations where domestic debris concentrations have high chronological focus and can be securely tied to contextual materials about the households that generated the debris, such sites can be significant for their information potential under Criterion D. This site consists of a jumble of artifacts ranging from a few nineteenth century items to an extensive assemblage from the 1940s to 1950s. The mixing of artifacts and lack of focus makes the dump assemblage at this site nearly worthless for addressing research questions about households on the Comstock. It is not significant under Criterion D.

More interesting than the dump feature, which was accurately characterized from the surface assemblage before monitoring, are the evidences of placering and materials storage. Placer deposits can be found in undisturbed contexts along most of the canyons in the area. It is interesting to find them beneath more recent deposits, suggesting that the pattern of placer remains may be more extensive than is indicated by surficial indications.

The materials storage area with its mass of bark adds information about the logistical arrangement of Silver City milling operations that was not previously known. Although the wood slide going to this area was identifiable on documents, it was not known whether cordwood was processed and stored in this particular location.

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E & E Project No. ZU1050
Summit/ARS Project No. 1375-001/978
State Permit No. 258

April 4, 2001

VOLUME 2

Environmental Engineering and Consulting Services

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6.0 THE COMMUNITY OF DAYTON

by C. Lynn Furnis, Vickie Clay, Dave Schmitt, Jason Fancher, and Sabra Gilbert-Young

Dayton's earliest history is tied to the discovery of gold in California and in Gold Canyon (now Dayton) in 1849. The California gold rush drew people from all over the country. One of the major routes to California from the east passed by the mouth of Gold Canyon, so that the transportation corridor was an early element in Dayton's growth. News of the gold discovery brought hundreds of miners from California to Gold Canyon in 1850, where they worked the placers through the summer, then left for the winter (Griffith 1998:13-14).

Miners returned again in the spring of 1851, but many of them stayed on through the following winter, thus beginning the continuous occupation of the locality that would later become known as Dayton. In 1852, the Gold Canyon settlement had its first permanent buildings including a tavern, trading post, and boardinghouse, all made of logs. Miners continued to work and prospect in Gold Canyon until they eventually struck the Comstock Lode at the head of the canyon (now Virginia City and Gold Hill) in 1859 (Griffith 1998:12-15).

The Chinese community in Gold Canyon originated with the group of laborers imported to dig the Rose Ditch in 1856. Eventually at least 180 Chinese occupied the area, working mainly as placer miners. This led to the settlement name of Chinatown until it was replaced by Dayton in 1861 (DeQuille 1876:10). This population was down to 50 by 1859 (Kelly 1862:213). The exact location of Chinatown is not known. According to Kelly's directory the Chinese Quarter was west of the old log store, but the Lyon County Sentinel (July 11, 1881) places it close to the railroad yard near the river on the east side of town, which is in the vicinity of the northern end of MS001 North. Chinese artifacts are commonly found throughout the central part of Dayton during construction excavations but these finds have not been formally reported.

Captain James Simpson observed Chinatown in 1859 when placer gold mining was still the main occupation, though the area showed signs of being worked out. There were 12 houses and two stores. None of the population of 150 were female and about one-third were Chinese (Simpson 1876:90-91); this figure agrees with Bancroft (1890:95). Small numbers of American Indians also worked at the placers (Hazlett 1922:31). As noted previously, Sir Richard Burton the famous British explorer (1861:554) passed through Chinatown in 1860, between the height of placer activities and the onset of the milling industry. The town then consisted of a single line of ranches and frame houses.

The character of Dayton changed abruptly with the discovery of the Comstock Lode in 1859. The first effect of this event on Dayton was near-abandonment; scarcely six people remained and many of the buildings were relocated to the vicinity of the new strike (Angel 1881:500). Despite this temporary reversal, the advantages of its location for milling and transportation were obvious (Bancroft 1890:111; Angel 1881:60). Dayton began its shift from a placering to milling center almost immediately, when two water-powered arrastras were built.

As discussed in more detail in the milling chapter, this technology underwent rapid change and expansion in and around Dayton. The town hosted increasing numbers of hay yards and blacksmith shops.

The year 1861 saw major political and urban changes for Dayton. It became the county seat for Lyon County in the newly created Nevada Territory. The town was surveyed on a gridiron pattern, marking expansion from its former linear pattern, and its citizens adopted the town name presently in use.

By 1863, Dayton had about 1000 to 1500 inhabitants and newly constructed buildings, most of which were built within a year (Doten 1973:714). This made Dayton the third largest town in Nevada at the time. The platted townsite was lined with buildings the full length of Main Street from the Carson River to the west edge of the Bluestone Building. Pike Street expanded northward almost to Rock Point (Hazlett 1922:53). The town continued growing during the early years of the Comstock boom. In 1865 the town had 2500 inhabitants, a school, Masons' and Oddfellows' lodges, a brewery, three grocery stores, seven hotels, and five saloons (Angel 1881:500). Much of town was destroyed by fire that same year, but was rapidly rebuilt.

Milling in the vicinity of Dayton peaked in the 1870s, with 11 mills totaling 185 stamps, but the population was already on the decline, down to 1500 inhabitants in the early 1870s (Ansari 1989:79).

The general decline of the Comstock that started in 1878 hit Dayton even harder than the core of the district and by 1880 the population dwindled to 200. Despite the small population many services were still offered, including post office, telegraph, express, hotel, drugstore, three general merchandise stores, several saloons, two blacksmith shops, two shoe shops, and a barber shop (Angel 1881:500). This level of business interests was less a function of the local population than the continuing importance of Dayton as a stopover for travelers. For example, the blacksmith shop of G. P. Randall, purchased in 1874, expanded to occupy an entire city block by 1880 (Angel 1881:501).

The Carson and Colorado Railroad (C&CRR) was built through Dayton in 1880, corresponding with a regional depression. Due to the poor timing, the railroad barely survived and added little to the significance of Dayton. The various mining discoveries in central Nevada finally provided a spur to Dayton's milling industry as ore was shipped from these discoveries by rail for processing. Due to the distance of haulage, however, successful districts soon constructed their own mills, shutting Dayton out of most of the productive market. The population grew to about 700 early in the century, but this did not prevent removal of the county seat to the agricultural center of Yerington in 1911. The railroad did not survive the Great Depression and it was abandoned in 1934 (Ansari 1989:79; Myrick 1962:169-170, 202).

6.1 COMMUNITY AS A THEORETICAL FRAMEWORK

What is meant by "The Community of Dayton" is open to interpretation by historians, archaeologists, geographers, and sociologists, as well as by Dayton residents themselves. At one point in time, one might simply have said that Dayton was a small town and left it at that. But the situation is more complex now. In recent years, long-time residents of Dayton have become embroiled in an argument with residents of Genoa over which place officially qualifies as the first "permanent" settlement in Nevada (Griffith 1998). Local and regional historians also are divided on the issue, their claims focus on the year 1851.

Interestingly, the Dayton-Genoa controversy over first settlement status hinges on a fine distinction between two definitions of settlement. For Genoans, who can prove that their town boasts the first permanent, Euro-American built structures in Nevada, a settlement is defined as a place with permanent buildings that are inhabited year-round. Genoa, and its earlier iteration – Mormon Station – has been continuously occupied since 1851, though it had only eight or ten residents in that first year. Dayton-first advocates insist that their early and large population of gold miners who worked the placers of Gold Canyon through spring, summer, fall, and winter seasons of 1851, though living in tents, constituted a permanent settlement, despite the fact that permanent wooden or brick buildings were lacking (Griffith 1998:12-14). The Dayton-Genoa debate is ultimately about whether a settlement is a set of physical features, such as buildings on the landscape, or is an interactive group of people in a place regardless of whether any form of permanent structures were built.

If one is to believe Webster's New World Dictionary (Friend and Guralnik 1960), both groups are correct in their claim. That reference clearly reflects the common American understanding of the word settlement as a place or as a group of people. Webster's defines settlement as "... an inhabiting or colonizing, as of a new land... a group of people or a place concerned in this; colony... a small or isolated community; village." The conclusion that 'first settlement" researcher, Martin Griffith (1998:12), has reached about Genoa and Dayton is that, indeed, both qualified as Nevada's earliest settlements – Genoa because of its first buildings and small, permanent population, and Dayton because of its year-round population of miners. In brief, this is the debate over Dayton the settlement.

A separate question is that of Dayton the community. The words "settlement" and "community" refer to similar phenomena, but are not exactly synonymous. Community is defined as " the people living in the same district, city, etc., under the same laws... the district, city, etc. where they live... a group of people living together and having interests, work, etc. in common... as, a college community... society; the public." There is some overlap in the meanings of settlement and community, but settlement applies more to a newly-settled community or to one that is small and isolated. Community does not carry this connotation; it applies to a place or a population of variable size, one that can be large or small.

And as with Webster's definition of settlement, a community can be both a physical, inhabited place and the people living together in that place. This very issue has been considered in depth by social historian Thomas Bender in his study of "community" in the United States (Bender 1978). His research indicates that social scientists do not share one definition of community, as more than 90 different definitions of the concept were found in a 1955 search of the literature (Bender 1978:5). As a specialized example, consider the use of "community" by Frederick Jackson Turner (1920:73-74). In relation to the American frontier, Turner defined it as a particular settlement type. A community was a town in which the residents shared ideals of religion, morals, economics, and education. In fact, the land on which such colonial towns were established was customarily granted to groups of people, often religion-based, not to individuals. In this instance, the community as a place encompassed and defined a community of people as well. The two virtually were one in the same.

Bender (1978:7) suggests that a community is a "network of social relations marked by mutuality and emotional bonds. This network...is the essence of community, and it may or may not be coterminous with a specific, contiguous territory....A community involves a limited number of people in a somewhat restricted social space or network held together by shared understandings and a sense of obligation. Relationships are close, often intimate, and usually face to face." If one wishes to study a community, studying a particular town may or may not achieve this end depending on whether the community of interest is contained within a single town-sized territory (Bender 1978:10). Any physical community of residences, businesses, industries, and governmental buildings probably harbors multiple social networks at any given time, so that more than one community may exist within a town or village or colony. For example, a sizable Chinese population lived in Dayton throughout the nineteenth century. Undoubtedly, there was a Chinese community within the larger Dayton community as well as a non-Chinese community. And the Dayton Chinese may have been part of a larger Chinese network of social relations that transcended Dayton, perhaps including Chinese people in Virginia City, Carson City, and other settlements in the region.

Dayton, Nevada is a small town, and in the sense that it is a place where many people live together and are subject to the same rules and laws, it has been a community according to Webster's first definition. It also may qualify as a network of social relations in Bender's sense of community, at least during certain periods of its life.

As previously discussed, Dayton's history is characterized by dramatic population fluctuations beginning in the early 1850s as a mining camp of a few hundred men, with summer influxes of hundreds more. By 1856, there were at least 200 in town, 180 of whom were Chinese and for whom the place was renamed Chinatown. In 1859, the population was 150, including 50 Chinese men. By early 1860, about six people remained in town, following the shift of mining focus to Virginia City. Yet, within three years, over 1000 residents lived in Dayton, the new county seat of Lyon County. By 1865, there were 2500 residents, but this number had declined to 1500 by the early 1870s, plummeting to 200 by 1880. The population slowly increased to 500 by 1905 (Angel 1881:500; Ansari 1989:79; DeQuille 1876:10; Griffith 1998:11-15; Kelly

1862:213; Simpson 1876:90-91; Suits-Shuman 1905:53). Such tremendous population swings in Dayton must have greatly impacted the place and the people that comprised this community.

Dayton served many roles simultaneously, being an ore milling center in the 1860s, a service center for travelers from the 1850s to the present, an agricultural center for most of its life. As part of the Comstock Mining District, Dayton was a peripheral community to Virginia City, at the heart of the mining and urban action. This role as a marginal service and industrial center in the Comstock is of interest here, the question being how Dayton differed from the core area in terms of its material culture.

ARCHAEOLOGICAL AND HISTORICAL RECORDS RELATING TO DAYTON

Presumably, the social community of Dayton fluctuated as dramatically as and simultaneously with its population changes. The archaeological deposits that were discovered and studied as part of the Dayton mercury cleanup monitoring effort were generated by members of the Dayton community, but only during particular phases of Dayton history. There is one building feature from MS004 that may have been a business establishment, dating from the late 1860s. It falls within the Birdsall Mill Period III, Phase 2 development and time frame, just past the height of the ore-milling heyday of the town (Table 4.2-1). All of the MS001 archaeological deposits with domestic debris date from the 1880s and 1890s, from Period V, Phase 2 and from Period VI, Phase 1, Phase 2, years when milling had significantly decreased and the population of Dayton consisted of 200 to perhaps 300 persons. So the years of interest in Dayton as a community for archaeological and historical record purposes are the late 1860s, 1880 to 1890, and 1896 to ca. 1905.

Dayton in the Late 1860s

By 1865, Dayton had county government buildings, a brewery, seven hotels, an Odd Fellows' hall, a Masons' lodge, a school, three grocery stores, various other stores, five saloons, dozens of houses, hay yards, and ranches on the outskirts of town (Angel 1881:500; Burton 1861:554; Hazlett 1922:72-73). That year a fire swept through the heart of town and though much of it was rebuilt, one cannot say for sure how many of the pre-fire establishments were still thriving in the late 1860s.

The *Pacific Coast Business Directory for 1871-1873* (Langley 1871:348-349) lists 41 businesses in Dayton, including five hotels, two boardinghouses, four saloons, one billiards saloon, one brewery, one bakery, one tobacco and fruit shop, one butcher shop, two boot and shoe shops, a jeweler and watchmaker, one book and stationery store, a clothing store, a dry goods store, two general merchandise stores, a lumber yard, two carpenters, one doctor's office, one pharmacy, two livery stables, a harness and saddle shop, two blacksmiths, a wagon shop, a hay yard, a hair salon, a Wells Fargo & Co. agency, one attorney-at-law, and one ore mill or "reduction works." Nearly all of the listed establishments were located on Pike Street or Main Street, truly in the heart of Dayton. This complement of businesses presumably closely reflects

the scene in town in the late 1860s, after the 1865 fire and at the time that the Fea 8 structure stood at the Birdsall & Carpenter Mill site (MS004).

The town of Dayton filled several roles at any given time. It served as a service center to passersby on the Overland Trail from 1852 through the 1860s. Through its other specialized services, it was connected to nearby settlements and towns. For instance, Dayton provided goods such as wood and hay and fresh horses to surrounding towns such as Silver City, Virginia City, and Mound House during the 1860s and 1870s. It early on became a major ore milling location, providing a vital service to the core ore-producing communities of Gold Hill and Virginia City from the periphery of the mining district.

Ranches were already established in Dayton by 1860 (Burton 1861:554) and to this day, the town retains a rural community feel, surrounded as it is by fertile farmland adjacent to the Carson River.

Dayton in the 1880s

The Dayton businesses listed in the *Pacific Coast Directory for 1880-1881* numbered only 21, as compared with 41 for 1871. The merchants included two hotel proprietors, three liquor dealers, a butcher, two sellers of general merchandise, two boot and shoe makers, a combined books, stationery, and jewelry merchant, one barber, one druggist, one attorney, one Wells Fargo & Co. agent and stockbroker, two blacksmiths, a hay, grain, and lumber merchant, a public hall manager, a theater manager, and the manager of a telegraph company (McKenney 1880:167). Interestingly, no restaurants were listed for 1880, nor for 1871, though several were mentioned in the 1862 directory for Dayton (Kelly 1862:223, 227, 229). It may be that the local hotels had their own restaurants that were not listed separately. Limited assortments of meals were probably offered at many saloons of the day, but in Dayton in 1880, no saloons were mentioned. Another possibility with saloons and restaurants is that a few existed in Dayton in 1880 but simply did not pay for listing in the directory.

Also listed in 1880, were 15 local government employees who filled such positions as constable, sheriff, district attorney, district clerk, county clerk, treasurer, and more, suggesting that Lyon County facilities were providing a large proportion of jobs for those 200 persons still living in town. A few of the government workers maintained Dayton businesses at the same time (McKenney 1880:167).

In an effort to measure the stability and possible long-term existence of a community in Thomas Bender's sense, directory listings for 1871, 1880, 1882, and 1886 were compared. What was sought was the number of 1871 merchants and craftspeople who were still listed in Dayton in the 1880s. In the 1880 directory, 10 merchants from the 1871 directory were listed and nine of them were in the same lines of work they had been in 1871 (Langley 1871:348-349; McKenney 1880:167). There were 11 merchants listed in the 1882 directory that had been recorded in 1871; the 1886 directory lists five merchants from 1871 (McKenney 1882:629-630; 1886:875). Those

five in 1886 represent 12 percent of the Dayton businesses listed for 1871 and 24 percent of the listed 1886 businesses.

For Dayton's commercial sector, one-fourth of the businesses active in 1871 were still operating nine years later in 1880 under the same ownership, and 12 percent of them lasted until at least 1886 – a period of 15 years. This suggests a fair degree of stability within the business community.

The population had declined from approximately 1500 in 1871 to 200 persons by 1880, comprising a decrease of 87 percent in nine years. Going strictly by directory listings, the 1880 Dayton businesses decreased only by 49 percent during the same period. The 1882 businesses numbered 23, having decreased in number 44 percent since 1871, and in 1886, 21 merchants were listed, matching the 1880 group in number (49% of 1871 businesses). Business establishments in Dayton did not decrease in the same proportion as the population did between 1870 and 1886, suggesting that those that had invested in property and local enterprise were less willing or able to leave when times got hard perhaps they were able to adjust to changing times, refocusing and tailoring their services and merchandise more to highway and railroad travelers and to increasing numbers of agriculturalists in Dayton Valley.

One of the social organizations in Dayton – the Odd Fellows – was active from at least 1862 through 1895. Several relief reports were reviewed dating from 1874 to 1895. Not only were many of the members' names on the lists the same as the merchants, constables, and other government officials found in the business directories from 1871 through 1886, but at least 96 Odd Fellows were members from at least 1874 to 1895 (I.O.O.F. Annual Relief Report of the Dayton Lodge, No.5 [I.O.O.F. ARRDL5], December 31, 1874; I.O.O.F. ARRDL5, December 31, 1885; I.O.O.F. ARRDL5, December 31, 1887; I.O.O.F. ARRDL5, December 31, 1895 all on file at the Nevada Historical Society, Reno, file 88-30).

This tremendous longevity of 21-year membership in a local social and benevolent organization is firm evidence that a core group of Dayton residents formed a real community in Dayton, sharing economic, social, governmental, spacial, and political responsibilities literally for decades. The Odd Fellows Dayton Lodge included members who resided in Dayton, as well as the nearby communities of Sutro, Silver City, and Fort Churchill, so social relations were maintained with individuals in other towns.

Though the C&CRR began operations in Dayton in 1880, it did not seem to have much effect on the business district of Dayton as evidenced by directory listings for the 1880s. As noted previously, the timing of the railroad's arrival coincided with a major economic slump in the Comstock Mining District that severely affected Dayton's mill industry along with Comstock mining.

Dayton in the 1890s

Dayton business directories have not been located for any of the 1890s, so their listings cannot be compared to those from the 1870s and 1880s. One from 1905 was located and 20 businesses are listed there for Dayton, though all of the merchants' names were new ones when compared to all earlier directories, except for one shared name in the 1886 and 1905 directories (McKenney 1886:875; Suits-Shuman 1905:53-54). While the names changed over time, the number of businesses did not, even though there were 500 citizens in Dayton in 1905. This adds to the notion of economic and social stability in Dayton through the 1890s as well as in the 1880s.

Over time, the types of businesses and occupations changed. Dayton Valley attracted Italian immigrants in the late 1800s and early 1900s, many of whom acquired farm property and succeeded in raising crops and animals. By 1905, ranching and farming were listed as the primary industries in Dayton (Suits-Shuman 1905:53), and saloons became more plentiful. After having no saloons listed in 1880 (perhaps listed as "Liquors, Retail"), three were included in the 1886 directory, and five were listed in 1905, three of them owned by Italian or Swiss-Italian proprietors based on the surnames Bartolomei and Pierotti, Benassi, and Quilici (Suits-Shuman 1905:53-54).

6.2 GENERAL SITE SURFACE ARTIFACTS (MS001)

Dayton, like most urban centers, is surrounded by and rests upon a cluster of artifacts generated throughout the life of the site. At MS001 artifacts are present ranging from the late nineteenth century to the present (Figure 6.2-1). The most significant artifacts from a historic perspective probably are timbers and other parts of the Sutro Tunnel, brought to the site for use in yard improvements on one private lot. However, because these items have been removed from their original location they cannot be considered NRHP eligible. There are hundreds of historic artifacts (over 50 years old) on the ground surface and in subsurface strata, but the distribution of these materials cannot confidently be associated with particular activities or households. Identification of household context is generally critical for studies of domestic artifacts to have significance in an urban setting. Such identification at this site is hampered by being outside of the area covered by detailed insurance company maps.

In the case of the Comstock region, there is a long-term research agenda oriented toward studies of ethnic groups and their related material culture (Hattori 1975; Thompson 1992; Wrobleski 1996). Several University of Nevada, Reno field schools have been conducted in Virginia City, at saloons catering to particular ethnic groups. In 1993 and 1994, Dr. Donald Hardesty conducted a field school on the site of the Hibernia Saloon, and in 1995 on the site of Costello and O'Brien's Shooting Gallery and Saloon. At the present time, Kelly Dixon is managing the excavation of a bar frequented by black clientele in Virginia City.

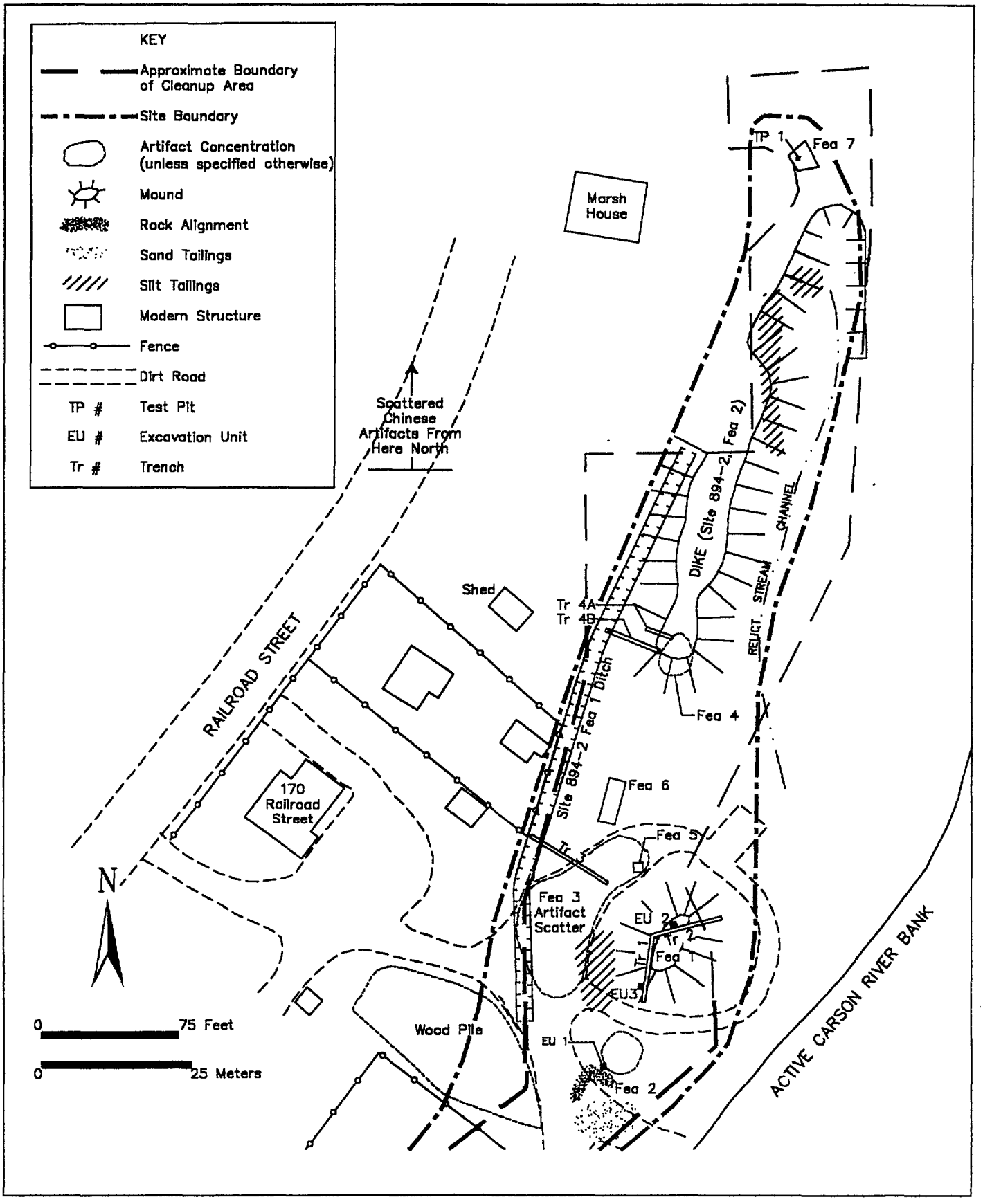


Figure 6.2–1. Site map for the Keller and Company Mill and other features at MS001.

The MS001 surface scatter lacks contextual ties to specific households and thereby particular ethnic groups in Dayton. Nevertheless, the assemblage has been generated by the townsfolk of Dayton over time. The majority of the collected artifacts dates to the late nineteenth century, to the years after milling had climaxed and was in decline. As noted above, Dayton's population ranged from 200 to approximately 500 persons between 1880 and 1905; therefore, the historic-era debris that comprised the surface scatter at MS001 was generated by this small population. The assemblage can provide a picture of the quality of material life in Dayton during its years of economic decline and has much to offer in that regard. It is briefly discussed below.

Subsurface concentrations of artifacts also are present at MS001 and these would suggest the possibility of more meaningful patterning and perhaps sufficient information content to be eligible under Criterion D. Information derived from test excavations and trenches indicates that many subsurface artifacts have generally been moved around, fragmented, and redeposited as fill episodes. However, during later monitoring of contaminated sediment removal at MS001, several intact artifact dumps of household debris were noted and formally excavated as unexpected finds. At MS004, the remnants of a dugout structure were discovered, recorded, and excavated during the same removal operation. Additionally, sparsely scattered historic artifacts were collected by archaeological monitors as they appeared during the contaminated sediment removal. The general surface site debris is described in this section; feature-specific material is described below by feature number.

SURFACE ARTIFACT CONCENTRATION (MS001)

Some 524 artifacts (MNI) were collected from the "surface" of MS001 in 1998, representing in actuality mostly subsurface artifacts that were exposed during bulldozer/backhoe excavation. In most cases, the 1998 ground surface had already been removed before artifacts were observed or collected. Those counted here were surface artifacts from non-feature areas of the site or were from disturbed surface strata above Fea 1 and 6. The assemblage is briefly summarized in Table 6.2-1. It is dominated by glass food bottles and by glass, metal, and ceramic food serving vessels. While many mid- to late-twentieth century artifacts such as golf balls, machine-made bottles, plastic, etc were observed in the surface layer, a surprisingly large percentage date from the 1870s, 1880s, and 1890s, suggesting that the site has been a peripheral, unofficial dumping area for the Dayton community for over 100 years. Several ceramic sherds from the surface assemblage crossmend with sherds from various feature strata, confirming that subsurface strata within the features were cut into by earth-moving vehicles during removal of contaminated sediments.

Table 6.2-1. Surface Artifacts from MS001 Grouped by Functional Category	
Architectural Artifacts	28
Domestic Artifacts	17
Food Bones	26
Retail Food Containers	122
Food Serving/Preparing Artifacts	133
Group Services Artifacts	2
Industry and Commerce Artifacts	20
Personal Artifacts	57
Transportation Artifacts	8
Unknown Function Artifacts	111
Total MNI	**524**

6.3 ARTIFACTS FROM THE KELLER & CO MILL SITE (FEA 1, MS001)

The Keller & Co mill mound contained certain artifacts related to the Dayton community in addition to those related to milling. Fea 1 strata were discussed in detail in Reno and Clay (1996), and in Figure 3.2-1. Artifacts are discussed below.

As with the discussion of Fea 1 mill artifacts, the non-mill artifacts from the same strata within the mound feature are summarized in two tables – Tables 6.3-1 and 6.3-2 – the first of which includes all test phase artifacts, the second of which is composed of monitoring phase artifacts from TP 3. In each table, artifacts are ordered according to specific strata and interfaces. But the strata from each phase of work are not correlated with each other. Though certain deposits may lay within all excavated units, this is not known for certain. Test phase artifacts were field-described in less detail than those from the later phase of work at MS001 and their information potential is correspondingly more limited for analytical purposes. The data provided in Table 6.3-1 indicate that over three-fourths of the assemblage consists of fragments of glass and iron, too small for object or function identification. Subsurface iron artifacts from MS001 were in extremely poor condition, to the point that many nails could not be identified as to type. Some lumps of iron are suspected of being nails but could not be identified as such with certainty.

Of the test phase artifacts that were identifiable, none was found to be a fancy, expensive, or extraordinary artifact. All are common, simple types of artifacts that might be found in a mid- to late-nineteenth century home or boardinghouse. Very likely the leather gasket had a specialized purpose but this purpose is not known. There are two obvious modern artifacts from

Table 6.3-1. Domestic Artifacts from Fea 1, Testing Phase at the Keller & Co. Mill Site, MS001.

Artifact Group	Artifact Type	Stratum										Total MNI
		1	0	1A/5	5	6	0.25	7	10	11	13/14A	
Architecture	Windowpane			1				4				5
Domestic	Chimney, lamp						2	1			1	4
	Hanger, Wire Coat						1					1
Food Remains	Bone, large mammal			1			2					3
Food Containers	Bottle, wine			1	1							2
	Jar, glass	1										1
	Tab, aluminum pull	1										1
Food Serving	Dinnerware, wie			2	1							3
Personal	Bottle, medicine			1			1					2
	Cloth, fine black							1				1
Multiple Use	Bucket	1										1
	Wire, baling	1										1
	Lug, bale						1			1		2
Munitions	Cap, percussion						1					1
Unknown Function	Bottle, glass	4	3	7	3		1		1	1		20
	Can part			1								1
	Gasket, leather		1									1
	Glass fragment					8	4	3	10	1	1	27
	Iron fragment		7	19	1			9	65	226		327
	Leather fragment										1	1
	Metal, melted soft							1				1
	Peg, wooden				1							1
	Strap, iron									1		1
Total MNI		8	11	33	7	8	13	19	76	230	3	408

Table 6.3-2. Domestic Artifacts from Fea 1, TP 3, at the Keller & Co. Mill Site, MS001

Artifact Group	Artifact Type	Stratum							Total MNI
		2A	3ABCD	4/4A	5	6	7A/7B	8A/8B	
Architecture	Chimney, lamp	1	1						2
	Linoleum	1							1
	Shingle, composition	1							1
	Windowpane	1	1	1	1	1	1	1	7
Food Remains	Bone, cow	1	8				3		12
	Bone, pig	1	1						2
	Bone, sheep		2						2
	Bone, mammal		47						47
Food Containers	Bottle, Cathedral pickle		1						1
	Jar, Chinese stoneware	1							1
	Bottle, wine	1	1		1	1			4
Food Serving	Vessel, wie	1							1
	Vessel, green glass	1							1
Personal	Bottle, medicine	1							1
	Bottle, patent medicine			1					1
	Button, Prosser porcelain					1			1
Unknown Function	Bottle, glass	2	5			1			8
	Unknown glass	1				1			2
	Unknown metal	2	1	3	2	2	2	1	13
	Unknown rubber				1				1
	Rod, iron						1		1
	Sheet, zinc			1					1
	Unknown frag							1	1
Total MNI		16	68	6	5	7	7	3	112

the Fea 1 test phase assemblage. The first is an aluminum pull tab from a beverage can, post-dating 1962, found in Str 1 (Martells 1976:14), and the second is a wire clothes hanger found in Int 6A. This twentieth century artifact suggests that modern-era disturbance occurred within the portion of Int 6A located in EU 3.

The small Fea 1 test phase assemblage reflects a primarily domestic grouping of artifacts with few items coming from any one stratum other than glass and iron fragments. The distribution of domestic material does not provide a clear pattern within Fea 1 except that there is less of it below Str 7 than above. When compared with the distribution of mill artifacts (Table 3.2-1), it is apparent that mill artifacts are most concentrated in Str 7, Str 10, and Str 11, though slag, nails, and quartz ore are present as "noise" in most deposits. Domestic and mill debris did not comprise mutually-exclusive distributions, but upper layers held more domestic and less mill artifacts and lower strata contained more mill and less domestic debris. This general trend probably reflects the historic uses of the site, with milling being the primary use of the site during the 1860s, lapsing into an abandoned, peripheral lot, reused as a *de facto* community dumping site in later years.

As discussed in Chapter 3, few datable artifacts were observed during the test phase. Several pieces of sun-colored amethyst (SCA) glass were found in Str1, Str 6A, and in Str 11, dating between 1880 and 1920. The wire coat hanger observed in Str 6A is a large, twentieth century object that suggests Str 6A dates from the 1900s or more plausibly dates to earlier years but has been disturbed in the twentieth century.

Artifacts recovered from TP3 are listed in Table 6.3-2. The mill artifacts from TP 3 are presented in Table 3.2-2, and are found in only five of the seven stratigraphic units. From that table it is apparent that the assemblage differs within the 3ABCD unit from the surrounding TP 3 strata. This difference is also reflected in the domestic artifacts in Table 6.3-2. Str 3ABCD was upper fill from a historic-era trench. The trench was excavated through existing Str 4, 5, 6, 7A, 7B, 8A, and 8B (see Figure 3.2-4). In Table 3.2-2, Str 3ABCD is the only deposit that contains machine-cut nails and does not contain quartz ore. It is apparent that Str 3ABCD contained most of the food bones from TP 3, accounting for 92 percent of all mammal bones in the unit (Table 6.3-2). Few other domestic artifacts were recovered from the trench fill.

Excavations at the Keller & Co. Mill site recovered a modest assemblage of 63 animal bones (Table 6.3-3). Most were collected from Str 3ABCD in TP 3 (Table 6.3-4). Beef (*Bos* sp.) bones are represented by a variety of cuts, including three low quality cuts from the foreshank, one small cut from the chuck, and single-serving high quality cuts from the rib and sirloin. The single pork (*Sus scrofa*) bone is a thin, saw cut neck portion, a sheep (*Ovis aries*) femur represents a leg of lamb portion, and small, sawed sheep ischium appears to be a single-serving loin steak. Excavations in Str 2 retrieved a butchered *Bos* thoracic spine and a saw-cut pork scapula that represents a cut from the shoulder, and a single, weathered distal cow scapula (chuck) was collected from Str 7. Elsewhere in Fea 1, a beef rib (cross or short rib), tibia shaft

Table 6.3-3. Numbers of Identified Animal Bones per Taxon/Animal Size Class from Feature Investigations and Locus I, 26Ly529.

Species	Fea. 1	Fea. 5	Fea. 6	Fea. 7	Locus I	Totals
Bos sp.	12	39	42	138	5	236
cf. *Bos* sp.				2		2
Sus scrofa	2	26	8	29	1	66
cf. *Sus scrofa*				1		1
Ovis aries	2	30	11	68		111
cf. *Ovis aries*				4		4
cf. *Ovis aries*				5		5
Gallus domesticus		12	1			13
Aves (bird)		21	4	5		30
Pices (fish)		1				1
Herpetofauna		2	2			4
Large Mammal	1	260	256	928	15	1460
Medium Mammal	3			6		9
Small Mammal	5		1	24	2	32
Unidentified	38	665	229	1948	3	2883
Totals	63	1056	554	3158	26	4857

Table 6.3-4. Numbers of Identified Large Mammal Bone and Large Mammal Bone Fragments by Stratum, Fea 1.

Taxon	Str 7			Str 3			Str 2			Mound Level 1			Totals		
	T	B	S	T	B	S	T	B	S	T	B	S	T	B	S
Bos sp.	1		1	7		4	1		1	3		3	12		9
Sus scrofa				1		1	1		1				2		2
Ovis aries				2		1*							2		1
Large Mammal				1		1							1		1
Totals	1		1	11		7	2		2	3		3	17		13

* Knife cuts/striations
T=total number of specimens; B=number burned/calcined; S=number saw-cut

(hindshank), and single serving round steak were recovered from Level 1 (surface stratum) in general mound excavations.

Dated artifacts from Str 3ABCD include fragments of an aqua glass cathedral pickle bottle (ca. 1840 to ca. 1880) (Spillman 1983:79), a brown glass, moldblown bottle (ca. 1850 to 1920), and nine machine-cut nails (1830 to ca. 1920) (Fontana and Greenleaf 1962:58-59). Based on these dates, the trench may have been dug and filled anytime between 1850 and the mid-1880s.

Artifacts from the TP 3 strata provide date ranges, offering time periods within which the strata may have been created. Beginning with the lowest strata in TP 3 and working up towards the ground surface, artifacts from Str 8A/8B were present but provide no date ranges. The same is true of Str 7A/7B. In Str 6, one plain porcelain Prosser 4-hole button was recovered, dating between 1840 and ca. 1910 (Albert and Adams 1970:4-8), providing a *tpq* of 1840. In Str 5, black rubber (1851 to present) and a moldblown patent medicine bottle (1850 to ca. 1920) was found, offering a *tpq* of ca. 1850 (Luscomb 1979:170; Schulz et al. 1980:1-8). The 1850 to ca. 1920 range is the only one found for Str 4/4A, while for the uppermost stratum, Str 2A, several dated artifacts were identified. Included is a plain wie vessel with a black printed partial mark: IRONSTONE CH ... \[illust. Victorian coat-of-arms] ... (ca. 1860 to ca. 1920), a fragment of red linoleum (ca. 1890 to present), black composition shingle (ca. 1920 to present), and part of an opaque green glass "Jadeite" dish or plate dating from ca. 1930 to ca. 1945 (Florence 1995:34-45; Godden 1983:11, 552; Israel 1968:300).

Str 2A has a *tpq* of 1930, whereas the lower strata have *tpq* between 1840 and 1851. Each stratum yielded few artifacts, therefore few date ranges were obtained. Those identified time ranges were generally broad; nevertheless, no later period artifacts were found in strata 4/4A through 8A/8B, suggesting that they are all mid- to late-nineteenth century deposits. Str 3ABCD post-dates all of those strata (ca. 1850s to 1880s) and underlies Str 2A. The TP 3 strata seem to be more intact and older than those exposed in the Fea 1 test phase excavation units and trenches. No sun-purpled glass (1880-1920) was noted in any of the TP 3 strata, whereas several pieces were found in various test phase strata (Str 1, Str 6A, Str 11).

A few generalizations can be made about the Fea 1 artifact assemblage as a whole. As noted above, common bottles, dishes, buttons, lamp chimneys, windowpanes, bucket and can parts, and food bones characterize the Fea 1 material. No articles associated with children nor specifically with women or men were identified, though mill-related artifacts presumably are associated with adult males; wine bottles suggest adult alcohol consumption. Additionally, fragments of one Chinese-made, imported brown-glazed stoneware food jar were recovered, suggesting an ethnic element in the Str 2A deposit. The Fea 1 domestic assemblage includes artifacts from the United States, such as the cathedral pickle bottle; from France or England the porcelain button; from China and England or the United States the brown-glazed stoneware and marked wie sherd.

6.4 ARTIFACTS FROM THE ASSAY OFFICE (FEA 6, MS001)

The suspected demolished assay area near the Keller & Co. mill mound (Fea 1) also contained several strata with numerous artifacts related to community household debris rather than milling or assaying. Figures 3.3-1, 3.3-2, and 3.3-3 illustrate the plan view and strata in this feature. Most debris occurred in Str 2 and Str 9, while Str 2 appeared above most of the demolished debris and may have been a trash deposit placed in a swale to help bring the local topography to grade for subsequent use. Str 8 and Str 9 appeared to be burned or partially burned ash and debris deposits within larger ash deposits (Str 7A), possibly representing the burning and demolition of an assay office (Fea 6-1). Again the entire stratigraphic sequence appears to be filling a swale in the local topography. Artifacts not related to an assay function are described below.

Domestic artifacts from Fea 6 comprise 1214 (46 %) of the 2641 MNI recovered from the feature; the remainder are ore-milling and architectural artifacts and are discussed in the Assay Office section of Chapter 3. As indicated in Chapter 3, the stratigraphy of Fea 6 is complex and may represent on-site brick and wood structural demolition. Mixed between brick rubble and assay artifact layers, two or three domestic debris strata were isolated (Str 2, 4, and 9). Those containing much domestic debris are the focus of this section. In Table 6.4-1, household artifacts from all Fea 6 strata are summarized according to gross functional group. At least a few domestic artifacts were recovered from nearly every stratum.

Table 6.4-1. Non-Mill Artifacts from the Assay Office, Fea 6, MS001, Summarized by Functional Group.

Artifact Group	Upper Strata				Lower Strata								Total MNI
	1	1A	2	5	4	8	7	9	7A	11	13	21	
Domestic	2	2	3		3		3	4	1				18
Food-Related	25	44	159		17	2	6	99		1	3	1	657
Group Services								3					3
Munitions			1					1					2
Personal	1	4	15		4	2	3	18					47
Unknown Function	21	74	58	1	49	22	29	216	4	2	9	2	487
Total MNI	49	124	536	1	73	26	41	341	5	3	12	3	1214

The rate and pattern of deposition at Fea 6 is of interest. The order in which strata were laid down relative to each other has been explained by Vickie Clay (Figure 3.3-2 and Figure 3.3-3). By overlaying manufacture time ranges for datable artifacts to their respective strata, a second perspective is brought to Fea 6 deposition.

Despite the large number of artifacts recovered from Fea 6, few provided time ranges of 10 years or less. The *tpq*s and estimated periods of deposition for each stratum that yielded artifacts are presented in Table 6.4-2. Based on these, it appears that all strata from Str 9 and above were created in a span of 10 years at the most. The Str 9 *tpq* is derived from several Redington Florida Water bottles (1884-1890) that were reused and labeled as Code Elfelt & Co. ketchup bottles (1874-1898). It is assumed that all strata above Str 9 must post-date 1884 though the *tpq*s for Str 7, 8, and 4 pre-date 1884 (1874, 1880). Based on a moldblown glass crown bottle finish (1892 to ca. 1920) from Str 2, one may assume that Str 2 was deposited around this time and that Str 1A and Str 1 definitely post-date 1892 despite their older *tpq*s.

The artifacts from all strata except Str 2 and 9 are listed by group and type in Table 6.4-3. No childrens' artifacts were observed, though many adult items were noted as evidenced by the wine, liquor, and beer bottles, and by the fragmentary ball clay tobacco pipe from Str 4. Pieces of two different ceramic figurines came from Str 1 and from Str 7, perhaps suggesting possessions of an adult female. Utilitarian, brown-glazed stoneware sherds were recovered from food storage jars made in China for use by Chinese in the United States and elsewhere. These and a fragmentary glass olive oil bottle suggest an Asian and Mediterranean ethnic group occupation in Dayton. A total of 554 animal bones was recovered from excavations in and adjacent the Fea 6 structure, most of them from Str 2. Most of the identified specimens represent the remains of domestic animals, including sheep, pig, numerous cow (Tables 6.3-3 and 6.4-4) and a single chicken specimen. General surface collections recovered a large, multiple-serving beef foreshank and excavations in the assay area returned two beef cuts from the hindshank, a sawed proximal rib, and a sawed sheep ischium that represents a relatively large leg cut.

FEA 6, STR 2

Str 2 was a domestic debris-filled stratum of at least 3x3 m extent, forming half of an oval, the eastern portion being truncated by bulldozer excavations. It varied from approximately 5 to approximately 20 cm thick. A total of 553 MNI was collected from Str 2, only 15 MNI of which are mill-related (Chapter 3). The bulk of the assemblage is treated here, being of a domestic character (Table 6.4-1), with 80 percent attributed to food bones (n=427).

The Str 2 artifacts are discussed here by functional group, beginning with domestic furnishings. Three items are included – a milk glass lamp globe, a colorless glass lamp chimney, and the sun-purpled glass stem from a compote or goblet.

Table 6.4-2. *Termini Post Quem* and Estimated Years of Deposition for Assay Office, Fea 6, Strata.

Stratum	*T.P.Q.*	Years of Deposition
1	1883*	1895-present
1A	1880	1892-1920
2	1892	1885-1900
5	-	-
4	1880	1884-1900
8	1874	1884-1898
7	1880	1884-1910
9	1884*	1880-1895
7A	-	-
11	-	-
13	-	-
21	-	-

* Date is not the latest initial manufacture date (*tpq*), but the next to the latest date. The latest date is ca. 1970 or later, based on one modern, intrusive artifact.

Items relating to food consist of faunal food remains, glass, ceramic and metal containers, and food serving vessels. Although animal remains were collected throughout stratigraphic excavations in the Fea 6 structure, they were especially abundant in Str 2 (Table 6.4-5). Identified pork remains in Str 2 include cuts (one each) from the rib, ham, and neck, and sheep bones are represented by portions of the chuck (NISP = 1), short rack/rib (NISP = 4), and leg/foreshank (NISP = 5). Cattle bones are most abundant and are largely represented by expensive, high quality cuts from the short loin and rib (Table 6.4-6). Most of the short loin cuts represent single serving purchases, including at least four individual T-bone steaks. Beef bones reflecting moderate quality purchases are represented by a few cuts from the rump, arm, and cross/short rib, and three foreshanks, including one large, multiple serving cut, reflect inexpensive, low quality purchases. Fifty-eight percent of the Fea 6 large mammal remains are burned (Table 6.4-5) and represent the highest proportion of burned bone in the five analyzed assemblages from Dayton. Most were recovered from Str 2 (NISP = 166) and are largely represented by small fragments. Similar to the modest burned bone aggregates from Fea 5 and Feat 7 (see below), most (80%) of the Str 2 burned bones are calcined and probably reflect the intentional burning of bone refuse. While little can be inferred from the small faunal aggregates recovered from Str 1, 4, and 9, the high proportions of expensive single-serving cuts from Str 2 reflect occupation by an individual or small group of high economic means.

Table 6.4-3. Artifacts from Selected Strata within the Assay Office, Fea 6, Organized by Function.

Artifact Group	Artifact Type	Stratum										Total MNI
		1	1A	5	4	8	7	7A	11	13	21	
Domestic	Chimney, lamp	1	1					1				3
	Figurine	1					1					2
	Globe, milk glass lamp		1									1
	Linoleum						1					1
	Object, glass						1					1
Food-Related Artifacts	Bone, mammal	10	35		10							55
	Bottle, glass	3	2		1	1	4			2		13
	Bottle, beer		1									1
	Bottle, liquor	1	1		1							3
	Bottle, mineral water	1				1						2
	Bottle, wine	2	2		3		1			1	1	10
	Bottle, ketchup	1										1
	Bottle, olive oil				1							1
	Jar, Chinese stoneware	1					1					2
	Pitcher, majolica	1										1
	Tumbler, glass	3			1							4
	Vessel, wie	2										2
Personal Artifacts	Bottle, Florida Water					1						1
	Bottle, medicine						1					1
	Bottle, patent medicine	1	2		1							4

Table 6.4-3. Artifacts from Selected Strata within the Assay Office, Fea 6, Organized by Function.

Artifact Group	Artifact Type	Stratum										Total MNI
		1	1A	5	4	8	7	7A	11	13	21	
	Button, porcelain sew-through						2					2
	Fabric, tan clothing		1									1
	Shoe, leather		1		1	1						3
	Part, watch				1							1
	Pipe, tobacco				1							1
Unknown Function	Fragment, various materials	18	63		36	19	19	4	2	6		167
	Bottle, glass	1	9	1	11	3	7			3	2	37
	Foil, aluminum	1										1
	Part, metal		2									2
	Sheet, iron and zinc	1			1		1					3
	Stopper, cork		1				1					2
	Strip, metal		2				1					3
Total MNI		49	124	1	69	26	41	5	2	12	3	332

Table 6.4-4. Types and Numbers of Identified Beef (*Bos*), Pork (*Sus*), and Lamb (*Ovis*) Bones from Fea Investigations, 26Ly529.

Element	Fea 1			Fea 5			Fea 6			Fea 7		
	Bos	*Sus*	*Ovis*	*Bos*	*Sus*	*Ovis*	*Bos*	*Sus*	*Ovis*	*Bos*	*Sus*	*Ovis*
Skull					1					1	2	
Mandible											2	
Isolated tooth				1	2						2	
Scapula	1	1		1			1	1	1	5	1	9
Rib	3			3	4	8	13	1	2	20	2	3
Humerus				2	2	2	1			9	3	4
Radius	1			1		2	3			8		
Ulna	1			2			2			4	3	1
Cervical vertebra	1	1		1	1	1		1	1	5	1	4
Thoracic vertebra	1			4	3		5	1	2	10	4	13
Lumbar vertebra				2	1	2	10	1		8	3	9
Innominate	1		1	2	2	1	2	1	1	13	1	9
Femur	1		1	12	1	5	1			13	1	6
Patella				1								1
Tibia	1			1		1		1	3	20		2
Fibula								1			1	
Calcaneus				1			1		1	5		1
Astragalus				2			2			4		1
Metapodial						2						3
Carpal/tarsal	1			2		1				13		
Phalanx					8	5					3	
Misc. vertebra				1	1		1					2
Totals	12	2	2	39	26	30	42	8	11	138	29	68

Table 6.4-5. Numbers of Identified Large Mammal Bone and Large Mammal Bone Fragments from Selected Strata and Assay Area 1, Fea 6.

Taxon	Str 9			Str 4			Str 2			Str 1			Assay Area 1			Totals		
	T	B	S	T	B	S	T	B	S	T	B	S	T	B	S	T	B	S
Bos sp.	2		2	4	1	4	25		20	4		2	4		3	39	1	31
Sus scrofa	1		1				3	1	2	4		3				8	1	6
Ovis aries							10	2	1				1		1	11	2	3
Lg Mammal	16	9	3	3	3		225	163	5	7		2	4	2	3	255	177	13
Totals	19	9	6	7	4	4	263	166	28	15		7	9	2	7	313	181	53

T=total number of specimens; B=number burned/calcined; S=number saw-cut

Table 6.4-6. Types and Numbers of Identified Beef Cuts Recovered from Stratigraphic Excavations in Fea 6.

Butcher Unit	Rank	Str 9 NISP	Str 4 NISP	Str 2 NISP	Str 1 NISP
Short loin	1	1	1	8	
Sirloin	2		1	1	
Rib	2			5	
Rump	4			1	
Chuck	5				1
Cross/short rib	6			2	
Arm	6			1	
Foreshank	9		1	3	
Hindshank	9				1
Misc. rib		1	1	4	2
Totals		2	4	25	4

Food containers from Str 2 consisted of 22 glass and ceramic bottles and jars. Only one solid or condiment food container was found – the unglazed stoneware lid from a Chinese-manufactured brown-glazed jar. There are 22 glass beverage bottles, including one brown beer bottle, 10 brown liquor bottles, four olive green wine bottles, one mineral water bottle, and one soda water bottle. In addition, there are four glass bottles of unknown beverage type. The presence of a beer bottle in Str 2 dates it to post-1873 (Wilson 1981:1). Two of the bottles are embossed with manufacturers' names. The first is a liquor bottle base which reads: F B Co\3, and the maker is unknown. The second is a mineral water bottle produced by Hunyadi Janos and filled with spring water from Hungary. It was first produced in 1863, and imported to California ca. 1879 (Schulz et al. 1980:142). It is noteworthy that nearly all of the "food" containers from Str 2 are actually beverage bottles.

Nine food serving vessels were recovered in sherds. There are two plain, wie plates and one platter, one wie spout from a large pitcher, and sherds from two other wie vessels of unknown form. One of the latter is marked with a black print: ... PAT ... \ ... BU ... . Both plates are small 7 inch dia size; the platter is oval or rectangular but too fragmentary for measurement. Small fragments from a yelloware vessel with Rockingham glaze and molded design probably were part of a teapot or pitcher, and finally, there are fragments from two colorless glass tumblers, one of which is faceted.

In the munitions category, one metal casing was recovered of 12-gauge shotgun shell dimension.

Sixteen artifacts of a personal nature were collected. These include a ceramic spherical bead of 0.38 inch dia, four clothing fasteners, leather from a shoe or boot upper, a ball clay tobacco pipe stem, eight medicine bottles, and one porcelain pigment container. Among the clothing fasteners are two four-hole sew-through shell buttons, each 0.38 inches wide, each plain with a sunken hole panel. There is one black glass button with molded facial design and missing metal wire shank, and a bone collar or cuff stud (Figure 6.4-1). The black glass button design consists of an overall conical face into which three S-curved spokes are sunken. Within each spoke or groove, three faux faceted studs are molded. A larger stud stands at the button center.

The group of medicine bottles includes two colorless glass and one aqua glass vessel, each with an applied patent finish. One of these is a small, complete pill bottle, of 1.56 inch height and 0.75 inch dia, with a wide mouth. Four others are rectangular, brown glass bitters bottles, three of which are embossed with parts of this label: DR. HARTER'S\WILD CHERRY\BITTERS\ST.LOUIS\DESIGN\PATENTED, and it dates between 1885 and 1920

Figure 6.4-1. Ornate black glass button from Str 2, Fea 6 at MS001.

(Wilson and Wilson 1971:118). The fourth bottle is a fragment of Dr. J. Hostetter's Stomach Bitters, produced between 1858 and ca. 1920 (Holbrook 1959:166). The eighth medicine bottle is a large, octagonal brown bottle, embossed: BOLLMAN. It is further distinguished by a smoothly bumpy texture, as if produced in a wooden mold.

One small white porcelain disc was recovered that is 0.69 inch in dia, with a flat base and concave top. It may have served as a shallow container for rouge make-up, waterpaints pigment, or a similar substance.

There are 58 MNI of unknown function from Str 2. At least 17 are remnants of glass bottles, contents unknown, with several partially fused from heat. Fragments from five cork bottle stoppers were also found, in 0.5 to 0.75 inch dia that may have fit beverage, medicine, or other bottles. Most other unknowns are metal artifacts, such as lumps that may be corroded nails, copper wire, and links of chain.

Str 2 Discussion

The complexion of Str 2 is very much an adult one. There is not much variety of artifact type, and there is a heavy emphasis on liquor bottles, wine bottles, bitters bottles that held alcoholic substances, tumblers, a high proportion of expensive, single-serving cuts of meat, and a smattering of plain white wie plates. Part of a tobacco pipe was found, signifying adult male, as does the bone collar stud. It would appear that some person or group was living well in Dayton. Because of the lack of many other household kinds of artifacts in Str 2, it seems that this particular deposit may have come from a commercial bar, private club, or restaurant and not from a private domicile or boardinghouse. There are no condiment bottles or food cans, and few dishes, suggesting even more the possibility of garbage from a bar or private men's club that served a limited range of meals as well as liquor.

Few mill artifacts came from Str 2. As shown in Table 6.4-2, the *tpq* for Str 2 is 1892, derived from a moldblown crown-style bottle finish, a type first made in 1892 (Putnam 1965). Other artifacts within it date from the mid-1880s, suggesting that Str 2 was deposited after the mills at MS001 were gone.

FEA 6, STR 9

Based on excavations and unit profiles within Fea 6, the areal and vertical dimensions of Str 9 are similar to those of Str 2, though more deeply buried and shifted slightly to the north. Str 9 was encountered in EU 7, 6, 5, 3, and 2, occurring in thicknesses ranging from approximately 2 cm to 18 cm; Str 2 lay in all of these units as well, but was separated from Str 9 by several intervening strata (Figures 3.3-1, 3.3-2, and 3.3-3). The *tpq* for Str 9 is 1884, based on two of the 341 MNI collected from the layer (Table 6.4-1).

Domestic artifacts are few, composed of four glass, fragmentary lamp chimneys. Food-related artifacts are more abundant as they are composed of 99 MNI of food remains, retail food containers, and food-serving and preparing vessels. Food remains consist of one peach pit and 62 mammal bone NISP. Of the bones, 19 are identifiable and include two cow bones (1 rib [cross or short rib cut], 1 lumbar vertebra [short loin cut]) one pig pubis bone (rump cut), and 16 large mammal bones (Table 6.4-5).

Food containers from Str 9 include alcoholic and non-alcoholic beverage bottles, and staples and condiment bottles. There are three glass beer bottles, in brown and green glass, as well as nine mouthblown dark green glass wine bottles. One of the beer bottles is embossed: ... CO .... All of the six wine bottle finishes are applied laid-on-ring types with inner diameters of 0.75 to 0.81 inch, but three of them seem larger than average for wine bottles with outer diameters of 1.19 inches. At least three wine bottles have deep, kick-up bases, but based on the finish types none is a champagne bottle. Base diameters range from 2.38 to 3 inches. A partial shoulder seal from one of the wine bottles was recovered, it is embossed: CHA .... Two glass liquor bottles also were found, the first a dark brown rectangular bottle with applied finish of unusual form, with a patent-style top and wide collar beneath, which together form a center groove in which to attach a sealing wire.

The second is a dark green glass case gin bottle with a square body and partially embossed: J.T. .... The lettering and bottle shape match bottles that held Clubhouse Gin, produced by J.T. Daly in San Francisco from the 1850s to 1870 (Wilson and Wilson 1968:59-60). This identification means that the gin bottle from Str 9 is very old in comparison to other components of the assemblage, in bottle years. Glass bottles tend to have short life spans and generally enter the archaeological record in just a few years following their manufacture.

Three other bottles held European mineral water. One of the bottles is a complete, dark green glass quart-size bottle that held mineral water from Hungary. It is an unusual style, moldblown, having short blob finish, short neck, and short, rounded shoulders. On the base, it is embossed: SAXLEHNERS\BITTERQUELLE\HUNYADI\JANOS. As noted above in the Str 2 food container discussion, the water marketed by Hunyadi Janos was first bottled in 1863, but its appearance on the American West Coast is thought to date later, to ca. 1879 (Schulz et al. 1980:142). The remaining mineral water bottles are tall, cylindrical stoneware vessels, also of quart size, with orange to tan slip, and exterior salt glazing. Both are thought to be from the Nassau region of Germany, where famous mineral water wells existed. One of the bottle sherds is stamped: No ... . It was probably followed by a number that indicated a particular bottlemaker within a particular guild. They probably date between 1850 and ca. 1890 according to Leavitt (1999:1-10).

Three other aqua and bright green glass beverage bottles were collected; they are cylindrical and 3 inches in dia.

Seven glass containers were identified as food bottles. The first is an aqua, wide-mouth bottle with packer finish. Three others are aqua bottles, free-blown with crude applied laid-on-ring finishes, kick-up bases, and narrow, thin-walled bodies. They are classic, European-made olive oil bottles from the nineteenth century, probably from France or Italy (Switzer 1974:61, 64-65). The other four food bottles apparently held ketchup, as each retains a painted label stating: CODE, ELFELT\& CO\TOMATO KETCHUP\SAN FRANCISCO\CAL which were in business between 1874 and 1898 (Zumwalt 1980:86). The intriguing thing about the ketchup bottles is that all of them were recycled heavy, aqua glass Florida Water bottles made by different companies (Figure 6.4-2). Their embossings are provided in Table 6.4-7. The bottles provide a fascinating case of bottle reuse in San Francisco. Since three different brands of Florida Water are represented, it is apparent that Code, Elfelt & Co. had fixed on a particular bottle style to market their sauce. All of the Florida Waters, regardless of brand, conformed to a style that was readily recognizable as a Florida Water bottle. Such reuse of bottles was a common practice in the mid- to late-nineteenth century in the United States, and especially in the American West where bottles and local glass manufacturing houses were in very short supply (Schulz et al. 1980:7).

Table 6.4-7. Embossings on Florida Water Bottles Reused as Ketchup Bottles from Fea 6, Str 9, the Assay Office, MS001.

Quantity	Embossing	Years of Manufacture
2	FLORIDA WATER\REDINGTON & CO.\SAN FRANCISCO	1884-1890
1	CRANE & BRIGHAM\SAN FRANCISCO	1861-1880s
1	FLORIDA WATER\MURRAY & LANMAN\ DRUGGISTS\NEW YORK	ca. 1842-1920

Six more Murray & Lanman brand Florida Water bottles were collected from Str 9 that presently do not have Code, Elfelt & Co. labels on them. It is likely that they too held ketchup, but as this cannot be proved, they are counted below as toilet water bottles. Based on the combination of years of operation of the ketchup manufacturers and of the various Florida Water producers, it seems that the bottles had to have been filled with ketchup between 1884 and 1890, the most narrow time frame within the group and in which all other date ranges overlap.

Eight glass and ceramic vessels and one metal utensil were employed for serving and preparing food. There are parts of two colorless glass faceted tumblers and a fragmentary Rockingham-glazed brown and gold teapot. Four wie vessels were found, including a thick-

Figure 6.4-2. Code, Elfelt, & Co. tomato ketchp labels on Florida water bottles

rimmed serving bowl (plain), one saucer (molded body fluting), and two vessels of unknown form (plain). One of the last is labeled with the black printed mark of Robert Clulow, an English Staffordshire potter operating in 1802 until an unknown later date (Godden 1983:153). In addition, there is a plain, porcelain dinner plate (10 inch dia) from Str 9 that crossmends with a sherd from the surface stratum of the assay office feature. This suggests that Str 9 was cut into by bulldozer excavation at the time of site monitoring. The final food artifact is a metal handle from a fork or spoon.

Three artifacts categorized as Group Services items were found. Two relate to group communication as they are imported stoneware bottles of large, bulk size that would have held dry ink or glue (Figure 6.4-3). Each carries the impressed body mark of POWELL\BRISTOL within an oval, made between 1830 and 1906. Powell-produced stoneware ale bottles were actively marketed and are commonly found in Western American archaeological deposits that date between 1865 and 1875 (Chace 1982:Table 2). It is not known if the bulk ink bottles follow the same trend. The other artifact is a solid brass oval handle for a water faucet or bibb.

One munitions artifact was recovered – the base of a brass cartridge casing of 0.63 inch dia. It is a centerfire type with external primer, and no headstamp is visible.

There are 18 personal artifacts from Str 9 (Table 6.4-8) including clothing parts, shoes, personal accessories (eyeglasses, clay tobacco pipe), and cosmetic and medicine bottles. All of the buttons and one eyelet found could be worn by men, women, or children, but the most complete of the shoes is definitely a heavy work shoe or boot for a man or boy to wear on his left foot. The six Florida Water bottles may have contained this popular toilet water while in Dayton, Nevada, but as noted above they more likely held ketchup. Such bottles were produced between ca. 1842 and 1920 (Devner 1970:47; Fike 1987:244; Wilson 1981:134). Only one embossed patent medicine bottle was collected, the Balsam of Wild Cherry bottle. The medicine was sold as a remedy for colds, coughs, whooping cough, bronchitis, sore throat, croup and "every affection of the throat, lungs, and chest" (Wilson and Wilson 1971:146). It was marketed from 1842 through 1883, with a hiatus of a few years between 1857 and the mid-1860s. The majority (63%) of non-mill artifacts from Str 9 falls into the category of multiple-function and unknown function. Included are parts of five glass bottles, four cork bottle stoppers of various sizes, seam solder from at least two cans, a fragmentary sun-purpled glass lid with ground edge and rounded rim, pieces of burlap, one lead foil fragment, nearly 200 iron fragments, six brass fragments, three copper fragments, one heavy iron bar, eight cuprous metal bar fragments, a flexible metal strip, a brass hexagonal threaded fitting, a brass petcock, a 1-inch long slot-head screw, copper wire, and miscellaneous fragments of glass, rubber, ceramic, leather, and three of modern plastic. The plastic pieces post-date 1950 and most likely are only 10 to 20 years old. Their presence in Str 9 within EU 7 indicates an intrusion of some sort, either by rodent or tree root activity, or by human means. Everything else from Str 9 is consistently late nineteenth/early twentieth century in age. Not one machine-made bottle was found in Str 9, nor in Str 2 several strata above it.

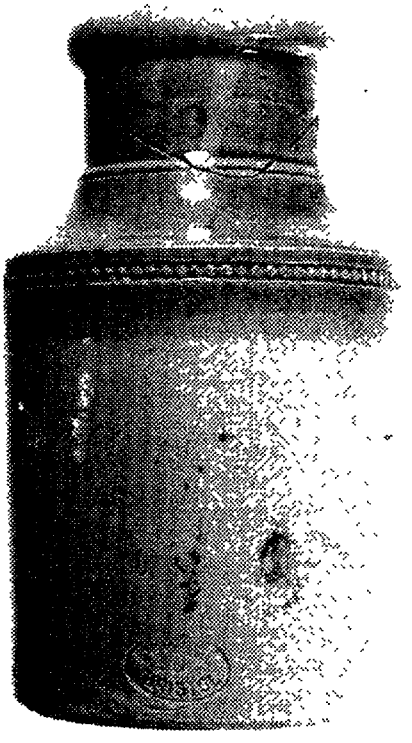


Figure 6.4-3. Powell stoneware bulk ink bottle from Str 9, Fea 6, MS001.

Table 6.4-8. Personal Artifacts from Str 9, Assay Office (Fea 6), MS001.

Artifact Type	Material	Description	Marks, Labels	Total MNI
Lens, oval eyeglass	Glass	Pale green, 1.5 x 0.94 inches, convex on one face	None	1
Button, large	Hard rubber	Plain, 4-hole sew-through, 1.19 inch dia	N.R. Co.\ GOODYEAR'S P=T May 6, 1851	1
Button, Prosser	Porcelain	Plain, 4-hole sew-through w/ hole panel, 0.44 inch dia	None, probably made in France between 1840 and 1910	2
Eyelet, clothing	Ferrous metal	Plain, 0.25 inch dia	None	1
Heel, shoe	Leather	Thick, stacked, with nails and nail holes	None	2
Shoe, left foot	Leather	Heavy work shoe or boot	None	1
Pipe, tobacco	Ball clay	White, bowl frag and stem frag	None	1
Bottle, Florida Water	Glass	Aqua, cylindrical with long neck and oil finish	FLORIDA WATER\ MURRAY & LANMAN\ DRUGGISTS\ NEW YORK	6
Bottle, medicine	Glass	Sun-purpled colorless, large prescription finish, 1.44 inch outer dia, 0.56 inch inner dia, body shape unknown	None	1
Bottle, patent medicine	Glass	Aqua, double bead, applied finish, oval body shape, small	None	1
Bottle, patent medicine	Glass	Aqua, applied brandy finish, short neck, octagonal body, pint size	DR. WISTAR'S\\ BALSAM OF\\ WILD CHERRY	1

Str 9 Discussion

The Str 9 assemblage was deposited in the 1880s. It is a highly-burned, ashy matrix, with wood ash and plenty of charcoal present that suggests wood was burned in place. Perhaps wooden structural members burned down at Fea 6. None of the artifacts, other than assay crucibles, cupels, kiln liners, and nine of the 62 mammal bone NISP exhibit modification by fire, therefore, most artifacts must have been deposited within Str 9 after wood-burning had occurred.

Presence of adults and males is reflected by the assemblage as nothing was identified that specifically indicates female or child presence. There is a fair variety of artifact types and of functional groups represented in comparison with the Str 2 assemblage. Where 26 artifact types (not including 10 architectural and mill types) were identified among the Str 2 assemblage, 42 non-industrial types were classified among Str 9 artifacts, therefore, Str 9 is a more diverse deposit. The largest functional group in Str 9 is the Unknown Function group, exaggerated by the large number of unidentified metal fragments. But Food-related is the next largest group, followed by Personal artifacts (Table 6.4-1). Many functional groups are not included, such as transportation, agriculture, non-mill industry, handicrafts, and religion or ritual, and domestic furnishings artifacts are only minimally represented by four fragmentary glass lamp chimneys.

A great proportion of the small assemblage of food-serving artifacts consists of group-serving vessels including a hotelware serving bowl, a pitcher, and a teapot or pitcher. There are four, and possibly as many as 10 ketchup bottles of one brand. Such a large number of bottles with the same product in the same deposit infers that Str 9 artifacts are the result of one or more dumping episodes occurring within a short time, perhaps from a restaurant, hotel, or boardinghouse in Dayton. Because of the overall diversity of the assemblage and the large number of personal articles, the boardinghouse or hotel scenarios are favored.

One point that should be considered here, is that while the assay-related artifacts have been discussed separately in Chapter 3, they were encountered within the same context as the non-mill artifacts discussed here. An association of time and place is assumed for the whole assemblage, as a unit of deposition. Artifacts from all of the functional groups were distributed fairly evenly throughout Str 9. Assay crucibles, cupels, bricks, kiln liners, quartz ore, and slag were not clustered together in one area to the exclusion of domestic artifacts. They were all deposited in Str 9 ash within a limited time period. If the assay office burned in place and if Str 9 is the evidence of that event, then innumerable assay artifacts would be expected to be found in Str 9. As these kinds of artifacts are subjected to extreme heat in normal assay procedures, they appear heat-altered most of the time and do not provide evidence for or against a structural fire at the site. A few personal and domestic artifacts may have been in the office at the time of the fire and these would have been charred or fused. Hence, the many non-assay artifacts that are uncharred must have been deposited after the fire, and the structural fire must have taken place in the early to mid-1880s.

Thirty artifacts from Str 9 can be identified as to place of origin and 26 of those also can be identified as to manufacturer (Table 6.4-9). An interesting marketing and supply trend is illustrated by the marked artifacts. For the town of Dayton in the 1880s, a significant influx of and reliance upon goods from San Francisco is indicated. For 43.3 percent of the labeled artifacts from Str 9, Fea 6 were manufactured in San Francisco, while only 26.7 percent came from the East Coast, and 30 percent were imported from Britain and Europe. While the majority of artifacts were American-made, most were coming from the West Coast region, reflecting the economic strength and stability of San Francisco at that time. There was, however, still a strong reliance on imported goods from across the Atlantic Ocean.

Table 6.4-9. Known Manufacturers and Origins of Str 9 Artifacts, Assay Office (Fea 6).

Artifact	Place of Origin	Manufacturer	Count	Fea/Str
Assay crucible	London, England	PAR ... Battersea Works	1	9
Assay crucible	San Francisco, CA	J. Taylor & Cie	4	9
Wie vessel	Fenton, England	Robert Clulow	1	9
Gin bottle	San Francisco	J. T. Daly, Clubhouse Gin	1	9
Mineral water bottle	Hungary	Hunyadi Janos	1	9
Catsup bottle	San Francisco	Code, Elfelt & Co.	4	9
Florida Water bottle	San Francisco	Crane & Brigham	1	9
	San Francisco	Redington & Co	2	9
	New York	Murray & Lanman	7	9
Balsam of Wild Cherry bottle	San Francisco	Dr. Wistar	1	9
Bulk ink bottle	Bristol, England	Powell	2	9
Rubber button	New Jersey	Novelty Rubber Co.	1	9
Prosser porcelain buttons	France	—	2	9
Mineral water bottle	Nassau, Germany	—	2	9

SUMMARY REMARKS ABOUT STR 2 AND STR 9 ARTIFACTS , FEA 6

It appears that Str 9 and Str 2, and all of the intervening strata were deposited within a short period, perhaps between ca. 1882 and ca. 1892. The Str 9 artifact assemblage represents on-site structural fire and post-fire garbage dumping. The domestic artifacts from Str 9 may have been initially discarded at a nearby boardinghouse, then hauled to the periphery of the former industrial area of Fea 6, where an assay office probably stood. It is not known when the office was built, as archaeologists were unable to excavate to the base of cultural deposits during monitoring and contaminated sediments removal operations. The structure probably burned down in the early to mid-1880s, after which the local residents proceeded to use the site for refuse disposal. Str 9 reflects this transition of property use in Dayton.

The Str 2 material offers insight into the use of the same site a few years later. Fea 6 continued to be used for at least occasional domestic trash disposal by Dayton business owners and residents. It is dominated by food bones from mammals, many of which were burned at the site, therefore wet garbage was brought to the site and purposely burned there, along with other kinds of artifacts. It has been suggested previously that the Str 2 assemblage was generated by a commercial eating and drinking establishment such as a bar or restaurant, or by a private social club that served liquor and hot meals.

Str 9 and Str 2 domestic artifacts represent garbage-dumping activities by local Dayton commercial establishments, with Str 9 artifacts probably coming from a boardinghouse or hotel and Str 2 artifacts from a bar, restaurant or private club. Once the assay office had been destroyed, the community began to use the former industrial ground for indiscriminate trash disposal.

6.5 DOMESTIC TRASH DUMP (FEA 5, MS001)

Monitoring of contaminated sediment removal revealed two locations where subsurface deposits of artifacts and perhaps features occur. Fea 5 is a small, dense concentration of domestic household artifacts dating to the 1880s. The artifacts are on top of the demolished mill remains (Fea 1). A 1x1 m test pit (TP 1) and three 1x1 m surface scrapes (SS 1-3) were hand excavated in this concentration yielding a number of artifacts (Figure 3.2-3). This scraping removed about 10 cm of deposit before construction could be halted in this area. Most artifacts are glass bottles along with ceramics and bone.

Due to hand excavation of a test pit and surrounding mechanical exposures it is possible to closely discern the limits of this trash deposit to an area of about 2x3 m with a thickness of 10 cm or less resting on top of distinctive mill tailings (refer to Figure 3.2-4). A 1x1 m test pit and three 1x1 m surface scrapes removed most of this deposit which was confined to a single stratum (Str 2).

ARTIFACTS FROM FEA 5

The single stratum (Str 2) that comprises Fea 5 yielded a large assemblage of late nineteenth century artifacts dominated by food bones (Table 6.5-1). A fair number of architectural artifacts and personal artifacts, the latter dominated by Hostetter's and others' patent medicine bottles, were also recovered.

Table 6.5-1. Fea 5 Artifacts by Functional Group, from MS001

Artifact Group	No of MNI	% of Assemblage
Architectural	121	8.8
Domestic	6	0.4
Food	1108	80.1
Industry/Commerce	4	0.3
Personal	55	4.0
Transportation	3	0.2
Multiple Use/Unknown Function	85	6.2
Total	1382	100.0

Artifacts of an architectural nature are summarized in Table 6.5-2. Architectural objects are included here rather than with mill artifacts as was done for Fea 1 and Fea 6 artifacts because very few mill artifacts came from Fea 5 and because it is thought to post-date all milling and assay activities at MS001. It is noteworthy that both machine-cut and wire-drawn type nails are present, though most of the iron objects including iron nails are in very corroded condition, the two types could be distinguished in many cases. Wire nails were not produced in the United States until 1880, but they dominated the American nail market by 1900 (Wells 1998:86-87).

The presence of both nail types offers a clue as to period of deposition. Cut nails predominate at Fea 5 suggesting they were discarded in the late 1880s or early 1890s.

The milled lumber in Fea 5 includes one piece of redwood lath and pieces of another board of unknown wood type. Many brick fragments were recovered from the deposit and all of them are standard, red brick, however, no fire brick came from Fea 5.

Only fragments of a few domestic furnishings were identified, including sherds from two milk glass lamp globes, three glass lamp chimneys, and a small ornamental saucer. The saucer is unique as it is but 3 inches in dia, composed of porcelain fabric, decorated with cobalt blue spongeware design, and painted gilt lines on rim, below rim, and around center cup depression (Figure 6.5-1).

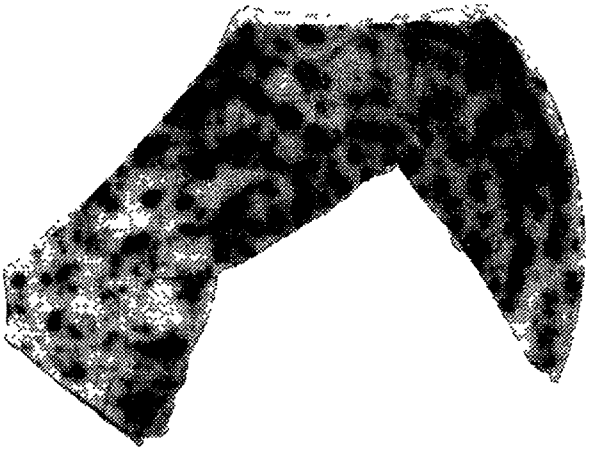


Figure 6.5-1. Miniature porcelain saucer with blue spongeware design from Fea 5, MS001.

Table 6.5-2. Architectural Artifacts from Fea 5, MS001.

Artifact Type	Total MNI
Board, wooden	2
Brick, red	3
Mortar, brick	2
Nail, machine-cut	68
Nail, roofing	1
Nail, wire drawn	15
Nail, unidentified	21
Putty, window	1
Shingle, asphalt	2
Windowpane, glass	6
Total MNI	121

The huge number of food-related artifacts (1,108 MNI) is largely attributable to the 1,056 NISP food bones recovered from Fea 5; one peach pit also was found. A large and diverse assemblage of animal remains was collected from the Fea 5 dump (Table 6.3-3). In addition to a number of butchered beef, pork, and lamb bones, 12 chicken (*Gallus domesticus*) bones and a single fish vertebra offer evidence for the consumption of two additional food species. Identified beef bones are represented by a variety of skeletal portions (Table 6.4- 4). These include three cuts of moderate quality from the arm, rump, and short/cross rib, and a variety of low quality cuts from the foreshank and hindshank (total NISP = 9); two relatively large foreshank (distal humerus) portions appear to represent inexpensive, multiple serving cuts (cf. Lyman 1987). More expensive cuts from the beef round are abundant (i.e., femora; Table 6.4-4) and include both individual round steaks (NISP = 6) and a few large distal portions that represent multiple serving cuts (Figure 6.5-2). Additional high quality cuts include two T-bone steaks from the short loin, a single serving sirloin steak is reflected by a thin, saw-cut ilium piece, and four butchered thoracic vertebrae/proximal ribs represent cuts from the rib. Identified pork bones also reflect a variety of meat cuts (Table 6.4- 4). Eight phalanges provide evidence for the occasional consumption of pigs feet, and butchered ribs and thoracic vertebrae (NISP = 7) represent cuts from the rib and loin. Two *Sus* humeri represent picnic shoulder cuts and a proximal femur (Figure 6.5-2) represents a single roast/ham. A number and variety of sheep bones was also collected from Fea 5 (Tables 6.3-3 and 6.4-4). Sheep ribs (NISP = 8) include cuts from the chuck and short rack, and five femora represent high quality portions of the leg. Additional lamb bones include two cuts from the foreshank, one cut from the neck, and two butchered vertebrae which appear to be single serving chops from the loin. Fifty (4.7%) of the Fea 5 animal bones

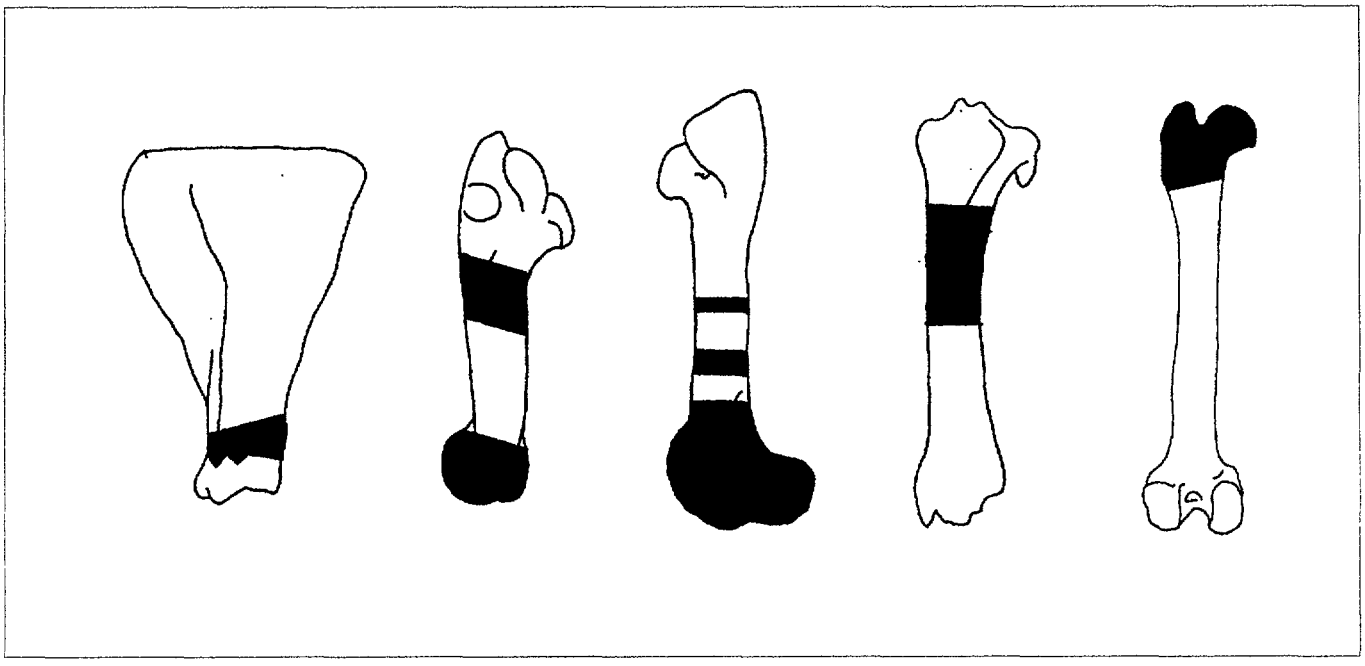


Figure 6.5-2. Selected butchered bones from Fea 5. Jagged lines represent breaks and straight lines represent saw cuts; shaded areas represent the archaeological specimens. Left to right: *Bos* scapula, humerus, femur, and tibia; *Sus* femur (scales vary). Most of the illustrations are adopted from Lyman (1977).

are burned and are largely represented by small, unidentifiable calcined fragments. Since the calcination of bone reflects prolonged exposure to intense heat (e.g., Stiner et al. 1995), these specimens probably represent the intentional burning of trash rather than roasting or grilling.

Beverage and food containers were collected, 26 of which are free- or moldblown glass bottles and jars and three of which are ceramic bottles. These and the food serving and preparing artifacts are presented in Table 6.5-3. Presumably, the tan stoneware ale bottle is from England though it is not marked. Eight of the cylindrical beer bottles are amber glass and of export style, indicating they post-date 1873 – the year lager beer was first bottled in the United States (Wilson 1981:1). One black glass beer bottle is also present. One of the beer bottles retains a remnant of paper label glue on its neck and two others are embossed on the base. The first bears the mark – FHGW\24 – representing Frederick Hampton Glassworks, of England, dating between 1880 and 1900 (Toulouse 1971:202). The second is embossed: C&CO LIM\8, and it is the mark of Cunninghams & Co., of Pittsburgh, Pennsylvania, dating between 1879 and 1907 (Toulouse 1971:119-121).

Table 6.5-3. Food-Related Artifacts from Fea 5, MS001.

Artifact Type	Retail Container	Food Serving/Preparing	Total MNI
Bottle, ale	1		1
Bottle, champagne	1		1
Bottle, export beer	9		9
Bottle, liquor	5		5
Bottle, mineral water	2		2
Bottle, wine	5		5
Bottle, Worcestershire sauce	2		2
Bottle, capers	1		1
Bottle, pickled food	1		1
Can, hole-in-cap	1		1
Lid, glass jar	1		1
Lid, wie teapot		1	1
Bowl, glass mixing		1	1
Cup, wie		1	1
Plate, wie dinner		7	7
Plate, wie small		3	3
Saucer, wie		1	1
Tumbler, faceted glass		2	2
Vessel, wie		6	6
Total MNI	29	22	51

There are five cylindrical liquor bottles in brown and dark green glass, with applied brandy finishes; none is marked as to maker or product. One champagne bottle and four of the wine bottles are turnmolded olive green glass bottles, the wine bottles having applied laid-on-ring finishes. Another wine bottle is of brown glass, with sloping shoulders and held Rhine wine, probably imported from Germany (Schulz et al. 1980:75). Finally, the two mineral water bottles are of slipped and salt-glazed stoneware, probably from the Nassau region of Germany (Leavitt 1999).

The capers or brandied cherries bottle is distinctive in that it is formed of bright green glass, rectangular in shape, sides straight, front and back panels concave, and corners chamfered. One other bottle likely held pickled food and is a rectangular vessel of colorless glass, embossed: ... NEW YORK. As for condiments, two Lea & Perrins brand Worcestershire aqua bottles were identified, one bearing the base mark: A.G.B.CO., the mark of the Albion Glass Co., of England, and dating the bottle between 1880 and 1900 (Toulouse 1971:38-39). A slip-on type glass lid from a large glass collected, measuring 7.5 inches in dia was collected. Such a jar may have held candy, dried fruit, flour, or other bulk ingredient.

Among the ceramic food-serving and -preparing vessels, most are plain, undecorated wie. Several of these have black printed makers' marks on their bases. There are three small wie plates, each 7 to 7.5 inches in dia, two of them with marks. The first carries a partial Powell & Bishop mark, coming from Hanley, England and made between 1876 and 1878 (Godden 1983:509). The second bears the Burgess & Goddard mark illustrated in Figure 6.5-3. It is estimated to date between ca. 1870 and 1890. This mark is not found in Godden (1983), but is mentioned by Wetherbee (1996:138, 141) as the mark on an illustrated white ironstone pitcher produced in 1878 and on a handleless cup and saucer set.

The same Burgess & Goddard mark is found on one dinner-size plate and on a wie vessel of unidentified form from Fea 5 as well. This suggests several pieces from a matched set or from Burgess & Goddard open stock were discarded at about the same time. The partial printed mark: ... NGLAND, and the impressed mark: 3\38 were found on two of the other dinner plates.

The group of unidentified ceramic vessels provides the only decorated wares among the ceramic food artifacts, but all are represented by very small sherds. Two wie sherds exhibit brown underglaze transferprint floral design. A third wie fragment has an underglaze transferprint and possibly painted design of dark brown print and dark blue possibly painted background design. The fourth sherd is white porcelain, decorated with a painted overglaze design in red.

Artifacts relating to Industry and Commerce are all from milling activities and consist of two sulphur lumps, one quartz crystal, and a piece of lead foil. Admittedly, the foil could be from assay activities or from a wine or champagne bottle seal.

Figure 6.5-3. Burgess & Goddard ceramic mark on small white improved earthenware plate, Fea 5, MS-001.

Many personal artifacts were recovered from Fea 5, including definite feminine articles such as two glass beads, a finger ring, three ornate black glass buttons (Figure 6.5-4),and a perfume bottle. Both beads are 0.25 inch wide, one is white and plain, the other colorless and faceted. The ring is thin, stamped cuprous metal forming a narrow band with a widened, smooth center area. It is approximately size 5 to 6.5, and appears to have been a very inexpensive ring, currently too corroded for an accurate description of its design. Seven buttons were found in all, three are black glass, and thought to be for feminine clothing because of their large sizes (0.63 to 0.75 inch dia) and facial designs. One is fused and incomplete, but the largest retains its romantic facial, molded design of a woman's hand holding a single large rose with stem and leaves still attached. A nearly complete colorless glass perfume bottle was collected, cylindrical in shape and 3.5 inches tall by 1.5 inches wide. It is embossed on the body thusly: LUBIN\ PARFUMEUR\ PARIS.

The other personal artifacts not necessarily associated with females are composed of three porcelain buttons (two "piecrust" molded design and one with painted green concentric rings). A mother-of-pearl collar or cuff stud, a brass eyelet (0.13 inch dia), the metal laces hook from a lace-up boot, a black composition tobacco pipe stem, a bone umbrella handle, an incised bone handle or tube, and 38 medicine bottles of various sorts.

The incised bone tube is in many pieces, all of which probably fit together. Together they formed an ornate cylinder of at least 5.75 inches in length and 0.75 inch dia. One end of the cylinder is plain and only 0.5 inch wide, 2.75 inches long. Its interior is hollowed out in a round shape, that comes to a point 2 inches from the finished end. The interior surface has 10 incised rings located 0.5 inch below the mouth. It presumably was fitted over a round, pointed rod of some type. The incised pieces formed the opposite end of the tube, being 3 inches long and 0.75 inch wide at maximum. The incised end has a collar of 0.31-inch width. Below the collar are two ribs parallel to the tube's length, with the intervening 0.38 inch span between them being plain. The other side of the tube is incised with parallel diagonal grooves. The interior of this end of the tube is hollowed out as a square or rectangle. In the center between the two ends, part of the tube is solid, not hollow. It is apparent that the tube articulated with two other parts – one a rounded rod, the other an angular shaft in cross-section. Possibly, the tube was part of a handle/shaft assembly for an umbrella.

The medicine bottles comprise a large and interesting class within the Fea 5 assemblage. Five bottles in cobalt blue, colorless and brown glass are unembossed, generic medicine bottles. There is a single colorless glass homeopathic medicine vial. One prescription medicine bottle was collected -- a colorless glass panel bottle embossed: TARRANT & CO\DRUGGISTS. This bottle is from New York and post-dates 1871 (Fike 1987:113). There are 31 patent medicine bottles comprised of 22 Dr. Hostetter's Stomach Bitters large, square brown glass bottles (1858 to 1934), three McMillan & Kester brand Essence of Jamaica Ginger bottles (1875 to 1879), and one square, brown glass Peruvian Bitters bottle (1878 to 1884). Five unidentified bottles with

Figure 6.5-4. Ornate black glass button from Fea 5, MS001.

partial embossed or painted labels (Fike 1987:36, 129; Wilson 1969:131) were also noted. One painted label reads: TO KEEP HEALTHY\ DO YOU KNOW A REMEDY FOR A\E ... , attached to a large octagonal brown bottle body with bumpy texture. The bottle is also embossed: ... LL ... MAN, thought to stand for BOLLMAN. No information has been found about this name.

The many moldblown Hostetter's Bitters bottles carry several different basal embossings that indicate different bottle manufacturers' molds. As far as is known, all fall within the general period of 1858 to ca. 1920; several bases were embossed with an X, U, M, W, or L or a 7(Fike 1987:36). It is well known that Hostetter's Bitters and many other patent medicines with high alcoholic content, though sold as medicines, were frequently consumed as liquor.

The Transportation group is represented by three artifacts. The first is a 0.5 inch dia copper burr for a rivet, a fastener commonly used on leather harnesses and other straps for horses and mules. The second is a copper rivet, and the third artifact is a patch or tack part composed of two leather rectangles held together with two copper rivets. Dimensions of the rectangles are approximately 4x3 inches in size.

A subgroup of the unknown function artifacts is the Multiple Purpose group. It includes 18 metal artifacts consisting of 4 small iron tacks, an iron sheet, one large bolt, a chain, two lengths of thin copper wire, one piece of ferrous wire, and eight short lengths of aluminum wire. The collected bolt is 8.5 inches long and 0.75 inches wide, with a square nut attached. Aluminum wire is an unusual find that may be a modern artifact, but that potentially could have been manufactured in the late nineteenth century. Aluminum articles were being produced as early as the mid-1850s (Peterson 1962:334-341).

The remaining 67 artifacts are unknown as to specific function. Included are sherds from glass bottles, can parts including seam solder and wire bales, a zinc cap, cork bottle stoppers, a zinc pry-off cap, metal discs, brown textile, and a bone tube. Several interesting mechanisms, each consisting of a knob 1.25 inches in dia, with a white metal collared disc, brass connecting rod of 1.25 inches in length to which is attached a semi-circular disc pierced by a hole, and cork gaskets that articulate with the white metal discs. Five of the discs with gaskets were recovered, along with one knob, three connecting rods, and one fairly complete assembly of all elements. They had a specific, but currently unidentified, function.

Fea 5 Discussion

Fea 5 artifacts provide a glimpse of life in the Dayton of the early 1880s. It is assumed that Fea 5 is the result of one or two individual dumping episodes by the same or different local residents. It may or may not, therefore, represent the material discards from a single, private or commercial "household." This assemblage includes a modest grouping of structural materials that may represent minimal building repairs or yard clean-up carried out off-site, then discarded at MS001 as secondary dumping. There is a smattering of mill-related artifacts, of draft animal

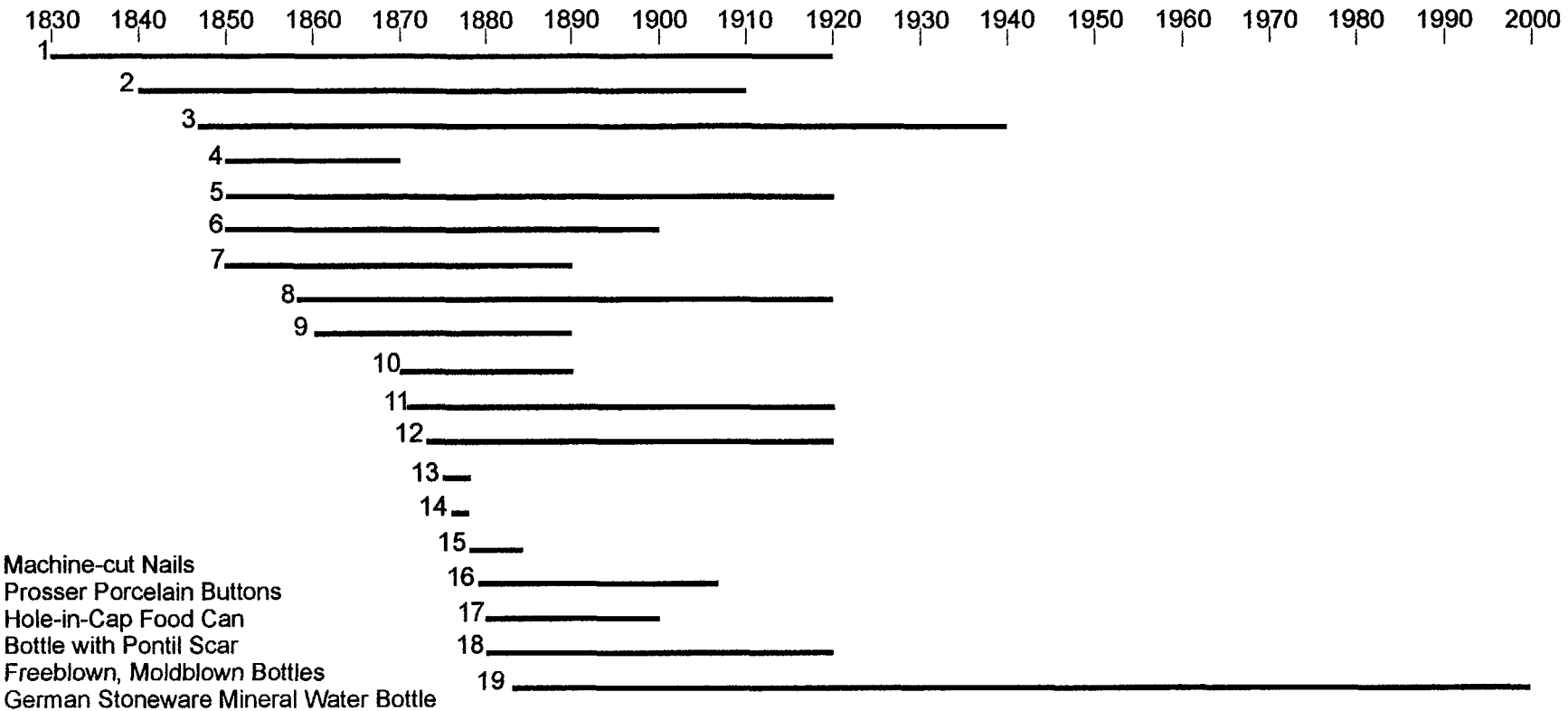
tack, and of domestic furnishings in the guise of kerosene lighting artifacts (chimneys and globes). But there are also large numbers of food bones and patent medicine bottles. The faunal remains are too abundant and varied to have been consumed by a single family within a short period of time. Rather, they must have resulted from meals at a restaurant, boardinghouse, or company diningroom, as for a railroad section crew. The bones came from several mammal species, as well as from chicken and fish. They are a mix of cuts in terms of economic rank (steaks versus roasts), and of serving size, including individual steaks and chops, and multiple-serving cuts such as leg of lamb, picnic ham, and beef roasts.

Patent medicine bottles are represented by 38 bottles, most of which contained Hostetter's Stomach Bitters in quart sizes. Hostetter's and other brands of bitters, as well as other patent medicines of the time, contained high levels of alcohol and were frequently consumed in place of liquor, as cheaper and more socially-accepted alternatives. It is entirely possible that the bottles from Fea 5 were the result of such behavior. Their presence in such large quantity in a small garbage deposit suggests rapid consumption of the stomach bitters by one or more persons. As with the food bones, the bitters bottles indicate consumption by many people in a short time period, more people than would live in a typical family household.

Fea 5 is rife with adult artifacts, particularly the ale, beer, champagne, liquor, wine, and patent medicine bottles, as well as a ball clay tobacco pipe fragment. There are a number of artifacts related to females, such as an inexpensive metal finger ring, glass beads, ornate black glass buttons, and a perfume bottle. But no artifacts indicative of children were recovered.

At the time Fea 5 was created, only about 200 people lived in Dayton. There was a limited number of businesses in town, particularly of the kind that prepared and served meals. For example, in the 1882 business directory, only four such businesses are listed, including the Union Hotel, an unnamed hotel that may have been more of a boardinghouse establishment, the Sazerac Saloon, and the Delta Saloon (McKenney 1882:629-630). By 1881, C&CRR had been built through Dayton, comprised of a depot, railroad yard, and other facilities (Myrick 1962:170-171). The C&CRR complex was situated just a few hundred feet west and southwest of the Fea 5 dump. So it is entirely feasible for the debris to have come from the C&CRR.

The *tpq* for Fea 5 is 1883, based on the iron wire nails in the deposit. A graphic summary of all known date ranges for the Fea 5 artifacts is provided in Figure 6.5-5. Based on the trend indicated by the time ranges, that includes several very narrow ranges, Fea 5 was likely formed between ca. 1878 and 1885. Interestingly, both ceramic and glass vessels lay within the feature that have short time ranges. Whereas ceramics typically remain in circulation for many years after they are manufactured and before they enter the archaeological record, retail food and medicine bottles follow the opposite track. They usually are discarded within months or a few years of being marketed, but at Fea 5 both kinds of objects with similar time ranges are present. This suggests that the datable, marked ceramics at Fea 5 were broken within a few years of their manufacture and purchase. This in turn suggests that the dishes had been used at a restaurant or boardinghouse where they were receiving intensive use, with high breakage rates. Virtually all of the dishes are plain, sturdy white wie vessels that commonly served as "hotelware" in the second half of the nineteenth century. This type of ware fits with the proposed use and origin of the ceramic vessels from Fea 5.



1 Machine-cut Nails
2 Prosser Porcelain Buttons
3 Hole-in-Cap Food Can
4 Bottle with Pontil Scar
5 Freeblown, Moldblown Bottles
6 German Stoneware Mineral Water Bottle
7 Black Glass Bottle
8 Hostetter's Stomach Bitters Bottle
9 Spongeware Saucer
10 Burgess & Goddard Plates
11 Tarrant & Co. Druggists Bottle
12 Lager Export Beer Bottles
13 McMillan & Kester's Essence of Jamaica Ginger
14 Powell & Bishop Plate
15 Peruvian Bitters Bottle
16 Cunninghams & Co. Bottle
17 Frederick Hampton Glassworks Bottle
18 SCA Bottle Glass
19 Wire Drawn Nails

Figure 6.5-5. Artifact time ranges from Fea 5, MS001.

6.6 DOMESTIC TRASH DUMP (FEA 7, MS001)

A small trash dump (Fea 7) was exposed during bulldozing near the north side of MS001 North. Since it was adjacent to the Marsh residence driveway, it was only partly exposed and appeared to continue under the driveway. The portion of deposit available for study is about 3x3 m with approximately 10 cm of deposit remaining after blading exposed the feature. A 1x1 m test pit (TP1) and three 1x1 m scrapes (SS 1-3) in this area indicated that this is a secondary dump deposited on a former surface rather than in a pit (Figure 6.6-1). A stratigraphic profile of the east wall of TP 1 illustrates the cultural deposit (Str 1, Fea 7) overlying a series of overbank flood deposits (Figure 6.6-2). Str 1 may also contain some flood deposit mixing, although the artifacts do not appear to have been dispersed widely across the area by local flood episodes. Artifacts from this feature are described below.

ARTIFACTS FROM FEA 7

Fea 7 yielded nearly 5000 MNI (4841 MNI), 65 percent of which are food bones (Table 6.6-1). Another 25 percent consists of architectural remains, most of which are machine-cut and unidentified nails. Altogether the artifacts fall into ten functional categories, not counting those of unknown function. Fea 7 dates to the late 1890s, making it a more recent deposit than Fea 5, Fea 1, or Fea 6 garbage deposits. As with Fea 5, Fea 7 is presumed to be an assemblage accumulated over one or several trash disposal episodes generated by Dayton town residents.

Table 6.6-1. Artifacts from Fea 7, Organized by Functional Group, MS001.

Artifact Group	MNI	Percent of Assemblage
Architecture	1190	24.6
Domestic	15	0.3
Food Remains	3158	65.2
Food-related Artifacts	128	2.6
Group Services	2	0.05
Industry and Commerce	14	0.3
Munitions	5	0.1
Personal	59	1.2
Transportation	2	0.05
Multiple Use	39	0.8
Unknown Function	233	4.8
Total MNI	4845	100.0

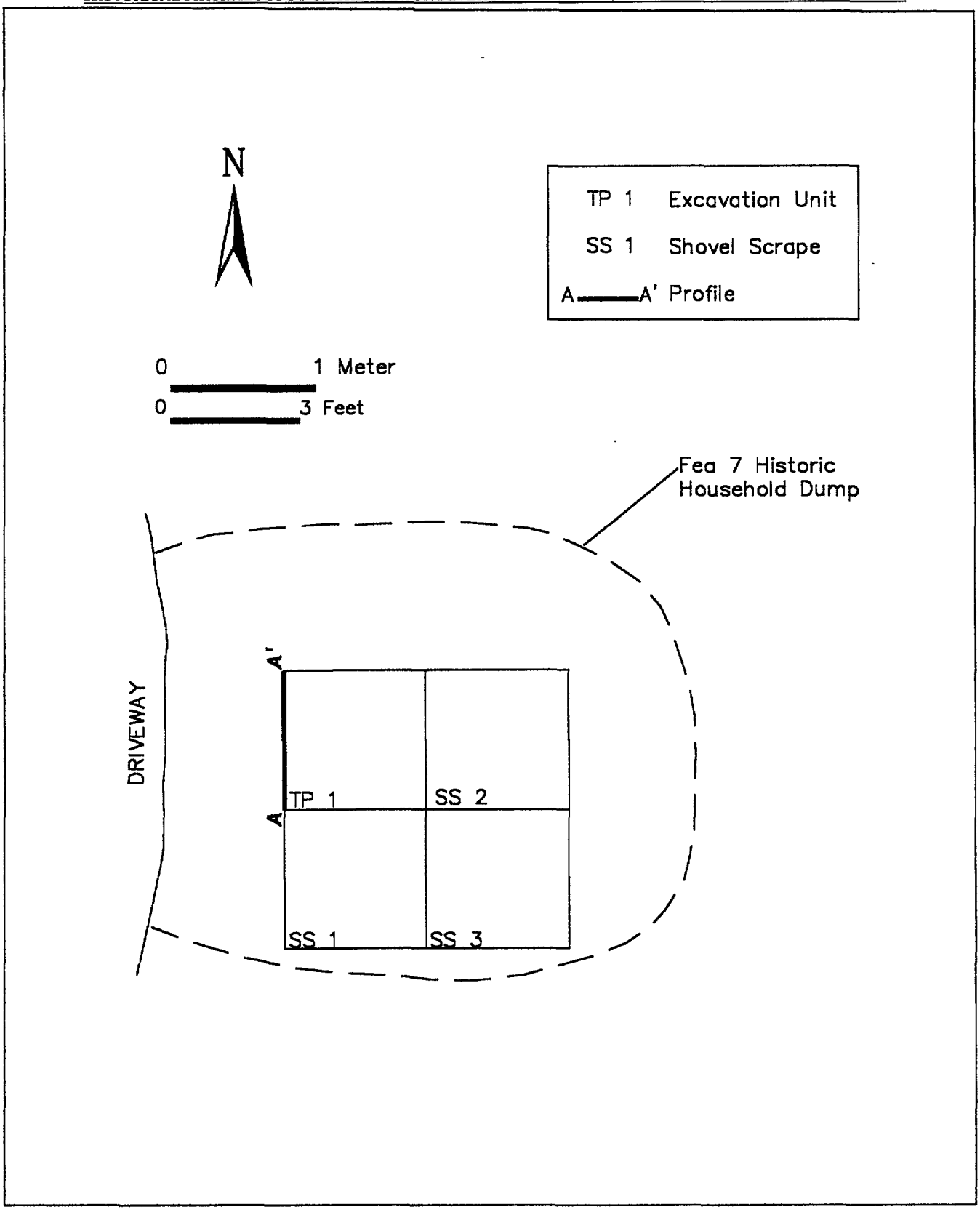
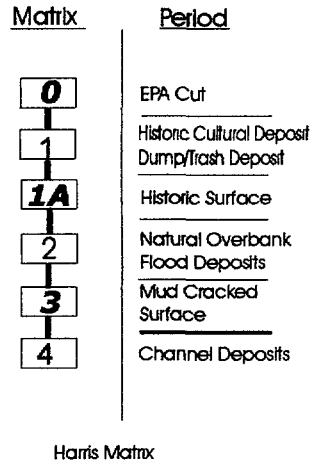


Figure 6.6–1. Plan view of Fea 7 and excavation layout at site MS001.

East wall in EU 1 (Roll 959-2, fr.1).



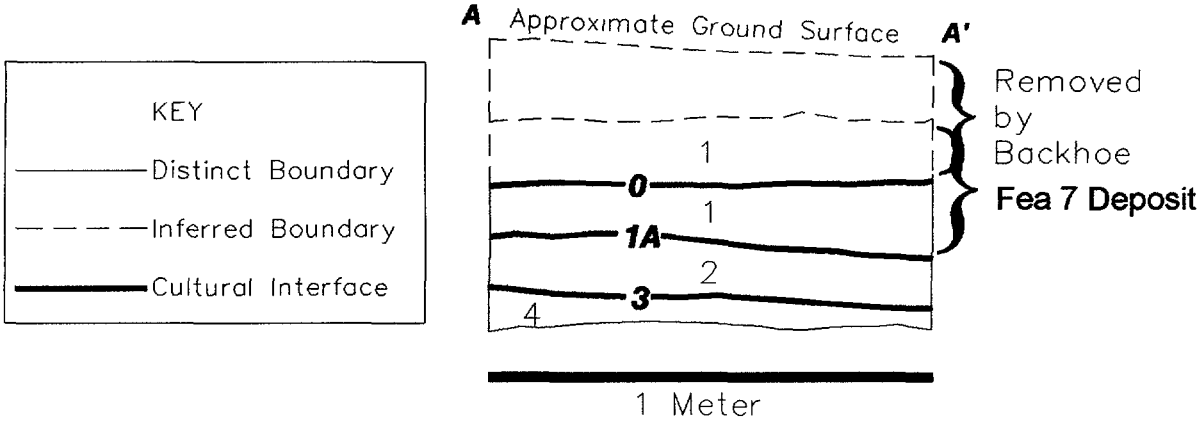


Figure 6 6-2. Photograph, Harris matrix, and stratigraphic profile of the east wall of EU 1 in Fea 7, MS001.

Stratigraphic descriptions:

0 EPA cut across Str 1.

1 10YR4/2 (dry), 10YR2/2 (moist); gravelly sandy loam; massive; non-sticky, non-plastic, dry slightly hard; round pebbles to cobbles, roots very common; common cultural material, charcoal, ash, bone to 50% of volume; abrupt smooth boundary.

1A Interface on which Str 1 cultural debris was tossed.

2 10YR5/3 (dry), 10YR3/3 (moist); fine sand to silt loam; massive horizontal bedding; non-sticky, non-plastic, dry soft; 20% subrounded pebbles and cobbles, no roots; little cultural material; abrupt smooth boundary.

3 10YR7/3 (dry); cracked mud silty clay interface on top of Str 4 sands.

4 10YR5/3 (dry), 10YR4/3 (moist); poorly sorted pebbly sand to sandy loam; non-sticky, non-plastic, dry soft; massive to single grain; no cultural material; boundary unknown; channel deposits.

Figure 6.6-2. Stratigraphic descriptions for Fea 7, in EU 1, MS001.

The abundant architectural materials in the deposit include building materials such as a 1-inch-thick board fragment, rubble from at least three standard red bricks, a piece of gray flagstone or slate, composition black shingle, and colorless and pale green glass from 11 windowpanes. The architectural hardware artifacts are most numerous, with 864 machine-cut nails, eight wire nails, and 300 nails too corroded for more refined identification. Included is one 9.5 inch long spike fitted with an eye at its head.

There are 15 MNI associated with furnishings one might find in a home, boardinghouse, or hotel. These include one milk glass lamp globe, five fragmentary glass lamp chimneys of colorless glass, parts of two terra cotta flowerpots, a mirror of unknown size, and six fragmentary ornate glass and ceramic vessels that may have graced the shelves in a parlor. Among these are a rectangular vessel of SCA glass with a thick scalloped rim; a round, SCA pressed glass vessel with thick walls, faceted body, and scalloped rim; a colorless, round pressed glass vessel with raised diamond pattern on body; a milk glass vessel with round shape and pressed design of thick exterior ribs; a thick milk glass vessel with pressed design of facets, wide rim and raised, hexagonal dots on the body; and finally a porcelain artifact with thin walls and faint traces of blue painted decoration. All of the domestic items are incomplete, making for a basic and coarse-grained description.

The remains of food were extremely plentiful in Fea 7. Excavations there recovered 3158 animal bones (Table 6.3-3). One hundred thirty-eight specimens (4.4%) are burned and include large numbers of small calcined bone fragments. The five jackrabbit (*Lepus* sp.) bones bear no evidence of processing and appear to manifest natural accumulations and, although unidentified, the bird specimens probably represent domestic or wild fowl food remains. Food bones are dominated by beef cuts that represent an array of body parts (Table 6.4-4) and a mixture of both single serving cuts and large, multiple serving portions (Figure 6.6-3). Large numbers of tibiae (and associated astragali, calcanei, and tarsals), distal humeri, radii, and ulnae indicate that inexpensive, low quality cuts from the hindshank and foreshank were commonly consumed. Many of these cuts represent multiple serving portions and suggest that they were purchased by a family or small group residence. Beef cuts of moderate quality and expense include cuts from the arm (NISP = 2) and cross/short rib (NISP = 5). Four saw cut scapula blades represent moderately priced, single serving chuck steaks, three thin cuts from the rump also reflect single serving steaks, and a large saw-cut innominate (ischium) represents a multiple serving rump roast (Figure 6.6-3). Thirty-two high quality cuts were recovered and include expensive T-bone, sirloin, and rib eye steaks (total NISP = 16), as well as individual round steaks (NISP = 4) and two multiple serving roasts from the distal round.

Similar to the assemblage of beef bones, a number and variety of pork and especially lamb bones were collected from Fea 7 (Table 6.4-4). Pork bones include cuts from the shoulder (NISP = 3), foreshank (NISP = 3), head/jowl (NISP = 4), and eight single serving chops from the rib/loin. The single fibula represents part of a pork roast or ham, and three phalanges indicate that pigs feet (hock) also were consumed on occasion. Large numbers of sheep thoracic and lumbar vertebrae suggest that lamb chops were often consumed, as were cuts from the chuck (NISP = 9). Ovis innominates and femora also are abundant and reflect both single serving portions and large, multiple serving leg cuts and roasts (cf. Figure 6.6-3). The recovery of a

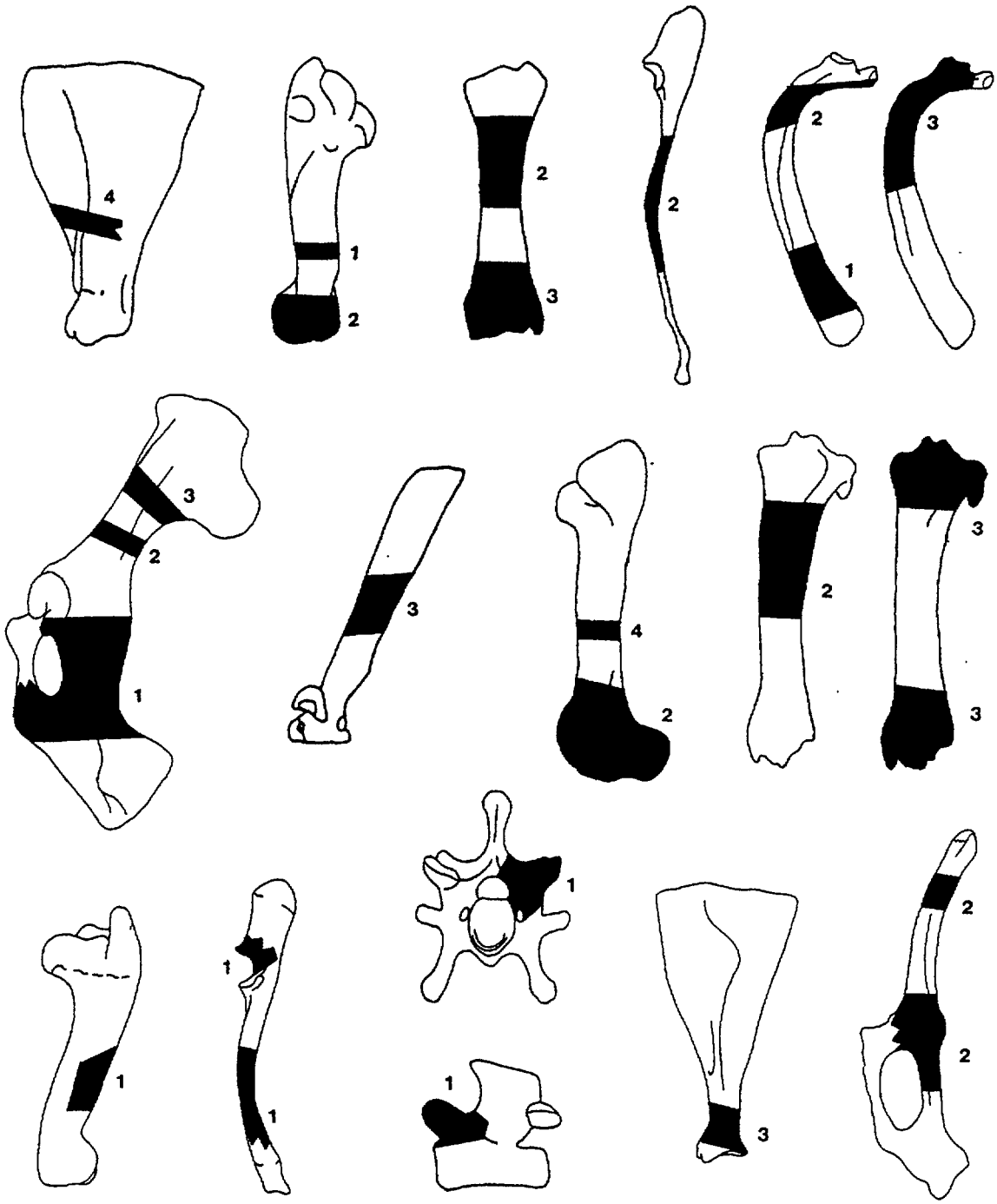


Figure 6.6-3. Selected butchered beef, pork, and lamb bones from Fea 7. Jagged lines represent breaks, straight lines represent saw cuts, and numbers denote the number of specimens; shaded areas represent the archaeological specimens. Top row, left to right: *Bos* scapula, humerus, radius, ulna, and ribs. Middle row: *Bos* innominate, thoracic vertebrae, femur and tibiae. Bottom row: *Sus* humerus and ulna; *Ovis* cervical vertebrae (top), lumbar vertebrae (bottom, scapula and innominate (scales very). Most of the illustrations are adopted from Lyman (1977).

single ulna and two tibiae suggest that low quality cuts from the foreshank and hindshank/distal leg were rarely purchased.

A large number of retail food containers and food-serving and -preparing artifacts was collected, as shown in Table 6.6-2. Based on their marks and forms, it is apparent that many of the vessels were imported. Among the glass and ceramic beverage vessels, there are four tan to grayish white stoneware ale bottles, presumably from Britain. Nine glass beer bottles were recovered, with lipping tool-formed collared brandy finishes and export lager shapes. They are formed of brown, green, and aqua glass. Three of the brown glass bottles are basally embossed: +\MGCo\11(1); +\MG CO\8 (2). MG Co. is the mark of Modes Glass Co., of Cicero, Indiana, dating between 1895 and 1904 (Toulouse 1971:360). None of the five liquor bottles is marked. However, sherds from one stoneware "tiger whiskey" bottle are present, signifying imported Chinese liquor. The others are glass, moldblown bottles, one of which is black glass, pre-dating 1890 (Wilson and Wilson 1968:13). Wine and champagne bottles are plentiful, with seven turnmolded and freeblown wine bottles in dark green and gold green glass, and 13 champagne bottles with their distinctive applied finishes and deep kick-up bases.

Non-alcoholic beverage containers included one glass soda water bottle, unmarked, and nine stoneware and glass mineral water bottles. The seven stoneware mineral water bottles are tall, handmade cylindrical vessels of 3 to 4 inch dia, with tan to orange slips and exterior salt glazes. All are believed to have been made in the Nassau region of Germany and to have held mineral water from Selters, Germany due to two bottles impressed with marks characteristic of bottles from Selters. One is impressed near its shoulder in script: Num 42\\[impressed ring] ...ERS\ [illustrated eagle in center]. This configuration dates the bottle to the 1870-1885 period (Leavitt 1999:5, 8). The second bottle is impressed: ... 16\No. 56. Most of the Fea 7 mineral water bottles were imported from Germany. No marks were found on any of the generic beverage bottles, all of which are glass vessels.

A few (n=10) solid or condiment food containers were collected, including two glass jars, two colorless glass jar lids, five aqua glass condiment bottles, and one Chinese-manufactured brown-glazed stoneware vegetable jar. The jar lids are of interest, as one is 3 inches in dia, with a ground edge; the second is a "slip lid", 3 inches in dia, with an interior surface of stippled texture and embossed: 187.

Food-serving artifacts are predominantly ceramic, but few of them are adorned with any sort of decoration. Those that are decorated include two Chinese bowls, one vessel of unknown form, a pitcher, and a large dish lid. The bowls are porcelaneous stoneware, one of Four Seasons hand-painted overglaze pattern, one of plain celadon, and the vessel with unknown form is porcelain with dark blue painted underglaze design. One ornately-molded handle fragment from a pitcher was identified, as well as an oval, molded stylized flower finial from a large dish lid.

Table 6.6-2. Food-Related Artifacts from Fea 7, MS001.

Artifact Type	Retail Container	Food Serving/Preparing	Total MNI
Bottle, ale	4		4
Bottle, beer	9		9
Bottle, beverage	7		7
Bottle, champagne	13		13
Bottle, liquor	5		5
Bottle, mineral water	9		9
Bottle, soda water	2		2
Bottle, wine	7		7
Bottle, pickled food	1		1
Jar, glass	2		2
Jar, Chinese stoneware	1		1
Lid, glass jar	2		2
Bottle, condiment	4		4
Bowl, Chinese		2	2
Bowl, pressed glass		1	1
Bowl, wie		4	4
Cup, wie		3	3
Cup, porcelain		1	1
Saucer, wie		8	8
Plate, wie dinner		14	14
Plate, wie small		3	3
Platter, wie		2	2
Dish, small wie		6	6
Bowl, porcelain sugar		1	1
Pitcher, wie		2	2
Finial, serving dish lid		1	1
Vessel, ceramic		8	8
Goblet, glass		1	1
Tumbler, faceted glass		3	3
Crock, stoneware		1	1
Pan, yelloware		1	1
Total MNI	66	62	128

Undecorated wares and minimally-decorated wares include bowls, cups, saucers, small possibly fruit dishes, small and large dinner plates, and platters. Each of these ware types is described below in turn. There are four plain, thick-walled wie single-serving size bowls in the assemblage, none of which has a maker's mark. A fifth bowl is SCA pressed glass, decorated with a diamond pattern. The cups comprise a group of four, with one porcelain cup decorated with a gilt rim line and three wie cups, two of which are plain and one decorated with molded faceting on the body. There are six plain wie saucers and a seventh with molded, faceted design, all measuring between 6 and 7 inches. Interestingly, five of the saucers have black printed makers' marks. Two are Thomas Furnival & Sons marks from Cobridge, England dating between 1878 and 1890, and a third is a J & G Meakin mark dating from ca. 1890 to ? and made in Hanley, England (Godden 1983:263, 427). A fourth saucer has an unknown mark, crudely printed: IRONSTONE CHINA\[illustrated Victorian Coat of Arms]. The fifth saucer is also unidentified but is thought to be English in origin. It consists of: PRINCE OF WALES\ [illustrated Victorian coat of Arms]\ ... (Figure 6.6-4).

There are five small plain wie dishes from Fea 7, of 5.25 to 6 inch dia. Each is like a miniature soup plate – deeper than a plate, more shallow than a bowl, two of the dishes are marked. The first carries the black printed mark of William Adams, of Tunstall and post-dates 1896 (Godden 1983:22-23). The mark includes the illlustrated Victorian coat-of-arms, below which is printed on a festooned ribbon: IRONSTONE WILLIAM ADAMS CHINA\ TUNSTALL. The second dish which dates from 1851 to ? (Godden 1983:427) is impressed on the base: J&G MEAKIN\[illustrated illegible crest]. In the 1897 Sears & Roebuck Catalogue, a set of plain white "stone ware" or "granite ware" china was advertised for sale as open stock. The maker was J. & H. Meakin of Hanley, England and the ware was stated to be the "... most durable earthen ware made in the world. Warranted not to craze. One set of the above will out-wear three sets of the domestic goods, and will cost but a trifle more" (Israel 1968:678). H. Meakin may refer to Harry Meakin of Hanley who worked in the pottery business ca. 1870 (Godden 1983:426). The many Meakin vessels from Fea 7 may well be from such an open stock set of tableware.

Three plain wie plates of 6.5 to 7.5 inch dia were identified. All three are labeled with black printed marks, two of which are "Thomas Furnival & Sons" marks (1878-1890), the third a "PRINCE OF WALES" mark (Godden 1983:263)(Figure 6.6-4). E. Asbury & Co. produced Prince of Wales brand ceramics from 1875 to 1925, but Godden (1983:26, 515) does not provide a mark like the ones from Fea 7. Dinner size plates of 9 to 12 inches in dia number 14 from the deposit. All are plain wie vessels, six with makers' marks – two Thomas Furnival & Sons (1878-1890), one Thomas Hughes of Burslem, England (1860-1894), one Prince of Wales, and two Burgess & Goddard (ca. 1870-1890) (Godden 1983). The Burgess & Goddard marks are not found in Godden but they consist of: [illustrated Victorian coat-of-arms]\ROYAL.PATENT.\ IRONSTONE.\ BURGESS & GODDARD. Some of the Fea 7 marks show ROYAL on one line, then PATENT IRONSTONE on a second line. In addition to plates, two oval platters were recovered, one of which is 12 inches long. It has a partial, unidentified mark: [illustrated lion] RO ... .

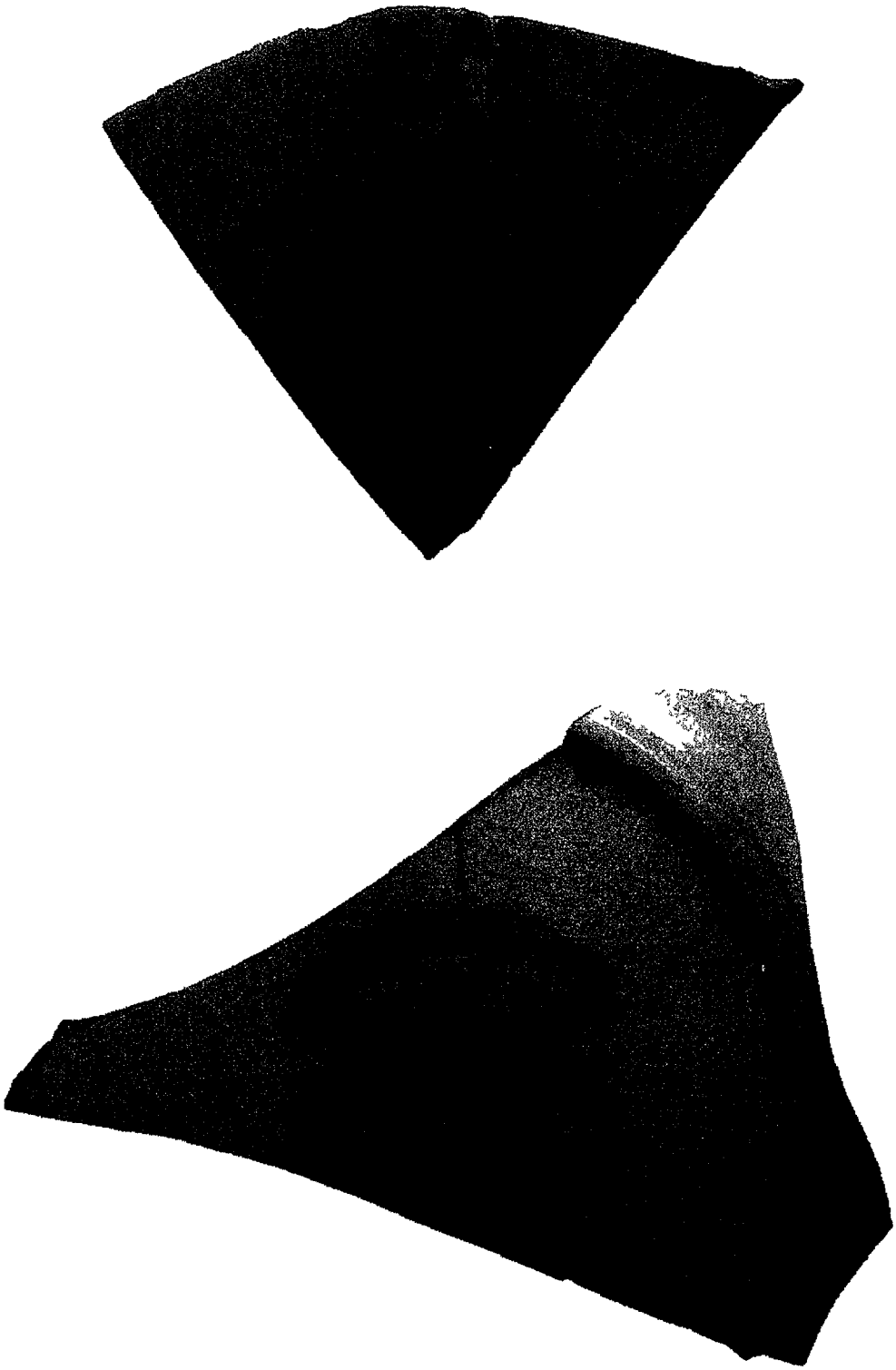


Figure 6.6-4. Prince of Wales ceramic mark on white improved earthenware saucer base, from Fea 7 dump, MS001.

Additional wie food-serving vessels from Fea 7 include two pitchers with ornate, molded handles and rim and an ornate oval finial from a lid for a serving dish or soup tureen. The porcelain handle from a sugar bowl was found as well.

All in all, the ceramic tablewares from Fea 7 provide a picture of intensive usage with frequent breaking of dishes, as would be expected in a restaurant or boardinghouse. This seems to be the case for several reasons. First, many broken dishes are found in the assemblage. Second, many different vessel forms are present that carry the same few maker's marks. For instance, the Thomas Furnival mark is found on dinner plates, small plates, and saucers. J & G Meakin marks are found on saucers and small dishes. Third, just a few makers' marks appear in the assemblage, but repeatedly, and most of the vessels, regardless of maker, conform to the same design pattern – plain white hotelware. The date ranges for the dishes based on their marks and when compared with date ranges for other artifacts contradicts the norm for ceramics. These dishes entered the archaeological record within a few years of their manufacture, rather than decades later as would be expected for typical family household use. In short, they were broken soon after they were purchased.

Artifacts associated with group services consist of only one fragmentary stoneware ink bottle 3 inches wide, with brown glazed exterior.

There are 13 artifacts relating to industry and commerce. Ore mill/assay artifacts include nine milky quartz chunks, one piece of lead sheet, and one piece of copper sheet. An iron rivet was found, relating to metalworking. One distinctive wide and flat carpenter's pencil lead, used in marking lumber was also found.

The munitions functional group is composed of five brass cartridge casings, four of which are 12 gauge shotgun shells, each headstamped: U.M.C.CO\NO.12. All are products of the Union Metallic Cartridge Company, of Bridgeport, Connecticut. They date from ca. 1860 to 1911 (Hogg 1982:151). The fifth casing is headstamped H and is a rimfire Henry Flat .44 calibre casing, dating from 1860 to ca. 1934 and manufactured by the Winchester Repeating Arms Co, of New Haven, Connecticut (Barnes 1969:296).

Fea 7 yielded a respectable and fairly diverse assemblage of personal artifacts, dominated by clothing fasteners and medicine bottles. The closest thing to jewelry that was found is a yellow metal tag or small plaque stamped BABY. It likely was part of a bracelet, book cover, or other keepsake article for a small child.

The 21 clothing fasteners include 19 buttons, one shell collar stud, and a brass eyelet. Buttons consist of eight porcelain, six shell, and five metal buttons. All porcelain buttons are the Prosser type and seven of them are four-hole sew-through fasteners made between 1840 and ca. 1910, ranging in diameter from 0.19 to 0.69 inch. All are plain except for one with "piecrust" molded facial decoration. The eighth porcelain button is a domed "gaiter" button, of 0.5 inch dia, produced from 1858 to ca. 1910 (Albert and Adams 1970: 4-22). All of the porcelains were probably produced in France by the Felix Bapterosses company.

The six shell buttons, in shades of ivory, pink, and gray may represent two matched sets of buttons, as two styles and two size ranges are identified. The two largest shell buttons are two-hole type, with flat faces, fish-eye hole panel, and one central and one outer incised ring. They measure 0.5 and 0.56 inch. The four remaining buttons are smaller, measuring 0.31 to 0.38 inch wide. Each has four sew holes within a very small, sunken hole panel, on a semi-conical face with flat back. The small buttons are typical shirt buttons, as likely to be sewn on mens' and boys' shirts and long underwear as to baby clothes, or the waists, blouses, skirts, dresses, undergarments, and nightclothes of women and girls. The larger pair may have been sewn to male shirts or to female outer garments. It is noteworthy that shell buttons were recovered from Fea 7 – a late 1890s deposit as after ca. 1890-1895 shell buttons made from American freshwater shells were very common and popular (Claassen 1994:80; Jones 1946:103-104). Ocean shell buttons had been the norm prior to this, but were imported and expensive and correspondingly less abundant. One of the large buttons from Fea 7 is quite iridescent and may be ocean shell, while the remainder are more dull and may well be freshwater shell buttons. One collar stud was found that is made of shell and measures 0.44 inch in dia at the back.

Six metal fasteners were identified, five of which are sew-through buttons for male work pants. All are stamped ferrous metal with the exception of one that has a stamped brass face disc crimped over a ferrous back. The sew-through buttons measure 0.5 to 0.59 inch wide, and date between ca. 1830 and 1940. The sixth button is a shanked type of 0.5 inch dia, dating from 1825 to present (Luscomb 1979:17). It is very rusted but appears to have had a stamped design on the front. Such a button may have adorned a man's suit vest or coat, or a woman's formal skirt, waist, or coat.

Two leather shoe parts were found – one stack from a heel and an upper fragment with one lacing eyelet and three lacing holes in place. The heel has metal shoe nails embedded in it and is 1.38x1.38 inches in size. The two parts may have come from one shoe.

Fragments of three ceramic tobacco pipes were recovered from Fea 7. They represent adult, leisure activities. Two are white ball clay pipes with plain bowls and attached stems. One stem fragment is stamped: McDOUGALL\\GLASGOW. Each word is enclosed by a rope-bordered rectangle with an oval rope loop at each end of the rectangle. Complete stem lengths and bowl sizes and shapes are not discernible. McDougall pipes were produced in Glasgow, Scotland from 1846 to 1968 (Walker 1977:165, 343). The third pipe is known from a sherd of white, glazed porcelain, with a raised rib just below one end. This end probably articulated with a detachable stem of wood, rubber, or plastic, as was common on German pipes. Evidence for hobby collecting of natural objects is provided by a fragment of ocean shell. The fragment is very shiny and has regular brown dots on its exterior surface, as for a cowry shell.

Pastime artifacts for children were also recovered from the Fea 7 dump, including the unglazed porcelain upper ends from two doll arms or legs. Four miniature porcelain vessels have been identified as two cups, one plate, and one teapot knob. The pieces are all different and therefore are not members of a matched play tea set. The first cup has faded remnants of an overglaze painted design in blue. The second cup is nearly complete and sports a handle and a

handpainted overglaze medallion design of green, pink, and blue flowers, with a red rim and handle line, and an equatorial band (0.25 inch wide) of tan-gold lustrous paint, edged on both sides by a thin black line and accented with occasional black dots within the band (Figure 6.6-5). This cup is a Japanese product, certainly dating it to the early- to mid-twentieth century and making it more recent in age than most other artifacts within Fea 7. The miniature plate is plain porcelain, double-footed, and 4 inches in dia. It closely resembles in form and color the full-size dinnerware vessels recovered from Fea 7. Two slate pencil lengths were also noted.

The final group of personal artifacts consists of 20 moldblown glass medicine bottles. There are two generic medicine bottles – one pale green and cylindrical, the other colorless and rectangular. The remaining 18 bottles are patent medicine bottles that held various products. Those with embossings confirm the presence of at least one Dr. Hostetter's Stomach Bitters bottle (1858 to ca. 1920), one Dr. J.J. McBride's King of Pain bottle (1869-1890), two Dr. J.G.B. Siegert & Hijos Angostura Bitters bottles (1872-1909), and one Jamaica ginger bottle (embossed: JA ... \JR ...) of unknown brand (Fike 1987:36, 42, 172; Schulz et al. 1980:58-61,64-65). The unmarked patent medicine bottles are mostly rectangular in shape, and include vessels of colorless, aqua, cobalt blue, brown, and SCA glass.

There are two transportation-related artifacts from Fea 7. First, a ferrous metal buckle commonly attached to horse tack was collected. Second, a large horseshoe was found, of 6 inch length and 5.5 inch width, fitted with toe and heel calks, apparently worn in winter (Berge 1980:242-243).

A number of metal articles could have served several purposes and so are lumped here as Multiple Use artifacts. Among the 39 MNI are 23 iron tacks, one slot-head screw, one bolt, one washer (3.13 inch dia), one length of iron wire, and 12 pieces of iron sheet.

The remaining functional group of artifacts is the "unknown function" group, composed of 233 MNI. Rusted iron lumps dominate this group, numbering 204. Many may be nails that are too corroded to identify as such. Also included are remnants of 11 glass bottles, two can fragments, three metal strips, an iron hook, an iron tool fragment, one heavy iron rectangle, one thin cuprous metal ring, an angled, hinge-like piece of iron, and 8 MNI of miscellaneous glass, metal, and ceramic fragmentary objects.

Fea 7 Discussion

Manufacture date ranges for Fea 7 artifacts suggest that the refuse was deposited on the site in the late 1890s to very early 1900s. Not only are there marked ceramic tablewares with initial dates of manufacture of 1890 and 1896, but there are several glass bottles that date from 1892 and 1895 at the earliest. Inclusion of wire nails, SCA glass, and a Japanese-made toy porcelain cup further support this contention, as well as total lack of machine-made bottles (post-1903) and sanitary food cans (post-1904).

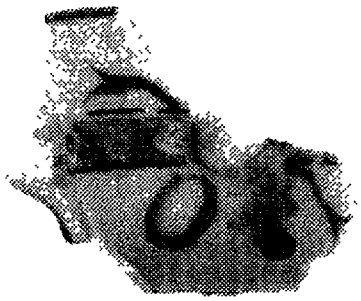


Figure 6.6-5. Toy teacup of porcelain from Japan, Fea 7, MS001.

As with Fea 5, there is a pattern here of large numbers of food bones, sporting a variety of cuts and species (cow, pig, sheep) coupled with a healthy assemblage of plain white ironstone tablewares. Together these argue for the origin of much of the refuse as being a restaurant or boardinghouse. At Fea 7 especially, the beef and pork bones represent a greater proportion of low-rank and group-size meat cuts than of high-rank (expensive) and individual cuts, while the lamb bones suggest the opposite. One might get the same kind of assemblage from either a boardinghouse or from a restaurant, though the restaurant would have been a working-class restaurant, serving mostly economical meals of moderate to low cost as opposed to a high-class establishment that specialized in individual and expensive cuts of meat.

Other kinds of food-related artifacts such as food bottles and jars offer few clues as to other kinds of foods served with the meats. There are very few condiment bottles, two Chinese preserved vegetables jars, and a pickle bottle. Beverage bottles on the other hand are abundant, particularly champagne, German mineral water, beer, and wine bottles. All of these beverages may have been consumed with meals. But the preponderance of champagne bottles is intriguing. It is not the typical fare of a bar or saloon, nor the drink one would consider most commonly served at a boardinghouse or workingman's restaurant. Perhaps Fea 7 includes garbage from one or more special celebration events such as a wedding reception or large birthday party. Such an event may have taken place in a local restaurant in Dayton. It is also interesting that Chinese food containers and ceramic tablewares are included in the assemblage. The overall assemblage, including the faunal remains, is not characteristic of an ethnic Chinese deposit. But it is not out of the question for Chinese persons to operate or work in a restaurant that served primarily American foods. The Chinese artifacts may also simply be part of a separate trash dumping at Fea 7.

Other notable characteristics of the Fea 7 deposit are the evidences it provides for different age groups and gender groups contributing to the trash deposit. First, in regard to age groups, there are childrens' artifacts, including doll parts, toy dishes, and slate pencils so commonly used by school children in the nineteenth century. And there are adult artifacts, such as the many alcoholic beverage bottles and several clay tobacco pipes. Gender-specific artifacts include the doll parts and toy dishes that are typically the belongings of little girls. No definite adult female artifacts were identified though the many ornate pressed glass vessels classified as "domestic furnishings" strongly suggest adult female presence. A few clues represent males, as with the metal sew-through trouser buttons, and indirectly through the clay tobacco pipes and numerous beer, wine, champagne, and liquor bottles.

Many architectural artifacts were recovered from Fea 7. These do not fit with the restaurant or boardinghouse scenario. But as noted above, the feature presumably is comprised of one or more dumping episodes, all of which took place within a short time, perhaps within a year or two. If this is the case, the architectural, Chinese, and various other materials did not arrive at the site all at one time nor from one place of origin in Dayton.

Fea 7 artifacts are later in time than Fea 5 artifacts, and Fea 1 and 6 artifacts. The Fea 7 material may have come from the same household or business as Fea 5 artifacts, but at a later

time, probably at least ten years later. Some of the same ceramic makers' marks are present at both features, suggesting either that they came from the same establishments or that people in Dayton had limited choices of ceramics and other goods during the 1880s and 1890s.

6.7 RIVER STREET DUGOUT (MS004, FEA I-8)

Trenching activities in the lower areas of the Birdsall Mill, MS004, specifically in Tr A in Loc I revealed one segment of back wall and floor of a domestic dugout (Fea I-8) below multiple episodes of mill tailings and terrace constructions. This was identified at the base of Tr A as a concentration of historic bottles and fragments associated directly with wood flooring or wall material. Eight 1x1 m and 0.5x1 m probe units (PR 1-8) were used to find the extent and nature of the dugout remnant (Figure 6.7-1). Actual remains include the dugout cut (Int 17B) into the hillside, approximately 12 ft in length and 5-6 ft deep, and intact milled wood wall or floor covering (Int 17A). Associated artifacts (Str 13, 13A and17) extended from the cut eastward for 4-6 ft to a cut that appears related to later terrace construction of Fea I-4, I-4-1, and I-5-1 along the base of the hillside in this part of MS004. The Tr A profile illustrates the relationships of strata, interfaces, and features in and overlying the dugout (Figure 6.7-2). Artifacts from this structure proved very interesting and are discussed below.

DUGOUT ARTIFACTS (FEA I-8)

Two strata within Fea I-8 yielded artifacts (Str 13A and 17). The collected assemblage is small, comprised of 158 MNI. The largest functional categories represented are architectural and unknown function groups. The most interesting artifacts are from the food container, industry and commerce, and personal categories. Architectural materials and hardware are represented by 22 machine-cut and 18 unidentified iron nails, pieces of board, at least two thin floor boards, parts of two standard red bricks (7.75x3.75x2.25 inches), and one flat glass sherd from a windowpane. One of the wooden boards is a very chunky segment of reddish wood that measures 8.5 inches long by 4.75 inches wide by 2.25 inches thick. Thin, very fragile and decayed wood fragments were recovered from much of the basal surface of Str 17. The wood was consistently oriented in an east-west direction, suggesting wooden flooring within the Fea I-8 structure. In the northwest corner of the feature, where most of the wine and champagne bottles were found, thin wood pieces lay both beneath and above the bottles indicating a wall had fallen on the bottles which stood on a wooden floor. As with the iron artifacts all over the Birdsall & Carpenter and Keller & Co. mill sites, the iron nails from Fea I-8 are extremely corroded and many cannot be identified as to type.

Twenty-six animal bones were collected from Loc I (Table 6.3-3). A thin, single serving round steak and an unidentifiable large mammal bone were recovered from Tr A as well as two sawed beef ribs found south of the trench. Stratigraphic excavations in the Fea I-8 dugout retrieved 19 bones; 11 were collected from the fill and eight were recovered from the floor. Fill materials included eight large mammal bone fragments, a sawed pork rib, and a butchered beef ulna and radius that reflect a single, multiple serving cut from a foreshank. A beef foreshank cut

PR 2 Dugout floor and artifacts (Roll 978-5, fr.32).

PR 1 Dugout floor and artifacts (Roll 978-5, fr.15).

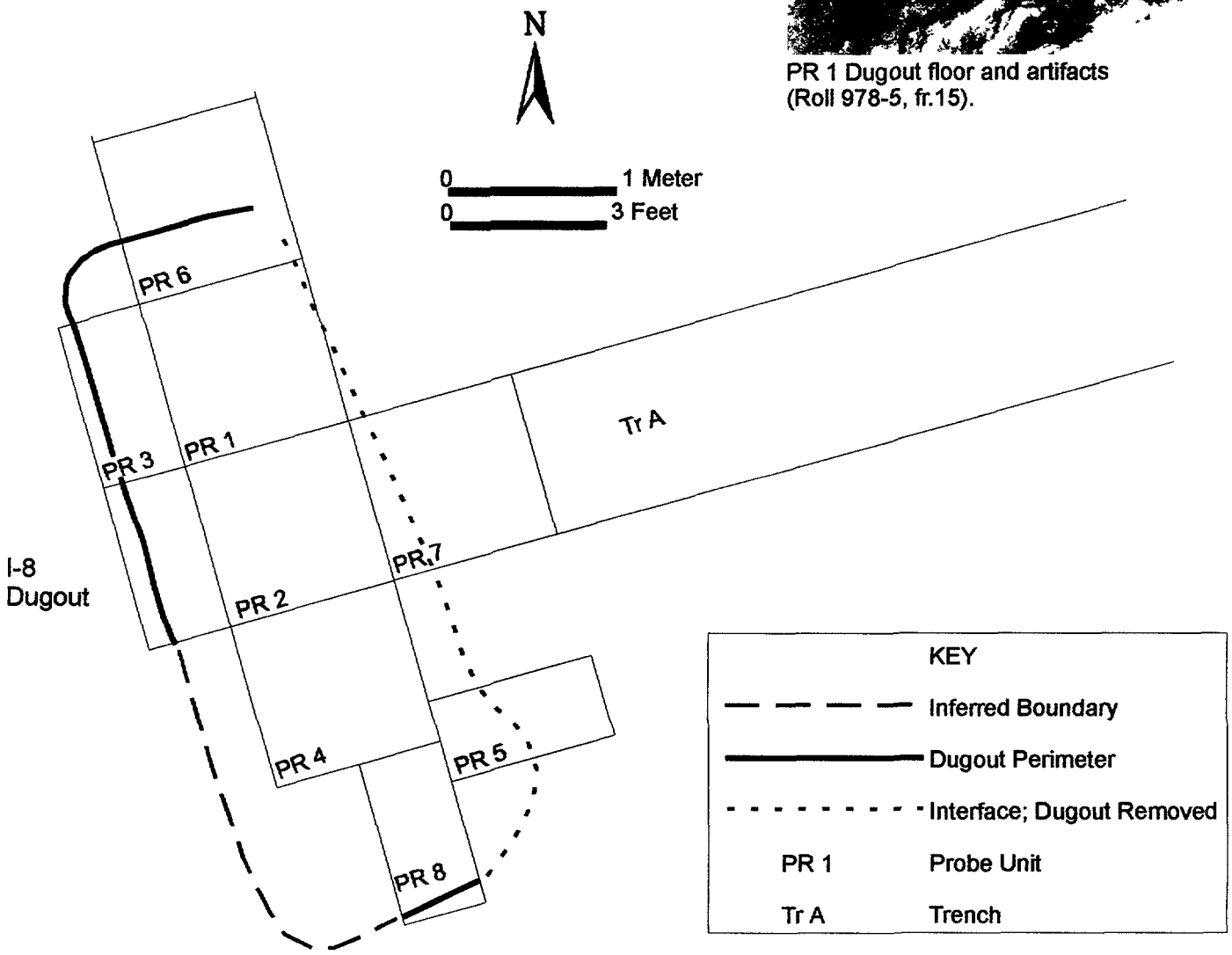


Figure 6.7-1. Fea I-8 dugout plan view and photographs of floor

was discovered on the dugout floor along with four large mammal bone pieces and three calcined bone fragments. Although the Fea I-8 fill and floor appear to represent separate depositional events, the modest faunal data provide no such evidence.

The metal handle from a small fork or spoon with a simple "threaded" handle pattern was recovered. In addition, one lapped-end food can measuring 3.5 inches in dia and 14 glass beverage bottles were collected. Most of the bottles were broken and clustered in the northwest corner of the feature. There are 10 olive green, freeblown wine bottles, each with a deep kick-up base, Bordeaux bottle shape, and wide, sturdy applied finishes of the laid-on-ring type, several of these are fire-polished. One complete champagne bottle was recovered as well as a complete cylindrical black glass liquor bottle with applied brandy finish and short rounded shoulders measuring 9x2.5 inches. An aqua soda water bottle with bare iron pontil scar and lipping-tool formed blob top was identified, embossed on the heel: U ... ON GLASS W ... \\PHILA ... The bottle was produced by the Union Glass Works in Philadelphia and the iron pontil mark indicates that it dates between 1845 and 1870 (Jones 1971:71; Toulouse 1971:351). The final vessel is a large aqua bottle, with base diameter of nearly 5 inches and thought to have held a beverage. All of the bottles are freeblown or moldblown, generally dating between ca. 1850 and ca. 1920 (Schulz et al. 1980: 5-8).

An assemblage of 13 MNI comprises the Personal function group, most of which are clothing and shoe parts. Six buttons were found including one large sew-through bone button of 0.75-inch dia, two iron four-hole sew-through buttons for male trousers, and three matching metal buttons composed of at least two metal discs, pierced by two sew-holes, and covered with brown woven wool cloth. These last three are large (0.75 inch dia) and totally corroded on their faces as well as being covered with cloth, perhaps accidentally, so that their facial forms cannot be discerned. Nevertheless, they comprise a partial set of buttons. A large wad of brown woven wool cloth was also recovered from Fea I-8, thought to be the remains of a man's shirt or female outer garment. The three matched buttons must have been attached to this article. A small piece of blue cotton denim was retrieved suggesting remnants of male work clothing. Besides buttons, a very large brass eye for a clothing hook fastener was recovered, probably sewn to a feminine garment.

The dugout stratum yielded parts of two leather boots, both presumably worn by males. One is a nearly complete pull-on type boot of small size. It is the right boot and measures only 2.63 inches wide at the ball of the insole, and perhaps no more than 10 inches in length. The second boot is represented only by chunks of leather outsole heavily encrusted with a mass of rusted hobnails. Without question the second boot was a heavy work boot for a man or boy.

Two other personal artifacts are identified as medicine bottles, one brown and one aqua glass, neither is embossed.

The eight artifacts included in the Industry and Commerce group consist of a large iron pick for digging, six fragments of quartz and red chert perhaps from ore, and one 1867 five dollar gold coin. The pick had two pointed ends, one of which has broken off, it is 20 inches long and

3 inches wide at the center. The gold coin is American-made, minted in San Francisco, and is barely scratched, as if it had not been in circulation very long before it was lost or placed in Fea I-8 sediment. It is ornamented with the Liberty head facing left and wearing a coronet bearing the word: LIBERTY on one face, and surrounded by 13 equispaced stars. An eagle with spread wings and head facing left is stamped on the obverse side. The words .UNITED STATES OF AMERICA . FIVE D. surround the eagle and the arrows and olive branches in its talons, as well as the ribbon overhead on which IN GOD WE TRUST is written. The coin bears an S mint mark and according to Reed (1969:212), 47,181,832 coins of this variety were minted between 1866 and 1908.

Artifacts of unknown function consist of 60 fragments, the bulk of which are corroded iron fragments and a few pieces of glass.

Fea I-8 was a small wooden structure, the floor of which lay directly on bare earth. Its western and presumably back wall had been cut into the natural hillside. The artifacts indicate the feature most likely not a domestic building, at least not one that was intensively inhabited. There is very little household debris from Fea I-8 – a few food bones, no ceramic or metal dishes, no cups, no pots and pans, no cast iron stove parts. Instead, clothing and boots for males were found, one of which is small enough to fit a boy or a small man. And there is a cache of wine and other beverage bottles and a gold coin at one end of the structure. The only tool from Fea I-8 is the large pick that could have been used in mining or other kinds of manual labor that required digging.

The dugout certainly has the feel of masculine use. It may have been a domicile for one or more males who did not prepare their own meals and only summered in Dayton, or more reasonably a storage room used by occupants who lived or worked in a different, nearby building. There are gender-specific artifacts from Fea I-8, most notably the leather boots, brown wool garment, and pick that strongly suggest a male presence. The many beverage bottles indicate use by adults, and the numerous Bordeaux-style wine bottles further suggest occupation by persons of Mediterranean ancestry. No artifacts associated with children were found, though as noted above, the pull-on type leather boot is small enough to fit a boy.

The dugout must have been used in the late 1860s or early 1870s, based on the restricted date ranges of two artifacts. The first, of course, is the 1867 gold five dollar coin, which provides the *tpq* for Str 17. The second is the Union Glass Works bottle with its bare iron pontil mark, dating between 1845 and 1870. The bottle's end date of ca. 1870 meshes nicely with the gold coin date, during these years, the Birdsall & Carpenter Mill was in full operation a short distance to the south. Fea I-8 may have stood on Birdsall property, but the artifact assemblage from it is not at all industrial in character. It is not considered to be a mill feature unless it served as a mill caretaker's or watchman's shack. The small number of artifacts, the limited variety, and generally restricted temporal ranges argues for a short occupation of the dugout.

6.8 DISCUSSIONS AND COMPARISONS OF THE FAUNAL ASSEMBLAGES FROM MS001 AND MS004

by Dave N. Schmitt, Jason Fancher, and Sabra Gilbert-Young

Based on their meat yield, rarity, and gustatory preference of the consumer, beef cuts from different portions of a carcass have different market values and it should be possible to identify socioeconomic variability based on the types and abundances of recovered beef cuts (e.g., Schulz and Gust 1983a, 1983b). Specifically, the model predicts that those of means were more likely to have purchased expensive roasts and steaks (e.g., rib, sirloin, and short loin cuts) and low income individuals and households are assumed to have predominantly purchased lower cost cuts from the neck, foreshank, and hindshank. Table 6.8-1 presents the numbers of beef bones by economic rank/quality recovered from the analyzed feature assemblages in Dayton. While the small size of some assemblages are problematic and socioeconomic inferences should consider other material remains, the faunal data reflect some differences in the inhabitants economic means. The most salient difference in beef quality is found in the Fea 6 assemblage, especially the bones recovered from Str 2. The wealth of expensive, high quality cuts, including T-bone and rib eye steaks, suggests that this assemblage was deposited by an individual or small group of high economic means. The composition of this aggregate is statistically similar to beef bone frequencies recovered from Fea 5 (Table 6.8-1), but this latter feature is a dump and may include food refuse from a number of nearby households and/or establishments. Similarly, the large numbers of low quality cuts in the Fea 7 dump reflect low economic means, but this assemblage may also reflect food bones deposited by a number and variety of individuals and groups. Regardless of the number of individuals, groups and/or group size, the overall composition of beef remains in the two dumps suggests that those who deposited trash in Fea 5 were better off than those who used Fea 7.

Table 6.8-1. Numbers of Beef Bones by Economic Rank/Quality from Fea Investigations, 26Ly529.

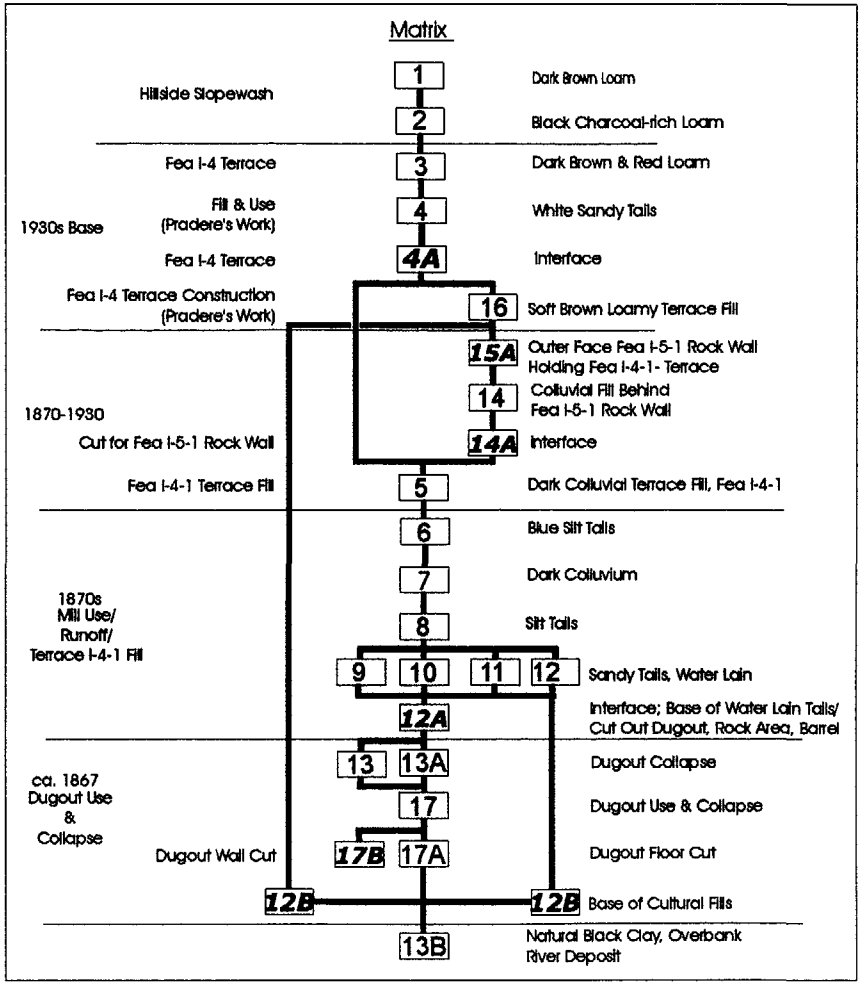
Rank@	Fea 1	Fea 5	Fea 6	Fea 6, Str 2	Fea 7
High (1-3)	4	19	17	14	32
Medium (4-6)	3	3	6	4	25
Low (7-9)	4	11	8	3	63
Totals	11	33	31	21	120

@ After Schulz and Gust (1983a, 1983b); see also Figure 1.

Kolomogorov-Smirnov statistics: Fea 1:Fea 5, D=.212, p>.05; Fea 1:Fea 6, Str 2, D=.358, p<.05
Fea 1:Fea 7, D=.161, p<.05; Fea 5:Fea 6, Str 2, D=.222, p>0.5
Fea 5:Fea 7, D=.309, p<.001; Fea 6, Str 2:Fea7, D=.455, p<.001

A comparison of the relative proportions of the three primary meat types from feature investigations (Figure 6.8-1) discloses only a few subtle differences. Each assemblage is dominated by beef. Save for the modest lamb bone assemblage from Str 2 in Fea 6, lamb represents the secondary source of meat, followed by pork. Interestingly, similar proportions of beef, pork, and lamb were found in the Fea 5 dump, suggesting that the individuals/groups who

Tr A, view west- northwest (Roll 978-4, fr.36).



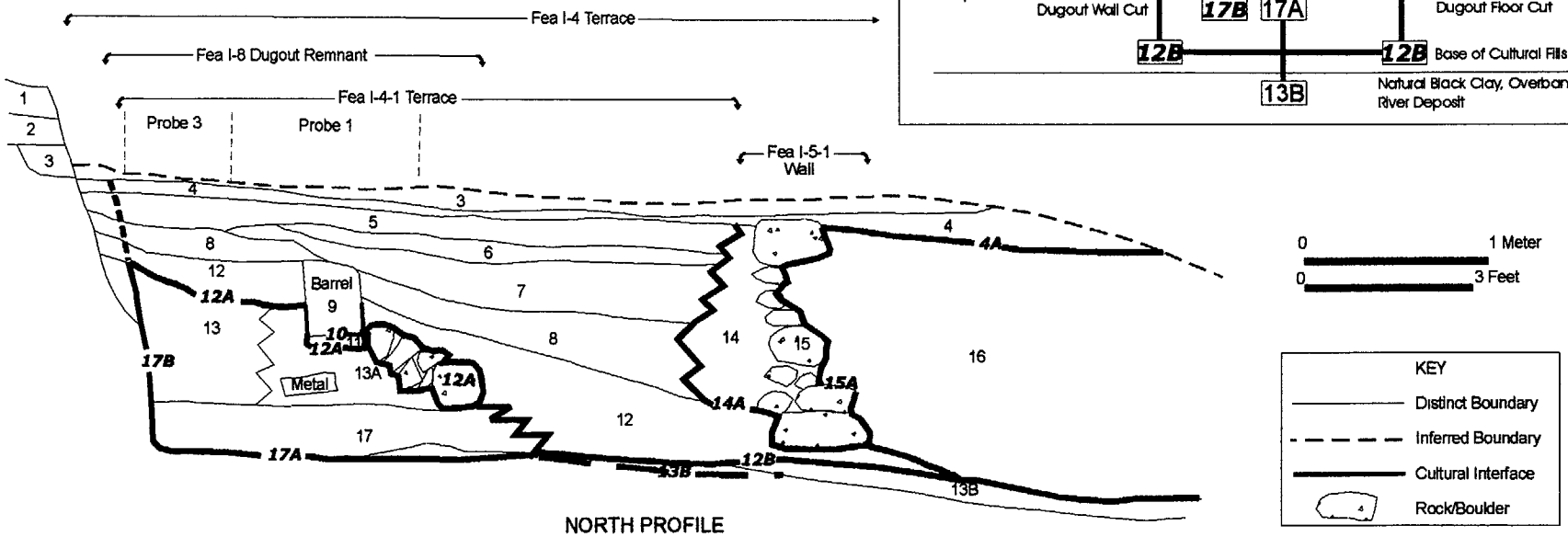


Figure 6.7-2. Photograph and stratigraphic profile for Tr A and Fea I-8 dugout in Loc I, MS004.

deposited food refuse here preferred variation in their diet. However, Fea 5 is a dump that may have been used by a number of nearby groups and individuals, and a variety of unknown behavioral, economic, and/or ethnic factors may be intermixed in this accumulation.

Questions of ethnicity and the MS001 faunal assemblages are addressed below under Research Questions.

SUMMARY

Dayton's historic faunal remains provide information on some aspects of consumer behavior, economic means, and subsistence. Regardless of context, each of the recovered faunal assemblages reflects a reliance on domestic meat. Cattle bones are most abundant in each of the analyzed assemblages and clearly suggest that beef was the most frequently consumed meat type; beef bones typically dominate faunal collections from local non-Asian, Euroamerican historic sites and communities (Figure 6.8-2) and the archaeofaunas from Dayton prove no exception. A number and variety of *Bos* body parts was recovered from most feature investigations and the large numbers of saw-cut bones and cut locations suggest that most represent retail market purchases. Since the Comstock and vicinity supported a number of livestock operations and slaughterhouses it is likely that most of the beef bones represent fresh meat purchases from locally slaughtered livestock. From at least 1871 through 1886, Dayton had an active butcher shop in town. In 1871, it was known as Wenzell & Co., butchers, located on Main Street (Langley 1871:349). From 1878 through 1880, Winzell & Campbell ran the meat market in Dayton in partnership, and Winzell is presumed to be the same person as the Wenzell of 1871 (McKenney 1878:182; 1880:167). In 1882, Dayton's local meat market was known as the Union Market. According to its advertisement for that year, the owner J.L. Campbell carried "HOME-CURED BACON AND HAMS, Beef, Pork, Mutton, Corned Meats, Rendered Tallow" (McKenney 1882:630). By 1886, Campbell was listed as a "butcher" (McKenney 1886:875). It is clear that throughout the 1870s and 1880s Dayton residents had access to fresh meat, including beef, lamb, and pork. In fact, as of 1877, 30 butchers were listed in the business directory for the region. There were seven butchers in Carson City, four in Reno, seven in Gold Hill, two in Silver City, and 10 in Virginia City. By 1882, 25 butchers were enumerated for the same area (McKenney 1877:223; 1882:686-687).

In addition to the plethora of butcher shops in the Comstock Mining District in the 1870s and 1880s, one should bear in mind that Dayton had become primarily a ranching and farming community once Comstock mining and milling had gone into depression, a phase locally called *borasca*. Animals were raised in the area for the food market. Cattle and sheep were especially abundant in northern Nevada until the devastating winter of 1889-1890, when a huge proportion of them froze or starved to death (Young and Sparks 1985:134-135). Even in a substantial milling community such as Dayton it is reasonable to assume that the availability of fresh meat was dependent upon local supply, as well as the demands of local and neighboring market communities (cf. Conlin 1986; Schmitt and Zeier 1993).

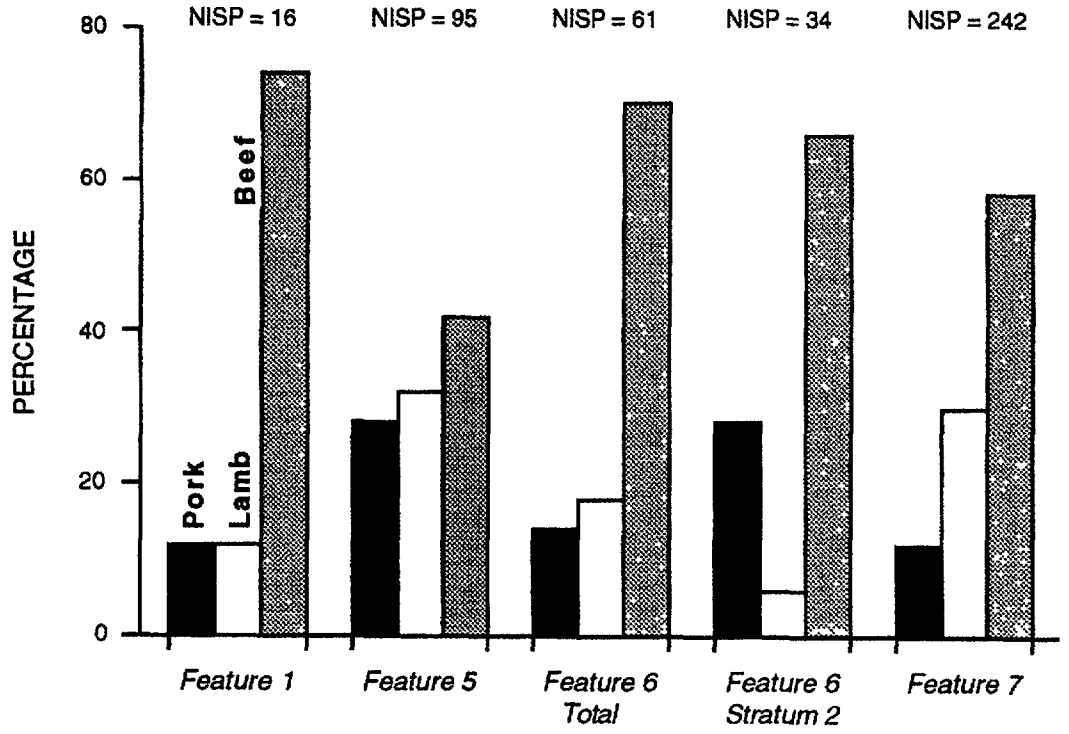


Figure 6.8-1 proportions of pork, lamb, and beef bones from feature investigations at 26Ly529

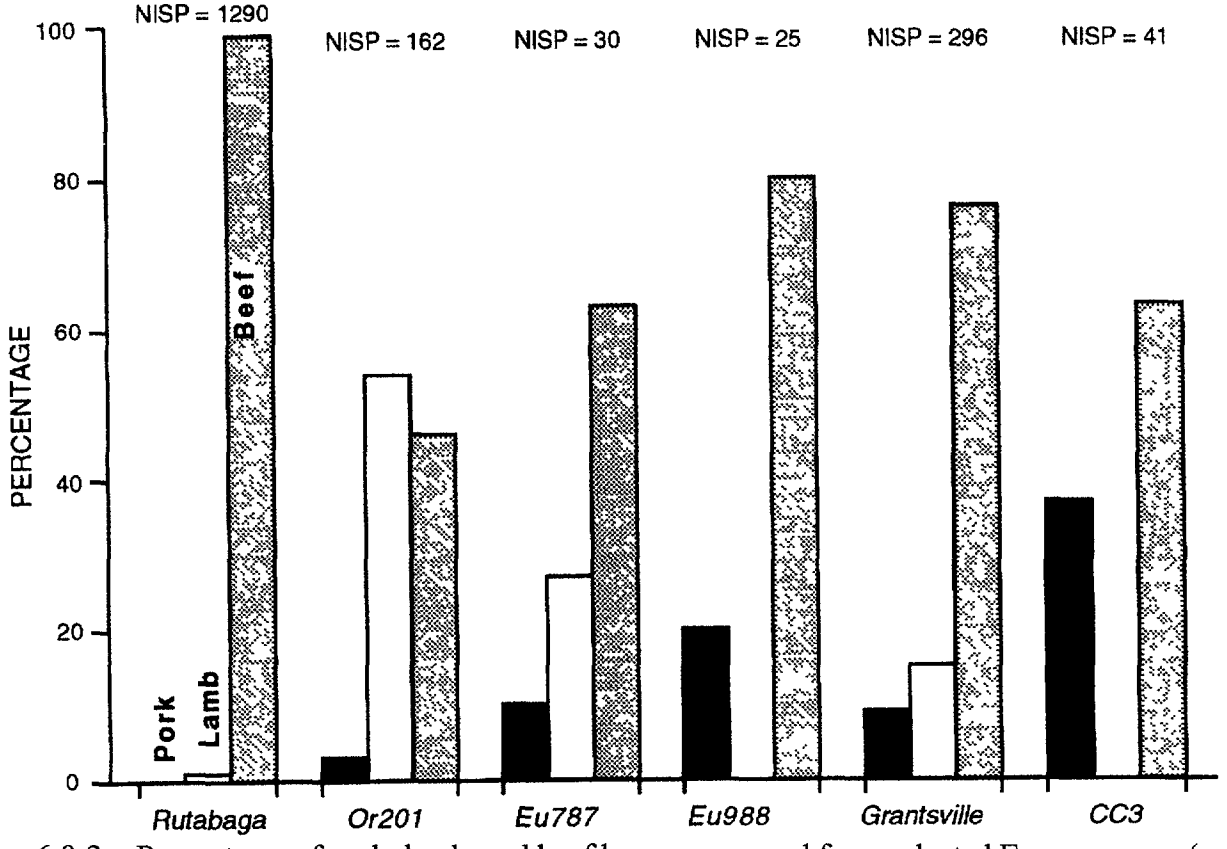


Figure 6.8-2 Proportions of pork, lamb, and beef bones recovered from selected Euroamerican (non-Asian) sites/contexts in Nevada (after Schmitt 1999) Left to right Rutabaga, Roberts Mountains (Dansie 1994), 26Or201, Carson City (Schmitt and Lupo 1995), 26Eu787 and 26Eu988, Mt Hope (Schmitt 1985), Grantsville (Schmitt and Zeier 1993, Zeier et al 1989); Copper Canyon Camp (Fenicle et al 1999)

Regardless of cut quality, most of the beef bone assemblages contain the remains of both large, multiple serving roasts and individual steaks. Meat storage was doubtless a problem in local historic contexts, including isolated camps and small towns such as Dayton, and the presence of multiple serving cuts suggests that food preparation by families/small groups was common. Since Dayton was a community that supported restaurants, saloons, and hotels (Ansari 1989), it is possible that some of the multiple serving specimens in the large Fea 5 and 7 dump assemblages represent refuse from such establishments.

The large numbers of *Ovis* bones indicate that lamb/mutton often was consumed; in fact, lamb bone frequencies are second only to beef in most feature aggregates. A variety of cuts was found in most of the features, including saw-cut roasts and single serving chops, and it is likely that most represent retail purchases of fresh lamb that was raised and slaughtered locally. Although the "head-to-toe" part representation of pig bones in some feature aggregates may reflect fresh pork, it is possible that most of the bones represent packed-pork purchases. As noted in an important study by Hattori and Kosta (1990), packed (salted, cured and/or pickled) pork was a common meat source and often a dietary staple in western historic contexts. Moreover, commercially packed barrels may contain bones from nearly the entire animal and, because of its storability, packed-pork "was particularly well suited for use under frontier conditions" (Hattori and Kosta 1990:82). Similar to the recovered beef and lamb bones, the pork bone assemblages also include individual chops and multiple serving portions, but offer little information on group composition. Specifically, packed-pork storability and ease of preparation may have been advantageous for working families and/or group households, as well as households occupied by single individuals (Schmitt and Zeier 1993). Regardless of type, *Sus* bones were collected in each feature assemblage and clearly indicate that pork was enjoyed on occasion.

6.9. RESEARCH QUESTIONS

A set of research questions were put forth in Chapter 1 that relate specifically to the recorded non-industrial artifact assemblages from the monitoring phases of work. In this section, those questions are considered. Again, the research questions are:

1) Is there a distinctive pattern to the commodities found in the trash deposits from MS001?

2) Does the trash deposition appear to be secondary dumping from the main part of Dayton or from adjacent residences or businesses?

3) Is there any indication of ethnic butchering patterns in the artifact and bone assemblages at MS001?

4) Can any indication of the demographics of household composition (including age and gender) be inferred from the artifacts?

5) What do these trash deposits reveal about life in late nineteenth century Dayton?

6) How does Dayton as a peripheral town compare to Virginia City as a core town within the Comstock Mining District?

7) How does consumer product availability here compare to that at other locations in the western United States?

Is there a distinctive pattern to the commodities found in the trash deposits from MS001 ?

Some commodity patterning has been observed in the MS001 deposits. The MS001 assemblages comprise parts of Fea 1 and Fea 6, and all of Fea 5 and 7. The first noteworthy point about the trash deposits at MS001 is that they all date to the 1880s and 1890s. Dayton has been continuously occupied since 1851 and yet the debris clusters encountered at MS001 only relate to community life in Dayton thirty years after its beginning. This situation may be explained by two factors.

First, the division and uses of property in Dayton varied with time. In the area of MS001, the earliest uses of the property may have been residential occupation by Chinese men who worked on the Rose Ditch and on Gold Canyon placers in the 1850s. There is disagreement in historical accounts as to where the early Chinese population of Dayton was centered. But the area east of town, near the river, has been posited as one of two likely areas, making MS001 a candidate. The next use, during the 1860s, was for milling of Comstock ores, the Keller & Co. Mill being the prominent one (Fea 1). Then an assay office may have been constructed adjacent to the Keller & Co. Mill site, but after the mill was gone. The office was perhaps built in the 1870s. By ca. 1880, this assay office had burned down, signaling the end of MS001 as a mill-related site. In 1881 the C&CRR established itself just to the west and southwest of MS001, effectively forming a sort of barrier between MS001 property and the main part of Dayton. The trash deposits that have been studied are the result of post-1880 dumping at MS001, after which time the area was unoccupied, and located on the outskirts of town, was available for informal dumping of garbage.

To reiterate, the property was first possibly a residential area for a population that was considered and treated as peripheral to the dominant Euro-American population. Next the place served as an industrial area that was located outside the business and residential districts of Dayton. And finally, MS001 became a place peripheral to all of town and even to the railroad tracks and yards. The property changed in function several times through the years and yet in every case retained a peripheral status in relation to Dayton the community. In short, uses changed but the common view of the location was probably always as marginal land.

The second factor regarding 1880s and 1890s trash deposits is the nature of the monitoring excavations. Archaeological exploration was bound by the horizontal and vertical extents that contaminated sediments removal required. As a result, only cultural remains identified within the upper portion of MS001 sediments were recorded and excavated. Deeper

and older deposits may exist at MS001 but were not encountered except for the mill-related features (Fea 1 and 6), and these were not always followed by pre-mill sediments. For this reason, earlier trash deposits may exist but were not exposed.

A third factor is flooding. According to David Myrick (1962:171) a flood occurred in late January, 1881 that put Dayton under water, damaging the partially constructed C&CRR grade and tracks in and around Dayton. As detailed in Chapter 3, the MS001 property has been exposed to considerable flooding over the years due to its proximity to the river. The 1881 flood presumably carried away most debris that would have been on the surface of the site at the time. But after that flood, new accumulations of trash would have appeared as townsfolk occasionally deposited their debris on the site. This may partially account for the preponderance of post-1880 trash deposits in the MS001 project area.

Several trends or patterns are apparent among the artifacts and commodities from the debris clusters found on the former Keller & Co. Mill site. Generally, in every deposit, comparatively few glass and ceramic food containers and virtually no metal ones (i.e., tin-plated ferrous metal cans) were found. Meanwhile, where large food bone assemblages were encountered, there were usually large numbers of alcoholic beverage bottles, as well as a few soda and mineral water bottles. The lack of canned goods may be a function of metal preservation at the site. MS001 is notorious for yielding metal artifacts in extremely poor condition. Still, excavators noted few iron stains in the sediments of decayed can size. In addition, food and other cans of the 1880s and 1890s typically had soldered side and end seams. Since solder is lead, it does not corrode as rapidly as the ferrous can fabric. A few pieces of seam solder were retrieved from Str 9 of Fea 6 and from Fea 5, and a few ferrous can fragments were noted at Fea 7, but these are the only can remnants from MS001.

At Fea 5 and 7, large numbers of ceramic hotelware dishes were recovered as well as many food bones and beverage bottles. The complexion of all of the MS001 domestic dumps is similar to this, leading to the contention that most of the garbage came from commercial eating, drinking, and lodging establishments in Dayton. It is this scenario that also explains the dearth of food cans. Restaurants, saloons, and boardinghouses in Dayton probably purchased food supplies in bulk, relying on perishables such as potatoes, dried beans, apples, flour, carrots, and the like for the meals that they prepared and served. Small cans of vegetables and fruits were expensive, especially for feeding large groups of people.

In all of the domestic deposits except Fea 1, moderate numbers of wie fragmented tablewares were collected. Nearly all of the table ceramics are plain, white hotelware, very few are porcelain, and even these are undecorated and white in style as well. Only a few of these have simple molded designs; the rest are plain. In addition, the many wie vessels were made by a handful of English potters. The same marks are found in more than one feature or stratum. This strongly suggests first, that the dishes and associated bones and bottles had belonged to one or more restaurant, boardinghouse, or food-providing saloon in town, and second, that such an establishment(s) was habitually dumping garbage at MS001.

Ceramic maker's marks are interesting in themselves as indicators of economic status, origin of artifacts, trade and shipping networks and more. The 18 wie vessels with identified ceramic marks from MS001 are presented in Table 6.9-1. Of the eight distinct marks found, four were found on multiple vessels. Two of the marks are somewhat obscure, as they are not found in Godden's *Encyclopedia of British Pottery and Porcelain Marks* (1983). All of the marks are English, but the presence of two uncommon, little known marks in the group suggests that Dayton restaurants and boardinghouses may have been acquiring especially inexpensive wares through their supply sources. The very plain nature of the marked and unmarked wares also suggests low cost, durable dishes were favored.

Table 6.9-1. Ceramic Makers' Marks from MS001 Trash Dump Features.

Mark	Origin	Vessel Type	MS001 Context	Total MNI
Adams, William	Tunstall, England	Dish, small	Fea 7	1
Burgess & Goddard	England	Plate, small	Fea 5	1
		Plate, dinner	Fea 5, Fea 7	2
Clulow, Robert	Fenton, England	Unknown	Fea 6, Str 9	1
Furnival, Thomas	Cobridge, England	Plate, dinner	Fea 7	2
		Plate, small	Fea 7	3
		Saucer	Fea 7	2
Hughes, Thomas	Burslem, England	Plate, dinner	Fea 7	1
Meakin, J&G	Hanley, England	Dish, small	Fea 7	1
		Saucer	Fea 7	1
Powell & Bishop	Hanley, England	Plate, small	Fea 5	1
Prince of Wales	?	Plate, small	Fea 7	1
		Saucer	Fea 7	1
Total No. of Vessels				18

It is noteworthy that most of the ceramic wares are from England. By the 1890s, United States potters in the East Liverpool area of Ohio had begun to successfully compete for the English wie market. In the late 1870s, there were already a number of pottery companies producing whitewares and they continued through the 1930s (Gates and Ormerod 1982:1-5). And yet, none of their wares are present at MS001, not even in Fea 7, which dates to the late 1890s. Fea 1, 5, and 6 date from the 1880s, but the East Liverpool wares had already found their way west by 1877. In that same year, at least six different shops in the Dayton area sold crockery. The first – James Toombs & Co. – was located in Reno, Washoe County, some 35 miles from Dayton. The second was Richard Mercer, operating in Gold Hill, approximately six miles north of Dayton, in Storey County. And the remaining four were situated in Virginia City,

seven miles north of Dayton. H.S. Beck, Heyman Bros & Co., Schoenfeld & Cook, and Wolf & Fletcher were the Virginia City crockery merchants (McKenney 1877:225). Apparently, dishes were widely available to Dayton residents and merchants.

By the 1890s, American ceramics definitely would have been commonly available in Nevada. Besides local retail and wholesale outlets, Dayton consumers had access to mail-order catalogs by this time. Such catalogs as Sears Roebuck & Co. and Montgomery Ward, carried sets and open stock sets of dishes. In the 1897 Sears Roebuck Catalogue, 16 different sets of ceramic tablewares and toiletry sets were advertized; 15 of the sets were English and one was French. Not one American potter was named (Israel 1968:678-683). Until this time, the English wares seem to have retained their reputation as desirable, durable dishes. Sears Roebuck & Co. did a tremendous volume of trade so that their failure to carry American goods must have heavily biased the ceramic artifacts that landed in archaeological sites from the 1880s and 1890s.

The preponderance of inexpensive, English, plain ceramic tablewares at eating establishments in Dayton may be accounted for by both consumer choice and wholesale suppliers' available stock.

As for other kinds of artifacts and commodities at MS001 dumps, there are interesting patterns. First, a great many bottled products came from San Francisco. From bitters, to tomato ketchup (Code & Elfelt Co.), to Florida Water, to J.C. Daly's Clubhouse Gin, numerous bottled products were manufactured and bottled in San Francisco. A few artifacts were produced in other regions of the United States, but far more came from Europe and Britain. These include the many wine and champagne bottles that presumably came from France. There are stoneware mineral water bottles from Germany, clay pipes from Scotland, stoneware ale bottles from Britain, a perfume bottle from Paris, and the abundant ceramic dishes from the Staffordshire district of England. Of course, Chinese ceramic vessels were found also, but these were imported for use by the Chinese, not for the general population of Euro-Americans who are thought to have generated most of the refuse that landed at MS001.

Considering how remote and quiet Dayton was after the demise of Comstock mining and milling in the late 1870s, the large number of imported goods at MS001 trash dumps is unexpected.

Does the trash deposition appear to be secondary dumping from the main part of Dayton or from adjacent residences or businesses?

At the dugout feature (Fea I-8) at MS004, the artifacts represent primary deposition. They were items left in the building at the time it collapsed or was abandoned. This is evident by the fallen wall and the bottle cache located in the northwest corner of the structure as well as by the association of other artifacts with the wooden floor remnants and with the fill just above the floor.

Trash deposits from the Keller & Co. Mill site (MS001) definitely represent secondary dumping by Dayton residents. Based on the nature of the artifacts in each MS001 domestic deposit, Fea 1, 5, and 6 assemblages probably came from commercial eating and/or drinking establishments located in the main part of Dayton. The Fea 7 assemblage is the most recent trash dump, dating to the late 1890s. It seems to be a mix of private household trash and restaurant or boardinghouse debris and may well have come from nearby residences. However, the best that can be determined at present, the closest occupants to the central part of MS001 during the 1880s and 1890s were railroad personnel working for the C&CRR.

To be accurate, most recorded trash dumps at MS001 are believed to be composites of one to three dump episodes from various Dayton sources. Nevertheless, the dump assemblages are dominated by what appear to be restaurant, saloon, or boardinghouse refuse. Based on listings in Dayton business directories for the years 1880, 1882, 1886, and 1905, the number of eating establishments in Dayton remained small for two decades. During 1880 there were two hotels, no saloons, no boardinghouses, and no restaurants mentioned. In 1882, as noted above, two hotels and three saloons were listed, but no restaurants or boardinghouses. Three saloons and two hotels and no restaurants or boardinghouses again were noted in 1886, and in 1905 there were five saloons and one hotel, but no restaurants (McKenney 1880:167; 1882:629-630; 1886:875; Suits-Shuman 1905:53-54). Based on the directories, either there truly were no restaurants or boardinghouses in Dayton during the 1880s and 1890s, or they did exist but proprietors chose not to pay for directory listings. A third possibility is that restaurants existed within the Dayton hotels and were not separately listed. For most years, too, one hotel was always listed that had no name. In each such listing, a woman was mentioned as the proprietress. For 1880 and 1882, it was Mrs. M.L. Jaqua. In 1886, Mrs. D.C. Fox was the hotel owner. In 1905, Mrs. C.G. Rising was listed as renting "furnished rooms" (Suits-Shuman 1905:54). It may well be the common nineteenth century case that the unnamed hotels were actually boardinghouses run by widowed or abandoned women as a way of making a living after losing their husbands, a common scenario in the 1800s.

No addresses were given for the Dayton hotels and saloons, but they were probably located on or near Main and Pike streets , in the heart of Dayton.

Is there any indication of ethnic butchering patterns in the artifact and bone assemblages at MS001?

Since excavations in the Fea 1 (Str 2A), Fea 6 (Str 1, 2, 7), and Fea 7 dumps returned artifacts deposited by overseas Chinese inhabitants, comparative analyses of the features' faunas were conducted with the intent of identifying food bones deposited by Dayton's Chinese residents. First, recent research suggests that the types and frequencies of domestic mammal remains can provide evidence for differences in Euroamerican and Asian American subsistence practices (Schmitt 1999). A number of researchers discuss the emphasis of pork in the Chinese diet (see, for example, Dansie 1979; Langenwalter 1987 and references therein) and pork commonly represents the most abundant domestic meat type in overseas Chinese sites. Figure 6.9-1 presents the proportions of pork, lamb, and beef remains from a sample of Chinese sites in

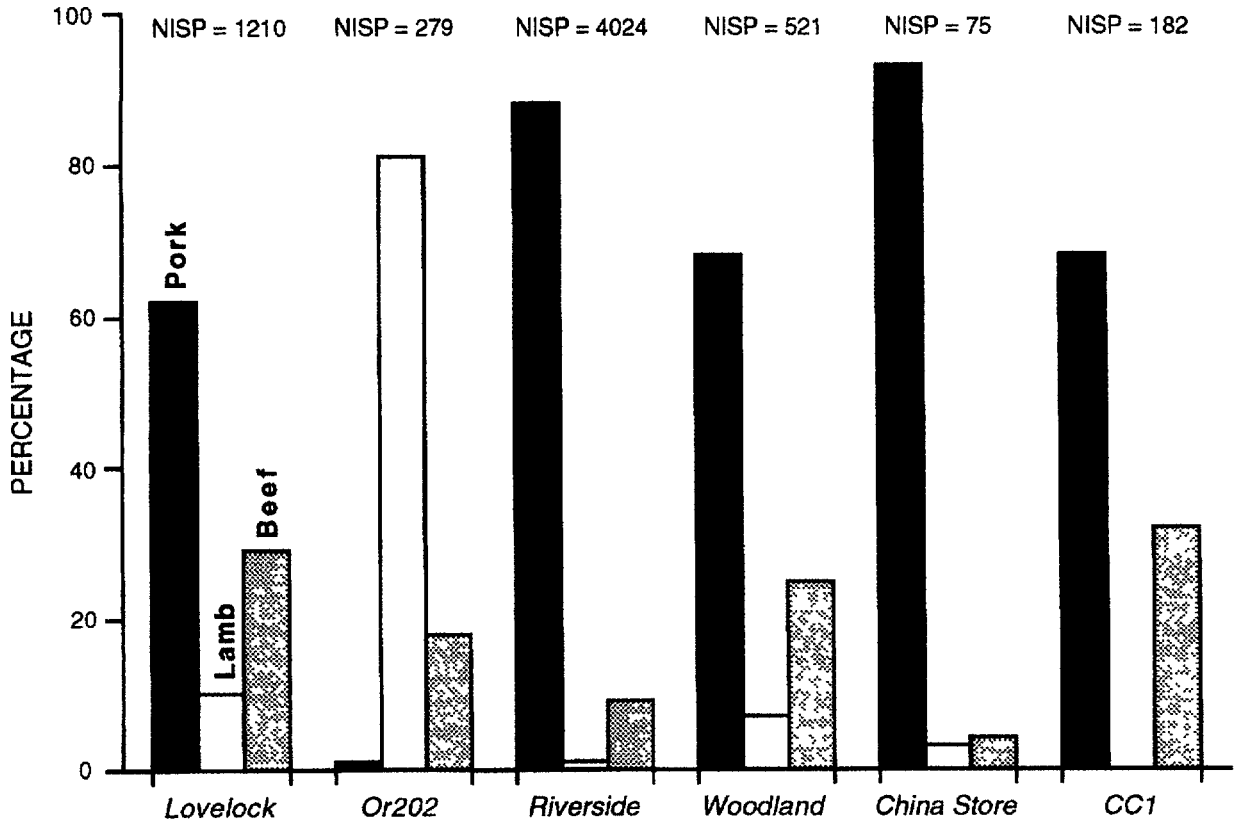


Figure 6 9-1 Proportions of pork, lamb, and beef bones recovered from selected Chinese historic sites/components in California and Nevada (after Schmitt 1999) Left to right Lovelock's Chinatown (Well 1 and 2, Building 1, Dansie 1979), 26Or202, Carson City (Schmitt and Lupo 1995); Riverside's Chinatown (Langenwalter 1987); Woodland Opera House, California (Gust 1984), Lower China Store, Madera County, California (Langenwalter 1980); Copper Canyon Mine Chinese Camp (Schmitt 1999)

Nevada and California. Except for the large numbers of sheep bones from 26Or202 where sheep were raised and slaughtered locally (Schmitt and Lupo 1995), pork bones clearly dominate each assemblage and are followed distantly by beef. Mammalian taxonomic abundances in Euroamerican faunas, however, disclose a rather stark contrast. As clearly shown in Figure 6.8-2, the proportions of domestic mammal bones in Nevada non-Asian Euroamerican sites show a marked preference for beef. In fact, wherever pork, lamb, and beef were utilized, lamb often was a secondary meat resource in Euroamerican sites and the lowest ranked meat resource in Chinese sites. A comparison of these data with taxonomic abundances in MS001 deposits finds the composition of the dump assemblages to be similar to other non-Asian Euroamerican assemblages and markedly different than regional Chinese sites.

Secondly, both ethnographic observations and archaeological investigations document the ubiquitous use of fish and fowl in the Chinese diet (e.g., Anderson and Anderson 1977; Gust 1984; Langenwalter and Langenwalter 1987). In addition, wild and/or exotic species have been reported at Chinese sites in Nevada (Dansie 1979; Schmitt 1999) and California (Langenwalter 1987; Gust 1984) but generally are absent or rare in regional Euroamerican sites (Dansie 1994). Because only five fowl bones and no fish or wild/exotic taxa were recovered from the MS001 dumps, the assemblages appear to represent "typical" non-Asian Euroamerican accumulation rather than a bone assemblage produced by overseas Chinese.

Finally, food bones deposited by overseas Chinese may contain high proportions of small pieces segmented by cleavers. For example, in their overview of faunas from Riverside's Chinatown, Langenwalter and Langenwalter (1987:48) note that meat cuts often were chopped into "small pieces that could be handled with chopsticks," and Schmitt (1999) reports similar butchering activities in a Chinese mining camp in Lander County, Nevada. This butchering pattern is not evident in the MS001 assemblages. The majority of the bones display saw marks produced by a retail butcher(s) and only 11 bones (largely unidentifiable pieces) from Fea 7 display chop marks.

In sum, while local Chinese deposited refuse into the Fea 1, 6, and 7 dumps, the recovered faunal data suggests that food bones were rarely, if ever, deposited. Either the amount of Chinese bone refuse was so small that specimens could not confidently be identified in these large assemblages, or local Chinese adopted the foodways characteristic of most local inhabitants, including a taste for beef ribs, roasts, and steaks.

As previously noted, 30 butchers worked in the area between Reno, Carson City, Virginia City, and Dayton in 1877. At least 12 of them had Germanic surnames and the same holds for the 25 butchers of 1882 (McKenney 1877:223; 1882:686-687). Many of the others had British names, suggesting ethnic indications in butchered bones from MS001 may be British and German patterns, introduced by regional butchers.

Can any indication of the Demographics of household composition (including age and gender) be inferred from the artifacts?

Since it appears that most of the artifacts in MS001 features originated at commercial eating and drinking establishments, the household demographic compositions that can be inferred from the feature assemblages do not reflect composition of typical family households for the most part. Interestingly, in the Fea 1 (Keller & Co. Mill) and Fea 6 (assay office) domestic trash deposits, adult-associated artifacts were common, while children's artifacts were absent.

No specifically feminine or masculine articles were found at Fea 1, though wine bottles were collected that may have been emptied by one or both genders. At Fea 6, Str 2, numerous bottles holding alcoholic beverages and medicines strongly indicate adult consumption. No feminine articles were identified, but a clay tobacco pipe and bone collar stud, as well as liquor bottles imply "maleness." The Fea 6, Str 9 assemblage includes many beer, wine, and liquor bottles, including a Clubhouse Gin case bottle, suggesting adult male consumption. In addition, part of a heavy leather work boot, a ball clay tobacco pipe, and the numerous assay artifacts also are attributed to adult males. No feminine artifacts were identified in Str 9. So debris from the milling-related features, even the domestic material, is dominated by adult and adult male artifacts.

At Fea 5 – a domestic refuse deposit – numerous adult artifacts, a few male artifacts, and several female artifacts were discarded. Again there were many bottles for ale, beer, champagne, liquor, wine, and patent medicines high in alcoholic content most of which presumably were emptied by adult males, but possibly by adult females as well. Fea 5 yielded a clay tobacco pipe (adult male) and glass beads, a finger ring, ornate black glass buttons, and a perfume bottle that strongly indicate female use and discard. If all of this material came from one place in Dayton, such as a boardinghouse or restaurant, then many personal belongings of the proprietors and proprietresses were discarded along with food and beverage remains. Otherwise, the personal artifacts may have come from a private residence, dumped separately from the food refuse.

The Fea 7 assemblage is the most robust and varied in its age- and gender-related artifacts. There are adult artifacts, adult male artifacts, male, female child belongings, and adult female articles. It is very possible that Fea 7 included artifacts from a family residence as well as from a boardinghouse or economy restaurant. It may also be that a family in Dayton, perhaps a widow and her children, operated a boardinghouse, so that all of the Fea 7 assemblage is from one source.

The question of ethnicity is raised again here, in regard to household composition. As previously noted, a small number of Chinese-manufactured ceramic vessels was collected from MS001 features. Sherds from utilitarian, brown-glazed stoneware food jars came from Fea 1, Str 2A, and from Fea 6, Str 1, 2, and 7. One such jar, two porcelaneous stoneware bowls, and one tiger whiskey bottle came from Fea 7. In each context, only ceramic food vessels of Chinese origin or modification were identified. The faunal remains do not indicate Chinese food remains or foodway practices.

So the intermittent presence of Chinese artifacts at MS001 is intriguing yet puzzling. It may be that the northern part of MS001 was occupied by Chinese laborers in the early days of Dayton and that their domestic debris continues to be churned up, surfacing in later domestic deposits. Perhaps, the Chinese vessels were deposited along with other vessels, bottles, and food bones from restaurants and boardinghouses where Chinese people worked. According to the 1910 federal census, five adults of Chinese birth lived in Dayton – Mary Sing was a 58-year old woman who worked as a housekeeper; the others were men between 88 and 22 years old. Two of the men worked as cooks in a hotel, the third was a laundryman, and the fourth was retired (United States Department of Commerce and Labor, Bureau of the Census; Thirteenth Census of the United States: 1910, Dayton Precinct, Nevada). In earlier years, Chinese immigrants commonly may have worked in Dayton hotels, boardinghouses, and restaurants, where a few of their ethnic belongings would have been discarded occasionally.

What do these trash deposits reveal about life in late nineteenth century Dayton?

This question is indirectly addressed within most of the other research questions and is not separately considered here.

How does Dayton as a peripheral town compare to Virginia City as a core town within the Comstock Mining District?

While the community of Dayton came into existence in 1851, preceding Virginia City by eight years, it was quickly overshadowed by Virginia City in terms of fame, glamour, population, mineral production, and most other elements. Where at first Gold Canyon (later Dayton) was a mining camp of modest size, it lost this distinction as soon as the Comstock Lode was discovered in what is now Virginia City. Interest, effort, and population immediately shifted from Gold Canyon to Virginia City in 1859. The population of Virginia City eventually climbed to 23,000, while Dayton's maximum population was ca. 2500 in 1865. At their heights, Dayton had but 11 percent of the population that her upland neighbor claimed.

Within just a few years of extracting the Comstock silver, miners in Virginia City realized that Dayton had several resources that Virginia City lacked, mainly water, wood, and cultivatable land. Dayton became the home of numerous ore mills, powered by water from the Carson River. Already established as a service center along the California or Overland Trail, Dayton provided a focal point and place of passage for wood-cutters and charcoal makers who harvested trees in the Pine Nut Range to the south (Hazlett 1922). In these ways, Dayton became a satellite, service town that was inextricably linked to the needs, wants, activities, and fortunes of Virginia City. Both towns were county seats – Dayton for Lyon County, Virginia City for Storey County.

Virginia City was a large mining town that formed the nucleus of the Comstock Mining District; Dayton was a small milling town on the outskirts of that district. With the notoriety, major money investment, huge population, and daily needs of Virginia City, it is expected that such a place would have extensive access to transportation networks, to goods, to entertainment,

and would attract salesmen, merchants, freight and coach drivers, miners, and characters of every sort. One result of this abundance is a rich and diverse archaeological deposit.

Selected artifact assemblages from Dayton have been scrutinized throughout this document. They represent *in situ* mill, assay, and domestic or commercial dugout remains, as well as informal household garbage disposal on property peripheral to downtown Dayton. Several archaeological contexts are represented. It is desirable to compare the assemblages from MS001 and MS004 with remains from Virginia City. At present, only one pertinent assemblage from Virginia City is available for comparison, having been described in a preliminary report. This is the Piper's Old Corner Saloon group of artifacts, dating between 1861 and 1883 (Dixon 1999).

The fit for comparison is not a perfect one. Artifacts from Piper's Saloon comprise an assemblage of *in situ* items, largely left in place after the 1883 fire that destroyed the saloon and adjoining opera house (Dixon 1999:15, 17). The only feature from Dayton that is also in place is the Fea I-8 dugout or shed, and it was not a saloon. The two do compare in terms of time, as both were occupied during the mid- to late-1860s. At this time, both communities had their largest populations -- 23,000 for Virginia City and 2500 for Dayton.

Dixon estimates that approximately 100,000 artifacts and pieces of artifacts were collected from Piper's Old Corner Saloon site, whereas 807 pieces, representing 158 MNI came from the shed structure at MS004 in Dayton. This is an ironic comparison in terms of quantities, coincidentally reflecting the great differences in the populations of Dayton and Virginia City. Both archaeological sites yielded some similar artifacts, though. For instance, coins were found in both places, as well as structural remains (iron cut nails, milled wood), olive green wine and champagne bottles, mammalian food bones, and clothing buttons (Dixon 1999:72, 107, 137, 163). For Fea I-8, the listed artifacts account for most of the recovered artifacts, while they are but a fraction of the items from Piper's Saloon. Few of the shed/dugout artifacts bore makers' marks so that little can be said as to markets and access to goods for Dayton in the late 1860s. Fea I-8 yielded the gold coin (American, minted in San Francisco) and an embossed soda water bottle from Philadelphia (Union Glass Works). The recovered wine and champagne bottles are unmarked but probably came from Europe.

Assemblages from MS001 trash deposits in Dayton were larger than the Fea I-8, yielding 8640 domestic MNI, as well as a few thousand more that are milling and assay office artifacts. The MS001 deposits date from ca. 1880 to ca. 1900 and so were formed at about the time or in later years that the Virginia City saloon burned down. Artifacts from both sites consist of:

- brass bibbs and cocks for beer kegs
- quartz crystals
- seashells
- German stoneware Selters mineral water bottles
- freeblown wine and champagne bottles
- British stoneware ale bottles
- faceted glass tumblers

- condiment bottles
- large and medium mammalian food bones
- plain wie dinner plates
- plain wie platters
- plain wie serving bowls
- ball clay "TD" tobacco pipes
- Dr. Hostetter's Stomach Bitters bottles
- Essence of Jamaica Ginger bottles
- British stoneware bulk ink bottles
- clothing buttons
- glass beads
- perfume bottles
- brass cartridge casings
- machine-cut nails
- wooden flooring
- window glass
- porcelain doorknobs
- glass lamp globes

The list demonstrates that Dayton and Virginia City residents had access to many of the same kinds of things, and that both obtained domestic and imported commodities during the 1860s to ca. 1900. Some of the above goods, such as ball clay pipes from Scotland and durable wie dishes from England, were inexpensive in their day, even though they were imported. For other articles, such as German Selters water and American patent medicines, their costs are not known. Interestingly, only one ceramic dish maker's mark was recovered from Piper's Saloon. It is a W. & T. Adams mark, from Tunstall, England. One similar but not identical William Adams China mark was identified from Fea 7. The same very plain kinds of table ceramics were recovered at both Comstock sites, but many of the MS001 dishes retain makers' marks, and eight of them have been firmly identified as to maker (Table 6.9-1). As noted by Kelly Dixon (1999:128, 189, 194-195), the dishes from Piper's Saloon are plain, inexpensive wares that contrast dramatically with the fancy, specialized, high quality bar glasses that were found with the dishes. She surmised that the artifacts reflected the priorities of the bar owner, who wished to create and maintain an upscale saloon, and to offer meals, but meals that were not the main draw of the place and that did not sustain its reputation. Few bar glasses were recovered from MS001 deposits but those found are all standard faceted tumblers. So the contrast seen at the Virginia City saloon does not carry over to the Dayton establishments that dumped their debris at MS001.

Based on MS001 artifacts and on directory listings for the 1870s and 1880s, Dayton does not seem to have supported a fancy, upscale bar for most of its post-1865 life. Yet the faunal assemblage from Str 2 of the assay office feature suggests expensive meals were being served somewhere in Dayton during the mid- to late-1880s. The Dayton assemblages paint a picture of life at a more basic, sensible level than the Virginia City material.

Numerous unique, exotic, or expensive artifacts were found in Piper's Old Corner Saloon strata that were not seen in Dayton deposits. Included are a carved stone cribbage board, a very ornate meerschaum pipe bowl, an elaborate ceramic water filter from London, piano parts, highly-decorated personal hygiene ceramic sets that have molded and transferprinted designs, ornate, matching porcelain vases, and fancy bar glass such as glass stoppers for decanters, ornate beer mugs, champagne flutes, brandy snifters, and cordials (Dixon 1999:62-118). Numerous other, more mundane artifacts surfaced, too, that were not represented in the Dayton assemblages.

Two points stand out in the Virginia City - Dayton comparison. First, as regards artifacts, businesses, and people, the Virginia City community was extremely dense, far overshadowing Dayton in sheer numbers. Second, the artifacts, businesses, and population in Virginia City were quite diverse when compared with those in Dayton. Piper's Old Corner Saloon artifacts demonstrate this in that besides large numbers of bar-related bottles, glasses, and dishes, such things as a toy gun, an aquarium, bellows, a fire hose, roller skates, opera house playbills, a seal press, book pages, a rubber syringe, and piano parts were recovered. This array of artifacts represents a tremendous variety of activities just from one establishment.

How does consumer product availability here compare to that at other locations in the western United States?

The products that have been found and identified in the Dayton features and in the Virginia City saloon site compare favorably to another western site of the same time period – Fort Bowie, in Arizona. Fort Bowie was an active U.S. military fort between 1862 and 1894 (Herskovitz 1978:1). It was occupied during the same years that Dayton debris was discarded at MS001.

The Fort Bowie assemblage numbers 17,000 MNI, much of it derived from the fort's common dump. This is close to twice as many artifacts as were recovered from Dayton. Over 2000 of the Fort Bowie items are glass bottles, that held Irish soda water, American mineral water, soda pop, root beer concentrate, beer, stout, champagne, wine, whiskey, kummel (a liquor), bitters, Jamaica ginger, sarsaparilla, 10 other patent medicines, Vaseline, chemicals, non-proprietary medicines, ink, leather dressing, German cologne, Florida Water, perfume, sewing machine oil, shoe blacking, shoe polish, snuff, tooth powder, flavoring extracts, cranberries, horseradish, lime juice, mustard, olives, peppersauce, olive oil, pickles, salad dressing, spices, Worcestershire sauce and more (Herskovitz 1978:5-25). Obviously, the Fort Bowie bottles provide much greater quantity and variety than the Dayton bottles. The population of the fort at any given time is not known. The artifact assemblage, however, represents continuous occupation of the site by military personnel for 30 years. This provides an in-depth view of material culture and life at the fort that the short-term dumps at Dayton cannot match.

The marked bottles from Fort Bowie were compared with those from Dayton. Some interesting patterns emerged. For example, most of the marks found on Dayton beer and liquor bottles also were found at Fort Bowie. Most of the marks are from the midwestern and eastern

United States. None of the marked patent medicine bottles from Dayton are represented at Fort Bowie, save one, Dr. Siegert's Angostura Bitters. There are numerous patent medicines from Fort Bowie and most of them were manufactured in the East (Herskovitz 1978:13). Many of the Dayton medicines came from the East or Midwest as well, but more of them were from San Francisco. This suggests that Dayton residents and Fort Bowie residents were getting some of their commodities through different supply networks, as would be expected for sites so far from each other. The same split is apparent among Florida Water bottles. Both sites yielded Murray & Lanman Florida Water bottles from New York, but only Dayton has Florida Water bottles from Redington & Co. and Crane & Brigham, both San Francisco firms.

The Dayton patent medicines include:

- Dr. Harter's Wild Cherry Bitters, St. Louis
- Dr. Hostetter's Stomach Bitters, San Francisco
- McMillan & Kester Essence of Jamaica Ginger
- Dr. McBride's King of Pain
- Peruvian Bitters
- Dr. Siegert & Hijos Angostura Bitters, Trinidad
- Dr. Wistar's Balsam of Wild Cherry

Ceramic makers' marks is another subset within the assemblages that can be compared. As previously noted, eight ceramic tableware marks were discovered on the many plain wie vessels from Dayton. Three of these also were recorded from the Fort Bowie dump, including an identical Burgess & Goddard mark (Figure 6.5-3). Altogether, 40 marks were identified at Fort Bowie, most of which were English in origin, but a few American ones as well.

In the case of ceramics, it would seem that Dayton residents had a very limited choice of tablewares by comparison. The Fort Bowie ceramic assemblage of 1147 vessels is extremely diverse in terms of makers as well as in terms of patterns and wares. The collection includes plain wie wares, molded wie vessels, transferprinted, and handpainted wares, as well as utilitarian yellowares and imported Chinese vessels of stoneware and porcelaneous stoneware. And wie vessels are the most common, followed by stoneware and then porcelain (Herskovitz 1978:96).

The question then is whether Dayton dump residents had no other choices than plain wie vessels produced in England or whether the nature of their businesses made these cheap durable wares the most practical for their purposes. The Dayton assemblage is expected to have less diversity simply because it is a smaller sample than the Fort Bowie assemblage. But the very redundant ceramic collection from Dayton suggests that the MS001 trash dumps represent debris from a narrow sector of the Dayton population. The dishes argue for specialized use in restaurants, bars, and boardinghouses. While one might expect this same pattern of uniformity from a military fort, it is not the case for Fort Bowie. Families resided there in private quarters and did their own cooking, enlisted men ate at a mess hall, and a restaurant at the fort served travelers. Over the course of 30 years, ceramics of every description were used and broken there.

The Fort Bowie residents had access to a large number of commodities as evidenced by the huge artifact assemblage. Their supply sources undoubtedly changed over the years, and new goods arrived with each group of soldiers and their dependents. Additionally, a trader's store was established at the fort, providing a local source for goods. Based solely on the artifacts, the Fort Bowie occupants had greater access to commodities than Dayton, Nevada townsfolk. But considering Dayton's proximity to major towns and to continental railroad service after 1870, Dayton presumably had access to an equally wide range of goods. Whether Dayton residents had the money or the motivation to purchase a wide range of goods, some of which were costly, is another matter.

7.0 TRANSPORTATION AND THE CARSON RIVER ROUTE

by Barbara J. Mackey

7.1 HISTORICAL SUMMARY

The terraces along the Carson River have been used as a transportation corridor in recorded history since the late 1840s. The path has varied depending on the condition of the terrain from floods, erosion, and use, thereby adding puddles, ruts, and rocks that needed avoiding. This avoidance created a network of overlapping, braided road segments of slightly rerouted trails and roads. The north side of the river was preferred. The south side did not offer as many water access points for weary travelers and their animals; the miry, rich soil prevented approaching the banks except at a few points (Simpson 1876). New eras of emigration brought about different uses and surfaces for the corridor from a footpath to the present US Highway 50.

EXPLORATION

The Carson River area remained the domain of the Washoe and Paiute until the competition and constant desire for resources lured outlanders into searching first for more fur environs and then minerals and land. Consequently, expeditions by trappers and trailblazers such as Peter Skene Ogden, Jedediah Smith, Joseph Walker, John Bidwell, and John Fremont tightened the undefined margins of the Great Basin and eventually they encountered the Carson River. Fremont is credited with naming the river after his scout, Kit Carson (Elliott 1987). Fremont crossed the river in 1844 east of the present Fort Churchill site and followed it east to its sink while on a mapping expedition between Washington and California (Figure 7.1-1).

> We followed the Indian trail through a tolerably level country, with small sage brushes, which brought us, after twenty miles' journey, to another large stream (the Carson River) timbered with cottonwood, and flowing also out of the mountains, but running more directly to the eastward. There were Indian lodges and fish-dams on the stream. [Fletcher 1980:121]

Although Walker and Fremont's expedition accounts record crossing the Carson River and following portions eastward towards Carson Sink or westward into the Sierras, neither mention the section of the river between Eagle Valley and the Fort Churchill site. Yet, within four years from Fremont's 1844 account, the Carson River corridor became one of the main routes to California.

OVERLAND TRAIL

With the increase of interest by the federal government in mapping expeditions and locating routes to California, small wagon parties of emigrants began making their way to

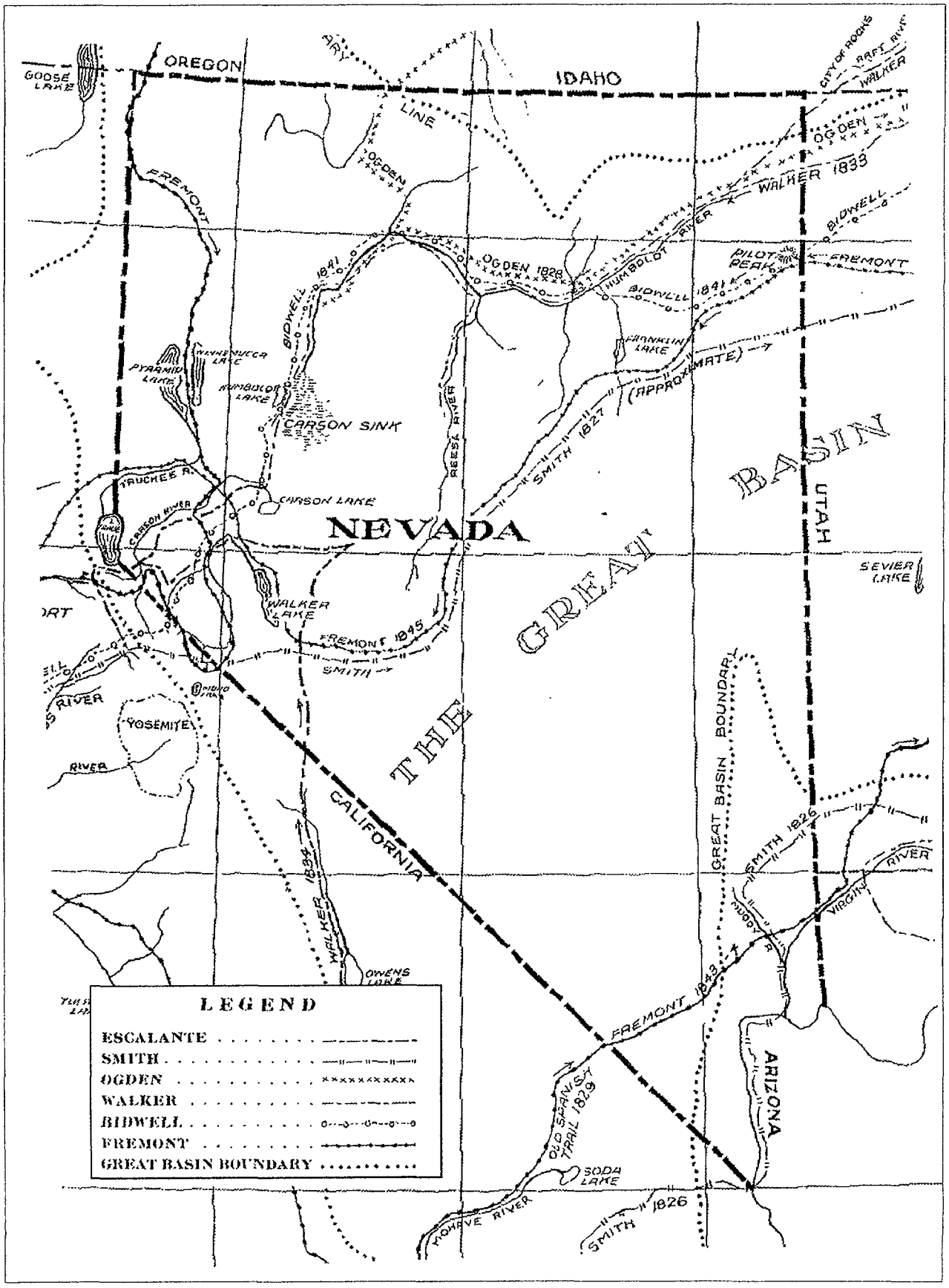


Figure 7.1-1. Recorded exploration in Nevada during the 1800s (Fletcher 1980:map inside back cover).

California even though there was no established course. Eventually, the crossing through Nevada down the Humboldt River valley became the most direct route to California. From the Humboldt Sink several trails were located to cross the Sierras – the Truckee Route, the Carson River route, the Beckwourth Trail, the Lassen Trail. The Carson River route, introduced in 1848 by Mormons returning to Salt Lake City from Placerville, was a later addition to the choices (Curran 1982).

The Carson River route left Humboldt Sink and headed south across the Carson Sink's Forty Mile Desert (as opposed to the Forty Mile Desert on the Truckee River route) to Ragtown west of Fallon (Figure 7.1-2). The trail followed the Carson River west (upstream) to a point now under the backwaters of Lahontan Dam near Silver Springs. Williams Station was established at this location in the 1860s. Emigrants either continued along the meander of the river or headed straight west to converge at the present site of Dayton. Leaving Dayton, the trail continued along the base of the mountains to Eagle Valley (Carson City), Carson Valley (Genoa), up Woodfords Canyon, through Carson Pass, and over the Sierras. The importance of the Emigrant Trail is illustrated even after the California gold rush by a count made for the first half of 1854, which listed 213 wagons, 360 horses and mules, 28 cattle, and 7,150 sheep passing through Dayton (Hazlett 1922:19).

In 1859, Captain James Simpson, U.S. Army Corps of Topographic Engineers, was charged with finding a new wagon road that was the shortest and easiest route between Salt Lake City and California. Simpson commented on the old emigrant road as "well beaten as any in the States" and "the bones of oxen attest the effects of the old Humboldt route." According to Simpson's guide, John Reese, who had traveled the Emigrant Trail frequently, the road was "objectionable, on account of high water in the spring overflowing the valley and forcing the road on the bluffs, which are very sandy...the desert between the sink of the Humboldt and the sink of Carson, and the scarcity of feed from Ragtown, on Carson River, to Big Bend of Carson, about 30 miles," (1876:91-92). Simpson's report (1876:89-91) described the scene along the Carson River at the site of Dayton (at that time referred to as China Town) on June 11, 1859. At China Town with a population of about 150 including 50 Chinese, evidence of mining was noted in diggings and "claim-shanties." The town consisted of 12 houses and two stores, one of the stores contained rooms for opium smoking, and gambling.

By 1866, Simpson's route had been adopted and referred to as the Overland Road (Figure 7.1-3). At Dayton, the route was lost in the maze of activity associated with the Comstock silver boom. With subsequent settlement in Eagle and Carson valleys, the route was designated as the road from Carson City to Dayton. Apparently, the trail stayed away from the river in the vicinity of town, skirting the west side of Dayton close to the base of the hills.

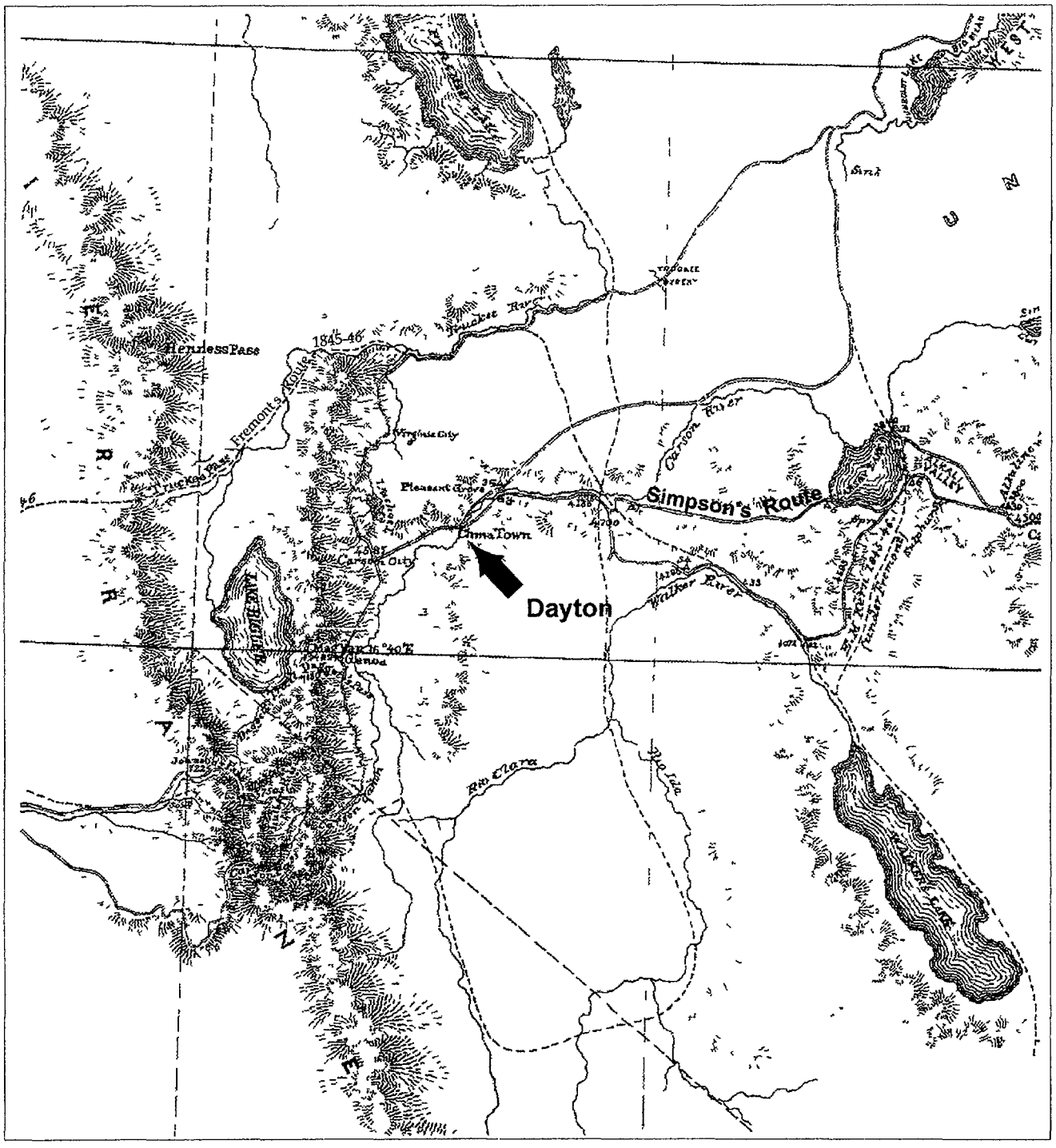


Figure 7 1-2 Captain James Simpson's travels through Nevada in 1859 while looking for the fastest and shortest route from Salt Lake City to California (Simpson, 1983[1876] end of volume)

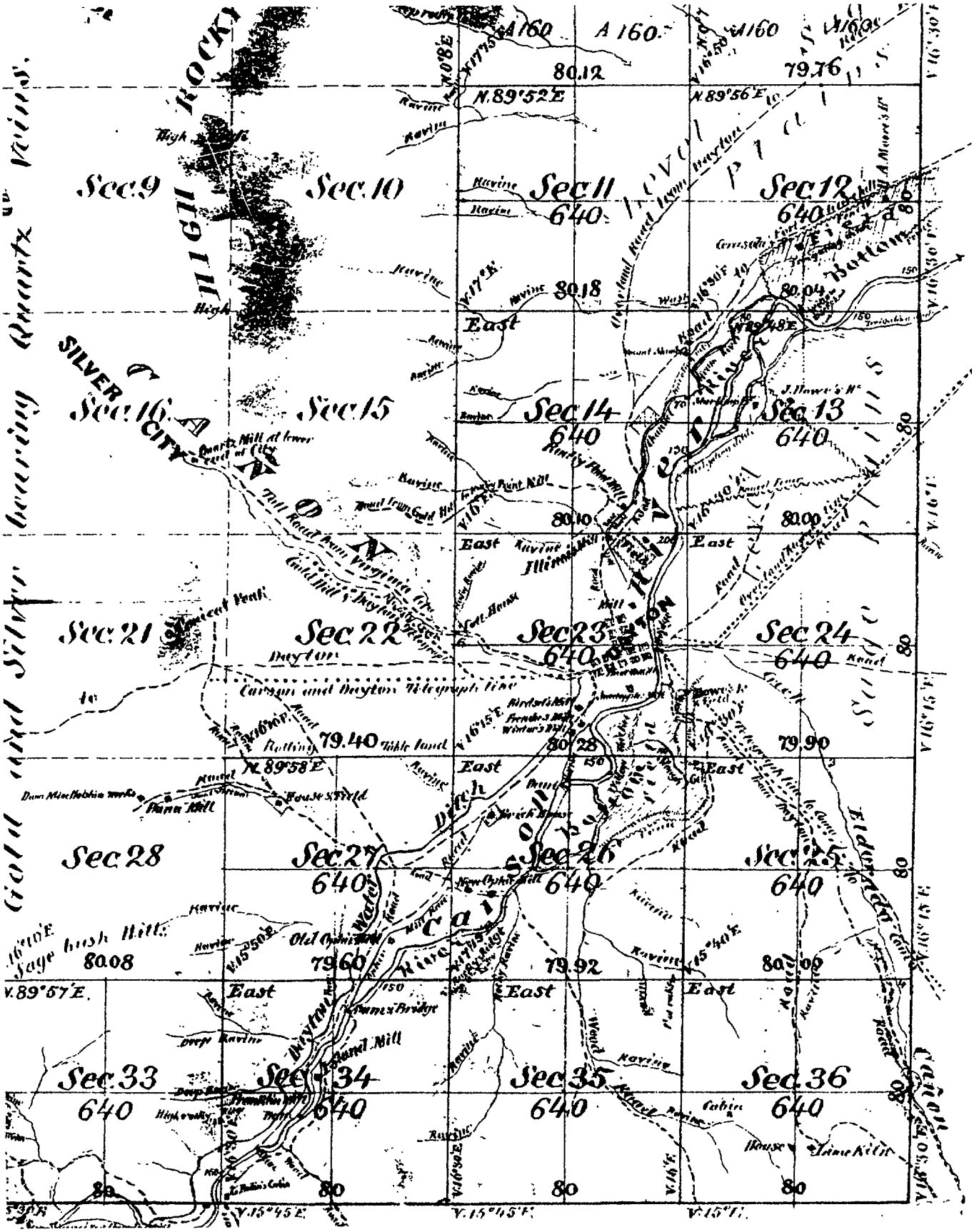


Figure 7.1-3. GLO 1866 T.16N, R.21E. (Note: Overland Road in Section 11).

PONY EXPRESS TRAIL

Another use of the trail commenced in 1860 with the Pony Express (Figure 7.1-4). The Pony Express was formed by the owners of the Overland Stage Line which operated as a passenger and freight line from the Missouri River to Salt Lake City. Senator Gwin of California convinced William Russell, the senior owner of the line, into offering faster mail service between the East and California. Russell, Majors, and Waddell organized a trail and a support network of stations, horses, and riders. The Pony Express trail used the central overland route, Simpson's faster route, that included sections of the Carson River route of the Emigrant Trail. A station was built at Dayton, called Spafford Hall's Station, and replaced with one on the site of the Union Hotel during the 1860-1861 operation of the Pony Express (BLM 1997). Remains of both stations have been destroyed.

WAGON ROAD

Traffic in local materials was also of great importance. This activity was initially done by pack trains and wagons carrying salt, cordwood, and timber to the Comstock and ore back down to mills on the return trip (see Figure 7.1-3). For example, 125 teams were observed passing through Dayton daily carrying loads of pinyon pine. The six hay yards in town were filled to capacity each night, with teams overflowing onto the surrounding streets (Hazlett 1922:53). Between 1886-1894, U.S. mail contracts were awarded and operated from Dayton to Virginia City and Dayton to Sutro; the mail was delivered to Dayton by overland and regional mail carriers (Due 1999). With the construction and operation of railroads – the Virginia and Truckee; the Dayton, Sutro, and Carson Valley; and the Carson and Colorado – the road continued to be used as an access corridor for delivery of people, resource materials, and supplies to and from the railroad lines. Travel also increased along the Carson River corridor with growth in Carson City.

LINCOLN HIGHWAY AND US 50

The next phase of the roadway along the Carson River route was the Lincoln Highway, the first transcontinental road and the foundation of the developing national system of interstate highways (Protteau 1984). The Lincoln Highway Association was organized in 1913 to promote an automobile route across the United States from New York to San Francisco – a coast to coast highway without toll charges. The highway was planned and almost entirely constructed prior to congressional highway legislation. Funding was provided by pledges to be used for building materials from major automobile manufacturers and parts suppliers such as General Motors, U.S. Tire Company, and Prest-O-Lite batteries. The association deployed a 1913 tour to determine the route, promote the highway, and solicit the aid of states in constructing the road (Lincoln Highway Association 1935)

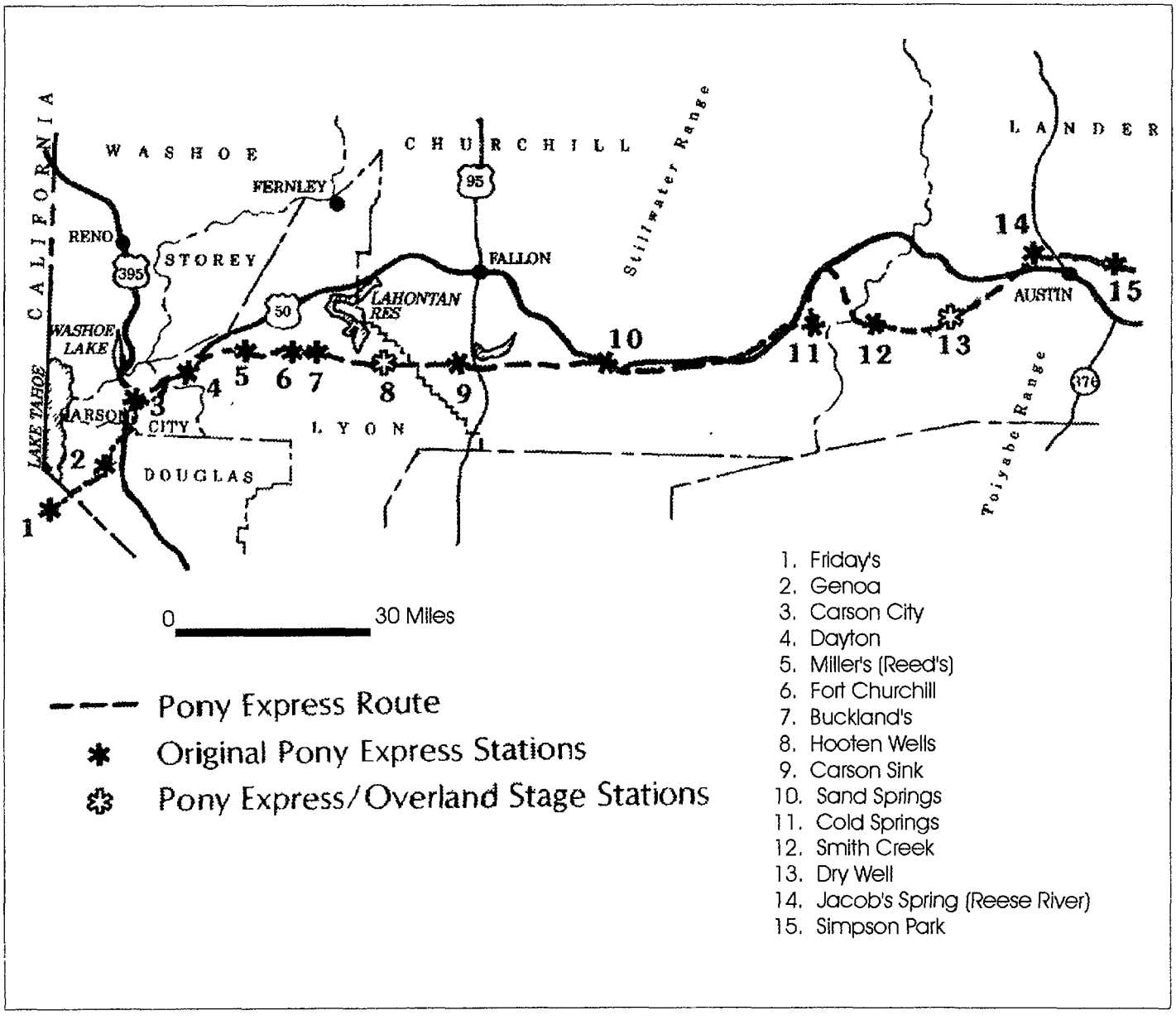


Figure 7.1-4. Pony Express Route through western Nevada with stations (BLM 1997).

Nevada was on the list of states to cross on the tour. The State legislature, which had been debating the merits of creating a department of highways and methods of highway funding, appropriated $25,000 to improve the road from the Utah to California lines for the 1913 tour. For the next several years Nevada continued to wrestle with a program of financing and routing roads. Utah became a stumbling block for Nevada's immediate inclusion in the Lincoln Highway by insisting the road enter Nevada from Wendover (the northern route) rather than Ely via Ibapah (the central route). The association was intent on including Nevada in the highway as part of the direct route to San Francisco and continued negotiations with Utah. The Federal Road Act of 1916 would aid Nevada in constructing their portion of the highway. In the meantime, while the political debate and standoff continued with Utah over the point of entry, the Victory Highway Association in Elko was formed in the 1920s to promote a northern road through Elko to Reno and continue to San Francisco. San Francisco actively supported the Victory Highway. While Utah continued to stonewall, the Victory Highway was constructed, consequently, the Lincoln Highway became the second highway completed across Nevada in 1926, and not hard surfaced until 1930 (Fey 1991). In the meantime, the Lincoln Highway Association basically was no longer needed with the enactment of Federal Highway system and dissolved in 1928. A detailed discussion of the Lincoln Highway Association is presented in the association's book (1935) and at the website of a revived association of the same name.

The Lincoln Highway initially was routed to Reno through Wadsworth from Fallon with a separate section linking Reno to Carson City and then up to Lake Tahoe. The construction of the Victory Highway changed the routing of the Lincoln Highway. An alternate route that became known as the Pioneer Branch and later State Route 2A, linked Fallon to Carson City through Dayton meeting the highway to Lake Tahoe (Figure 7.1-5). By about 1934, the highway through Dayton was rerouted, provided with drainage, and paved to a width of 24 ft (Figures 7.1-6, 7.1-7). Part of the road improvement included extensive cutting and filling to straighten and raise it above the floodplain of the Carson River. In Dayton, the reroute mainly eliminated a 90 degree turn onto Main Street from River Street and a 90 degree turn onto Pike Street from Main Street, but still employed downtown streets of Dayton as the thoroughfare (NSDH 1932; Bert Bedeau 2000, personal communication).

Nevada's contributions to the Lincoln Highway included the design of the highway bridge marker used along the entire length of the road. In addition, Gael Hoag from Ely became the General Secretary of the association from Ely. He designed road markers and signs and determined locations for the markers. The markers were mass produced by the association and placed using a nationwide program of Boy Scouts in 1928. Reinforced concrete posts were used except in congested areas or on surfaces not conducive to installing the posts; metal signs were placed in these areas. Extra markers were provided in case of breakage or for future use (Rein 1997).

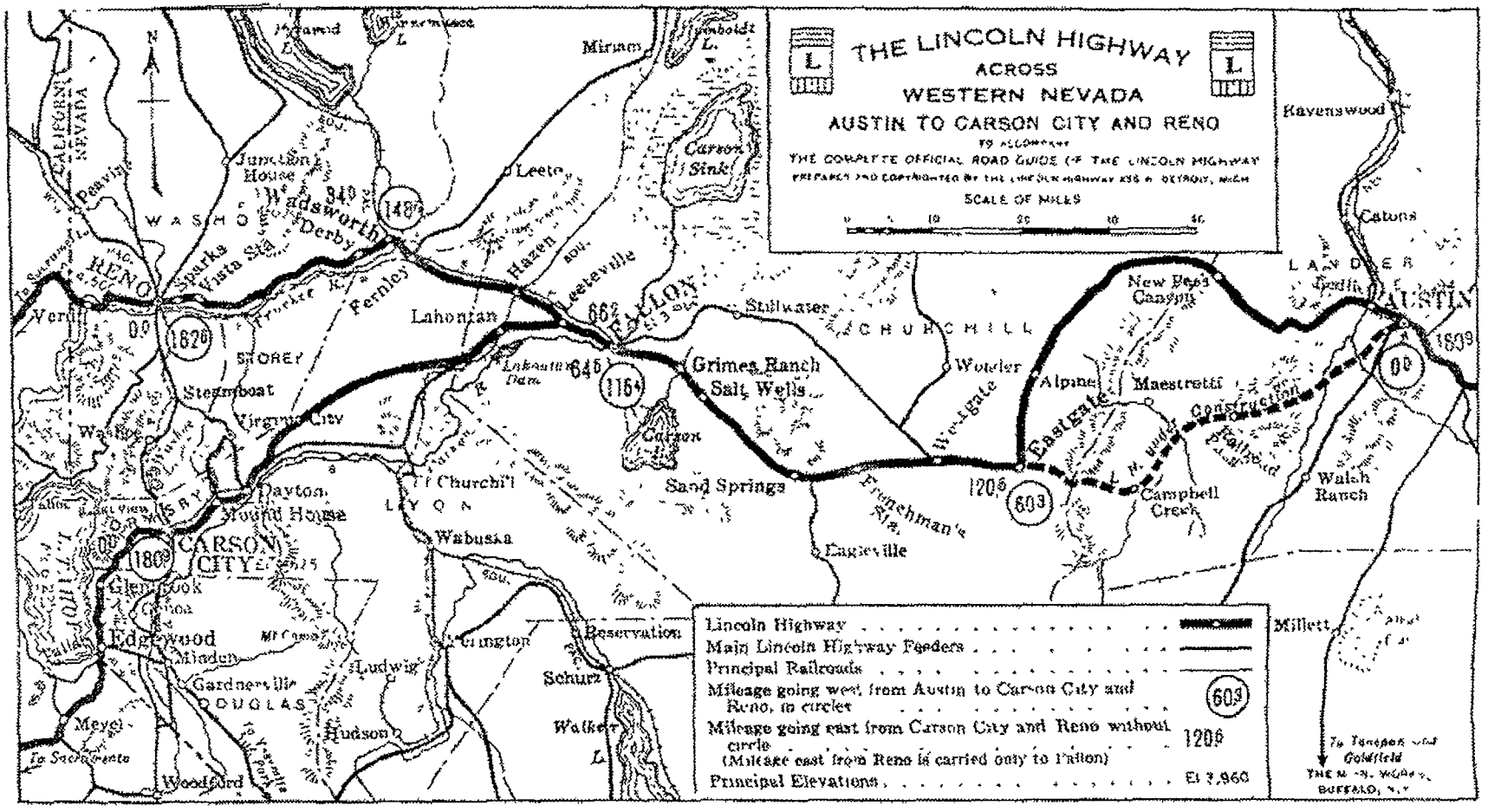


Figure 7.1-5. The Lincoln Highway Association map of the route across western Nevada.

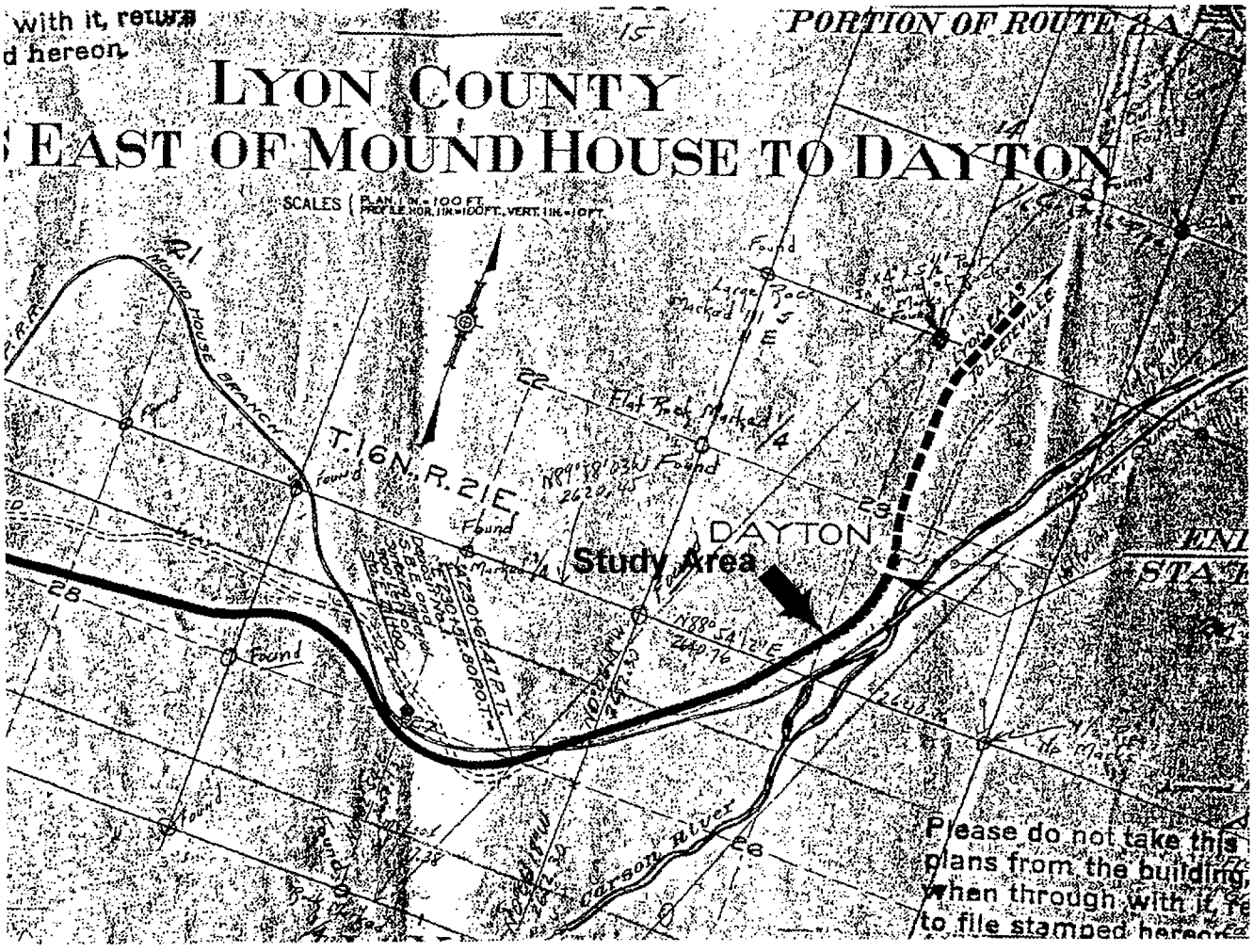


Figure 7.1-6. NHDH 1932 map of Route 2A (alternate Lincoln Highway) in study area.

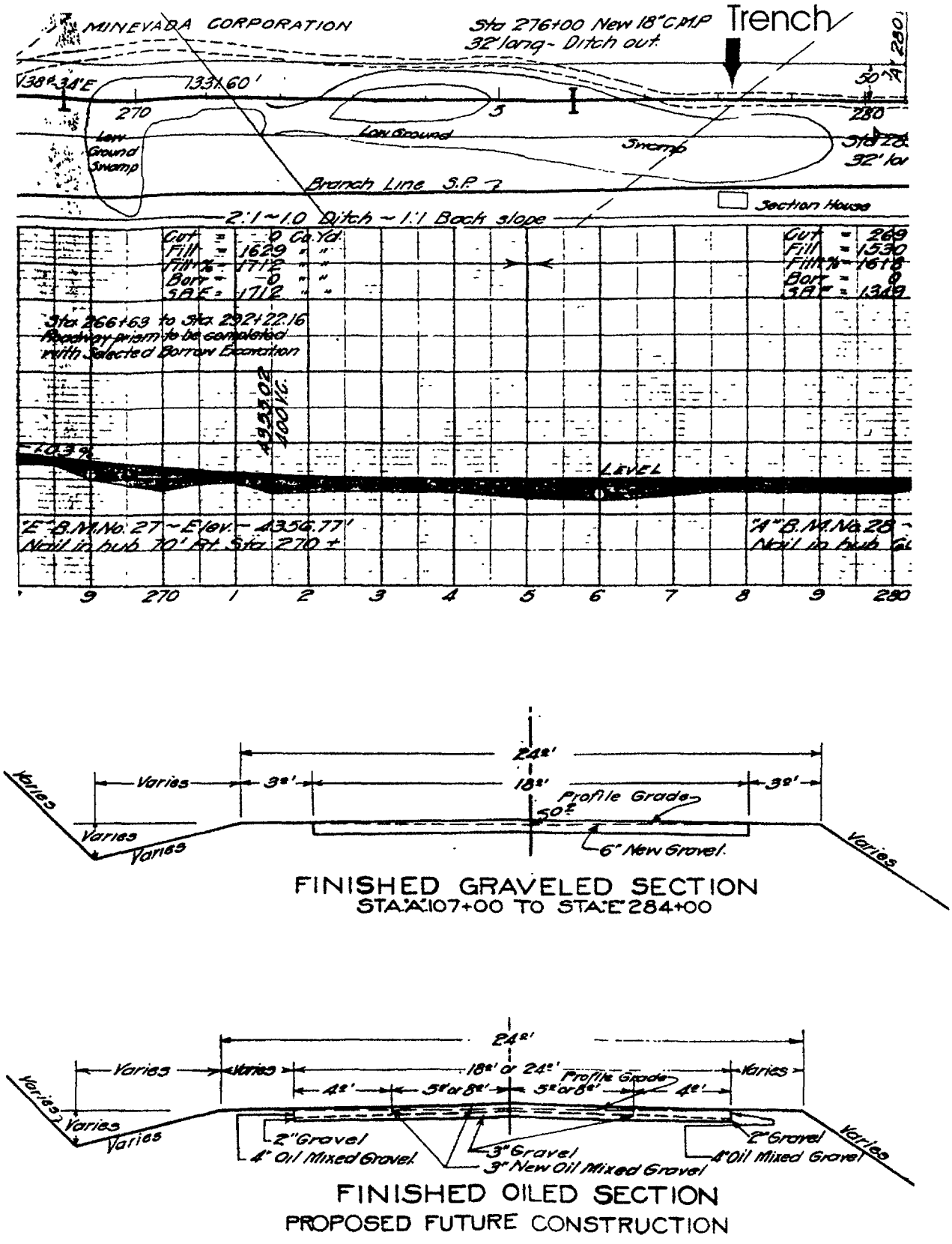


Figure 7.1-7. NSDH 1932 plan indicating cross sections of road at stake and location of project trench.

Highway 50 is the designation of the Lincoln Highway as part of the 1926 federal highway numbering system. Realignments of Highway 50 through Dayton occurred in the 1950s eliminating travel through downtown Dayton and on portions of the Lincoln Highway.

7.2 EXISTING REMAINS OF THE TRAIL AND ROAD SYSTEM

Existing remains of the Emigrant or Overland Trail and the Pony Express are no longer visible in Dayton. The area of the trails has been built up and paved over by modern homes, businesses, and roads. An abandoned section of the Lincoln Highway that extends beyond the southwestern end of River Street before it joins with Highway 50 about 1 mi to the south is the only known extant part of the historic Carson River transportation corridor within the project area (Figure 7.2-1). A decayed two-lane, asphalt covered road with run-off channels on both sides marks the segment remains.

7.3 A SECTION THROUGH THE ROAD

by Vickie L. Clay

A portion of an abandoned roadbed tucked against the hillside on the southwest edge of Dayton, and suspected to be a remnant of the Lincoln Highway, was trenched as part of the current project (Figure 7.2-1). The trench is oriented north-south and cuts the northeast-southwest trending roadbed on a bias creating a much longer profile than if the trench had cut the road at a perpendicular angle (Figure 7.3-1 location map). Overviews of this portion of the abandoned road before trenching are shown in Figures 7.3-2 and 7.3-3.

The profile (Figure 7.3-1) illustrates several levels of roadbed fill and possibly an early use and grading episode prior to placement of three layers of fill (Str 4, 5, and 6) topped with asphalt (Str 3). Most recent strata include those deposited after highway abandonment (Str 1, 2, and 10), all likely slopewash. Below slopewash is a discontinuous patch of worn asphalt road surface up to 4 inches thick and present for about 10 ft. Road base material (Str 4) consisting of 5-6 inches of gravelly loam extends for the entire width of the road and may have provided the pre-asphalt driving surface. Below Str 4, a yellowish brown and dark brown loam comprise the Str 5 and Str 6 fill levels, averaging 8 and 16 inches thick, respectively. All road fill strata appear to rest horizontally within a cut (Int 6A) and on a horizontal interface (Int 6B) that appears to be both a cut and fill surface graded level. The outer or eastern edge of the road fill strata form a gently sloping berm covered with Str 10 slopewash. All of these deposits appear to represent the last construction, use, and abandonment of this segment of roadway.

Below Int 6B, a gravelly loam road base material (Str 7) extends over the eastern three quarters of the profile and natural loam (Str 9) appears to have been cut into on the western

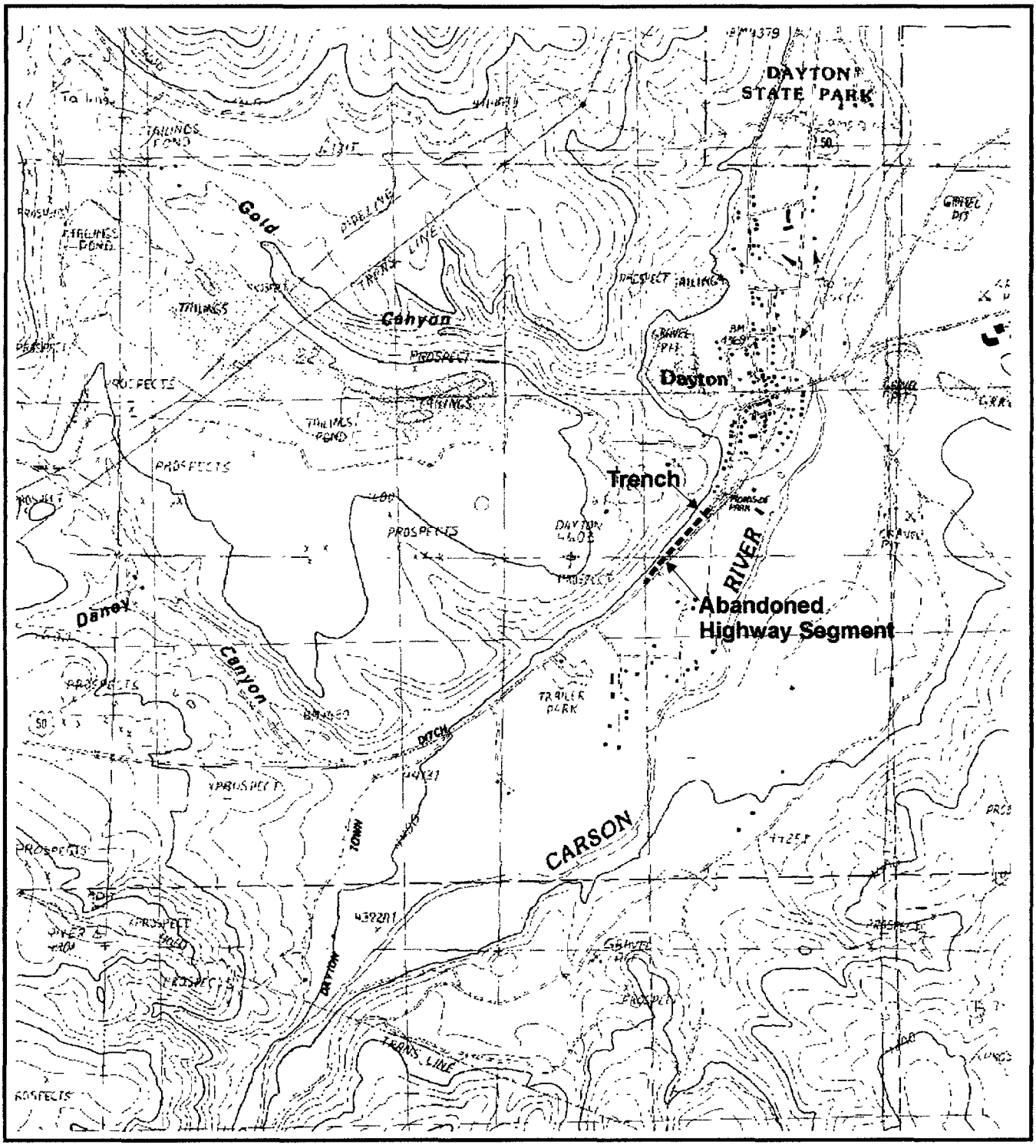
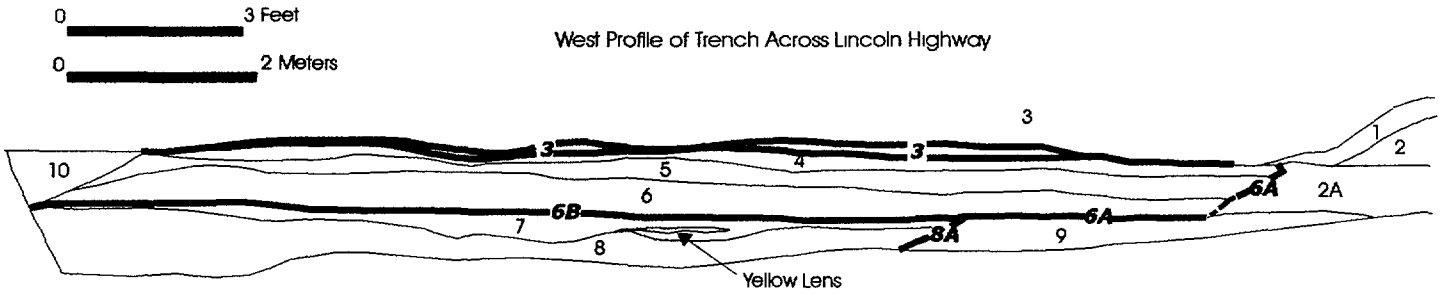
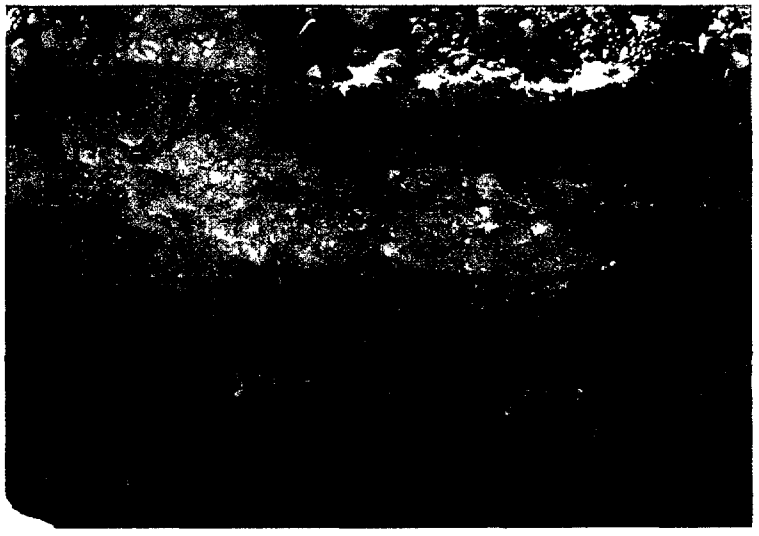
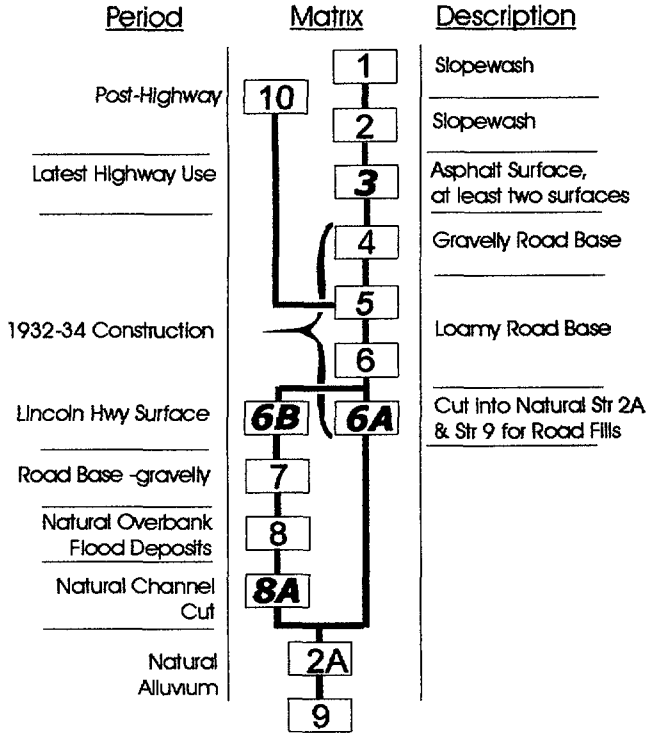
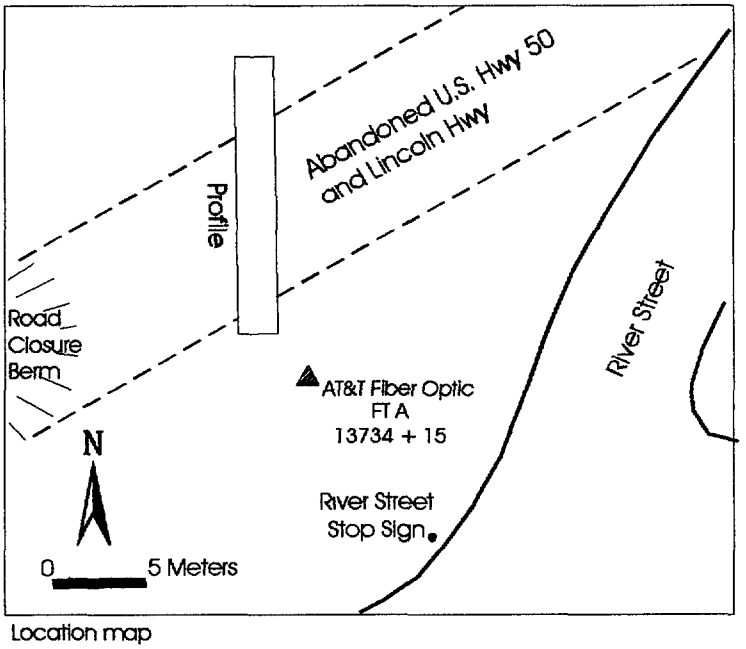


Figure 7.2-1. Site location map of the Lincoln Highway segment in the project area.









Location map

Figure 7.3-1 Stratigraphic profile, photograph of strata, Harris matrix and location map of the Lincoln Highway in Dayton.

1 10YR4/3 brown/dark brown (moist), 10YR6/3 pale brown (dry) with few white carbonate blebs; sandy loam texture with 20% gravels; single grain structure; non-sticky, non-plastic dry soft consistency; inclusions of few fine rootlets, strong HCl reaction; gradual smooth boundary; natural slopewash over highway cut.

2 10YR3/3 dark brown (moist), 10YR5/3 brown (dry); loam with 10% gravels; single grain to massive; non-sticky, non-plastic, dry soft; no HCl reaction; organic stain, few roots; gradual smooth boundary; slopewash.

3 Interface; 10YR2/2 very dark brown (moist), 10YR3/2 very dark grayish brown (dry); asphalt with 50% pebbles; massive lens; non-sticky, non-plastic, dry indurated; no HCl reaction; 50% pebbles, subrounded, rounded and angular; Lincoln Highway asphalt surface, at least 2 lifts.

4 10YR4/3 brown/dark brown (moist), 10YR5/3 brown (dry), mottles of few white carbonate blebs; gravelly loam; massive to single grain; non-sticky, non-plastic, dry soft; strong HCl reaction; ca. 25% multi lithic crushed and subrounded gravels slightly larger to less than 1/4 inch; abrupt smooth boundary; coarse grain road fill.

5 10YR4/4 dark yellowish brown (moist), 10YR6/4 light yellowish brown (dry), mottles of few white carbonate blebs; loam; moderate subangular blocky; non-sticky, non-plastic, dry hard; strong HCl reaction; carbonate blebs, structure may be from compaction; abrupt smooth; fine grain road fill, appears compacted.

6 10YR3/3 dark brown (moist), 10YR4/3 brown/dark brown (dry), mottles of white carbonate blebs; loam with 15% gravels; massive to coarse crumb; non-sticky, non-plastic, dry slightly hard; moderate HCl reaction; rounded and subrounded gravels, 1 basalt late stage biface; abrupt smooth boundary; road fill/base, may be natural fill or cut horizon in situ.

6A Interface.

6B Interface.

7 10YR3/3 dark brown (moist), 10YR4/3 brown/dark brown (dry), mottles of rare white blebs; gravelly loam with 25% gravels; massive to coarse crumb; non-sticky, non-plastic, dry slightly hard; moderate HCl reaction; round to angular igneous gravels; abrupt discontinuous wavy; possible gravelly fill.

8 10YR2/2 very dark brown (moist), 10YR3/2 very dark grayish brown (dry); loam; massive to coarse crumb; slightly sticky, slightly plastic, dry hard; moderate HCl reaction; black organic stain; abrupt smooth boundary; overbank, fine grain muds, wetland in meander channel.

8A Interface.

9 10YR4/3 brown/dark brown (moist), 10YR6/3 pale brown (dry); loam; massive to weak coarse crumb; non-sticky, non-plastic, dry slightly hard; strong HCl reaction; few rootlets; unknown boundary; natural alluvial soils.

10 10YR4/3 brown/dark brown (moist), 10YR5/4 yellowish brown (dry); loam; massive to coarse crumb; non-sticky, non-plastic, dry slightly hard; strong HCl reaction; few rootlets; abrupt smooth boundary; slopewash or post-road fill east of highway.

Figure 7.3-1. Stratigraphic descriptions for west profile of the Lincoln Highway.

Figure 7 3-2 Overview of abandoned segment of US Hwy 50 before trenching (Roll 970-6, fr 19)

Figure 7 3-3 View toward Dayton on abandoned segment of US Hwy 50 (Roll 970-8, fr 0)

quarter. Str 7 contains one yellow silt lense that may be related to ubiquitous mill tailings in this part of town. This suggests the possibility that Int 6B may have been an earlier, less engineered roadbed consisting of a rather simple cut and fill effort with some concern for increased gravel in the fill rather than a well engineered, bermed, multiple lift roadbed as noted in the overlying strata. Str 8 at the trench base appears to be black organic rich mud deposits likely related to abandoned meander channels of the Carson River within Int 8A, a suspected meander channel cut.

Figure 7.3-4 illustrates the gravel content of the various roadbed strata by size and quantity in a constant volume sample of 500 ml. The strata are indicated on the horizontal axis, gravel quantity on the left vertical, and gravel size class on the z axis. Gravel size classes are defined as: 1= >1 inch, 2=3/4-1 inch, 3=1/2-3/4 inch, 4=<½ inch. Peaks in the smaller size gravels (size 3 and 4) in Str 4 and Str 7 suggest that both deposits were likely prepared road base material. Strata other than Str 1 slopewash contain many fewer gravels than those in the road base deposits.

7.4 SUMMARY

Transportation along the Carson River route reflects the change in modes of transportation and their prevalence. From dirt paths to four-lane paved highways, the Carson River route has seen the influx of outlanders searching for new resources. The outlanders exploring on foot or horseback opened the area to freight wagons, railroads, and automobiles. Each mode brought an exchange of people, supplies, and information that not only changed the roadbed, it transformed the region from the Native American domain described by Fremont in 1844 to the bustling China Town encountered by Simpson in 1859 and eventually to present-day Dayton. The Emigrant and Overland trails subject to erosional reroutings and the fleeting impact of the Pony Express Trail are no longer evident. They have been consumed by later transportation surfaces and settlement. Some wagon roads retain integrity of location of the freighter and stage byways within Dayton such as Main Street, but the later thoroughfare, Route 2A/ The Lincoln Highway has been realigned so that its modern counterpart, US Highway 50, bypasses downtown Dayton.

The abandoned segment of the Lincoln Highway intersected by the project provides an interesting juxtaposition between recorded history and the archaeological record. According to 1932 NSDH plans and profiles of the proposed state highway federal aid project in Lyon County, the centerline aligns with the segment in the project area. The excavated trench matches the finished graveled section proposed for Sta. 270+79 (Figure 7.1-7). The trench strata, however, indicate the finished oiled section for proposed future construction was never done, instead, the gravel was covered with an asphalt layer when paved in about 1934. Alternately, the gravel base may have been oiled and this material may have completely leached away. Road construction and subsequent maintenance and improvement are continuous activities. This segment was

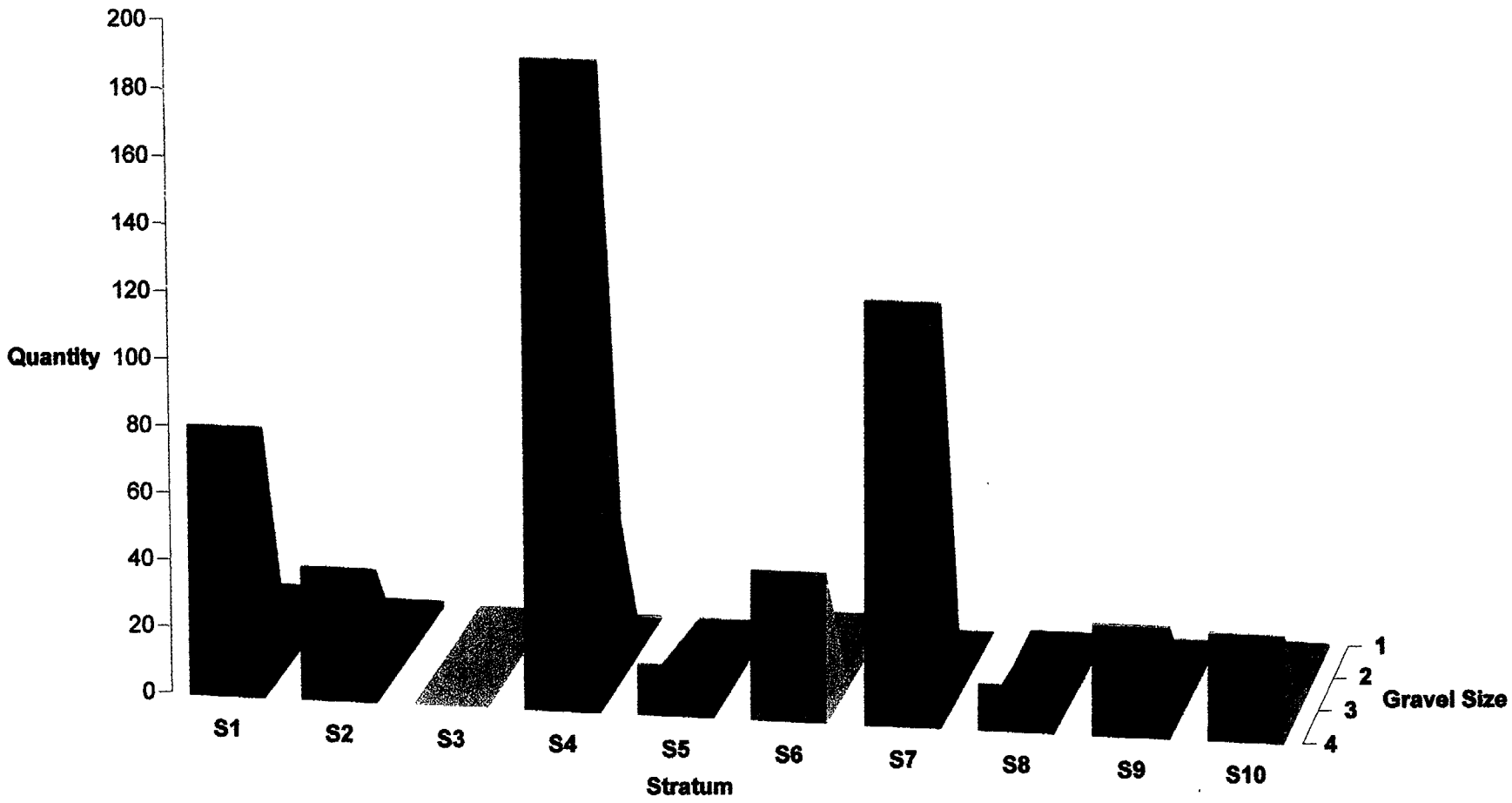


Figure 7.3-4. Lincoln highway gravel stratigraphy.

undoubtedly maintained by chip sealing (resurfaced with a combination of fine gravel and oil) and possibly resurfaced during its 24 year period of use prior to abandonment in 1956.

Below the asphalt, the 6 inches of gravel base observed, indicates close adherence to planned specifications. Below the base, the 2 ft of fill also fits precisely the amount of fill specified in the section at the top of Figure 7.1-7. This fill was important here to raise the road above a swampy area plotted on the road plan.

Much more interesting is the preservation of the old road, which comprised the original Lincoln Highway through this area. The highway plan map at the top of Figure 7.1-7 indicates the pre-1932 road in dashed lines. This road and the new one are on top of one another at the location of the trench in the study area. Due to the necessity of adding fill in this area, the old road surface, along with its irregular gravel subgrade, have been preserved intact and were observed in the profile. The difference between an engineered road versus a vernacular type is clear from the profile description. In one case there is strict adherence to plan and in the other there is the non-linear form derived from dumping and packing gravel into soft spots, mudholes, or ruts when required. Like so much of the Dayton area, the Lincoln Highway has joined the underground archaeological record as the town has been systematically raised above the periodic waters of the Carson River floodplain.

8.0 THE ROSE DITCH

The Rose Ditch formerly carried water from the Carson River to the mouth of Gold Canyon above Dayton (Figure 8.0-1). Through time the ditch has had several names, including Reese's Ditch, Chinese Ditch, Birdsall Ditch, Douglass Ditch, and Dayton Town Ditch. It runs along the upper end of the Birdsall Mill and constitutes a separate APE for this undertaking since a diversion and culvert was installed to keep floodwater from flowing over the MS004 area from the abandoned ditch. Although cleaning out the ditch above MS004 was considered, this course of action was rejected in favor of the diversion. The Rose Ditch is a prominent feature on the hillside south of town above the west side of US Hwy 50.

8.1 HISTORICAL SUMMARY

Construction of the Rose Ditch was started in 1856 by a company organized by J. C. Fain, John Reese, Stephen A. Kinsey, John McMarlin, James McMarlin, Christopher Merkley, Morris Fitzgibbon, and Orson Hyde and completed in August 1858 using Chinese labor (Angel 1881:51; Bancroft 1981:77). This group included some of the most prominent early settlers of the region, belonging to the Church of Jesus Christ of Latter Day Saints, commonly called Mormons. Originally designed to carry water for placer gold operations, the ditch later provided water for the Birdsall Mill and for the Dayton town water supply.

Forty to fifty Chinese were brought in to dig the ditch (DeQuille 1969:10). This appears to have been the impetus for introduction of Chinese to the Gold Canyon placers and to the community at the present site of Dayton, that once was called Chinatown due to the number of Chinese there. Dayton continued to have a significant though dwindling Chinese population until the early twentieth century.

The ditch location was shown on Ives' April 1865 survey of T.16N R.21E and on numerous other millsite plats on file with the county (Figure 7.1-3). This location is the same as that shown on the modern USGS map, as indicated on Figure 8.0-1.

The original locators of the ditch transferred it to Jacob H. Rose before its completion. Completion of the ditch resulted in disclosure of the embarrassing fact that it was incorrectly graded and refused to flow. This problem was quickly corrected by regrading the ditch (Angel 1881:51; Bancroft 1981:78). Zeier (1990:5) speculates that the long period of construction was due to laborers leaving the project at intervals to work the gold diggings but the change in ownership may also have had its effect on the progress of construction. Rose was involved with many speculations in land, ditches, timber, and toll roads throughout the region (Index to territorial records at the NSLA). Among the dams and ditches was one originating at Dutch Nicks (Empire) on the Carson River upstream of the diversion for the Rose Ditch (Utah Territorial Records: Deeds, Mining, and Real Estate Vol. C:121, 1861).

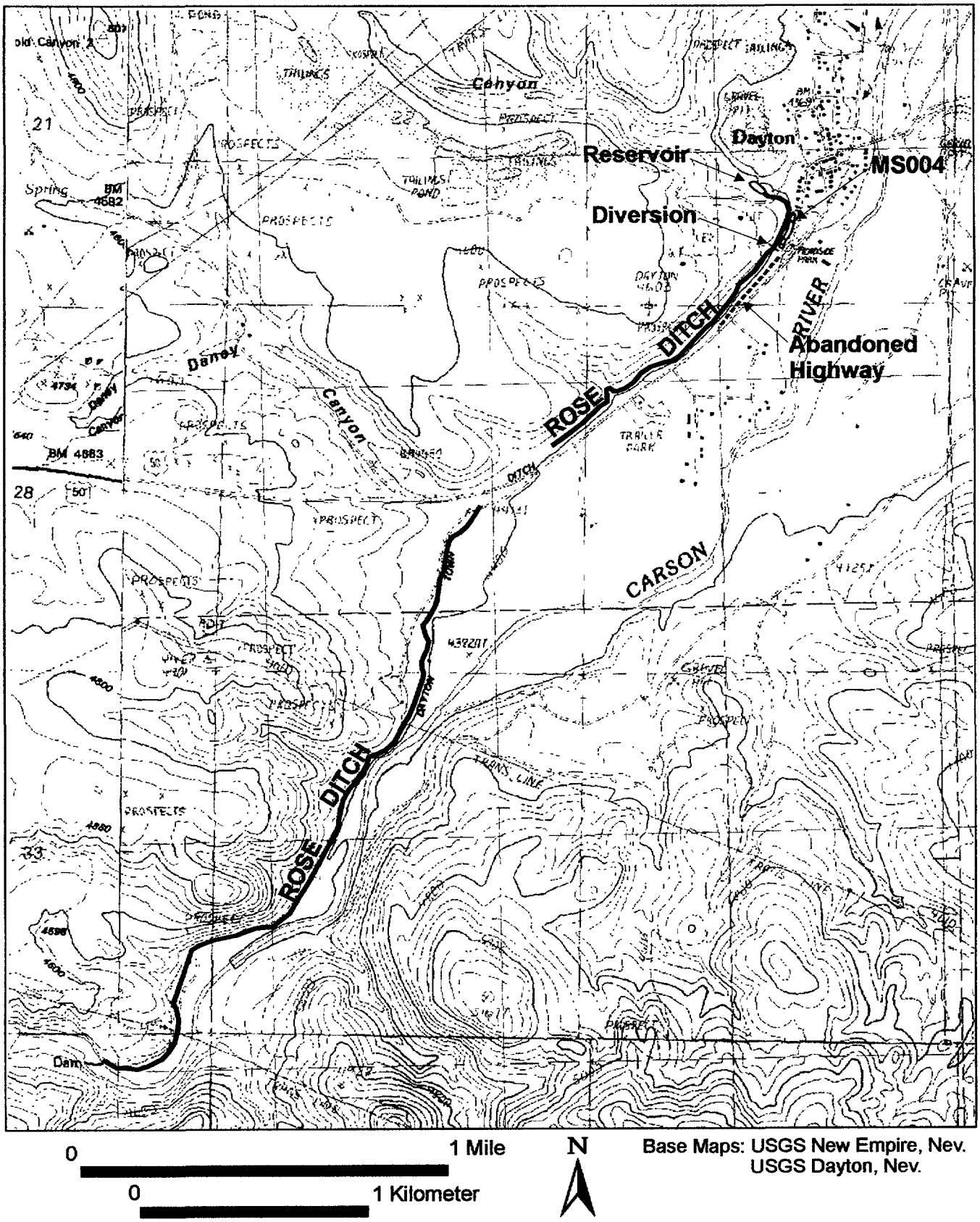


Figure 8.0-1. Location map for the Rose Ditch.

The construction period for the ditch predated the remarkable departure of most of the Mormon population for Salt Lake in response to an expected invasion by United States forces. Before this departure, the Mormons had near control over non-mineral resources in the area, including agricultural lands, woodlands, and irrigation works. Construction of this ditch is part of this pattern of infrastructural control, particularly regarding water supply. Judge Hyde departed from Carson Valley on September 6, 1866. Most others left on September 26 the following year (Elliott 1987:56-57). Early divestiture of this ditch may have had to do with the fact that it serviced a population that was entirely non-Mormon and was rather anti-Mormon in its sentiments.

The diversion dam for the ditch required repair in 1860 (Utah Territorial Records: Docket Probate Court 3/8/1860:343). Due to periodic flooding of the river, this was the first in a long series of repairs to the part of the system most exposed to catastrophic destruction.

As mentioned earlier, the ditch was purchased by Birdsall and Carpenter to power the 50 ft water wheel for the Birdsall Mill. At this time, the Rose Ditch was said to have a total capacity of 3000 inches (Gold Hill News 4 April 1865). The water supply facility was a major part of the milling operation, with a construction cost valued at $40,000 compared with $110,000 for the rest of the mill in 1866 (Browne 1868). An unusual use of the water was that it was run throughout the mill to be readily available to fight fire, an ever-present danger that consumed the nearby Rock Point Mill (Datin 1977). The mill did not use all of the water by any means. Water from the ditch contributed to the municipal water supply from at least 1864, though it was not the only supplier to the town (Hazlett 1922:70). Water was run to residences and other users by means of pipes (Surveyor General Report 1869:135).

Douglass was still running the ditch at the end of 1896, when he turned off water to non-paying placer miners (LCT 21 November 1896).

Conversion of the Douglass Mill by the Pecks in 1897 involved enlarging the ditch by 2 ft to a width of 6½ ft due to increased power requirements. A crew of 30 laborers supervised by George Rammelkamp supervised the work, which took about two weeks from mid-March to early April. This construction resulted in several water shutdowns to the town water supply during the remainder of March. There were some problems with the work. It appears that part of the widening was done at the expense of weakening the berm, since the ditch broke and took about a week to repair. The widening crew removed the "putty like substance in the bottom" leading to enough seepage above the mill to cause teams to mire in the road. To fix this problem, portions of the ditch had to be provided with a lining of puddled silt and clay (LCT 13,20 March, 3,24 April, 3 July 1897). Clearly this crew had little or no experience with constructing or maintaining hillside ditches in very porous alluvium and slopewash.

Conversion also included construction of a new penstock from the ditch to the mill to power new water wheels, that likely were turbines similar to Pelton wheels (LCT 12 June 1897).

A large box in the ditch above the Douglass Mill enabled the ditch to fulfill the needs both of the mill and town (LCT 17 July 1897). The mill under the Peck Brothers only operated until late July 1897, when insufficient water flowed through the ditch to power the mill. During this period the Rock Point Mill ditch dried up as well (Datin 1977). This closure of the ditch was used by the Pecks to continue widening the ditch above the mill to increase flow when the water rose again (LCT 31 July, 25 September 1897). The water was so low that C.V. Peck and a marshal inspected the upper reaches of the river to see if anyone was appropriating water illegally (2 October 1897). There is no indication that any foul play was discovered.

The ditch continued to be susceptible to damage. Near the beginning of December 1897, a heavy rain caused a landslide that carried away two lengths of the flume. This damage was repaired within two weeks, but as with all of the ditch closures, fire was a severe danger in the town while the ditch was shut down (LCT 11,18 December 1897). Following collapse of the Peck operation, Birdsall hired 14-15 men to repair the Douglass ditch and flume to reopen the mill in April 1898 for a brief final run (LCT 30 April 1898). After closure of the mill for the last time the ditch was devoted entirely to providing water to the town. The Rose Ditch was finally abandoned in 1975, when its function of providing part of the municipal water supply was fully taken over by wells.

8.2 EXISTING REMAINS OF THE DITCH

The Rose Ditch remains a prominent landscape feature above the highway when approaching Dayton from the south. The diversion dam in the Carson River and southern mile of the ditch were not revisited. The ditch is fairly intact where it runs through agricultural property between the Carson River and the point where it reaches the present US Hwy 50 ROW fence (Figure 8.2-1). In this area the ditch has symmetrical berms due to the nearly level ground that is traversed. The ditch has been obliterated within the US Hwy 50 ROW by construction of the four-lane highway. Despite this, there is no mention of the ditch in archaeological inventories done before this section of road was expanded to four lanes (Moore 1981). At least two generations of bridges spanned the ditch at this location. A reconstruction is documented in 1897:

> A new bridge has been placed across the Douglass ditch on the Carson road. The old one was badly stove up by heavy teams, it not being strong enough for the heavy hauling that is now being done on the road. [LCT 12 June 1897]

Aside from minor local washouts, silting, and berm collapses the ditch is in good condition from the highway crossing to the point above the Birdsall Mill where it has been destroyed by recent grading done as part of residential construction. Beyond this point, the reservoir at the northern terminus of the ditch remains intact.

Figure 8.2-1. Portion of the Rose Ditch south of U.S. Hwy 50 (Roll 970-8, fr.1).

Figure 8.2-2. Start of northeast portion of the Rose Ditch (at tree) from U.S. Hwy 50 (Roll 970-8, fr.3)

The start of intact ditch north of US Hwy 50 is shown in Figure 8.2-2. While contouring the steep hillside between this point and Dayton, the ditch assumes an asymmetrical form with a cut on the uphill side and a large berm on the downhill side. The top of the berm is flattened and serves as an access and maintenance route (Figure 8.2-3). A section of dry-laid rock retaining wall is visible in Figure 8.2-3 and shown in more detail in Figure 8.2-4. This portion of wall has been revealed by a slump that has removed the lower portion of the berm. This and other slumps are likely caused mainly by water percolating through the berm and undermining the downslope sediments. At this point on the ditch, about 0.1 mi south of the project diversion shown on Figure 8.0-1, the faced stone wall is 1.2 m high, set back 0.5 m from the downslope top of the berm, and is 1.7 m away from the inner lip of the ditch. The berm extends about 10 m downslope, but this dimension is highly variable along the length of the ditch. The ditch itself is presently 0.8 m deep and 2.5 m wide. The interior of the berm shows carbonate enrichment from ditch water saturating the berm and then evaporating.

The objective of modifying the ditch was to keep floodwaters flowing into it from reaching the area above MS004 and flooding onto the hillside of the Birdsall Mill. For this reason, the berm was breached, a diversion box was emplaced, and a culvert run down the hillside to the valley bottom. The point selected for this was immediately north of a small drainage running from the vicinity of the Dayton Cemetery. This drainage, along with the ditch, is shown in Figure 8.2-5. The portion of the ditch modified for the diversion is shown in Figure 8.2-6. The excavation for this diversion was limited to the downhill berm, so a subsurface cross-section of the ditch itself was not obtained. The surface cross-section and results of the excavation are discussed below. A fairly large portion of the ditch berm has slumped away southwest of the diversion (Figure 8.2-7). This slump, and other similar ones along the ditch, have not yet eliminated the berm, but likely will increase in size and cause breaches in the next few years unless stabilized. A typical segment of the Rose Ditch above the Birdsall Mill is shown in Figure 8.2-8. Unlike the ditch segments described to this point, that continue to carry storm water the same direction as designed, post-1970s ditch modifications have greatly altered the ditch in this area. A wooden diversion dam (Fea A-3) has been placed across the ditch at the southeast end of the MS004 area (Figure 4.0-1). Storm water from the southeast hits this diversion and spills downslope in an unimproved gully (Fea K-1) leading to a culvert under River Street (Figure 8.2-10). This unplanned diversion is undercutting the ditch in this area despite attempts to reinforce the ditch bottom with plastic sheeting and rocks. At the northeast end of MS004, the ditch has been demolished by blading for a house lot. As a result of this blading, slopewash and storm water have entered the ditch from this side, reversing its flow to the diversion. Along this portion of the ditch there is an access road bladed into the hillside above the ditch (Fea A-5, Figure 8.2-11). Details of the ditch above the Douglass Mill are provided below. The ditch has largely been eliminated by construction of roads and lots between MS004 and its terminus at the town reservoir, an earth-berm basin on the edge of Gold Canyon above town (Figure 8.2-12).

Figure 8.2-3. Typical hillside segment of the Rose Ditch southwest of Dayton. Rock retaining wall is revealed by berm collapse (Roll 978-RD, fr.18).

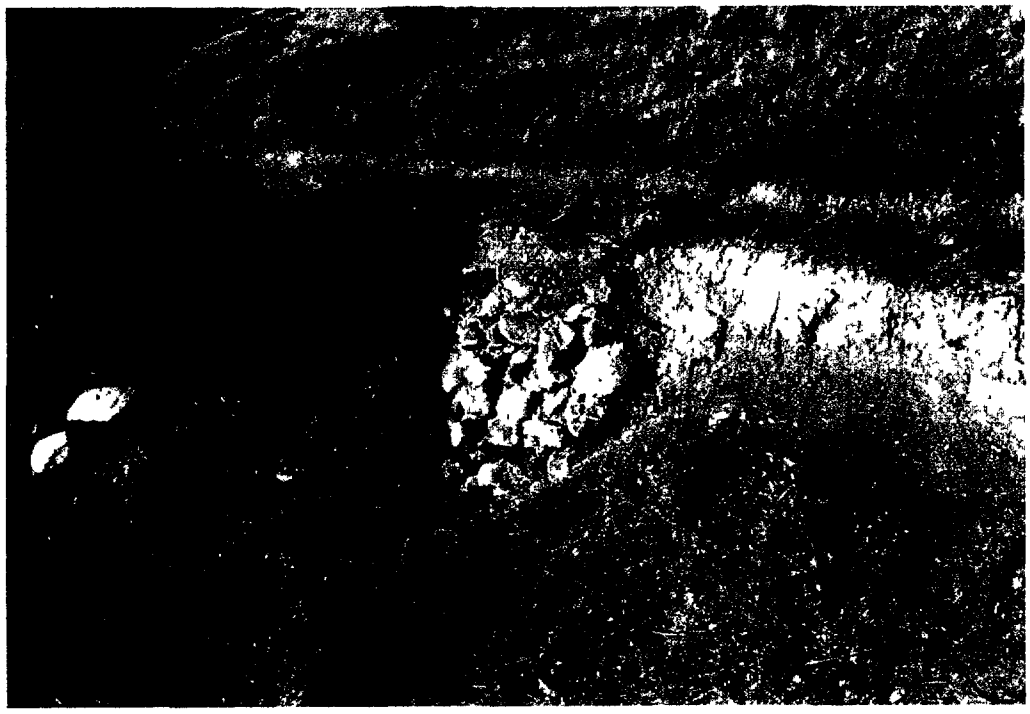


Figure 8.2-4. Rock retaining wall in the Rose Ditch revealed by berm collapse (Roll 978-RD, fr.17).

Figure 8.2-5. Rose Ditch southwest of Dayton. Project diversion is in the gully in center of photo (Roll 970-6,fr.21).

Figure 8.2-6. Detail of location selected for diversion and culvert (Roll 970-6, fr.18).

Figure 8 2-7 Erosional damage to Rose Ditch berm southwest of Dayton (Roll 970-6, fr 23)

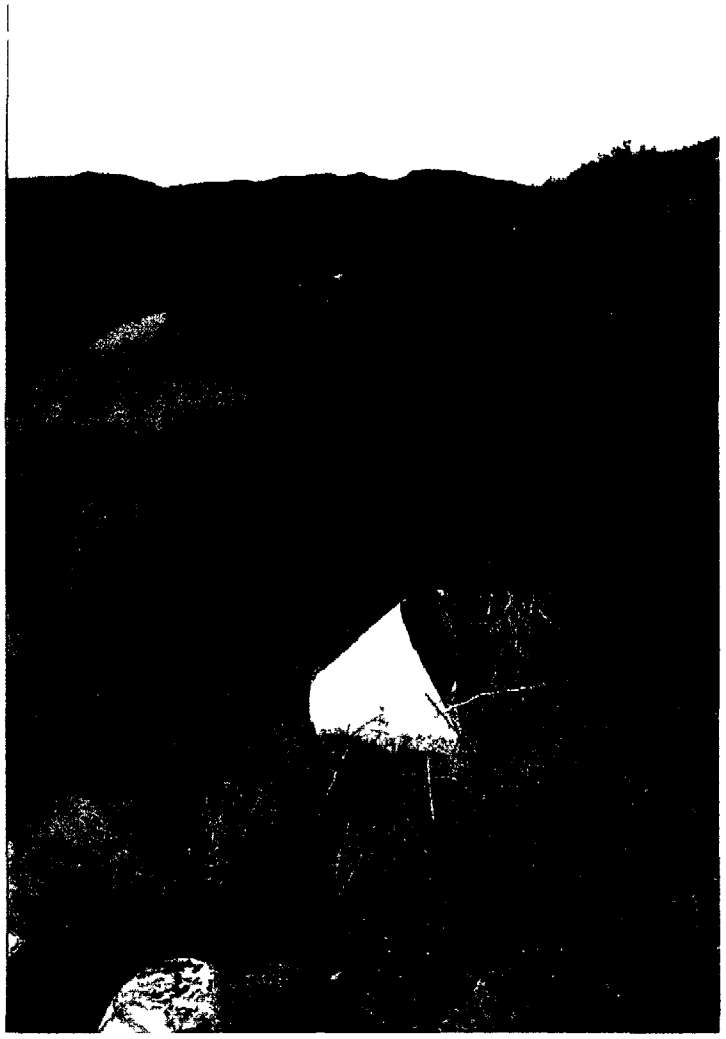


Figure 8 2-8 Typical segment of Rose Ditch above the Birdsall Mill (Roll 970-7, fr 11)

Figure 8.2-9. Modern storm water diversion dam in the Rose Ditch southwest of the Birdsall Mill (Roll 970-6, fr.7).

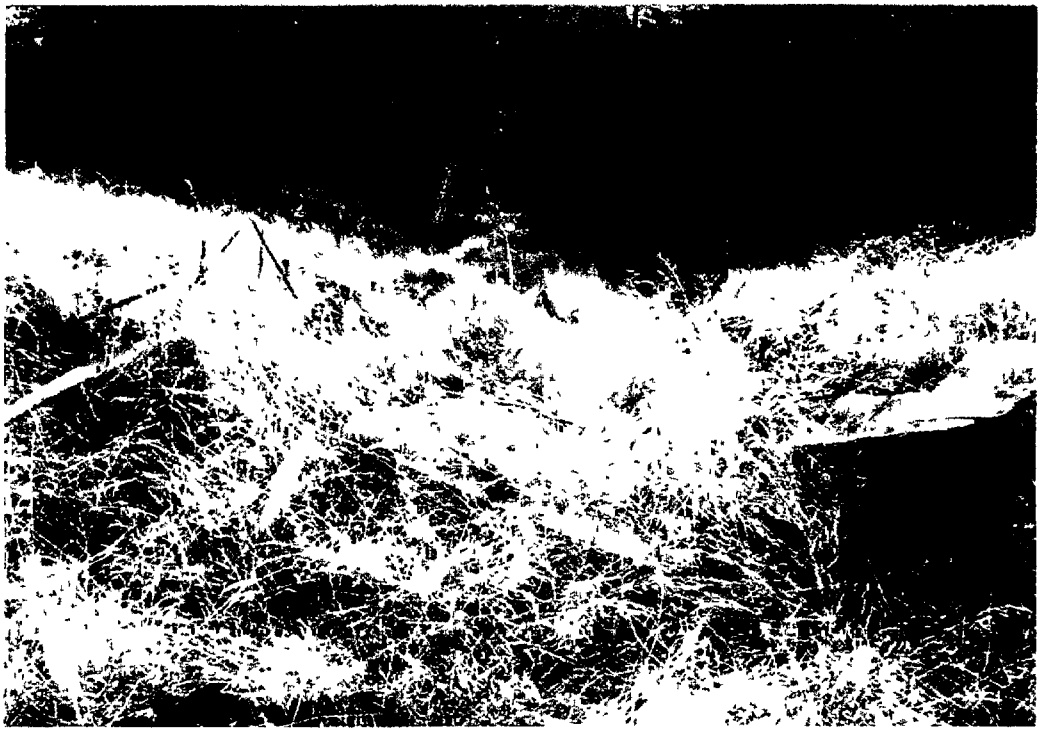


Figure 8.2-10. Gully below modern storm water diversion dam in the Rose Ditch southwest of the Birdsall Mill (Roll 970-6,fr.10).

Figure 8 2-11 Terrace or road above the Rose Ditch (visible at lower right) above the Birdsall Mill close to portion of ditch bladed away for house lot (Roll 970-7,fr 16).

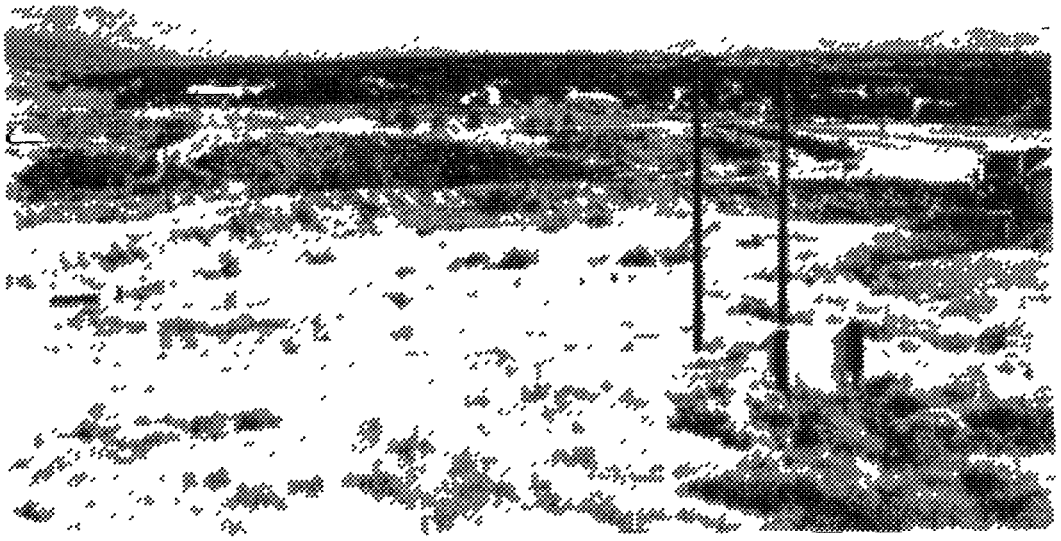


Figure 8 2-12 Reservoir at the northern terminus of the Rose Ditch (Roll 970-6, fr 27)

Numerous cottonwood trees once lined the ditch, but they have died since the ditch has fallen into disuse. Stumps of many of these trees still remain. A more recent addition to the ditch, most likely added when it was used for a municipal water supply, is a board lining supported by iron bolts and stakes. Only fragments of this lining still remain in place.

8.3 SURFACE DITCH DETAILS AT MS004

Surface mapping at MS004 was extended far enough upslope to provide information about the Rose Ditch above the Birdsall Mill. This was done partly because alteration of the ditch was considered during project design as one of the alternatives for reducing the amount of unwanted storm water drainage that flowed down the millsite hillside below the ditch. This drainage is a result of alterations that have taken place on the ditch following its abandonment in the 1970s.

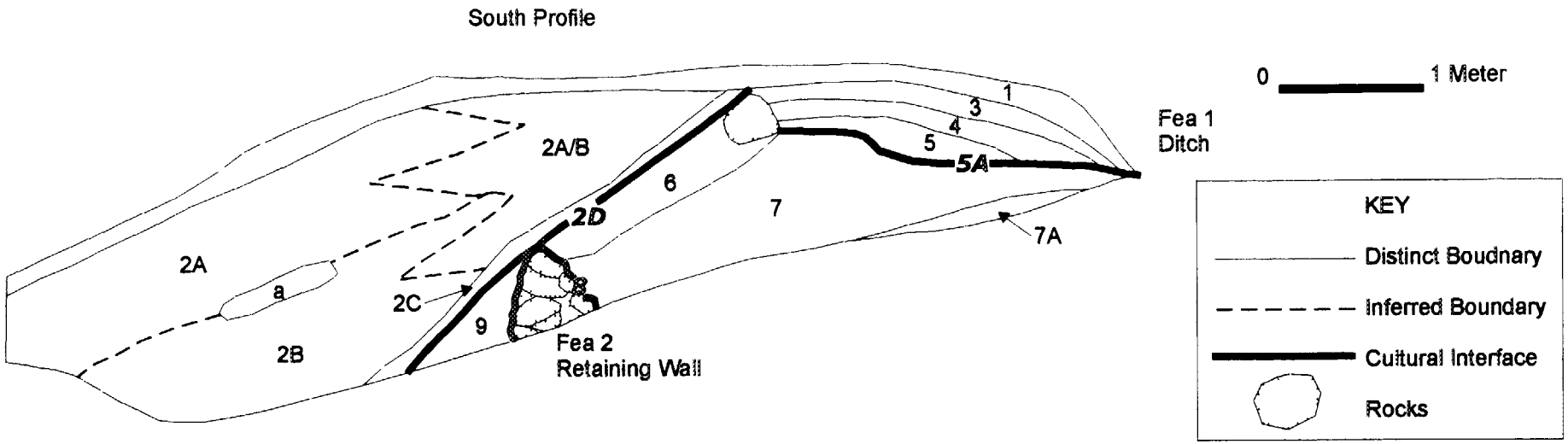
A total of 450 ft of ditch was surveyed in detail at MS004 (Figure 4.0-1). It is generally a meter or less wide at the bottom and is heavily silted-in. From the southwest corner of the bladed slope (Fea J-1) to the diversion the ditch has changed direction, flowing southwest with a drop of 2.36 ft by the time it reaches the diversion. From this divide above Fea J-1 the ditch flows northeast when there is storm water due to a drop of 1.57 ft, but with nowhere to go due to blading at the northwest end of MS004, the water simply ponds and overflows the ditch. The uphill side of the ditch is defined by a large cut. The downhill berm is typical of the rest of the ditch, and has a 1.5 to 2 m wide path on its top.

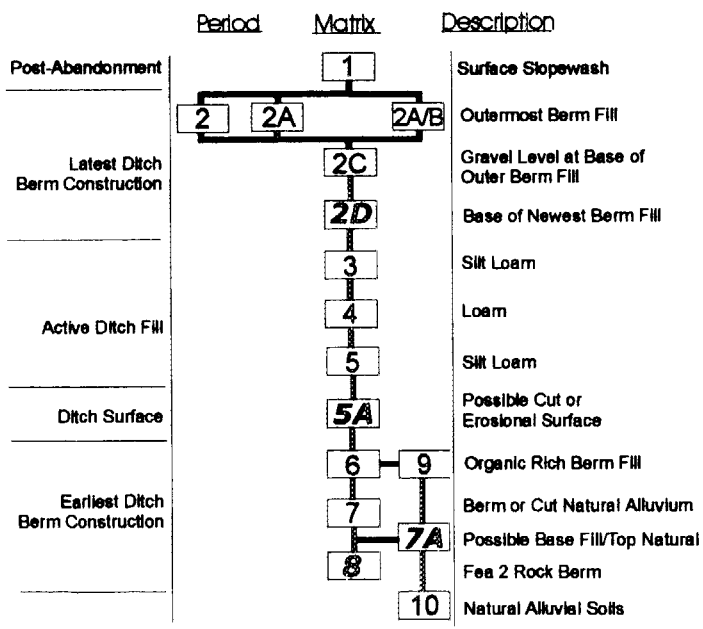
8.4 A SECTION THROUGH THE ROSE DITCH

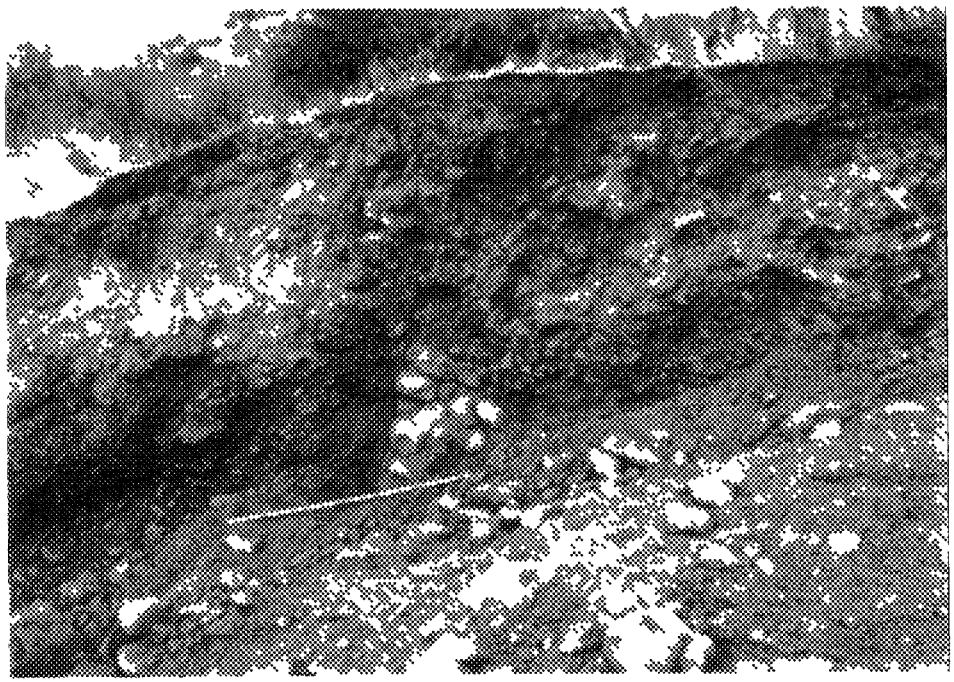
Due to placement of the diversion box and pipe, the entire ditch was not sectioned. Instead, a profile was made available of the south wall of a section through the down hill berm. This made it impossible to confirm interior construction details such as the possible use of a puddled clay lining.

Cross-sections of the ditch vary depending on the local topography. At the location where the water diversion pipeline was constructed for this project, the ditch profile (Figure 8.4-1) is in a location common to the entire traverse along the hillside overlooking the Carson River. At this location, the ditch is presently 1 m deep, 3.4 m wide at the top and 1.7 m wide at the base. The uphill side of the ditch is a steep cut in the hillside. The downhill berm is flat-topped and 4.0 m wide, providing an access road along the ditch. Fill from the ditch spills downslope at the angle of repose for an extent of at least 6 m and in many places much farther.

The sectioned ditch berm contains evidence of several episodes of use and construction. These include earliest berm construction with a downslope cobble/boulder retaining wall (Fea 2,







Photograph of south profile

Figure 8 4-1 Harris matrix, stratigraphic profile, and photograph of trench through the Rose Ditch berm

1 10YR3/3 dark brown (moist), 10YR4/2 dark grayish brown (dry); loam texture with 5% angular gravels to ½" dia.; upper 2-3 cm = platey, lower = massive, stratified coarse crumb structure; slightly sticky, plastic, dry hard consistency; no HCl reaction, inclusions of roots, rootlets, duff; abrupt smooth boundary; surface horizon, A1 soil horizon, slopewash.

2 10YR7/2 light gray (moist), 10YR8/1 white (dry), mottles 10YR7/6 yellow, 10YR5/3 brown; silt; weak coarse platey to bedded clasts; non-sticky, non-plastic, dry hard; no HCl reaction, few fine rootlets; discontinuous irregular boundary; redeposited or discontinuously preserved water laid silt clods possible tailings, ditch berm outer fill.

2A 10YR3/4 dark yellowish brown (moist), 10YR5/4 yellowish brown (dry); poorly sorted gravelly (igneous) sandy loam with 35% round to subrounded pebbles and cobbles; massive to single grain; non-sticky, non0plastic, dry soft; weak to moderate HCl reaction, rootlets; boundary unknown; stream alluvium, iron stain, ditch berm fill.

2A/B 10YR3/3 dark brown (moist), 10YR4/3 brown/dark brown (dry); sandy loam; weak angular blocky; slightly sticky, slightly plastic, dry hard; no HCl reaction; rootlets; abrupt smooth to Str 2C ditch berm fill.

2B 10YR4/4 dark yellowish brown (moist), 10YR5/4 yellowish brown (dry); gravelly sandy loam with 35% subrounded to subangular gravels and pebbles; massive to single grain; non-sticky, non-plastic, dry soft; no HCl reaction; abrupt smooth to Str 2C boundary

2C 10YR4/4 dark yellowish brown F(moist), 10YR5/4 yellowish brown (dry); pebbly sandy loam with 35% igneous to intrusive and volcanic round pebbles; single grain; non-sticky, non-plastic, dry loose; weak (locally) to strong HCl reaction; rare rootlets; abrupt smooth boundary; alluvial genesis.

3 10YR5/3 brown (moist), 10YR6/3 pale brown (dry), mottles 10YR5/3 (dry); silt loam with less than 1% well-sorted pebbles; platey to massive; non-sticky, slightly plastic, dry hard; no HCl reaction; common rootlets; abrupt smooth boundary; water laid deposit, fines, ditch fill or clean out.

4 10YR3/3 dark brown (moist), 10YR4/3 brown/dark brown (dry), mottles of white carbonate blebs; loam with 5% poorly sorted rounded pebbles and cobbles; massive; non-sticky, slightly plastic, dry soft; slight to locally strong HCl reaction; rootlets, carbonate blebs; abrupt smooth boundary; colluvium, ditch fill or clean out.

5 10YR4/3 brown/dark brown (moist), 10YR7/3 very pale brown (dry), mottles 10YR5/3 brown (dry); silt loam; platey to massive; non-sticky, slightly plastic, dry soft; slight to locally moderate HCl reaction; few rootlets; abrupt smooth boundary; water laid ditch fill.

6 10YR3/3 dark brown (moist), 10YR4/3 brown/dark brown (dry); sandy loam with 20% rounded pebbles; massive to granular; non-sticky, non-plastic, dry soft; weak to locally strong HCl reaction; rootlets; abrupt smooth boundary; organic-rich alluvium, berm fill behind Fea 2.

7 10YR4/3 brown/dark brown (moist), 10YR4/4 dark yellowish brown (dry); gravelly loam with 35% rounded pebbles and small cobbles; massive to angular blocky; non-sticky, slightly plastic, dry slightly hard; weak HCl reaction; rare rootlets; abrupt smooth to Str 7A; alluvium.

8 Interface. Fea 2 dry laid cobble retaining wall.

9 10YR3/3 dark brown (moist), 10YR5/3 brown (moist); sandy loam with 10% rounded gravel pebbles and cobbles; single grain; non-sticky, slightly plastic, dry soft; no HCl reaction; rootlets, worm burrows; unknown boundary; alluvium.

10 10YR3/3 dark brown (moist), 10YR4/3 brown/dark brown (dry), mottles of white blebs; gravelly loam with 25% pebbles to cobbles; massive; slightly sticky, slightly plastic, dry slightly hard; no HCl reaction; weathered cobbles; unknown boundary; alluvium with some soil development, clays, natural Qal on hillside.

Figure 8-4-1. Stratigraphic descriptions for the Rose Ditch berm.

Int 8) holding back Str 6, 7, and 10, a combination of reworked alluvium and organic rich fill horizons. Seated in this older berm are what appear to be water laid ditch strata (Str 3, 4, and 5) on what may have been an earlier ditch surface (Int 5A). A second episode of berm and ditch modifications are reflected by strata above the 2D interface. Strata above Int 2D double the berm width and include several strata (Str 2, 2A, 2B, 2AB, and 2C) all built on Int 2D which covers the earlier berm.

Evidence for two episodes of berm construction noted in the Figure 8.4-1 profile likely correspond to two of the several recorded remodels of the Rose Ditch. Lack of temporal artifacts prevent further designation of these strata with any confidence to the actual remodel period.

8.5 SUMMARY

The failure of the ditch to run when first constructed suggests the possibility that it was designed with an unusually shallow gradient, making engineering more difficult than usual. This possibility is suggested by the fact that the diversion is placed near the downstream end of the steep-sided valley the river follows between Empire and the start of the Carson Plains on which Dayton is situated. Normally, ditch engineering was quite fool-proof. The grade was established by using a simple spirit or pendulum level set to the desired grade and laying the instrument on grade stakes pounded into the ditch bottom as work progressed (Newell 1906).

In the course of 3.4 mi (17,952 ft), the ditch drops about 20 ft according to the USGS map contours. This results in an average gradient of 0.11 percent (a drop of 0.11 ft every 100 ft of ditch). This is not an unusual gradient for a ditch and should have presented no engineering problems. By way of comparison, archaeological recording of ditches of the Standish Ditch system in Honey Lake Valley, California showed that this informally engineered system employed gradients from 0.10 to 0.15 percent (Hause 1997). Another vernacular ditch system in Modoc County, California had a much shallower gradient of 0.05 percent (Mikesell 1997). The latter ditch served a small irrigation complex so the reduced flow at this gradient was not a problem.

The original ditch interior has been entirely removed in the course of widening in the 1890s and subsequent partial lining with wood. Natural exposures and the project-related trench through the berm near MS004 indicate that much of a retaining wall built within the berm, likely as part of original construction, has survived this remodeling and maintenance process. Historical records suggest that at least portions of the ditch have been deliberately lined with silt and clay (puddled) to reduce percolation through the bottom and berm.

Although the ditch is extremely important for the history of the region as the occasion for the introduction of a Chinese population, there is nothing in the material remains of the ditch to mark this connection. The ditch was designed and built as a typical earthwork of the period.

9.0 HISTORICAL ARCHEOLOGY ON THE COMSTOCK PERIPHERY

by Ronald L. Reno

The managerial goal of archaeological work related to the EPA Mercury Cleanup Project was simple. It was to identify, record, and evaluate the significance of all cultural remains in the APE. Further, any of these remains that were significant for their information potential were subjected to archaeological data recovery sufficient to offset to a reasonable degree any effects on the sites caused by the project. It is not enough to simply present documentation of these efforts along with a catalog of objects and features that were found. It is essential that an effort is made to interpret these materials in such a way that one or more contributions may result in any of the scholarly fields that may be germane to the project, such as history, anthropology, or archaeology.

The primary contribution of this study is toward the archaeology of a mining district peripheral area. This peripheral pattern includes support areas rather than mineral extractive areas, though there is a certain amount of mixing of these roles in space through time. Most general studies of the Comstock include chapters on the peripheral areas as milling centers, sources of fuel, and as transportation corridors. Detailed studies have been done of specific areas of the extensive periphery to the Comstock. These include historic archaeological work in the Tahoe Basin by the U.S. Forest Service, the Carson Range by University of Nevada field schools, and in the Pine Nut Mountains charcoal industry by a University of Nevada Masters student. All of these studies focus on the extraction of woodland resources for use on the Comstock. Aside from brief accounts and local history documents, little has been done to further the study of Comstock mills beyond what documentation was left to us from the nineteenth century. By far the most detailed documentation and analysis of the Comstock has been on the heartland itself, particularly the mines and communities at Virginia City and Gold Hill. It has been the community there that has attracted the most scholarly interest. Outstanding examples of such studies include the ongoing State Historic Preservation Office-sponsored project to computerize and analyze Comstock census records, Fliess' (2000) demographic analysis of the core communities, Goldman's analysis of the red light district, a series of three saloon excavations by University of Nevada field schools and volunteer programs orchestrated by the Comstock Archaeological Center (Dixon 1999), and a recent compendium on Comstock women (James and Raymond 1998).

From our vantage point at the beginning of the twenty-first century, it is clear that the communities and industries of Silver City and Dayton were on the periphery of the heart of the Comstock. The major core areas were Virginia City and Gold Hill. The reality of this division within the mining district was not at all clear during the early years of the district when it seemed possible that the lode extended in all of its wealth through all of the outlying sections of the district as well. As Angel (1881:494) puts it:

> The most feasible routes of travel to the new mines lay through this section; the only available water-power for the reduction of ores was along the Carson River; the overland travel came directly through it, and these facts, with the rich silver mines of the Devil's Gate and other districts, then supposed to be equal, if not better, than the Virginia and Gold Hill mines, had induced a large number of people to settle within its limits. In fact, Silver City was a town sooner than Virginia City or Gold Hill, and Dayton was supposed to be a candidate for the location of the future Capital.

The preliminary focus of study was on creating documentary models about events and expected material byproducts of these events in the various portions of the study area. During archaeological monitoring, evaluation, and data recovery the focus shifted to identifying and interpreting the activities that left reasonably intact material remains embedded in the present physical environment of Dayton and Silver City.

Basic documentation resides in the field notes for the project. A selection of that corpus has been presented and summarized throughout this volume. Also, throughout this work the various authors have consistently attempted to discern patterns in the complex interplay of material culture and the documentary record. These patterns have been used to inform discussions at varying levels of abstraction aimed at the final goal of this report – making contributions toward the methods, theories, and data specific to these various disciplines and subfields. Due to the inherent limitations of this project, along with the exigencies of the archaeological and documentary record, these contributions vary immensely in both detail and importance. The basic contribution at the level of adding to the data available for historical archaeological studies is in many ways the most important. Regardless of our subsequent and derivative analyses, these data remain intact for the use of future scholars. Another contribution is toward filling the major gaps in archaeological information presently available for the Comstock. Other contributions, along with some of their limitations, are discussed here following the thematic outline used throughout this entire volume.

9.1 MILLING

Mills resonate with the diverse meanings of dynamic systems; change is constant and inevitable keeping rhythm with a diversity of ores, tailings from various mines and mills, technological innovations, and economic needs of the owners.

A basic contribution of this work has been documentation of the location and layout of the succession of mills at MS001 and MS004. At MS001, our work has documented the thorough destruction of the Keller & Co. mill and its successors. The concentration of mill-related materials there has confirmed historic mapping of where the mill was thought to have been located. Presence of pieces of key machinery also confirm that the predicted two phases of

mill construction, first as an arrastra mill and later as a Washoe Process pan mill did in fact exist at this location. At MS004, the location and layout of the original Washoe Process quartz mill was identified and confirmed in detail by a combination of historic records and archaeological remains. Due to project constraints, only a start was made on the archaeological study of the refinery and bluestone works at this mill. Surface mapping, historic photographs, and documents suggest that much of these critical subsidiary industrial areas remain largely intact in the archaeological record outside of the project APE.

The study of technological diversity and development was largely confined to the refinery area at the Lyon Tailings Mill at MS004. The tailings industry has been critical for much of the later mineral exploitation of the Comstock but has received little attention compared with the original development of the Washoe Process. Late nineteenth century tailings recovery depended on a highly focused emphasis on increasing the efficiency of the basic Washoe Process. It was based on exactly the same basic flowsheet and metallurgical chemical reactions. Important to the success of tailings milling was massively enhanced use of reagents – salt and bluestone – as documented in chemical analysis of mill residues and in contemporary accounts of how the mill was run.

Analysis of the Lyon Mill refinery has been important as the first attempt at an archaeological study of a Comstock refinery. This attempt was aided immensely by the existence of Hodges' detailed account of the place. However, archaeological studies indicated that actual construction diverged significantly from the drawings and descriptions provided by Hodges.

Pride and workmanship seemed to be exceedingly high in all aspects of the operation and throughout most temporal episodes discussed including the Birdsall & Carpenter and Lyon phases; however, the terminal Peck phase seemed to be less than a polished or honest operation and quickly failed. Distinguishing between the archaeological remnants of each period of operation given the presence of little more than foundations, earthen terraces, launders, floors, tailings, ore car tracks, a few temporally specific artifacts, and chemical residues has proven complex yet very interesting. The key mental adjustment required during fieldwork and analysis was the realization that our primary research area was not in the mill, but in the adjoining refinery. Suddenly the maze of perplexing features started falling into understandable patterns – patterns that were finally understood to their maximum potential only at the very end of the analysis and reporting process when field data, stratigraphic analysis, sedimentary analysis, chemical analysis, and artifactual analysis were finally available for comparative study.

Our research has shed light on the diversity of ideologies applicable to Comstock Milling. Dominant in the folklore and documentary history of the area is the conspicuous consumption and waste indulged in during the opening years of the Comstock when fortunes were spent on dubious processes and on building showpiece mills. The tailings mills, and the Lyon Mill in particular, provide a counterexample. Instead, a determined conservative approach to

subsistence-level milling was practiced. In this instance both the documentary and archaeological records mesh. Hodges proudly points out many of the means used to cut costs through use of recycled materials. Most importantly, such recycling is highly visible in the archaeological record and was noted throughout the materials remaining at the Lyon Mill.

Historic research has shed invaluable light on the archaeological expectations and findings, allowing the foregoing models to predict actual ground placement of features and feature systems in the mill environment while archaeological evidence nearly always adds texture to the documentary expectations by seldom matching them and often contradicting them totally.

Study of the mill remains at MS004 has shown that seemingly barren areas can conceal deep feature-rich deposits. With adequate exposures and documentary support, much interpretation can be made of such features and deposits. An important aspect of our research at this mill has been the ability to identify various phases of milling operations and restructuring by analysis of chemical and physical properties of the sediments. Important characteristics were texture, color, and pH, along with content of iron, sulphur, copper, mercury, and sodium chloride. Analyses of gold and silver are important for assessing mill efficiency.

An important question regarding the succession of changes that occurred at the mill at MS004, was whether the final stage consisted of conversion to a cyanide plant. Additional documentary research yielded only the negative information that if such a modification was made, it failed to make it into the sources consulted. More convincing is the array of chemical samples taken throughout the mill area that failed to reveal any measurable trace of cyanide. Lack of a cyanide terminal phase for the mill is surprising given the magnitude of cyanide plant-construction that was taking place in the region during these years.

Landscape alterations resulting from milling and other cultural activities in both Dayton and Silver City have been extreme. No unaltered natural surfaces were present in any of the study areas. At MS030 in Silver City, the remediation area has probably been processed all the way to bedrock by placer miners and a small amount of sorted placer tailings form the base of the cultural deposits there. Much of the material deposited later incorporates a combination of mill tailings and unworked mine waste rock.

MS001 has been massively altered through time. Construction of the Keller & Cohen Mill involved using an oxbow of the Carson River as a reservoir and diverted part of the river through head and tail races for the water wheel. Later the entire Carson River changed its channel, sweeping through the former mill site. Still later, the Carson River again changed course to its present channel but that channel was subject to dredging operations in the late nineteenth to early twentieth century. The oxbow itself was so completely buried in mill tailings that it disappeared and was incorporated into an agricultural field. Similarly, sheets of mill tailings covered the rest of MS001 as well.

Terracing and rebuilding episodes have likewise completely altered the aspect of the hillside at MS004. Only in a few places was it possible to extend trenches deep enough to encounter unaltered natural slope materials. The terraces on River Street have been used and reused as tailings impoundments. Tailings and other fill have also been used there to raise the general land surface above the level of periodic floodwaters both from the Carson River and from surrounding hillsides. Until recently tailings pond deposits prominently covered this entire end of Dayton.

9.2 COMMUNITY

An extremely informal dumping pattern is seen in both Silver City and at MS001 in Dayton. This pattern is of discrete loads of trash simply being dumped close to the periphery of the occupied portion of town rather than at an established community dump site. Most information about the peripheral communities on the Comstock was collected at Dayton.

From the beginning of work at Dayton we expected to find fairly large numbers of artifacts in the course of monitoring. What was important was attempting to discern and to some extent explain patterning in the distribution and types of these artifacts.

Despite the fact that MS001 was used for varying purposes from at least the early 1860s, dumping of discrete deposits of community-related artifacts did not occur until the 1880s to 1890s. During this period this area was between the C&CRR and the Carson River, a zone that was well-suited to informal trash disposal. One possibility is that unusually powerful flood episodes in the early 1880s washed away or dispersed earlier debris concentrations. One map even shows the Carson River flowing through MS001, clearly directed in this path by the abandoned mill races.

Artifact content of the artifact concentrations strongly suggests that these resulted from dumping waste from commercial eating, drinking, and lodging establishments in Dayton. This establishes a more specific context for the remains and is important, since they represent caches of potential information that are not available elsewhere. Even if examples of the establishments were to be excavated, it is not likely that the kinds of waste hauled to secondary dumpsites on the edge of town would be represented on the premises.

Our basic model of the Dayton area as a peripheral zone to the Comstock suggests that artifacts should reflect a generally lower economic status and lack of conspicuous consumptive display expected in the core areas of Virginia City and Gold Hill, where amazingly elaborate foodways matched the high Victorian architecture of these places. The archaeological view from MS001 is more complex. Artifacts are generally of inexpensive types that support the model, but the quantities of imported European items argues for far more cosmopolitan tastes than expected for Dayton in the depression years of the 1880s to 1890s. Preponderance of materials from San

Francisco is as expected, but the general dearth of materials from the industrialized East and Midwest is surprising. Also, the faunal assemblage indicates a strong preference for relatively expensive cuts of meat. In short, the quality of the food consumed was high and expensive, but costs were reduced somewhat by simplified presentation at the restaurants and boardinghouses.

A key research question at MS001 was whether there was any indication that ethnic Chinese artifact concentrations were present. Chinese certainly lived nearby and small numbers of Chinese import artifacts occurred throughout the northern end of MS001. No discrete Chinese-related features were encountered. Analysis of the debris concentrations showed that none of the expected patterns for a Chinese assemblage were present. There was not only a lack of necessary quantities and types of Chinese artifacts, but lack of distinctively Chinese patterns of animal food selection and butchering practices.

Composition of the various aggregates of persons represented at the commercial businesses represented by the trash deposits varied considerably. They ranged from exclusively adult male assemblages to those with some evidence of feminine presence, to one with evidence of all expected members of a family present – perhaps resulting from boardinghouse discard.

Comparison of the artifact assemblage from Piper's Old Corner Bar in Virginia City and the dugout at MS004 along with the remains at MS001 showed some similarities in these diverse corners of the Comstock, as well as major differences. Many of the artifacts are in common in all of these places. However, there is much higher diversity in the artifacts present at the bar than in Dayton. Also, there are classes of artifacts that were clearly used to display status as an upscale bar. Both assemblages at the bar and at MS001 show an interesting aspect of status display in that it is not uniformly expressed in the material culture. At the bar, there was an aquarium, fancy water purifier, ornately carved cribbage board, and fancy bar glasses. These items sent a clear message that this was a quality establishment. However, the rest of the material assemblage was inexpensive and very similar to that found at Dayton. In Dayton, the emphasis was not on outward showiness, but was seen in the high quality of the food served on the rather plain ware. This bifurcation in assemblages designed for showy public display versus much more economical private portions of the same establishment has been well demonstrated in various archaeological investigations of bordellos. By way of contrast, such a bifurcation is not very evident in the Dayton materials.

Analysis of individual artifact types generally yielded patterns in common with other sites of the period. However, the numerous Florida Water bottles that had been re-marketed as catsup bottles are significant for material culture studies. This collection indicates a source of error in redistribution studies that depend on embossed labels for artifact origin and function. Since a given artifact deposit such as those at MS001 was created during a short period, the chances are high that even though re-labeled artifacts are uncommon in the regional material culture, they can be very high when artifacts were originally purchased from a single source that may have marketed high proportions of recycled bottles or other containers.

Finally, through comparison with other assemblages in the American West, it is clear that despite ready access to redistribution networks, far fewer available commodities were selected for purchase at the establishments represented at the various dumping locations than were selected at other places.

9.3 TRANSPORTATION

Both road and railroad transportation were studied in the course of this project. The major road we had the opportunity to study was the section of overland road through MS004 in Dayton that was successively altered into the Lincoln Highway, US Hwy 50 and presently the byway called River Street. This segment of road did not warrant a large investment of effort during this project, since it was simply trenched in one spot. This trench proved worthy of the monitoring effort.

In regard to the research question about the distinction between folk and engineered highway features, the trench clearly showed two totally different approaches to creating and maintaining road infracture during different periods. The early overland road that served briefly as the original Lincoln Highway is perfectly preserved here since the later road was built by covering the old road with fill. The original road is informal in nature, with a somewhat irregular top surface. More informative is the disposition of added gravel, which is in extremely irregular pockets and lenses. Clearly the gravel was added only as needed to fill ruts and mudholes.

In striking contrast are the strongly linear lifts of fill, gravel bedding, and asphalt used to create the new US Hwy 50 in the 1930s. Since we are fortunate in having the engineering drawings for this construction, it is possible to determine that the engineering plans were not simply rough concepts that did not have meaning outside an office. Rather, the plans were adhered to precisely. Here is dramatic evidence of a shift from road development in a vernacular sense to creation of a portion of America created by design but still following the same general contours of the landscape. The most recent development in this trajectory is the present 4-lane highway that cuts straight through this area, bypassing many former curves and byways such as this segment.

The precision of the engineering drawings leads to a further contribution, which is demonstration of their utility for locating the positions of vanished historical features that are located on the engineering drawings. In the MS004 area this included the former locations of the old overland road, of two wooden bridges, mill tailraces, and location of a previously undocumented turbine house.

Information about railroad transport was collected in both Silver City and Dayton. At MS030 in Silver City unexpected archaeological information was obtained about a cordwood

yard that was likely at the base of a flume where the wood was dumped downhill from the Silver City Spur of the V&TRR.

There was generally a lack of evidence for either the C&CRR at MS001 and the DCV&S at MS004. Instead, evidence was found for extremely light-duty narrow-gauge tracks on the upper terrace of the Birdsall Mill. This is surprising, for 3 ft gauge was expected in this area according to documents. Due to the lack of additional information about this railroad, a site form was not prepared. Based on wooden foundations uncovered during monitoring it is possible that a standard gauge siding approached the mill from north on River Street. If this is the case, these foundations were built after the C&CRR was widened to standard-gauge in 1905. This timing (after mill abandonment), plus the lack of railroad spikes in the feature timbers strongly suggests that the measurements and general appearance of the feature that makes it look railroad-related are coincidental.

9.4 GROUP SERVICES

The main intact feature relating to group services in the study area is the Rose Ditch. Although two additional water-management systems (Keller & Co. water mill water system and the Rock Point Ditch) were historically present at MS001, both have been completely obliterated by flooding, demolitions, and restructuring of the landscape to accommodate mill tailings.

In contrast, the Rose Ditch stands out as a prominent landmark on the southern approaches to Dayton. This ditch is of extremely high local significance since its construction was the occasion for the first documented introduction of Chinese laborers into western Utah Territory. These individuals stayed in the area to start a long run of placer operations in Gold Canyon and their occupation gave Dayton its most prominent early name – Chinatown.

Aside from surface recording of the ditch, the archaeological view of the site is extremely limited. The excavation monitored through the downhill berm, along with chance exposures elsewhere, indicates that the ditch was originally constructed with a stone retaining wall on the downhill side of the ditch. This wall has been subsequently buried and preserved by later generations of ditch expansion and maintenance. No data were available on the internal construction of the ditch since the ditch itself was not trenched.

9.5 SIGNIFICANCE

Significance of all of the cultural remains encountered in this project was evaluated primarily in relation to the federal Virginia City Historic District. As the premier post-California Gold Rush mining district in the United States its significance is extremely high and it contains material remains significant under all criteria for eligibility in the NRHP. Based on preliminary

studies of the project area it was suspected that elements contributing to that overall significance might be found, hence the use of archaeological monitoring throughout the project. This suspicion was confirmed during monitoring, hence the institution of archaeological data recovery at MS001 and MS004.

Archaeological loci and features at MS001 and MS004 contained in the project APE no longer exist except in the form of field notes, photographs, and this report. They no longer contribute to the significance of the site of Dayton.

Based on available archival information, the context of the Virginia City Historic District, surface recording, and our excavations, we continue to recommend the Birdsall and Carpenter Mill and its successors at MS004 eligible for the National Register of Historic Places (NRHP) under Criterion D for its research potential concerning milling technology in the late nineteenth century. The Lyon Mill is particularly significant as one of the earliest mills to successfully solve the difficult problem of specializing in processing Washoe Process tailings on the Comstock before the introduction of the cyanide process on the Comstock (Hazlett 1922:40). Significance of the mill complex is specific to certain areas. The original Birdsall and Carpenter Quartz Mill is sufficiently destroyed that it is not a good example of a Washoe Process Mill. Features in that area are not contributing to the significance of the site. Similarly, integrity of most remains in the mill yard has been severely compromised by post-abandonment construction, although individual features may remain intact subsurface. The most significant parts of the mill are the sulphuric acid works and bluestone works that are likely to be well preserved in the hillside on the northwest side of MS004. These remains represent industries that have not yet been studied archaeologically. In the future they could be excavated to supplement archaeological data recovery already done by this project at the mill refinery.

Due to extensive damage to the front of the mill and the mill yard it is unlikely to be significant under criteria A or C. None of the individuals associated with building and running the mill are of particular importance to the development of milling; it is not significant under Criterion B. The APE is outside of both the federal Virginia City Historic District and the state Comstock Historic District. However, a portion of the mill yard outside the APE extends into the federal historic district. In the mill lot east of River Street, only subsurface evidence of mill demolition is currently documented in what is now a bladed vacant lot.

Overall there is no question but that portions of the Lincoln Highway are eligible to the NRHP under one or more criteria. The problem for this project is whether the segment impacted by trenching during this project is a contributing element to that significance. Our conclusion is that the surface remains of the segment do not retain sufficient integrity to be contributing under any criteria. It has been cut at both ends by modern road construction and lies immediately adjacent to a modern 4-lane highway. While the subsurface section through the highway was interesting, and very informative about both the original construction of the Lincoln Highway road surface and subsequent construction of engineered US Hwy 50, the information is not

sufficient to warrant considering it adequate for NRHP eligibility under Criterion D. This is a case where useful information was obtained in a monitoring situation where full-scale archaeological data recovery would not have been warranted.

After documentary study, surface recording, and monitoring of the cut through the downhill berm of the Rose Ditch, we consider the Rose Ditch significant under Criterion A since it represents the first documented use of Chinese labor in Nevada and in one of the few relatively intact water systems used to support the Gold Canyon placer mines (Hattori 1990:38-4). The engineering details exposed in the berm and areas viewed near the project area are very typical of vernacular ditch construction and are likely to be found in other ditches that have not been so extensively rejuvenated through time. Therefore, the portion of the ditch in the study area is not significant under Criterion D for its research potential concerning design, construction, and use of early ditch systems. This assessment does not preclude the possibility that other segments may be found eligible under either criteria C or D. Although several extremely important individuals, including Orson Hyde and John Reese, were connected with the ditch, their association was not strong enough in relation to their primary local and regional importance as political leaders and creators of settlements to warrant considering the ditch eligible under Criterion B.

9.6 FUTURE RESEARCH

A major goal in any future research is to preserve archaeological information useful either for understanding the Comstock in more detail than is possible at present, or for portraying the history of the Comstock to the interested public. As a federal undertaking involving the Section 106 process, this project is a rarity on the Comstock since most of the land is under private ownership. Most archaeological work on the Comstock has been done during the course of university field schools or as part of the research for Masters' theses. An important aspect of preservation planning on the Comstock is utilizing federal undertakings whenever possible to enhance archaeological knowledge of the area.

If the opportunity arises, the intact portions of the Lyon Mill complex where the acid works and bluestone plant were located should be investigated in detail. They are in good shape archaeologically and are unlikely to have high mercury levels, which makes working in these areas much more practical than other places. If attempted, such work should plan from the outset to carry out an extensive program of chemical testing for the purpose of identifying the portions of the complex used for each part of the industrial processes.

It is important to continue searching for relatively intact mills or parts of mills on the Comstock. The Keller & Co. Mill was a good candidate for very high significance due to its early date and destruction after a short period of use. Only an archaeological study was able to

demonstrate that the demolition was intensive enough to negate most of its potential interpretive value.

This project has illustrated both the limits of sampling and the utility of monitoring in areas of relatively high archaeological sensitivity. At MS001 North, the array of backhoe trenches used during the testing phase cleanly missed finding the features that were ultimately subjected to data recovery by the narrowest of margins. Similarly, at MS004, the AT&T trench and our own array of trenches used during testing failed to encounter the extensive wooden foundations on the River Street terrace. In this case, the foundations were in an area not available for testing since later buildings were constructed on top of them. In both cases, the archaeological remains missed during testing would not have been identified and recorded without the presence of archaeological monitors during construction.

Our analysis of the mining community on the periphery of the Comstock was greatly hampered by a lack of detailed analysis of representative samples from the core. Although specific areas have been sampled, they have tended toward idiosyncratic places – ethnic saloons or Chinese quarters. Analysis of a sample of artifacts from the historic Virginia City dump (under BLM management) would greatly enhance the ability to make core-periphery comparisons. Additional samples of discrete peripheral dump sites, such as those from MS001, would add additional information about the range of variability of material culture from various establishments in Dayton and other communities on the Comstock.

The question of community itself is extremely difficult to address in the archaeological record when it is considered an interacting group of individuals. Much can be added to the details about the physical basis of such a community however. Due to the depositional record at Dayton, it is expected that many remains of early buildings and structures are buried throughout the town and its immediate vicinity. One such structure was excavated – the dugout at MS004. Evidence contained in these time capsules include presence of people of different ages and genders, structure function within the community, social and economic status indicators, and in some cases, ethnic indicators. Considering that nothing remains above-ground of the earliest Dayton settlement, a long-range objective clearly needs to be identification and study of these features. This is particularly important since the town has been enhancing its knowledge and marketing of the early history of the area.

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APPENDIX A

IMACS SITE FORMS

IMACS SITE FORM

PART A - ADMINISTRATIVE DATA

Intermountain Antiquities Computer System

***1. State No:** 26Ly83
***2. Agency No:** CrNV-03-1608
3. Temp. No: 894-3, MS030

4. **State:** Nevada **County:** Lyon
5. **Project:** Carson River Mercury Project (ARS #894, 978)
* 6. **Report No:**
7. **Site Name:** Silver City
8. **Class:** Historic
9. **Site Type:** Town; Locus 894-3: Trash Dump, Placer Tailings, and Cordwood Storage Lot
* 10. **Elevation:** 4840 to 5280 ft Silver City; 5000 ft at Locus 894-3
* 11. **UTM Grid Zone:** 11 272000 mE 4349540 mN NW edge at SR 342
271780 mE 4348980 mN W edge at American Creek
272420 mE 4349980 mN NE corner at Negro Ravine
272940 mE 4348260 mN SE corner at Gold Creek
272000 m E 4348880 m N at Locus 894-3
* 12. NE¼ SE¼ NE¼ of Section 8 T.16N R.21E
SE¼ SE¼ NE¼
SW¼ SE¼ NE¼
NW¼ NE¼ SE¼
SE¼ NE¼ SE¼
all SE¼ SE¼
NE¼ SW¼ SE¼
SE¼ SW¼ SE¼
SE¼ NW¼ NW¼ of Section 9 T.16N R.21E
SW¼ NE¼
all SW¼ NW¼
all NW¼ SW¼
all SW¼ SW¼
SW¼ SE¼ SW¼
all NW¼ NW¼ of Section 16, T.16 R.21E
NW¼ NE¼ NW¼
SW¼ NE¼ NW¼
SE¼ NE¼ NW¼
NW¼ of SE¼ of SE¼ of Section 8 T.16N, R.21E at Locus 894-3
* 13. **Meridian:** Mt. Diablo
* 14. **Map Reference:** Virginia City, 1967, USGS Nev.7.5'; Piedmont Engineering 1"=10 ft (SAIC 1993)
15. **Aerial Photo:** NDOT
16. **Location and Access:** Silver City is at the southern junction of SR341 and SR342 in Gold Canyon. From the intersection of SR341 and SR342 on the south end of Silver City, follow SR342 N 0.3 miles; turn west on the American Ravine Road. Locus 894-3 is on the right (north) side of the road 0.15 miles from the intersection. The locus is immediately before the unmarked junction of the American Ravine Road and the road to the Silver City Spur of the V&T RR.
* 17. **Land Owner:** Private, NDOT, Lyon County
* 18. **Fed. Admin. Units:**
* 19. **Location of Curated Materials:** No collections were made.

PART A - ADMINISTRATIVE DATA

State No: 26Ly83
Agency No: CrNV-03-1608
Temp. No: 894-3, MS030

20. **Site Description:** Silver City has a mining-related history starting with early placer mining and later importance as a transportation and milling center for the Comstock. Silver City also has been worked for lode minerals nearly as long as the main Comstock mines in Gold Hill and Virginia City. Lacking bonanza level discoveries, the mineralization in and near Silver City has made it possible to conduct long-term small-scale operations. All of these endeavors have resulted in a continuously occupied town that retains at least some of its mining heritage and active miners right to the present. Particularly since the 1960s the town has largely changed to a residential community for people who work in surrounding urban areas.

In the early 1850s the area that would become Silver City was part of the extensive territory meticulously worked for placer gold by miners based mainly in Chinatown (later Dayton) and Johntown, both located farther down Gold Canyon. The vicinity of Silver City is likely where the Grosh brothers made an abortive effort to mine lode silver but lode mining and exploration did not start in any significant way until the 1859 discovery of the Comstock Lode in what would later be Gold Hill. This discovery quickly led to mineral exploration of the surrounding area, including Silver City, for lode outcrops. These were rapidly identified in the Silver City area. Time was to show that the Silver City lodes were along an offshoot of the main Comstock Lode fault system, and that, ironically the values from this area consistently were higher in gold than silver. A community immediately began to form in Silver City due to this mineralization, its location about halfway up Gold Canyon between Dayton and Virginia City, its location at the major confluence of Gold Canyon and American Canyon, and finally, the presence of sufficient water for at least moderate-scale milling operations.

By the mid-1860s Silver City had developed into a town with the same layout that still remains today as shown on the GLO township plat surveyed from 1865 to 1867. The area is not congenial to easy town platting. The buildings are arrayed along the top and sides of a bedrock ridge running from northwest to southeast. The floor of Gold Canyon was devoted primarily to a series of mills, leaving the residences for over 1,000 people on the hillsides (Paher 1970:69). Charles Collins (1865) provides a vivid description of the place:

> Silver City, Lyon County, is situated about half way between Virginia City and Dayton. All of the stages running between Virginia and California, over the Placerville Route, pass through here, as well as a large proportion of the travel of the Territory. Silver City relies exclusively on the mining interests of the surrounding country for support. Some of the finest mills in the Territory, as well as the richest lodes, lay encompassed within her limits. The past year has been particularly noted for the number of private residences that have been erected and are now in course of completion. The citizens display a refined taste, as well as a confidence in the resources of the country, by the numerous gardens and other external and substantial improvements that they are constantly making. Almost every private residence is adorned by numerous trees planted around their dwellings, which has the effect of making favorable impressions on every one that either passes through or takes up a residence within its limits. Silver city is fully represented by societies, organizations and social institutions; which for numbers and unity, would be creditable to the reputation of larger cities. Having an abundance of granite and other building material contiguous to the city, the citizens have erected several blocks of buildings composed of the above material, which render them fire proof, and are substantial indications to the observing traveler, of the permanent growth and prosperity of the City.

At that time, there was only a Presbyterian church, but other denominations planned constructing others. Education in the town was on a private basis. Masonic and Odd Fellows lodges were present, as was a militia called the Silver City Guard. Dominant in all of the directories is a long list of 15 quartz mills. Of these, the one of the most historic significance is Almarin Paul's Pioneer or Devils Gate Quartz Mill where the Washoe

PART A - ADMINISTRATIVE DATA

State No: 26Ly83
Agency No: CrNV-03-1608
Temp. No: 894-3, MS030

Pan Process was initially developed. Unfortunately, unless it is buried by fill in the vicinity of the modern state historic marker, none of this mill remains today.

Silver City was the principal town in Lyon County during the 1870s (Langley 1871). The extent of the associated town buildings, mills, and mining claims are shown on the first accurate topographic map of the area, done by the Wheeler Survey in 1877.

Like the rest of the Comstock, Silver City dwindled in the 1880s to 1890s. Particularly hard hit were the milling and teaming interests. Small-scale milling and subsistence-level mining continued throughout the entire history of the district, however. A vivid description of subsistence mining in Silver City is provided by De Quille (1889:101-102):

> About the town are an immense number of small veins of gold-bearing quartz that pay from the surface down. Nearly every head of a family in the town has his own mine, and when he wants money he shoulders his pick, goes out to his mine, and digs it, as a farmer in the East digs a "mess" of potatoes. ... The people have lived off their home mines for thirty years, and constitute the most thoroughly independent mining community to be found in Nevada.

Small-scale mining continued to the extent that, aside from times of booms elsewhere in the state, Silver City was one of the main producers of gold and silver, with rising production in the 1930s before the precious metals industry was put on hold by the second world war (Gianella 1936:9; Smith 1932:10). This was accomplished with the aid of power equipment, open pit techniques, and efficient cyanide mills. It did not increase the population, which was only 67 in the 1930 federal census.

Some standing historic buildings and structures remain, including residences, mills, WPA privies, and outbuildings. The major buildings of historic age have been documented in building surveys for the Comstock, on file at the Comstock Historic District Commission office. Numerous roads, retaining walls, debris concentrations, dumps, mines (open pit, underground, lode and placer), prospects, waste rock dumps, tailings deposits, and foundations remain (including the foundations of the oldest intact foundry ruin in Nevada). The cemetery has one of the best collections of wooden and iron grave surrounds of any cemetery from the late nineteenth century.

This site form is compiled as context for EPA study area MS030, which is considered as a locus of 26Ly83 (Within the platted townsite it is recommended that future loci be identified on the basis of lots and blocks and for areas outside the townsite that mining claims be used when applicable). The study area comprises a small terrace adjacent to a fork where the road from Silver City to the Silver City Spur on the Virginia and Truckee Railroad departs from the road up American Ravine to American Flat. This area is off the main transportation corridor that ran along Gold Canyon. The main part of Silver City has been photographed many times, but the side canyon leading up to American Flat does not appear to have been photographed a single time.

In addition to being along one of the routes from Silver City to its hinterland, connecting ultimately with American Flat and Carson City, American Ravine was the scene of early Comstock placer mining in the 1850s. The parcel is about midway between the Bacon and Trench Millsite (downstream), the Silver City Mill (upstream on the American Flat Road), and the Union Mill (upstream on the American Ravine Road). Due to recent blading, tailings are visible in the study area. These tailings could be from either of the upstream mills.

The Trench Mill (Sparrow, Trench & Co.'s Mill; French Mill) was a stamp and pan mill built in 1861 that stood until at least 1904 (Browne 1868:352; SAIC 1993[2]:69-71). The Silver City Mill (Lambert's Mill) was a small steam-powered stamp mill constructed in 1861. The mill stood at least until 1864 but is not shown on an 1874 map of Silver City (SAIC 1993[2]77,84). The Union Mill was built in 1861 and is shown on an 1874 map of Silver City (SAIC 1993[2]:83-84). All of the Silver City mills were plagued by a lack of

PART A - ADMINISTRATIVE DATA

State No: 26Ly83
Agency No: CrNV-03-1608
Temp. No: 894-3, MS030

adequate water from the seasonal streams in American Ravine and Gold Canyon while the Carson River mills were in danger from seasonal flooding. Almarin Paul's Devil's Gate Mill relied on a well for much of its water and the Bacon Mill dug a 30 ft deep shaft and started drifting east in a successful search for additional water (Mining and Scientific Press 1867 15:55, 103).

As shown by the 1874 Ross E. Browne townsite map of Silver City, the bottom of American Ravine was lined by a scatter of small houses, much as it is today. In addition to the probability of roadside trash deposition, there is a likelihood of extensive domestic trash deposition from these residences.

The Silver City Spur of the V&TRR was constructed in about1873 (Myrick 1962:157). The spur was dismantled in 1880 (James 1998:239). This spur, which connected Silver City with the main line to the west, was a peculiar one. Due to the great difference in height between the main line and the bottom of Gold Canyon where Silver City was built, the spur did not descend to the level of the town. Instead it contoured along the north slopes of Grizzly Hill and ended there. Materials used at the mills, particularly ore and cordwood, were slid down to the floor of Gold Canyon and American Ravine by the means of an array of wooden flumes. Most of the flumes terminated in the vicinity of the confluence of these two ravines near the Trench Mill. Two of these flumes are shown terminating near MS030 on Wheeler's 1876-77 map of the Comstock. On the revised version of this map in Lord (1883), ore versus wood slides are differentiated. One of the flumes terminating by MS030 is identified as a "Wood Slide" on this map.

Locus 894-3 is a small concentration of historic debris. Although a few artifacts are consistent with attribution to the boom period of the Comstock, by far most artifacts date to the 1950s or later. Most artifacts are domestic refuse such as food and beverage containers. A few industrial artifacts are present, including cut spikes and remnants of a large wooden vat. The vat is clearly a late addition to the locus, and lies on top of domestic debris. Due to its position by the road, the debris could either be hauled from the main portion of Silver City or could have been generated by nearby households along American Ravine. The debris lies on a human-created bench along the side of the ravine. This bench contains remnants of mill tailings from a mill uphill of the site. It also contains rock from a nearby mine waste rock dump.

* **21. Site Condition (A-excellent, B-good, C-fair, D-poor):** Good

* **22. Impact Agents:** Redevelopment (town is still occupied and subject to constant modification). At least 10 cm have been recently bladed off the top of Locus 894-3.

* **23. Nat. Register Status (C-significant, D-non-significant, Z-unevaluated):** Significant; Locus 894-3 Non-significant.

Justify: The entire town is within the federal Virginia City National Landmark. Several of the older buildings contribute to the significance of the landmark but criteria have not been formally determined.

On its own merit, the town is eligible under Criterion A for its major contributions toward development of the Comstock Lode, especially for pioneering development of the Washoe Process of pan amalgamation – an innovation of international importance.

The town is significant under Criteron B for its association (including grave and memorial marker) for the Grosh Brothers. It is also significant for its association with Almarin Paul. Although mill ruins are not visible (but may be preserved under a parking lot south of Devil's Gate), proximity to this major landscape feature makes interpretation of the site possible.

Insufficient context is available to identify features that may be eligible under Criterion C. Due to the character of the place as a classic area of subsistence mining, characteristic features of this kind of small-scale operation may be eligible. It is likely that Donovan's Mill is eligible under this criterion. With the passage of another decade it is probable that the dome houses constructed during the 1960s will be eligible as examples of counterculture architecture.

PART A - ADMINISTRATIVE DATA

State No: 26Ly83
Agency No: CrNV-03-1608
Temp. No: 894-3, MS030

Archaeologically, the town and immediate surroundings contain a wealth of information in the archaeological and architectural record that may be used to address significant research questions about the mining community, mining, milling, and transportation support facilities. Due to the scope of the present project, none of these individual contributing elements under Criterion D are identified.

Although Locus 894-3 contains a few artifacts that date to the nineteenth century and many barely 50 years old, they are entirely surrounded by a mix of later objects. It is not possible to identify an early assemblage that could be confidently associated with a domestic household in American Ravine. There is no reason to consider this locus significant under criteria A-C. Due to lack of focus in the assemblage and lack of definite historic context for the debris this locus does not have the potential for contributing toward domestic lifeways/consumerism under Criterion D.

24. **Photos:** Photocopy, maps attached
25. **Recorded by:** R. Reno
* 26. **Survey Organization:** Archaeological Research Services (AR), Summit Envirosolutions (SY), 813 North Plaza Street, Carson City, Nevada 89701
27. **Assisting Crew Members:** V. Clay, L. Hause, C. L. Furnis
* 28. **Survey Date:** Nov. 5, 1996; Aug. 1998

List of Attachments:

Part B	✔ **Topo Map**
✔ **Part C**	✔ **Site Sketch**
✔ **Encoding Sheet**	✔**Artifact/Feature Sketch**
✔ **Photos**	**Other**

PART A - ENVIRONMENTAL DATA

Site No: 26Ly83
Agency No: CrNV-03-1608
Temp. No: 894-3, MS030

* **29. Slope:** 6-10 **(degrees)** **Aspect** 25 **(degrees)**

* **30. Distance to Permanent Water:** On site
Type of Water Source (A-spring/seep, B-stream/river, C-lake, D-other): Stream/River
Name of Water Source: American Ravine Creek

* **31. Geographic Unit:** Dayton Valley (BND)

* **32. Topographic Location:**
Primary Landform: Valley (E) **Secondary Landform:** Multiple (1)
Describe: Site 26Ly83 is on the bottom and sides of ravines and along ridge tops. Locus 894-3 is on the south side of the creek and appears to be a historically built terrace or bench made partly of what appear to be mill tailings. At least some of the material is unprocessed mine waste rock up to the size of small boulders.

* **33. On-site Depositional Context:** Locus 894-3 Stream Terrace (D)
Description of Soil: Locus 894-3 Archer (1984:64) describes the local soil as Unit 471, Oppio-Nosrac association. On north-facing slopes such as this site, soil is Nosrac grayish brown stony clay loam formed from colluvium derived from andesite or basalt. In addition, possible mill tailings have been exposed on site. These are poorly sorted very pale brown (10YR8/4 dry to 10YR7/4 moist) silt loam.

* **34. a. Life Zone: Upper Sonoran**
b. Community: **Primary On-Site:** Tall Sagebrush (P)
Secondary On-Site: Tall Sagebrush (P)
Surrounding Site: Riparian nearby (L)

Describe: Big sagebrush, desert peach, rabbitbrush, mustards, thistles, grasses, horehound. Site was originally covered by dense sagebrush, but nearly all vegetation has been bladed off.

* **35. Miscellaneous Text:** Archer (1984) *Soil Survey of Lyon County Nevada*; Most bottle dates from Giarde (1980) *Glass Milk Bottles: Their Makers and Marks*.

36. Comments/Continuations/Location of Curated Materials and Records:

Site No: 26Ly83
Agency No: CrNV-03-1608
Temp. No: 894-3

1. **Site Type:** Town; secondary trash dump.
* 2. **Historic Theme(s):** Domestic lifeways, consumer behavior, mining, milling transportation, frontier urbanism.
* 3. **Culture:**
Affiliation: Euroamerican
* 4. **Oldest Date:** Silver City ca. 1850; Locus 894-3 ca. 1870s **Recent Date:** Present
How Determined?: Locus 893-3 - oldest date from hand-tooled pushup on cylindrical bottle. Large cut spikes also of 19th century. 1935 licence plate (Nevada). Most datable bottle marks are from mid-1940s. Additional goods include 1930s-1950s bottle marks, paper dated 1951, and many obviously 1950s or later disposable goods such as toothpaste tubes.
* 5. **Site Dimensions:** Locus 894-3: 26m x 26 m ***Area:** 530 **sq m**
* 6. **Surface Collection/Method: (A-None, B-Grab sample, C-Designed sample, D-Complete collection):** None
Sampling Method:
* 7. **Estimated depth of fill: (A-surface, B-0-20 cm, C-20-100 cm, D-100 cm+, E-fill noted but unknown), F-Depth suspected but not tested):** Depth suspected but not tested
How Estimated (if tested, show location on site map): Locus 894-3: at least 20 cm of fill have been removed by recent blading. Since the terrace has been at least partly built up from mill/mine deposits total depth of cultural fill may exceed 100 cm on the downhill side of the terrace.
* 8. **Excavation Status: (A-Excavated, B-Tested, C-Unexcavated):** Excavated
Testing Method: Locus 894-3 exposed during EPA Mercury remediation. Artifacts and features recorded during monitoring.
* 9. **Summary of Artifacts and Debris:** Glass, metal, cut and round nails, bone, ceramics, leather, wire, cans, wood, rubber, domestic items, kitchen utensils, wagon parts, etc.
Describe: At the time of the initial visit in April 1996, the site was covered by big sagebrush and exhibited several possible pit or trench features. Secondary dump debris including domestic, milling, and architectural debris was noted. Since that visit the surface has been bladed to a depth of up to several inches, revealing thousands of artifacts. Mill-related artifacts were clearly not in original locations, mixed up among domestic debris. While a few nineteenth century artifacts were noted, including wine and ale/stout bottle fragments and cut nails, by far the majority of the artifacts were from the 1940s, continuing into the early 1950s. Mill tailings and mine waste rock were exposed as was additional fill material confirming that most if not all of the terrace was of human construction.

Observations during monitoring of the remediation excavations revealed a somewhat more complex set of stratigraphy at this location than indicated by the surface evidence. These observations related to placer mining, milling, transportation and materials storage, and the trash dump.

DUMP: The surface was covered in mixed age debris (Str 1), 1-2 m thick on the edge of the terrace and much thinner on top. Numerous wagon or truck loads of debris had been disposed of in this location of the ravine atop tailings and adjacent a major thoroughfare for some time. Artifacts included those commonly found in community dumps and may represent debris from local businesses such as bars or restaurants as well as from local households.

All of the artifacts recorded at Locus 894-3 were part of Str 1. Those with marks were recorded in greater detail than others, though all items were literally field-recorded between bulldozer sweeps on the site. Artifacts were not collected. The observed artifacts are listed in the following table, organized according to functional groupings.

Dump remains include square point shovel fragments, two fragments of cut bone, four large cut spikes, 1 cut nail, over 100 round nails, iron wagon axle thimble, 1 inch twisted wire rope tow cable, wood composite tank hoops constructed with wire nails, 2 large bolts, overall buckle, many shoes (mens', womens', childrens', leather, leather and plastic), gray granite pot lid and spatula, tooth paste tubes, costume jewelry pin, overall buckle, many other items not tabulated due to high volume of artifacts.

Detailed summary of artifacts follows:

Table 5.3-1. Artifacts Observed at MS030.

Artifact Group	Artifact Type	Description
Architectural Artifacts	Cut nails	a few
	Faced stone	2x2 ft
Domestic Artifacts	Ceramic tiles	
	Bed springs	
	Candy dish	green glass
	3 bleach bottles	cylindrical brown glass: MG [ligature]\PUREX/DES.PAT.APP. FOR 1682 on base, screw cap, dates from ca. 1958 (Toulouse 1971:357)
		cylindrical brown glass: 17 [illus. diamond and oval with "I"]\13\E1596 on base, Owens-Illinois Glass Company mark, dates from 1930 to ca. 1956 (Giarde 1980:80, 89-90)
		cylindrical brown glass: [illus. diamond and oval with "I"]\E1996 on base, dates from 1929 to 1956 (Giarde 1980:77, 80)
Food-Related Artifacts	Alcoholic beverage containers	cylindrical green glass bottle: SANDERSON & SON LTD\WM LEITH SCOTLAND on body, WM. SANDERSON\6 269\ ... EITH ... on base
		colorless glass, pint size bottle: Sunny Brook Brand on paper label; Federal Law Forbids Resale or REUSE OF THIS BOTTLE on body; NATIONAL DISTILLERS [in oval]\D-1\54 50\[illus diamond and oval with "I"] on base, dates to 1950 (Giarde 1980)
		colorless glass, oval 8-ounce bottle: NATIONAL DISTILLERS [in oval]\D-1\54 50\[illus diamond and oval with "I"]\HALF PINT on base, dates to 1950 (Giarde 1980)
		brown glass oval whiskey flask: D913\66-46\[illus diamond and oval with "I"] on base, dates to 1946 (Giarde 1980:77)

Table 5.3-1. Artifacts Observed at MS030.

Artifact Group	Artifact Type	Description
		brown glass bottles (2): Federal Law Forbids Resale or Reuse of this Bottle on body; VAT 69\SCOTCH WHISKEY 2 on base, dates from 1933 to 1964 (Munsey 1970:126)
Food-related Artifacts	Alcoholic beverage containers	colorless cylindrical glass bottle: 4/5 Quart on body; LP [within keystone]\390 on base, Knox Glass Bottle Company mark or Pennsylvania Bottle Company mark, dates from 1940 to 1952 (Giarde 1980:62; Toulouse 1971:333-334)
		colorless cylindrical glass bottle: 4/5 Quart on body; LM [within oval]\668 on base, Latchford-Marble Glass Company mark, dates from 1939 to 1957 (Toulouse 1971:332)
		green glass cylindrical bottle with kick-up base (wine)
	Milk containers	colorless glass milk bottle: Windmill Dairy\Minden on base
	Condiment containers	colorless glass, faceted catsup bottle: Duraglas[in script]\20 [illus diamond and oval with "I"] 5\6B\4064-E on base, dates from 1945-1955 (Giarde 1980:77, 95)
		colorless glass catsup bottle: 7354\HA\D 25 on base, Hazel Atlas mark that dates from 1920 to 1964 (Toulouse 1971:239)
		colorless glass mayonnaise jar: 209\NW\4 on base, Northwestern Glass Company mark, dates from 1931 to at least 1971 (Toulouse 1971:390)
		colorless glass mayonnaise jar: M805\LM on base, dates from 1939 to 1957 (Toulouse 1971:332)
		colorless glass cylindrical steak sauce bottle: 4[illus. diamond and oval with "I"] 4\Duraglas [in script]\9 on base, dates between 1944 and 1954 (Giarde 1980:77)
		colorless glass olive bottle: 20 [illus. diamond and oval with "I"] 6\3795-C on base, dates between 1946 and 1956 (Giarde 1980:77, 95)
		colorless glass cylindrical vinegar bottle: EJ802\9[illus. diamond and oval with "I"]51 on base, dates to 1951 (Giarde 1980:80)

Table 5.3-1. Artifacts Observed at MS030.

Artifact Group	Artifact Type	Description
Food-related Artifacts	Fruit containers	colorless glass fruit jar: AHK[within rectangle]\639[within rectangle] on base, Alexander H. Kerr & Co. mark, dates from 1944 to at least 1971 (Toulouse 1971:44)
	Miscellaneous glass food containers	colorless glass cylindrical bottle with textured base: A[within circle]\50-28\2 on base, has externally-threaded finish, 8 oz size, American Glass Works mark, dates from 1908 to 1935 (Toulouse 1971:22-23)
		green glass square bottle: 205\3[illus diamond and oval with "I"]6\16\Duraglas [script] on base, dates between 1946 and 1956 (Giarde 1980:77)
		colorless glass cylindrical bottle: GC[intertwined] 3\3516 on base, Glass Containers Inc. mark, dates from 1945 to at least 1971 (Toulouse 1971:220-221)
		glass cylindrical bottle: Duraglas[script]\4[diamond and oval with "I"]6\14 on base, dates to 1946 or 1956 (Giarde 1980:77, 80)
		colorless glass cylindrical bottle: 20[diamond and oval with "I"]5\7-B\4064ZE on base, dates to 1945 or 1955 (Giarde 1980:77, 95)
Food-related Artifacts	Sanitary metal food cans	
Food Preparation	Large enamelware pot	2 to 3 gal size
Group Services Artifacts	Ceramic sewer pipe sections	
Personal Artifacts	White glass square cosmetic jar	J&J [in script] on base, Johnson & Johnson mark?
	Colorless glass square jar	MERLE NORMAN\COSMETICS\SANTA MONICA\ CALIFORNIA on base
Transportation Artifacts	Wagon or sled part	
	Automobile door	
	Gear jack	
	Motor oil cans	one stamped Tydol
	Machine parts	

Table 5.3-1. Artifacts Observed at MS030.

Artifact Group	Artifact Type	Description
Miscellaneous Artifacts	Bulldozer parts	
	Metal cable lengths	1-inch diameter
	Metal wheelbarrow	with metal wheel
	Iron sheet	in large pieces
	Clay pigeons	
	Heavy metal pipe elbow	

*** 10. Ceramic Artifacts:**

Paste	Glaze/Slip	Decoration	Pattern	Vessel Forms	No.
White utility ironstone	salt	none		Cyl. bottle, prob. ale	1 (3 frags)
Gray utility ironstone	salt and brown glaze			Cyl. bottle, prob. ale	1
Misc. IWE and white earthenware					>1000

many polychrome patterns in transfer & gold leaf/mostly dinnerware, some serving vessels
" white earthenware "

***a. Estimated No. of Ceramic Trademarks:** 1 observed.
Describe: mark: PORT DUNDAS POTTERY C[OY.] GLASGOW (post-1866)

*** 11. Glass:**

Quantity	Manufacture	Color	Function	Trademarks	Decoration
9	Machine	Clear	½ Pint Liquor	Desc. below	
1	Machine	Brown	Liquor		
1	Mouth-blown, Hand pushup	Dark Green	Alcoholic Beverage		
1	Pressed	Green/White	Plate	"True King Ovenware Made in USA"	
1	Pressed	Clear	Stopper		Fluted design.
6	-	Aqua	Window		

Describe: [The Owens Illinois I in diamond and ellipse mark is referenced here as {OI}; the Owens dot in place of the I is referenced as {O}] Also, fragments include 2 aqua, 3 cobalt blue, >100 light brown, >1000 clear, >50 light green, 1 green, 10 dark green. The 9 "Natural Distillers" bottles mentioned above have D-1/54-50 on base and "Federal Law Forbids..." on shoulder, dating to 1934-64, most likely to 1950. A brown medicinal bottle with plastic cap has mark 7{OI}8/2S/10 dating to 1938 or 1948. A brown pint oval has mark D19/56 45 to left of recumbent {OI}. The plant dates from 1929-54, with a most likely date of 1945 for this bottle. A clear half pint oval has the "Federal Law..." mark, dating to 1934-64. A clear catsup bottle has a cursive "Duraglas" (1940-1963) and a base mark 20{O}5/2B/4064-E that likely further narrows the date to 1945. A clear square base is marked 4{O}9/18 dating to either 1929 or 1939. A clear

gallon base marked 7{OI}2 dates to 1932 or 1952. Finally, a small cylindrical bottle marked 50-28/3{Anchor Hocking H over anchor}1 post-dates 1938.

12. **Maximum Density-#/sq m (glass and ceramics):** 50

* 13. **Tin Cans:**

Type	Opening	Size	Modified	Label/Mark	Function
1 Cone top		4 5/8 side, conical base			beer/soda
>100 Sanitary					mainly fruit/vegetables

Describe: Cone-top can dates to 1937 to 1966.

* 14. **Landscape and Constructed Features (locate on site map):** Placer mining tailings, mill tailings, cordwood lot.
Describe:

PLACER MINING TAILINGS

The lowermost cultural stratum (Str 4) exposed and partially removed during remediation of this area consisted of a deposit of rounded cobbles and boulders overlying bedrock in the drainage base. We interpret these size-sorted deposits as evidence of the earliest placer mining along American Ravine, likely occurring in concert with other early Comstock placering activity during the 1850s. Due to the small size of the exposure, it was not possible to determine the spatial arrangement of these placer tailings.

MILL TAILINGS

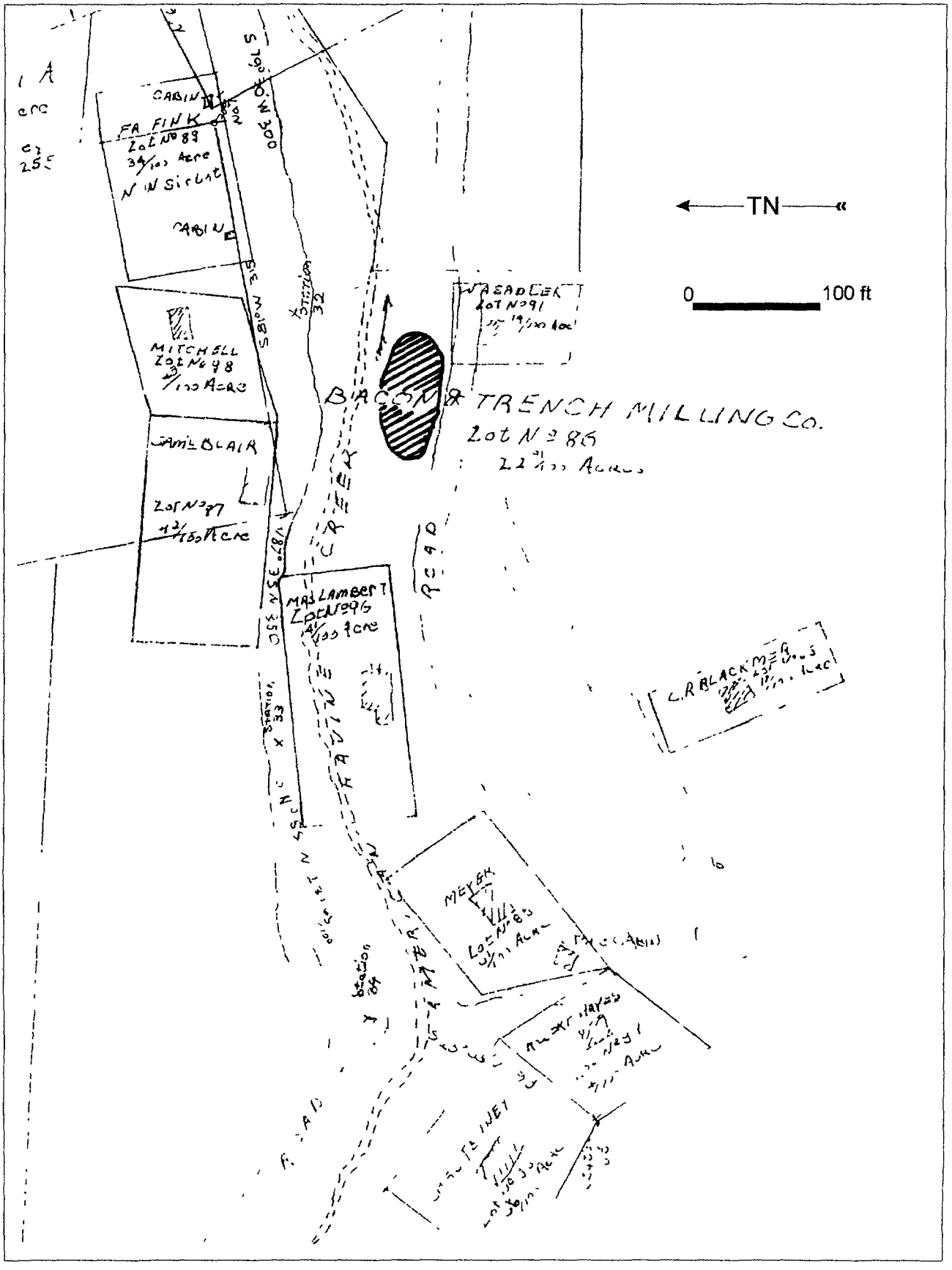
Yellowish brown silt loams (Str 2) comprise a 2-3 m thick deposit that forms the upstream half of the site terrace while dark brown fill deposits comprise the downstream portion. The silt loam appears to be fine mill tailings likely originating at one of the two upstream mills, the Silver City and the Union, operating between ca. 1861 and 1874+. It was unclear whether these tailings were in place or redeposited from their original location. Some hint of a ditch exposed on the terrace surface may provide the source for this tailings deposit. Bedding planes of these water lain deposits generally followed the sloping hill surface they covered.

Wooden tank remains on the surface of the site originated at one of the local mills, but it is clear that they had been removed from their original locations. These tanks are simply part of the mixed debris scatter rather than part of an intact mill feature system.

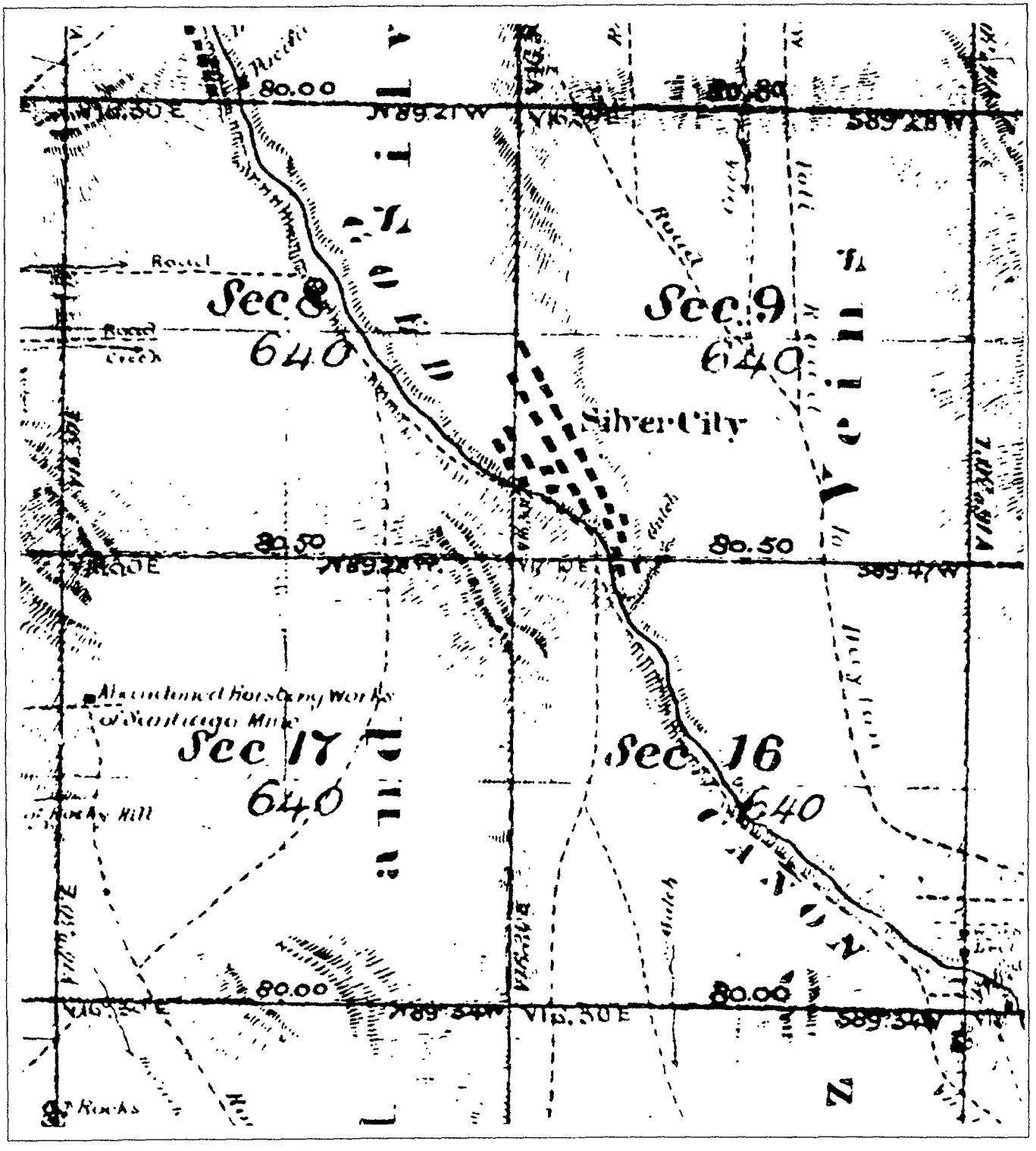
CORDWOOD LOT

The layer of ponderosa pine bark and decayed log fragments (Str 3) at the base of the mill tailings and in a narrow path south of American Flat Road suggest that logs or unmilled cord wood with bark may have been flumed down from the V&TRR Silver City Spur to this location prior to the deposition of the silt tailings. If this is the origin of the bark layer, it dates to the period from 1873 to 1880 when the spur was in use. The bark deposit is up to 0.5 m deep in areas and covers a 15 m N-S by over 5 m E-W area. Lack of a mill in this part of the canyon would have made it an excellent place for storing large quantities of cordwood. Most of the rest of the lower end of American Ravine and the portion of Gold Canyon in Silver City were so heavily built up that space was in short supply for such purposes.

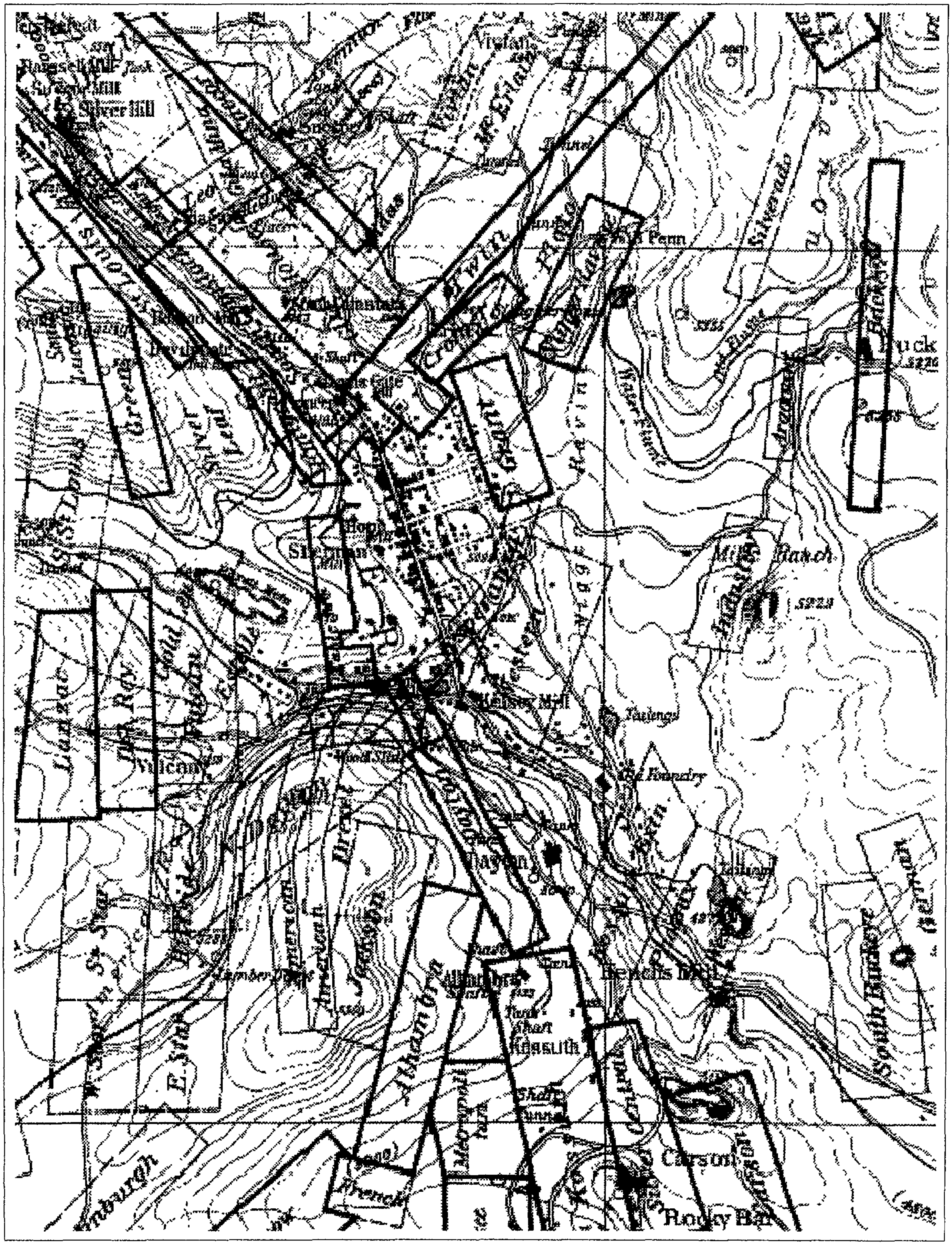
Silver City, looking down Gold Canyon (from Paher, 1970.68)



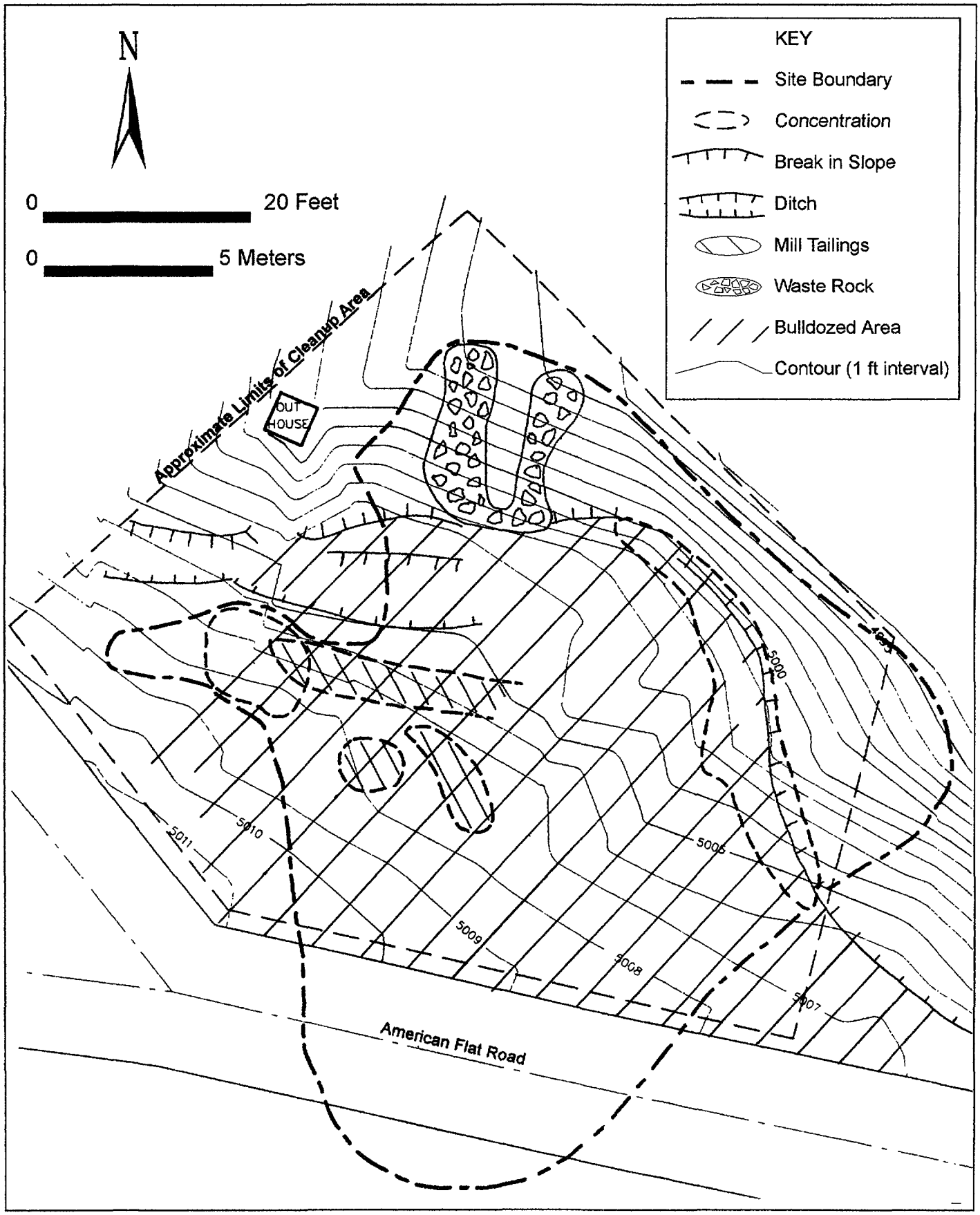
Portion of Silver City in American Ravine as mapped by Ross E. Browne in 1874.



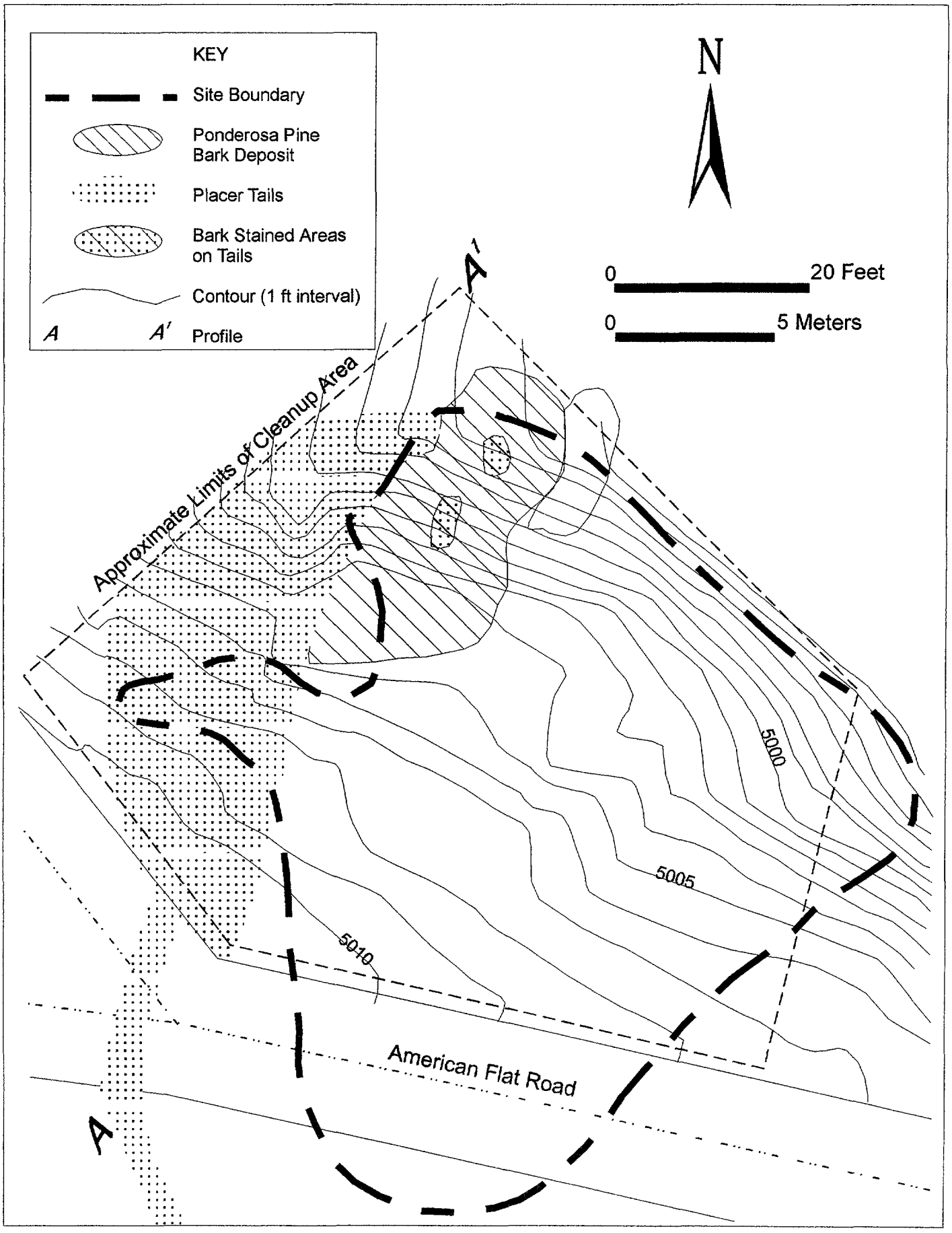
GLO township survey plat of Silver City, mapped in 1865-1867.



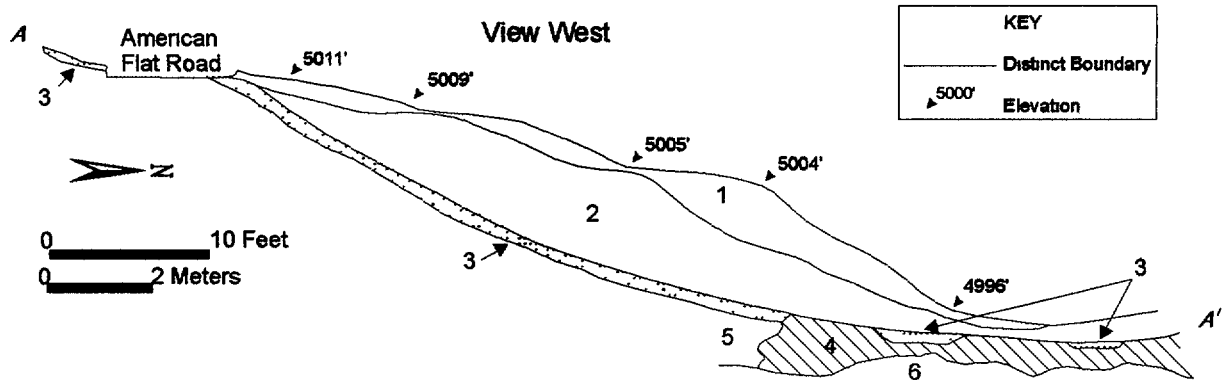
Silver City as mapped by the Wheeler Survey in 1877 with claim information added in 1881 (Lord 1883).



Surface site map of Silver City site MS030.



Subsurface deposits and cross-section location at Silver City site MS030.

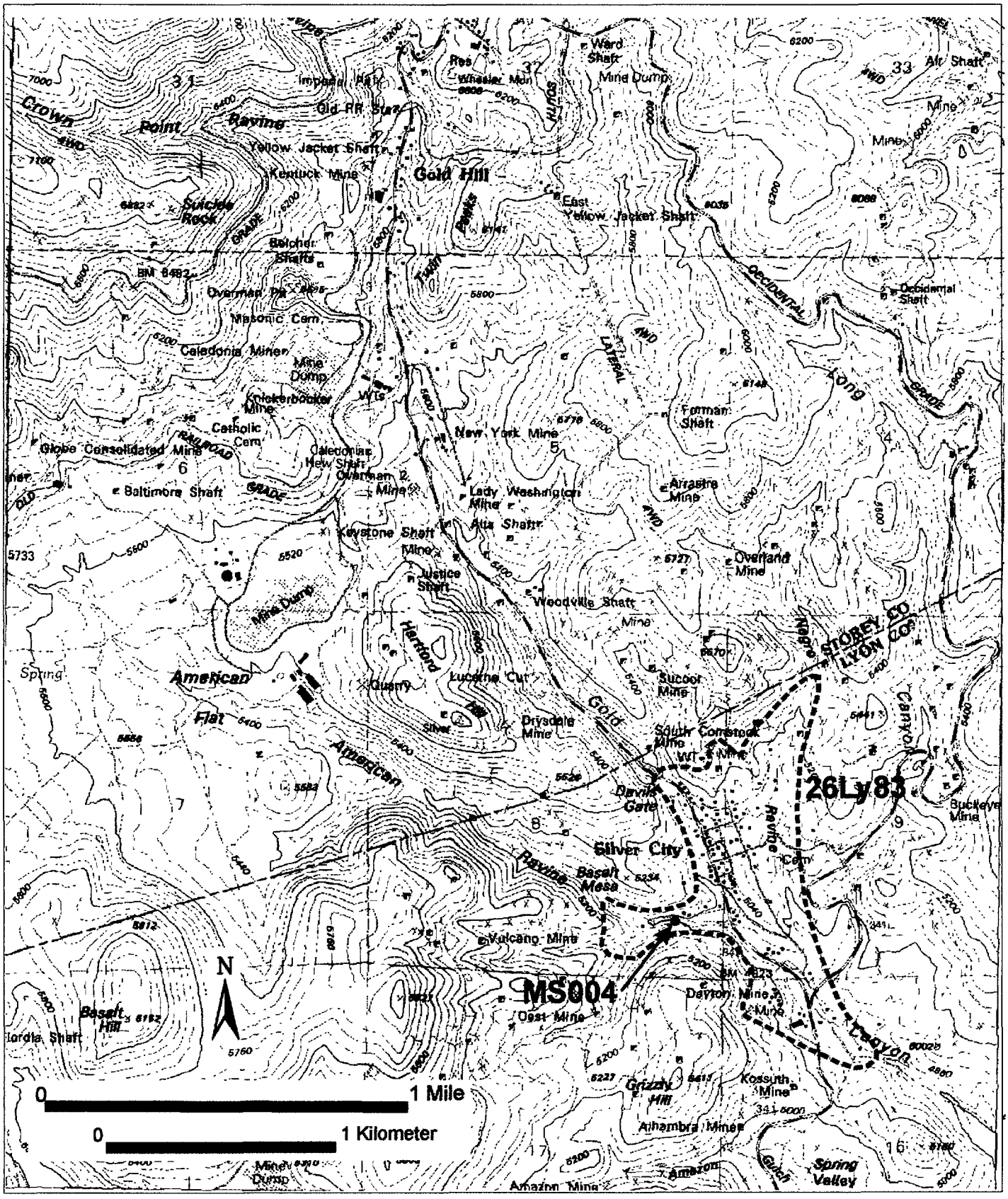


General Stratigraphic Descriptions.

1 Mixed age trash deposit, covers much of site surface, up to 2 m deep in places.
2 10YR6/4 light yellowish brown (dry); silty clay loam; massive; slightly sticky, slightly plastic, dry slightly hard; common roots, krotovina; abrupt smooth boundary; tailings deposit.
3 10YR2/1 black to brown (dry); organic-rich loam; massive; non-sticky, non-plastic, dry soft; common log fragments and most common bark fragments from Ponderosa pine, some appears burned, most rotted, 15 cm thick; abrupt smooth boundary; historic wood storage area.
4 Cobbly to bouldery alluvium; massive deposit above bedrock; placer tails.
5 Colluvial slope deposit; angular cobbles in loam to clay loam; boundary unknown.
6 Local bedrock in drainage base.

Period	Matrix	Description
1860-1960s	1	Mixed Historic Trash
1861-1874	2	Mill Tailings: Silver City Mill 1861-1864; Union Mill 1861-1874
1873-1880	3	Wood Storage, V&T RR; Silver City Spur
1850s	4	Placer Mining
	5	Colluvial Slope
	6	Bedrock

Stratigraphic profile, Harris matrix, and photograph at Silver City site MS030



Base Map: USGS 7.5' Virginia City, Nev.

Site location map for Silver City Site 26Ly83.

1990

IMACS ENCODING FORM

To be completed for each site form.
For instructions and codes, see IMACS Users Guide.

Encoder's Name D. Cobbey

A

1 [illegible] - [illegible] - [illegible] State Site Number

2 03 - 01608 Agency Site Number

6 Agency Report Number

10 05100 Elevation

11 Zone: 11, 11, 11, 11 — Easting: 272000, 271780, 272420, 272940 — Northing: 4349540, 4348980, 4349980, 4348260

12 1/4: NE, SE, NW, NW — 1/4: SE, NW, NW, SE — 1/4: NE, NW, NW, SE — Sec.: 08, 09, 16, 08 — T.: 16 N, 16 N, 16 N, 16 N — R.: 021 E, 021 E, 021 E, 021 E

13 7 Merid.

14 VIRGINIA CITY NV 75' USGS Map

17 PR Owner

18 Forest Dist./Park

19 Loc. Curated Materials

21 B Cond.

22 PR Impacts

23 C N.R.

26 SY Organ.

28 08 - - 98 Survey Date

29 08 Slope 025 Aspect

30 002 B Water: distance/type

31 BND Geog. Unit

32 E 1st 2nd Topographic Location

33 D Dep.

34 E PPL 1 2 3 Vegetation

35 SILVER CITY #17NDOTLYONCO Misc. Text, Site Name

B

2 Culture/Dating Method

3 Area

4 Collect

5 Depth

6 Excav. Status

7 Prehistoric Artifacts

8 Lithic Tools: # / type

9 # Flaking Stages

11 Ceramics: # / type

13 Features: # / type

14 Architecture: # / material / type

C

2 MN RT Historic Themes

3 EAI Cultures / Dating Method

4 1850 1870 Dates

5 99998 Area

6 A Collect.

7 F Depth

8 A Excav. Status

9 Artifacts: GL, ME, NA, BO, CE, LE, WI, CN, WE

14 ZMT ZML ZOT Features: # / type

15 Ø Architecture: # / material / type

PART A - ADMINISTRATIVE DATA

Intermountain Antiquities Computer System

***1. State No:** 26Ly938
***2. Agency No:**
3. Temp. No:

4. **State:** Nevada **County:** Lyon
5. **Project:** Carson River Mercury project (ARS 978/Summit 1375-001)
* 6. **Report No:**
7. **Site Name:** Lincoln Highway
8. **Class:** Historic
9. **Site Type:** Historic Highway
* 10. **Elevation:** 4380 ft
* 11. **UTM Grid Zone:** 11 246240 **mE** 4345500 **mN**
* 12. SW/SW/SE1/4 **of Section** 23, **T.**16N **R.**21E
* 13. **Meridian:** Mt. Diablo
* 14. **Map Reference:** USGS Dayton, Nev. Prov. Ed. 1987
15. **Aerial Photo:**
16. **Location and Access:** This segment of the Lincoln Highway is located at the southwestern end of Dayton. On US Highway 50 driving from Carson City to Dayton, take the River Street exit by the roadside park. River Street is the first exit on the left (north) against the hillside. The abandoned segment of the Lincoln Highway is immediately to the west and originally was part of what is now the US 50 route.
* 17. **Land Owner:** State of Nevada
* 18. **Fed. Admin. Units:** N/A
* 19. **Location of Curated Materials:** N/A
20. **Site Description:** An abandoned section of the Lincoln Highway that extends beyond the southwestern end of River Street before it joins with Highway 50 is a decayed two-lane, asphalt covered road with run-off channels on both sides. The Lincoln Highway was one of the first transcontinental road and the foundation of the developing national system of interstate highways (Protteau 1984). The Lincoln Highway Association was organized in 1913 to promote an automobile route across the United States from New York to San Francisco — a coast to coast highway without toll charges. The highway was planned and almost entirely constructed prior to congressional highway legislation. Funding was provided by pledges to be used for building materials from major automobile manufacturers and parts suppliers such as General Motors, U.S. Tire Company, and Prest-O-Lite batteries. The association deployed a 1913 tour to determine the route, promote the highway, and solicit the aid of states in constructing the road (Lincoln Highway Association 1935). Nevada was on the list of states to cross on the tour. The State legislature, which had been debating the merits of creating a department of highways and methods of highway funding, appropriated $25,000 to improve the road from the Utah to California lines for the 1913 tour. For the next several years Nevada continued to wrestle with a program of financing and routing roads. The Lincoln Highway Association basically was no longer needed with the enactment of the Federal Road Act of 1916 and the creation of the Federal Highway system; the association was dissolved in 1928. A detailed discussion of the Lincoln Highway Association is presented in the association's book (1935).

The Lincoln Highway initially was routed to Reno through Wadsworth from Fallon with a separate section linking Reno to Carson City and then up to Lake Tahoe. The construction of the Victory Highway changed the routing of the Lincoln Highway. An alternate route that became known as the Pioneer Branch and later State Route 2A, linked Fallon to Carson City through Dayton meeting the highway to Lake Tahoe. In 1934, the highway through Dayton was rerouted and paved (Bert Bedeau pers.com.2000). According to 1932 State of Nevada Department of Highways plans, the reroute mainly eliminated a 90 degree turn onto Main Street from River Street and a 90 degree turn onto Pike Street from Main Street, but still employed downtown streets of Dayton as the thoroughfare. Highway 50 is the designation of the Lincoln Highway as part of the 1926 federal highway numbering system. Realignments of Highway 50 through Dayton occurred in the 1950s eliminating travel through downtown Dayton and on portions of the Lincoln Highway.

PART A - ADMINISTRATIVE DATA

***1. State No:** 26Ly938
***2. Agency No:**
3. Temp. No:

* **21. Site Condition (A-excellent; B-good; C-fair; D-poor):** Poor

* **22. Impact Agents:** Highway Construction (HC), Erosion

* **23. Nat. Register Status (C-significant; D-non-significant; Z-unevaluated):** Non-significant

Justify: The Lincoln Highway is significant for the role it played in Nevada's history, particularly the economy. As a well-developed highway system, it can be associated with the thematic units pertaining to mining and milling, farming and ranching, transportation and communication, commerce (especially tourism), settlement, ethnic relations, the military, and the landscape. The highway is potentially significant under criterion a on the national, state, and local levels for association with important events that have contributed to broad patterns of history. The highway is also associated with the lives of significant people such as Carl Fisher, the founder of the Lincoln Highway Association [LHA], and Gael Hoag, the General Secretary of LHA from Ely; thereby, the highway may be significant under criterion b.

The integrity of the past and present roadbed relates to the extent the road segment is able to convey its significance in automobile travel during the 20th century. The pre 1932 road and the new one are on top of one another at the location of the trench in the study area. Due to the necessity of adding fill in this area, the old road surface, along with its irregular gravel subgrade, have been preserved intact and were observed in the profile. The difference between an engineered road versus a vernacular type is clear from the profile description. In one case there is strict adherence to plan and in the other there is the non-linear form derived from dumping and packing gravel into soft spots, mudholes, or ruts when required. Like so much of the Dayton area, the Lincoln Highway has joined the underground archaeological record as the town has been systematically raised above the periodic waters of the Carson River floodplain. Therefore, the surface integrity of design, material, workmanship, feeling, and association have all been compromised by subsequent road improvements. The setting has been lost with the changes in the area such as the development of the roadside park and construction of US 50. Only the location appears to remain intact.

This segment of the highway is recommended as a non-contributing element to the significance of the the Lincoln Highway.

24. Photos: Roll 970-6, fr. 19; Roll 970-8, fr. 0

25. Recorded by: B. Mackey

* **26. Survey Organization:** Summit Envirosolutions/Archaeological Research Services, 813 N. Plaza St., Carson City, NV89701

27. Assisting Crew Members: R. Reno, V. Clay

* **28. Survey Date:** 1-8 Nov 1999

List of Attachments: **Part C** **Topo Map**
Photos

PART A - ENVIRONMENTAL DATA

Site No: 26Ly938
Agency No:
Temp. No:

* **29. Slope:** 0-5 **(degrees)** **Aspect:** 33-247 **(degrees)**

* **30. Distance to Permanent Water:** 11 **x 100 Meters**
Type of Water Source (A-spring/seep; B-stream/river; C-lake; D-other): River
Name of Water Source: Carson River

* **31. Geographic Unit:** Dayton Valley (BND)
* **32. Topographic Location:**
Primary Landform: Valley (E) **Secondary Landform:** Terrace (R)
Describe: The road hugs the base of the hills at the edge of the valley.

* **33. On-site Depositional Context:** Alluvial (H)
Description of Soil: Below road bed – dark brown loam.

* **34. a. Life Zone: Upper Sonoran**
b. Community: **Primary On-Site:** Big sagebrush (P)
Secondary On-Site: Agricultural fields (U)
Surrounding Site: Riparian (L)
Describe: Riparian at Carson River, agricultural fields along SW edge of Carson Plains, big sagebrush on hillslopes. Associated plants in project area are big sagebrush, desert peach, cheatgrass, and perennial grasses.

* **35. Miscellaneous Text:**

36. Comments/Continuations/Location of Curated Materials and Records:

Protteau, Lyn
1984 *The Complete Official Road Guide of the Lincoln Highway*. Pleiades Press, Sacramento, California. Reprinted from original 1916 guide, Lincoln Highway Association, Detroit, Michigan.

Reno, Ronald L. and Vickie L. Clay
1996 *Archaeological Evaluation of the Carson River Mercury site at Dayton and Silver City, Nevada*. Prepared for Ecology and Environment, Inc. Archaeological Research Services, Inc., Virginia City, Nevada.

The Lincoln Highway Association
1935 *The Lincoln Highway: The Story of a Crusade that Made Transportation History*. Dodd, Mead, and Company, New York.

PART C - HISTORIC SITES

Site No: 26Ly938
Agency No:
Temp. No:

1. **Site Type:** Historic Highway
* 2. **Historic Theme(s):** Transportation
* 3. **Culture Affiliation:** American **Dating:** Historic Record
* 4. **Oldest Date:** early 1920s **Recent Date:** before 1956
How Determined?: Nevada was the last section to be completed sometime in the early 1920s. The segment through Dayton was abandoned prior to 1956 and the construction of US 50.
* 5. **Site Dimensions: *Area: sq m**
* 6. **Surface Collection/Method: (A-none; B-grab sample; C-designed sample; D-complete collection): Sampling Method:** A-none
* 7. **Estimated depth of fill: (A-surface; B-0-20 cm; C-20-100 cm; D-100 cm +; E-fill noted but unknown; F-depth suspected but not tested):** C-20-100 cm
How Estimated (if tested, show location on site map): Trenched
* 8. **Excavation Status: (A-excavated; B-tested; C-unexcavated):** A-excavated
Testing Method: The trench is oriented north-south and cuts the northeast-southwest trending roadbed on a bias creating a much longer profile than if the trench had cut the road at a perpendicular angle.
* 9. **Summary of Artifacts and Debris:**
Describe: None
* 10. **Ceramic Artifacts:**
Paste Glaze/Slip Decoration Pattern Vessel Forms No.
***a. Estimated No. of Ceramic Trademarks:**
Describe:
* 11. **Glass: Quantity Manufacture Color Function Trademarks Decoration**
Describe:
12. **Maximum Density-#/sq m (glass and ceramics):**
* 13. **Tin Cans: Type Opening Size Modified Label/Mark Function**
Describe:
* 14. **Landscape and Constructed Features (locate on site map):** Trail/Road (TR)
Describe: The abandoned segment of the Lincoln Highway intersected by the project provided an interesting juxtaposition between recorded history and the archaeological record. According to 1932 NSDH plans and profiles of the proposed state highway federal aid project in Lyon County, the centerline aligns with the segment in the project area. The excavated trench matches the finished graveled section proposed for that segment in 1932. The trench strata, however, indicate the finished oiled section for proposed future construction was never done, instead, the gravel was covered with an asphalt layer when paved in about 1934. Alternately, the gravel base may have been oiled and this material may have completely leached away. Road construction and subsequent maintenance and improvement are continuous activities. This segment was undoubtably maintained by chip sealing (resurfaced with a combination of fine gravel and oil) and possibly resurfaced during its 24 year period of use prior to abandonment in 1956.

Below the asphalt, the six inches of gravel base observed indicates close adherence to planned specifications. Below the base the two feet of fill also fits precisely the amount of fill specified in the section at the top. This fill was important here to raise the road above a swampy area plotted on the road plan.

PART C - HISTORIC SITES

Site No: 26Ly938
Agency No:
Temp. No:

15. **Buildings and Structures (locate on site map):**
 # Material Type # Material Type
Describe:

16. **Comments/Continuations: (Please make note of any Historic Record searches performed (for example - County Records, General Land Office, Historical Society, Land Management Agency Records, Oral Histories/Interviews)** NDOT Records, Carson City, NV.
Bert Bedeau-Comstock Historic District, telephone interview, 2000.

Summit Envirosolutions, Inc.
2000 *Supporters of the Comstock: Historical Archaeology of the Carson River Mercury Site, Dayton and Silver City, Nevada.* Carson City, Nevada.

Overview of abandoned segment of US Hwy 50 before trenching (Roll 970-6, fr.19)

View toward Dayton on abandoned segment of US Hwy 50 (Roll 970-8, fr 0)

1990

IMACS ENCODING FORM

To be completed for each site form.
For instructions and codes, see IMACS Users Guide.

Encoder's Name D. Cobbey

A

1 [illegible] - [illegible] - [illegible] State Site Number

2 [ ] - [ ] Agency Site Number

6 [ ] Agency Report Number

10 04380 Elevation

11 11 Zone; 246242 Easting; 4345500 Northing

12 SW 1/4; SW 1/4; SE 1/4; 23 Sec.; 16 N T.; 021 E R.

13 7 Merid.

14 DAYTON NV 7.5' 1987 USGS Map

17 ST Owner

18 [ ] Forest [ ] Dist./Park

19 [ ] Loc. Curated Materials

21 D Cond.

22 HC [ ] Impacts

23 D N.R.

26 SY Organ.

28 11 - 01 - 99 Survey Date

29 03 Slope; 200 Aspect

30 [illegible] B Water: distance/type

31 BND Geog. Unit

32 E 1st; R 2nd Topographic Location

33 H Dep.

34 E 1 2 3 Vegetation

35 [ ] Misc. Text, Site Name

B

2 [ ] Culture/Dating Method

3 [ ] Area

4 [ ] Collect

5 [ ] Depth

6 [ ] Excav. Status

7 [ ] Prehistoric Artifacts

8 [ ] Lithic Tools: # / type

9 [ ] # [ ] Flaking Stages

11 [ ] Ceramics: # / type

13 [ ] Features: # / type

14 [ ] Architecture: # / material / type

C

2 TR Historic Themes

3 [ ] Cultures / Dating Method

4 1920 1956 Dates

5 [ ] Area

6 A Collect.

7 C Depth

8 A Excav. Status

9 [ ] Artifacts

14 [illegible] Features: # / type

15 [ ] Architecture: # / material / type

IMACS SITE FORM

PART A - ADMINISTRATIVE DATA

Intermountain Antiquities Computer System

***1. State No:** 26Ly939
***2. Agency No:**
3. Temp. No:

4. **State:** Nevada **County:** Lyon
5. **Project:** Carson River Mercury Project (ARS 978/Summit 1375-001)
* 6. **Report No:**
7. **Site Name:** Rose Ditch (Reese Ditch, Chinese Ditch, Birdsall Ditch, Douglass Ditch, Dayton Town Ditch)
8. **Class:** Historic
9. **Site Type:** Ditch
* 10. **Elevation:** 4420 ft at dam; 4400 ft at reservoir
* 11. **UTM Grid Zone:** 11 273440 **mE** 4342020 **mN** at dam
276220 **mE** 4345580 **mN** at project diversion
276140 **mE** 4345880 **mN** at reservoir
* 12. NE/NW/NE 1/4 of **Section** 4 **T.**15N **R.**21E at dam
NE/SE/SW 1/4 of **Section** 23 **T.**16N **R.**21E at project diversion
SE/NE/SW 1/4 of **Section** 23 **T.**16N **R.**21E at reservoir
* 13. **Meridian:** Mt. Diablo
* 14. **Map Reference:** Dayton 7.5' 1987; New Empire 7.5' 1982
15. **Aerial Photo:** N/A
16. **Location and Access:** The project area is on the portion of the ditch immediately upslope (west) of the southern end of the town park where River Street meets US Hwy 50.
* 17. **Land Owner:** Multiple, including Lyon County, State of Nevada, and Private.
* 18. **Fed. Admin. Units:** None known (but entire ditch alignment not checked).
* 19. **Location of Curated Materials:** None
20. **Site Description:** The Rose Ditch formerly carried water from the Carson River to the mouth of Gold Canyon above Dayton . This ditch runs along the upper end of the Birdsall Mill and constitutes a separate APE for the EPA Carson River Mercury Project since a diversion and culvert was installed to keep floodwater from flowing over the MS004 area from the abandoned ditch. Although cleaning out the ditch above MS004 (the Birdsall Millsite) was considered, this course of action was rejected in favor of the diversion. The Rose Ditch is a prominent feature on the hillside south of town above the west side of US Hwy 50. It is largely intact over its 3.4 mile course from its diversion in the Carson River northeast to its terminus at a reservoir on the outskirts of Dayton.
* 21. **Site Condition (A-excellent; B-good; C-fair; D-poor):** Good
* 22. **Impact Agents:** Highway construction, improvement projects, erosion.
* 23. **Nat. Register Status (C-significant; D-non-significant; Z-unevaluated)**: Significant
Justify: The site is considered significant under Criterion a as the first major water development project used to develop the Gold Canyon placers. Also significant as the first documented project to use Chinese labor in Nevada, serving to introduce this group into a lasting association with placer mining in the area and into the local communities, particularly Dayton – that used to be called Chinatown.
Note: This evaluation does not apply to the portion of the ditch at its point of diversion, which was not examined.
24. **Photos:** Roll 970-6, fr 7,10,18,21,23,24; Roll 970-7, fr 11,16; Roll 970-8, fr 1,3; Roll 978-RD, fr 17,18
25. **Recorded by**: R. Reno
* 26. **Survey Organization:** Summit Envirosolutions/Archaeological Research Services, 813 North Plaza Street, Carson City, NV 89701
27. **Assisting Crew Members**: B. Mackey, V. Clay
* 28. **Survey Date:** 1-8 Nov 1999
List of Attachments: **Topo Map**
Part C
Artifact/Feature Sketch
Photos

PART A - ENVIRONMENTAL DATA

Site No: 26Ly939
Agency No:
Temp. No:

* 29. **Slope:** Multiple **(degrees)** **Aspect** Multiple **(degrees)**

* 30. **Distance to Permanent Water: 0 x 100 Meters**
Type of Water Source (A-spring/seep; B-stream/river; C-lake; D-other): River
Name of Water Source: Carson River

* 31. **Geographic Unit:** Dayton Valley (BND)
* 32. **Topographic Location:**
Primary Landform: Valley (E) **Secondary Landform:** Terrace (R)

Describe: Site originates in bed of Carson River, follows alluvial terraces, fans, and hillslopes.

* 33. **On-site Depositional Context:** Alluvium (A)
Description of Soil:

* 34. **a. Life Zone: Upper Sonoran**
b. Community: **Primary On-Site:** Tall sagebrush (P)
Secondary On-Site: Agricultural fields
Surrounding Site: Riparian (L)

Describe: Riparian at Carson River, agricultural fields along SW edge of Carson Plains, Tall sagebrush on hillslopes. Associated plants in project area are tall sagebrush, desert peach, cheatgrass, and perennial grasses.

* 35. **Miscellaneous Text:**

36. **Comments/Continuations/Location of Curated Materials and Records:**

Detailed notes for ditch remains at project location on file at Summit Envirosolutions, Carson City, Nevada.

PART C - HISTORIC SITES

Site No: 26Ly939
Agency No:
Temp. No:

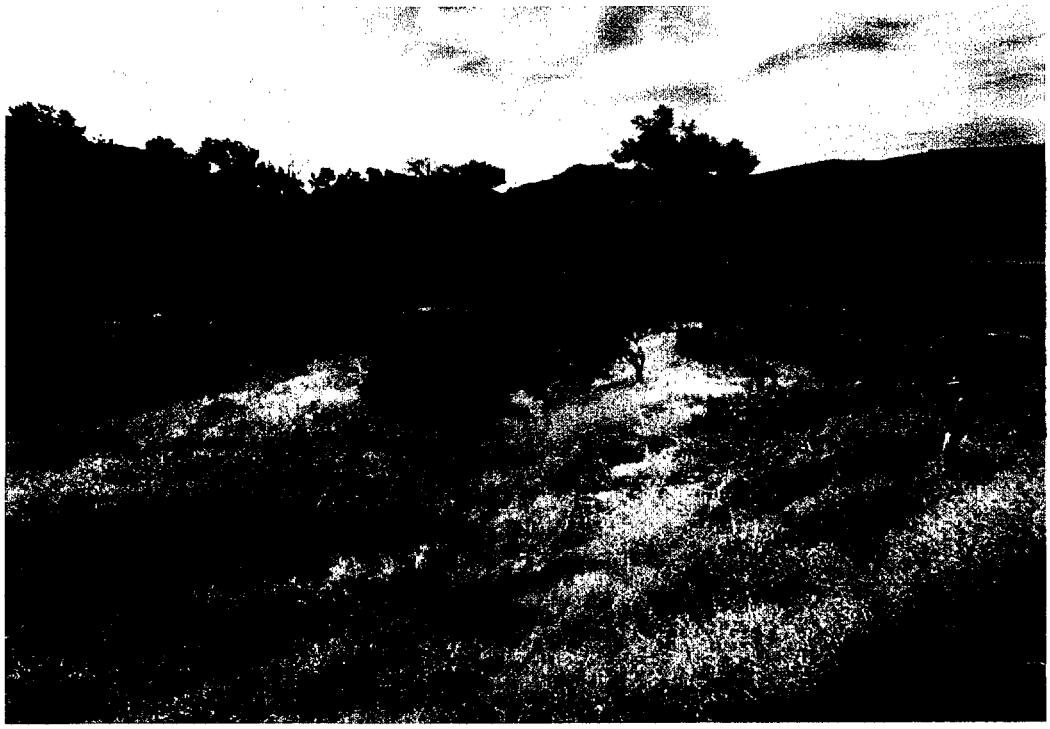
1. **Site Type:** Ditch
* 2. **Historic Theme(s):** Irrigation (WW); Mining (MN); Urban development (PL)
* 3. **Culture:**
Affiliation: Chinese (CH) **Dating:** Historical Record (I)
Affiliation: Euro-American (EA) **Dating:** Historical Record (I)
* 4. **Oldest Date:** 1856 **Recent Date:** 1970s
How Determined?: Original construction to abandonment documented.
* 5. **Site Dimensions:** 5,472 m (3.4 mi) x 20 m ***Area:** 109,440 **sq m**
* 6. **Surface Collection/Method: (A-none; B-grab sample; C-designed sample; D-complete collection):** None
Sampling Method:
* 7. **Estimated depth of fill: (A-surface; B-0-20 cm; C-20-100 cm; D-100 cm +; E-fill noted but unknown; F-depth suspected but not tested):** 100 cm +
How Estimated (if tested, show location on site map): Trench through berm.
* 8. **Excavation Status: (A-excavated; B-tested; C-unexcavated):** Tested
Testing Method: Recording of construction-related mechanical cut through berm (location shown on site map).
* 9. **Summary of Artifacts and Debris:** Only architectural materials, see feature description.
Describe:
* 10. **Ceramic Artifacts:**
Paste Glaze/Slip Decoration Pattern Vessel Forms No.
***a. Estimated No. of Ceramic Trademarks:**
Describe:
* 11. **Glass:**
Quantity Manufacture Color Function Trademarks Decoration
Describe:
12. **Maximum Density-#/sq m (glass and ceramics):**
* 13. **Tin Cans:**
Type Opening Size Modified Label/Mark Function
Describe:
* 14. **Landscape and Constructed Features (locate on site map):** Ditch; Reservoir.
Describe: The Rose Ditch remains a prominent landscape feature above the highway when approaching Dayton from the south. The diversion dam in the Carson River and southern mile of the ditch were not revisited. The ditch is fairly intact where it runs through agricultural property between the Carson River and the point where it reaches the present US Hwy 50 ROW fence (photos with this form are reproduced from the report and use the same numbering system as that document). In this area the ditch has symmetrical berms due to the nearly level ground that is traversed. The ditch has been obliterated within the US Hwy 50 ROW by construction of the four-lane highway. Despite this, there is no mention of the ditch in archaeological inventories done before this section of road was expanded to four lanes (Moore 1981).
The reservoir is an earth-berm basin on the edge of Gold Canyon above town.
15. **Buildings and Structures (locate on site map):** Diversion dam (BQ)

#	Material	Type	#	Material	Type
1	Wood (C)	Dam			

Describe: A wooden diversion dam (Fea A-3) has been placed across the ditch at the southeast end of the MS004 area. Stormwater from the southeast hits this diversion and spills downslope in an unimproved gully leading to a culvert under River Street.
16. **Comments/Continuations: (Please make note of any Historic Record searches performed (for example - County Records, General Land Office, Historical Society, Land Management Agency Records, Oral Histories/Interviews)**
Records searched at Lyon County Courthouse, Nevada State Library and Archives, State Engineers Office, Nevada Historical Society, Nevada State Museum, Nevada Department of Transportation.

Moore, J.
1981 *US 50 Overlay, E.A. 71069.* Cultural Resources Report NDOT-095-81C (NSM Report 18-144). Nevada State Department of Transportation, Carson City.

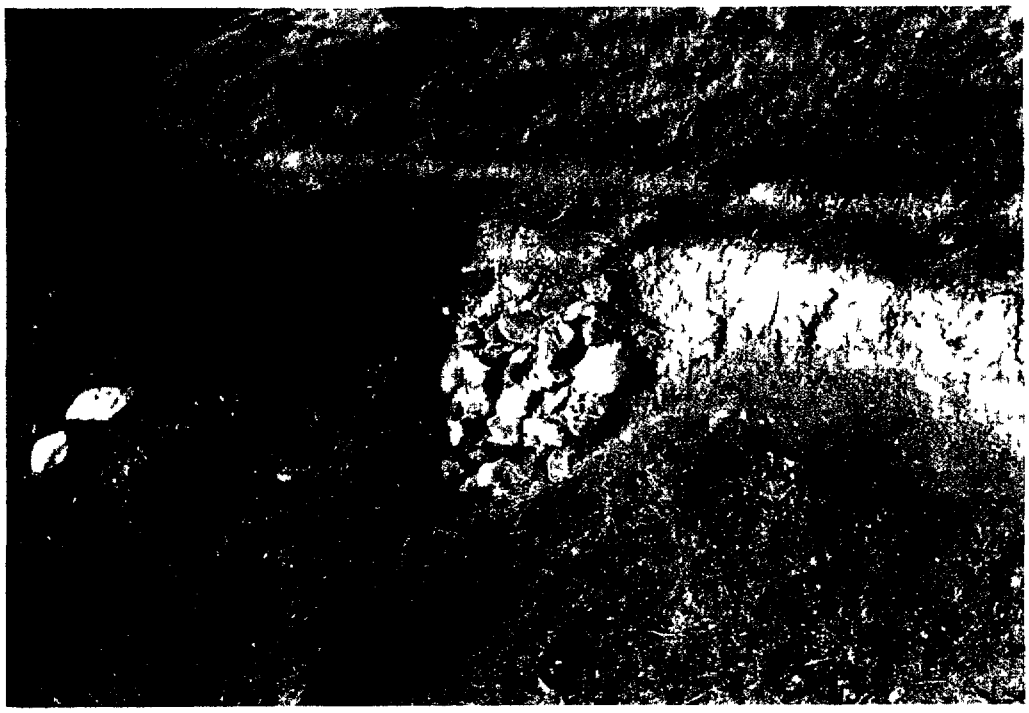
Summit Envirosolutions, Inc.
2000 *Supporters of the Comstock: Historical Archaeology of the Carson River Mercury Site, Dayton and Silver City, Nevada.* Carson City, Nevada.



Portion of the Rose Ditch south of U.S. Hwy 50 (Roll 970-8, fr.1).

Start of northeast portion of the Rose Ditch (at tree) from U.S. Hwy 50 (Roll 970-8, fr.3).

Typical hillside segment of the Rose Ditch southwest of Dayton. Rock retaining wall is revealed by berm collapse (Roll 978-RD, fr 18)

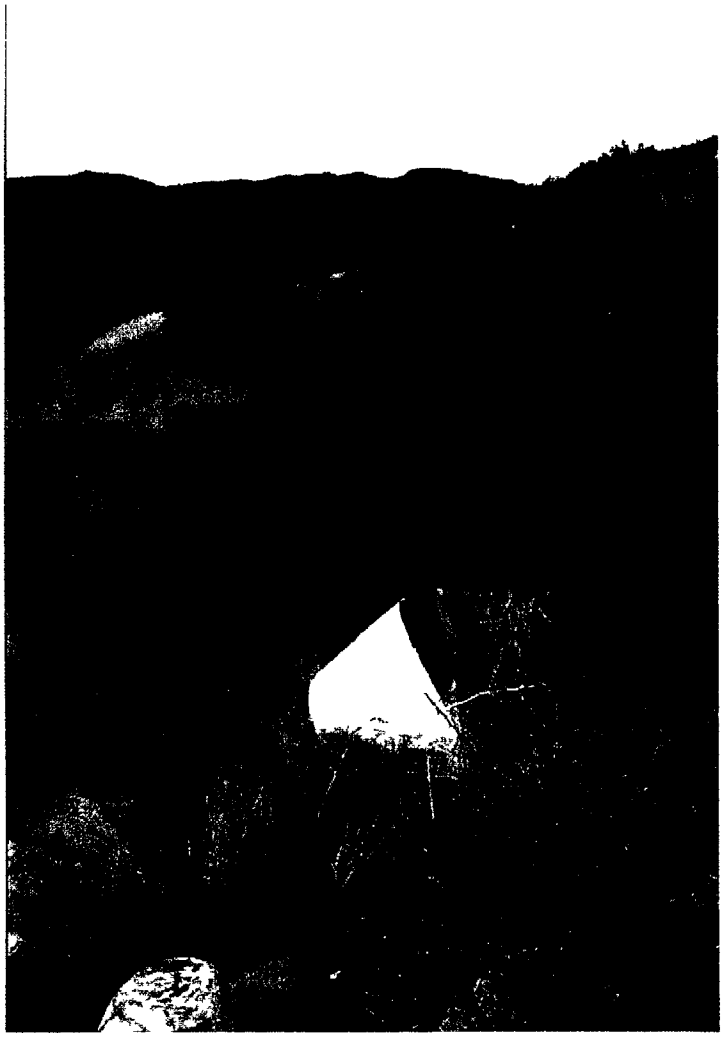


Rock retaining wall in the Rose Ditch revealed by berm collapse (Roll 978-RD, fr 17)

Rose Ditch southwest of Dayton. Project diversion is in the gully in center of photo (Roll 970-6,fr 21)

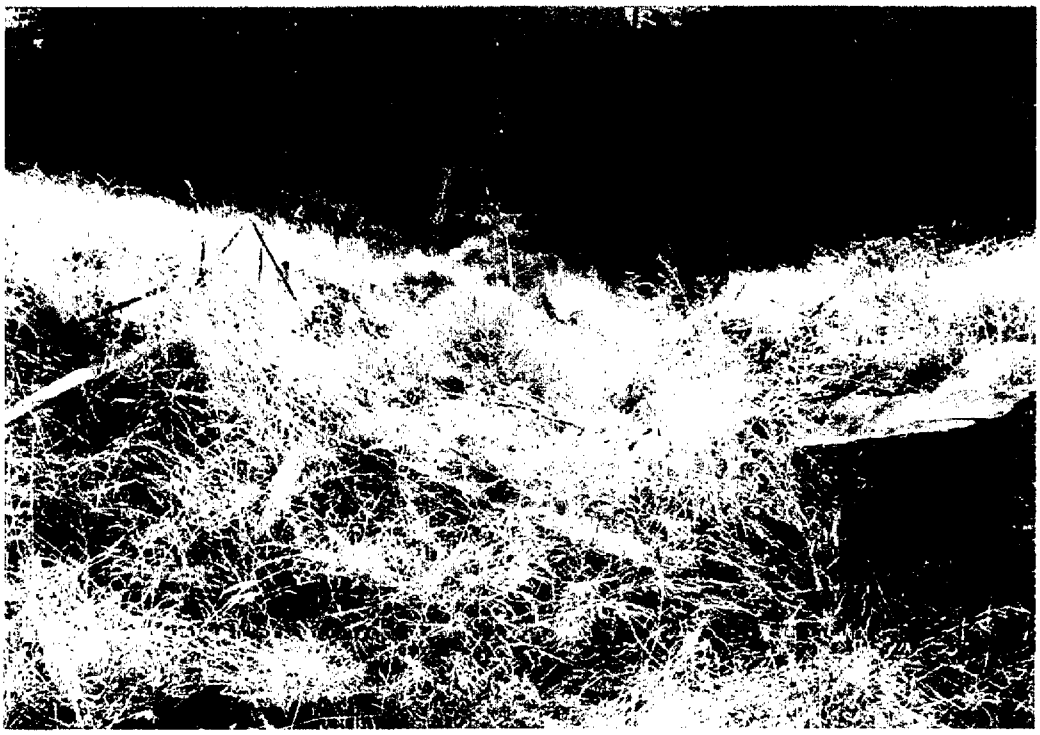
Detail of location selected for diversion and culvert (Roll 970-6, fr 18)

Erosional damage to Rose Ditch berm southwest of Dayton (Roll 970-6, fr.23).



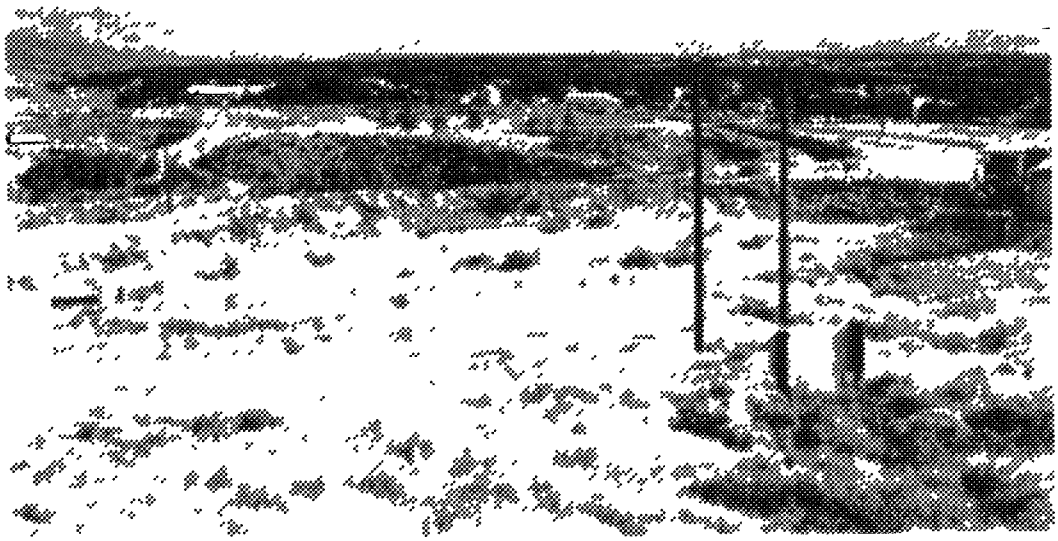
Typical segment of Rose Ditch above the Birdsall Mill (Roll 970-7, fr 11)

Modern storm water diversion dam in the Rose Ditch southwest of the Birdsall Mill (Roll 970-6, fr.7).



Gully below modern storm water diversion dam in the Rose Ditch southwest of the Birdsall Mill (Roll 970-6,fr.10).

Terrace or road above the Rose Ditch (visible at lower right) above the Birdsall Mill close to portion of ditch bladed away for house lot (Roll 970-7,fr 16)



Reservoir at the northern terminus of the Rose Ditch (Roll 970-6, fr 27)

APPENDIX B

SEDIMENT AND CHEMICAL ANALYSES

INSPECTORATE

ROCKY MOUNTAIN GEOCHEMICAL

A MEMBER OF THE INSPECTORATE GROUP OF COMPANIES

840 GREG STREET • SPARKS, NEVADA 89431 • PHONE (775) 359-6311 • FAX (775) 359-2944

Certificate of Analysis

DATE: Friday, June 16, 2000

JOB NO: 100-13-95

CLIENT: Summit Envirosolutions
813 North Plaza Street
Carson City, NV 89701 USA

INVOICE NO: 33002195

CLIENT ORDER NO:

REPORT ON: 27 Soils

SUBMITTED BY: Ron Reno

DATE RECIEVED: Tuesday, June 13, 2000

ANALYSES: Gold, Silver

ANALYTICAL METHODS: AA, Fire Assay / AA Finish, Fire Assay/Gravimetric

REMARKS: Project #: 978

CC: RMG File

E-MAILED TO:

All values are reported in parts per million unless specified otherwise. A minus sign (–) is to be read "less than" and a plus sign (+) "greater than." Values in parenthesis are estimates. This analytical report is the confidential property of the above mentioned client and for the protection of this client and ourselves we reserve the right to forbid publication or reproduction of this report or any part thereof without written permission.

ND=None Detected *1 ppm=0.0001%* *Troy oz./ton=34.286 ppm* *1 ppm=0.0292 Troy oz./ton*

The results of this assay were based solely upon the content of the sample submitted. Any decision to invest should be made only after the potential investment value of the claim or deposit has been determined based on the results of assays of multiple samples of rocks or minerals collected by the prospective investor or by a qualified person selected by him.

SAMPLE NO	ppb Gold	ppm Silver	ppm Silver
S-1	11450	500	+200.0
S-2	4680	252	+200.0
S-3	2010		59.0
S-5	1162		35.3
S-6	422		9.1
S-7	708		82.0
S-8	1320		44.0
S-9	3375	314	+200.0
S-10	5040	339	+200.0
S-11	812		27.0
S-12	1922		65.0
S-13	2028		53.0
S-14	3622	278	+200.0
S-15	2440		40.6
S-16	2128		30.9
S-17	18547	349	+200.0
S-18	450		12.6
S-19	4230	262	+200.0
S-20	5020		131.0
S-21	2103	7073	+200.0
S-22	1018		35.5
S-23	951		38.0
S-24	2115		58.0
S-25	2194		43.0

SAMPLE NO	ppb Gold	ppm Silver	ppm Silver
S-26	456		21.4
S-27	3229		161.0
S-28	13713	490	+200.0

Laboratory Analysis Report

Sierra Environmental Monitoring, Inc.

Summit Envirosolutions
Attn: Ron Reno
813 N. Plaza St.
Carson City, NV 89701

Date: 06/23/2000
Client: SME-600
Taken by: R. Reno
Report: 35372
PO #: ARS 978

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0439	S 1	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	50	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	16	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	1.1	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	77000	mg/Kg	0.3	Lambert	06/21/2000
Iron - ICP-OES	EPA 200.7	30000	mg/Kg	25	Jones	06/13/2000
Mercury - AA Cold Vapor	EPA 245.5	150	mg/Kg	0.2	Jones	06/19/2000

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0440	S 2	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	70	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	27	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0.35	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	4200	mg/Kg	0.3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	29000	mg/Kg	25	Jones	06/13/2000
Mercury - AA Cold Vapor	EPA 245.5	240	mg/Kg	0.2	Jones	06/19/2000

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Laboratory Analysis Report

Sierra Environmental Monitoring, Inc.

Summit Envirosolutions
Attn Ron Reno
813 N Plaza St
Carson City, NV 89701

Date: 06/23/2000
Client: SME-600
Taken by: R Reno
Report: 35372
PO #: ARS 978

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0441	S 3	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200 7	71	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300 0	22	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335 2	< 1 0	mg/Kg	1 0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200 2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0 02	%	0 01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200 8	1200	mg/Kg	0 3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200 7	20000	mg/Kg	25	Jones	06/13/2000
Mercury - AA Cold Vapor	EPA 245 5	460	mg/Kg	0 2	Jones	06/19/2000

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0442	S 5	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200 7	87	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300 0	93	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335 2	< 1 0	mg/Kg	1 0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200 2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0 84	%	0 01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200 8	49000	mg/Kg	0 3	Lambert	06/21/2000
Iron - ICP-OES	EPA 200 7	23000	mg/Kg	25	Jones	06/13/2000
Mercury - AA Cold Vapor	EPA 245 5	80	mg/Kg	0 2	Jones	06/19/2000

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PO #: ARS 978

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0443	S 6	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	69	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	85	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0.37	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	16000	mg/Kg	0.3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	19000	mg/Kg	25	Jones	06/13/2000
Mercury - AA Cold Vapor	EPA 245.5	37	mg/Kg	0 2	Jones	06/19/2000

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0444	S 7	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	37	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300 0	18	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1 0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	1.4	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	10000	mg/Kg	0.3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	85000	mg/Kg	100	Jones	06/15/2000
Mercury - AA Cold Vapor	EPA 245.5	21	mg/Kg	0 2	Jones	06/19/2000

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Taken by: R. Reno
Report: 35372
PO #: ARS 978

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0445	S 8	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	77	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	5	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	1.4	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	260	mg/Kg	0.3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	18000	mg/Kg	25	Jones	06/13/2000
Mercury - AA Cold Vapor	EPA 245.5	42	mg/Kg	0.2	Jones	06/19/2000

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0446	S 9	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	56	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	17	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	2.7	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	29000	mg/Kg	0.3	Lambert	06/21/2000
Iron - ICP-OES	EPA 200.7	12000	mg/Kg	25	Jones	06/13/2000
Mercury - AA Cold Vapor	EPA 245.5	290	mg/Kg	0.2	Jones	06/19/2000

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Taken by: R. Reno
Report: 35372
PO #: ARS 978

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0447	S 10	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200 7	<10	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	3	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335.2	< 1 0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0 31	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200 8	160	mg/Kg	0.3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	9900	mg/Kg	25	Jones	06/13/2000
Mercury - AA Cold Vapor	EPA 245.5	390	mg/Kg	0.2	Jones	06/19/2000

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0448	S 11	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	22	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	6	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	2.6	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200 8	2300	mg/Kg	0.3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	49000	mg/Kg	50	Jones	06/15/2000
Mercury - AA Cold Vapor	EPA 245.5	120	mg/Kg	0 2	Jones	06/19/2000

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Taken by: R Reno
Report: 35372
PO #: ARS 978

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0449	S 12	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	16	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	6	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1 0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	1.4	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	2800	mg/Kg	0 3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	32000	mg/Kg	25	Jones	06/13/2000
Mercury - AA Cold Vapor	EPA 245.5	88	mg/Kg	0 2	Jones	06/19/2000

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0450	S 13	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	12	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	3	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335 2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200 2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0.43	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	3600	mg/Kg	0 3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	20000	mg/Kg	25	Jones	06/13/2000
Mercury - AA Cold Vapor	EPA 245.5	110	mg/Kg	0 2	Jones	06/19/2000

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Date: 06/23/2000
Client: SME-600
Taken by: R. Reno
Report: 35372
PO #: ARS 978

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0451	S 14	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	<10	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	3	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0.41	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	1800	mg/Kg	0.3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	19000	mg/Kg	25	Jones	06/15/2000
Mercury - AA Cold Vapor	EPA 245 5	40	mg/Kg	0.2	Jones	06/19/2000

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0452	S 15	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200 7	12	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300 0	6	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335 2	< 1.0	mg/Kg	1 0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	2 2	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	1900	mg/Kg	0.3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	47000	mg/Kg	25	Jones	06/13/2000
Mercury - AA Cold Vapor	EPA 245 5	29	mg/Kg	0 2	Jones	06/19/2000

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Taken by: R Reno
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Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0453	S 16	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200 7	15	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300 0	8	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335 2	< 1 0	mg/Kg	1 0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200 2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0 71	%	0 01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200 8	1700	mg/Kg	0 3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	48000	mg/Kg	25	Jones	06/13/2000
Mercury - AA Cold Vapor	EPA 245 5	40	mg/Kg	0 2	Jones	06/19/2000

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0454	S 17	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200 7	20	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300 0	10	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335 2	< 1 0	mg/Kg	1 0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200 2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0 63	%	0 01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200 8	4700	mg/Kg	0 3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200 7	18000	mg/Kg	25	Jones	06/13/2000
Mercury - AA Cold Vapor	EPA 245 5	130	mg/Kg	0 2	Jones	06/19/2000

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Report: 35372
PO #: ARS 978

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0455	S 18	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200 7	45	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300 0	7	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335 2	< 1 0	mg/Kg	1 0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200 2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0 39	%	0 01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200 8	2700	mg/Kg	0 3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200 7	21000	mg/Kg	25	Jones	06/13/2000
Mercury - AA Cold Vapor	EPA 245 5	33	mg/Kg	0 2	Jones	06/19/2000

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0456	S 19	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200 7	240	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300 0	190	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335 2	< 1 0	mg/Kg	1 0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200 2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0 86	%	0 01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200 8	1000	mg/Kg	0 3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200 7	19000	mg/Kg	25	Jones	06/13/2000
Mercury - AA Cold Vapor	EPA 245 5	230	mg/Kg	0 2	Jones	06/19/2000

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Taken by: R. Reno
Report: 35372
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Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0457	S 20	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	61	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	30	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0.43	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	790	mg/Kg	0.3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	24000	mg/Kg	25	Jones	06/15/2000
Mercury - AA Cold Vapor	EPA 245.5	930	mg/Kg	0.2	Jones	06/19/2000

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0458	S 21	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	57	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	47	mg/Kg	3	Lowe	06/13/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	10.9	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	27000	mg/Kg	0.3	Lambert	06/21/2000
Iron - ICP-OES	EPA 200.7	74000	mg/Kg	100	Jones	06/16/2000
Mercury - AA Cold Vapor	EPA 245.5	43	mg/Kg	0.2	Rivera	06/20/2000

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John C. Seher
Managers

Laboratory Analysis Report

Sierra Environmental Monitoring, Inc.

Summit Envirosolutions
Attn: Ron Reno
813 N. Plaza St.
Carson City, NV 89701

Date: 06/23/2000
Client: SME-600
Taken by: R. Reno
Report: 35372
PO #: ARS 978

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0459	S 22	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	36	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	24	mg/Kg	3	Lowe	06/14/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0.27	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	5000	mg/Kg	0.3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	28000	mg/Kg	25	Jones	06/15/2000
Mercury - AA Cold Vapor	EPA 245.5	62	mg/Kg	0.2	Rivera	06/20/2000

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0460	S 23	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	31	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	16	mg/Kg	3	Lowe	06/14/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0.86	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	12000	mg/Kg	0.3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	80000	mg/Kg	100	Jones	06/16/2000
Mercury - AA Cold Vapor	EPA 245.5	50	mg/Kg	0.2	Rivera	06/20/2000

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Attn: Ron Reno
813 N. Plaza St.
Carson City, NV 89701

Date: 06/23/2000
Client: SME-600
Taken by: R. Reno
Report: 35372
PO #: ARS 978

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0461	S 24	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	26	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	24	mg/Kg	3	Lowe	06/14/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0.33	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	19000	mg/Kg	0.3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	12000	mg/Kg	25	Jones	06/15/2000
Mercury - AA Cold Vapor	EPA 245.5	160	mg/Kg	0.2	Rivera	06/20/2000

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0462	S 25	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	52	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	36	mg/Kg	3	Lowe	06/14/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0.24	%	0 01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	640	mg/Kg	0.3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	20000	mg/Kg	25	Jones	06/15/2000
Mercury - AA Cold Vapor	EPA 245 5	220	mg/Kg	0.2	Rivera	06/20/2000

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Attn: Ron Reno
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Carson City, NV 89701

Date: 06/23/2000
Client: SME-600
Taken by: R. Reno
Report: 35372
PO #: ARS 978

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0463	S 26	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	18	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	7	mg/Kg	3	Lowe	06/14/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0.87	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	25000	mg/Kg	0.3	Lambert	06/21/2000
Iron - ICP-OES	EPA 200.7	290000	mg/Kg	400	Jones	06/16/2000
Mercury - AA Cold Vapor	EPA 245.5	19	mg/Kg	0.2	Rivera	06/20/2000

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0464	S 27	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	11	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	26	mg/Kg	3	Lowe	06/14/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	0.91	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	17000	mg/Kg	0.3	Lambert	06/21/2000
Iron - ICP-OES	EPA 200.7	12000	mg/Kg	25	Jones	06/15/2000
Mercury - AA Cold Vapor	EPA 245.5	86	mg/Kg	0.2	Rivera	06/20/2000

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Laboratory Analysis Report

Sierra Environmental Monitoring, Inc.

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Attn: Ron Reno
813 N. Plaza St.
Carson City, NV 89701

Date: 06/23/2000
Client: SME-600
Taken by: R. Reno
Report: 35372
PO #: ARS 978

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200006-0465	S 28	10/08/1999		06/09/2000

Parameter	Method	Result	Units Of Measure	Detection Limit	Analyst	Date Analyzed
Sodium - ICP-OES	EPA 200.7	27	mg/Kg	10	Faulstich	06/13/2000
Chloride - Ion Chromatography	EPA 300.0	34	mg/Kg	3	Lowe	06/14/2000
Cyanide,Total	EPA 335.2	< 1.0	mg/Kg	1.0	Kobza	06/21/2000
Total Recoverable Metals - Acid	EPA 200.2	Completed			Kleinworth	06/13/2000
Sulfur, Total - LECO Furnace	LECO	<0.01	%	0.01	Hellmann	06/16/2000
Copper - ICP-MS	EPA 200.8	300	mg/Kg	0.3	Lambert	06/20/2000
Iron - ICP-OES	EPA 200.7	8400	mg/Kg	25	Jones	06/15/2000
Mercury - AA Cold Vapor	EPA 245.5	71	mg/Kg	0.2	Rivera	06/20/2000

Approved By: Sierra Environmental Monitoring, Inc **Date:** 6-23-00

This report is applicable only to the sample received by the laboratory. The liability of the laboratory is limited to the amount paid for this report. This report is for the exclusive use of the client to whom it is addressed and upon the condition that the client assumes all liability for the further distribution of the report or its contents.

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CARSON LAB DATA.XLS

		mg/Kg dry weight			Toxicity Characteristic Leaching Procedure (mg/L)			
Sample No	Depth (ft.)	Cyanide Amenable	Cyanide Total	Mercury Total	Mercury	Antimony	Arsenic	Barium
07B		-	-	240	ND (0.02)	-	-	-
11A		-	-	58	ND (0.02)	-	-	-
12A		-	-	360	ND (0.02)	-	-	-
13A		-	-	580	ND (0.02)	-	-	-
13C		-	-	240	ND (0.02)	-	-	-
19A		-	-	240	ND (0.02)	-	-	-
21A		-	-	190	ND (0.02)	-	-	-
22A		-	-	210	ND (0.02)	-	-	-
24A		-	-	320	ND (0.02)	-	-	-
HOT 1		ND (0.011)	ND (0.54)	-		-	-	-
HOT 2		ND (0.012)	ND (0.58)	310		-	-	-
J99-4-01A	0 - 1.5	ND (0.011)	ND (0.54)	95	ND (0.02)	-	-	-
J99-4-01B	1.5 - 3	ND (0.011)	ND (0.56)	110	ND (0.02)	-	-	-
J99-4-06A	0 - 1.5	-	-	200		-	-	-
J99-4-06B	1.5 - 3	-	-	340	ND (0.02)	-	-	-
J99-4-08A	0 - 1.5	ND (0.011)	ND (0.57)	92	ND (0.02)	-	-	-
J99-4-08B	1.5 - 3	ND (0.012)	ND (0.58)	110	ND (0.02)	-	-	-
J99-4-10A	0 - 1.5	-	-	58	ND (0.02)	-	-	-
J99-4-10B	1.5 - 3	-	-	62	ND (0.02)	-	-	-
J99-4-14A	0 - 1.5	ND (0.011)	ND (0.57)	320		-	-	-
J99-4-14B	1.5 - 3	ND (0.011)	ND (0.56)	360		-	-	-
J99-4-16A	0 - 1.5	-	-	9000		-	-	-
J99-4-16B	1.5 - 3	-	-	1900		-	-	-
J99-4-18A	0 - 1.5	ND (0.012)	ND (0.58)	200	ND (0.02)	-	-	-
J99-4-18B	1.5 - 3	ND (0.011)	ND (0.56)	210	ND (0.02)	-	-	-
J99-4-20A	0 - 1.5	-	-	3500		ND (0.030)	ND (0.30)	0.12
J99-4-20B	1.5 - 3	-	-	470		-	-	-
J99-4-23A	0 - 1.5	ND (0.011)	ND (0.56)	180	ND (0.02)	-	-	-
J99-4-23B	1.5 - 3	ND (0.011)	ND (0.56)	240		-	-	-
J99-4-27A	0 - 1.5	-	-	100	ND (0.02)	-	-	-
J99-4-27B	1.5 - 3	-	-	140	ND (0.02)	-	-	-
J99-4-31A	0 - 1.5	ND (0.011)	ND (0.56)	190		-	-	-
J99-4-31B	1.5 - 3	ND (0.011)	ND (0.54)	100	0.02	-	-	-
J99-4-33A	0 - 1.5	-	-	2.7	ND (0.02)	-	-	-
J99-4-33B	1.5 - 3	-	-	ND (1.2)	ND (0.02)	-	-	-
Regulatory Limits (corresponding highlighted samples exceed limits)								
TCLP (mg/L)		NA	NA	NA		NA	5	100
UTS (mg/L TCLP)		NA	NA	NA		2.1	5	7.6
UTS (mg/Kg)		30	590	NA	NA	NA	NA	NA

KEY:
ND - not detected above the reportable quantitation limit shown in parenthesis
" - " - not analyzed
NA - not applicable

CARSON LAB DATA.XLS

Sample No.	Depth (ft.)	Toxicity Characteristic Leaching Procedure (mg/L)						
		Beryllium	Cadmium	Chromium Total	Lead	Nickel	Selenium	Silver
07B		-	-	-	-	-	-	-
11A		-	-	-	-	-	-	-
12A		-	-	-	-	-	-	-
13A		-	-	-	-	-	-	-
13C		-	-	-	-	-	-	-
19A		-	-	-	-	-	-	-
21A		-	-	-	-	-	-	-
22A		-	-	-	-	-	-	-
24A		-	-	-	-	-	-	-
HOT 1		-	-	-	-	-	-	-
HOT 2		-	-	-	-	-	-	-
J99-4-01A	0 - 1.5	-	-	-	-	-	-	-
J99-4-01B	1.5 - 3	-	-	-	-	-	-	-
J99-4-06A	0 - 1.5	-	-	-	-	-	-	-
J99-4-06B	1.5 - 3	-	-	-	-	-	-	-
J99-4-08A	0 - 1.5	-	-	-	-	-	-	-
J99-4-08B	1.5 - 3	-	-	-	-	-	-	-
J99-4-10A	0 - 1.5	-	-	-	-	-	-	-
J99-4-10B	1.5 - 3	-	-	-	-	-	-	-
J99-4-14A	0 - 1.5	-	-	-	-	-	-	-
J99-4-14B	1.5 - 3	-	-	-	-	-	-	-
J99-4-16A	0 - 1.5	-	-	-	-	-	-	-
J99-4-16B	1.5 - 3	-	-	-	-	-	-	-
J99-4-18A	0 - 1.5	-	-	-	-	-	-	-
J99-4-18B	1.5 - 3	-	-	-	-	-	-	-
J99-4-20A	0 - 1.5	ND (0.015)	0.054	ND (0.030)		ND (0.060)	ND (0.30)	ND (0.030)
J99-4-20B	1.5 - 3	-	-	-	-	-	-	-
J99-4-23A	0 - 1.5	-	-	-	-	-	-	-
J99-4-23B	1.5 - 3	-	-	-	-	-	-	-
J99-4-27A	0 - 1.5	-	-	-	-	-	-	-
J99-4-27B	1.5 - 3	-	-	-	-	-	-	-
J99-4-31A	0 - 1.5	-	-	-	-	-	-	-
J99-4-31B	1.5 - 3	-	-	-	-	-	-	-
J99-4-33A	0 - 1.5	-	-	-	-	-	-	-
J99-4-33B	1.5 - 3	-	-	-	-	-	-	-
Regulatory Limits (								
TCLP (mg/L)		NA	1	5	5	NA	1	5
UTS (mg/L TCLP)		0.014	0.19	0.86		5	0.16	0.3
UTS (mg/Kg)		NA	NA	NA	NA	NA	NA	NA

KEY:
ND - not detected
" - " - not analyzed
NA - not applicabl

CARSON LAB DATA.XLS

Sample No.	Depth (ft.)	Toxicity Characteristic Leaching Procedure (mg/L)						
		Thallium	Vanadium	Zinc				
07B		-	-	-				
11A		-	-	-				
12A		-	-	-				
13A		-	-	-				
13C		-	-	-				
19A		-	-	-				
21A		-	-	-				
22A		-	-	-				
24A		-	-	-				
HOT 1		-	-	-				
HOT 2		-	-	-				
J99-4-01A	0 - 1.5	-	-	-				
J99-4-01B	1.5 - 3	-	-	-				
J99-4-06A	0 - 1.5	-	-	-				
J99-4-06B	1.5 - 3	-	-	-				
J99-4-08A	0 - 1.5	-	-	-				
J99-4-08B	1.5 - 3	-	-	-				
J99-4-10A	0 - 1.5	-	-	-				
J99-4-10B	1.5 - 3	-	-	-				
J99-4-14A	0 - 1.5	-	-	-				
J99-4-14B	1.5 - 3	-	-	-				
J99-4-16A	0 - 1.5	-	-	-				
J99-4-16B	1.5 - 3	-	-	-				
J99-4-18A	0 - 1.5	-	-	-				
J99-4-18B	1.5 - 3	-	-	-				
J99-4-20A	0 - 1.5	ND (0.015)	ND (0.060)	3.7				
J99-4-20B	1.5 - 3	-	-	-				
J99-4-23A	0 - 1.5	-	-	-				
J99-4-23B	1.5 - 3	-	-	-				
J99-4-27A	0 - 1.5	-	-	-				
J99-4-27B	1.5 - 3	-	-	-				
J99-4-31A	0 - 1.5	-	-	-				
J99-4-31B	1.5 - 3	-	-	-				
J99-4-33A	0 - 1.5	-	-	-				
J99-4-33B	1.5 - 3	-	-	-				
Regulatory Limits (								
TCLP (mg/L)		NA	NA	NA				
UTS (mg/L TCLP)		0.078	0.23	5.3				
UTS (mg/Kg)		NA	NA	NA				

KEY:
ND - not detected
" - " - not analyzed
NA - not applicabl

Table 1 High Mercury Soils Characteristics

SAMPLE LOCATION & DEPTH		TOTAL CONCENTRATION (mg/Kg dry weight)			TOXICITY CHARACTERISTICS LEACHING PROCEDURE (mg/L)					GOLD & SILVER ASSAY (ppm)	
Sample No.	Depth (ft.)	Cyanide Amenable	Cyanide Total	Mercury Total	Mercury	Barium	Cadmium	Lead	Zinc	Gold	Silver
19A		-	-	240	ND (0.02)	-	-	-	-		
21A		-	-	190	ND (0.02)	-	-	-	-		
HOT 1	0 - 2.0	ND (0.011)	ND (0.54)	-	0.72	-	-	-	-		
-10 to +48 mesh				6,270							
-48 to +65 mesh				18,700							
-65 to +100 mesh				11,500							
-100 to +200 mesh				16,000							
-200 mesh				7,630							
HOT 2	0 - 2.0	ND (0.012)	ND (0.58)	310	0.05	-	-	-	-		
-10 to +48 mesh				136							
-48 to +65 mesh				10							
-65 to +100 mesh				216							
-100 to +200 mesh				131							
-200 mesh				742							
J99-4-14A	0 - 1.5	ND (0.011)	ND (0.57)	320	0.2	-	-	-	-		
J99-4-14B	1.5 - 3	ND (0.011)	ND (0.56)	360	0.31	-	-	-	-		
J99-4-16A	0 - 1.5	-	-	9000	0.55	-	-	-	-		
J99-4-16B	1.5 - 3	-	-	1900	0.32	-	-	-	-		
J99-4-18A	0 - 1.5	ND (0.012)	ND (0.58)	200	ND (0.02)	-	-	-	-	1.605	103.9
J99-4-18B	1.5 - 3	ND (0.011)	ND (0.56)	210	ND (0.02)	-	-	-	-	1.294	52.6
J99-4-20A	0 - 1.5	-	-	3500	0.53	0.12	0.054	0.49	3.7	4.224	150.4
J99-4-20B	1.5 - 3	-	-	470	0.16	-	-	-	-	1.83	73.8

NOTES:

ND Not detected above the reportable quantitation limit shown in parentheses

"-" Not analyzed

* Additional TCLP analyses on this sample were non-detect for the following metals: antimony, arsenic, berylium, cadmium, chromium, nickel, selenium, silver, thallium and vanadium.

APPENDIX C

ARTIFACT CATALOG

Available separately in electronic format

APPENDIX D

The Process Used at the Comstock for Refining Coppery Bullion Produced by Amalgamating Tailings

by

A. D. Hodges, Jr.

1886

Compliments of the author

THE

Process Used at the Comstock

FOR

REFINING COPPERY BULLION

PRODUCED BY

AMALGAMATING TAILINGS.

BY

A. D. HODGES, JR.,
BOSTON, MASS.

READ BEFORE THE AMERICAN INSTITUTE OF MINING ENGINEERS,
AT THE PITTSBURGH MEETING,
FEBRUARY, 1886.

[TRANSACTIONS OF THE AMERICAN INSTITUTE OF MINING ENGINEERS.]

THE PROCESS USED AT THE COMSTOCK FOR REFINING COPPERY BULLION PRODUCED BY AMALGAMATING TAILINGS.

BY A. D. HODGES, JR., BOSTON, MASS.

THE process to be described, whatever other merits (or demerits) it may have possessed, certainly proved a financial success under the conditions of the locality where it was introduced and where a refining process had been sought previously in vain. I have ventured to bring it to the notice of the Institute in the hope that it may prove of some interest as a solution of a practical problem, such as is often presented to the metallurgist in the remote mining regions of the West.

The method was used first at the Lyon Mill at Dayton, Nevada, and has been adopted at other tailings-mills on the Comstock. These mills treat two classes of tailings: "sand," or material which has passed previously through the pans of the ore-mills; and "slimes," or the fine clayey material which, coming from the battery, is too light to settle in the tanks inside of the mills but is caught in large reservoirs outside. The slimes, never having been worked, are naturally richer than the sands; but the assay-values of each class vary considerably among themselves. At the Lyon Mill the sand assayed from $5 to $7 and the slimes from $15 to $25 per ton.

The tailings are amalgamated in combination pans (of wood and iron) with the aid of salt and bluestone. The best results have been obtained when, through the free use of sulphate of copper, the bullion produced has been very base. At Dayton the fineness of the bullion was kept designedly at from 150 to 250.

The amalgam is taken from the canvas strainers and retorted in cylindrical iron retorts, during which process, when properly conducted, the resulting bullion separates into two distinct parts. Next to the retort-body there is a shell of compact and partially fused material, nearly white in color (and hence called locally "white bul-

lion") with more or less of a reddish tinge. On top of this last, in the more central part of the retort, there is a reddish-brown, porous and comparatively brittle mass of what is called (by comparison) "base bullion." The latter is easily crushed and had been roasted and treated with sulphuric acid. But the white bullion had resisted all attempts before made to refine it. It was too dense to allow of crushing and its composition, about one-half silver and one-half copper, did not permit the successful use of any of the separating processes which had been tried.

The problem presented was to refine the material mentioned by some simple, cheap and quick process which did not require the establishment of any expensive plant or the services of any specially trained workmen, and which would not cause loss of precious metal. For, although the heavy and constantly increasing discount on the value of the silver in this product and the total loss of the copper (which was not paid for) rendered a refining process very desirable, yet on account of the losses incurred in previous trials the general management of the Lyon Mill had become very cautious and skeptical in the matter, and disinclined to incur any more expense in experiments. After some demur, at the end of 1873 a trial on one month's mill-run was allowed. No apparatus or material was used except that already on hand. The retort-bullion was assayed in advance and the assay-returns handed in. At the end of the experiment (during which no attempt was made to keep the fine silver separate) there was a very careful clean-up and the return in melted bullion-bars was compared with the assay reports.

Attached to the mill were sulphuric acid chambers and a bluestone factory. There were on hand a small, decrepit 5-stamp battery for crushing wet the base bullion, a small roasting furnace, dissolving tubs, crystallizers, and an old refining kettle. I afterwards substituted an iron Chili mill for the battery, and added two silver precipitating vats (using old settlers lined with lead), two or three filter-tubs, and a precipitating room; and, when the furnace was burned out, rebuilt it in a more convenient situation in a room of its own. This comprised all the new plant ever erected.

I give here the result of the first trial as copied from my books. Assays were repeated many times, and made very exactly.

Assay Returns.

	Date.	Ozs.	Assay Fineness.			Ounces of Pure Metal.			Ounces of Pure Metal.		
			Ag.	Au.	Tot'l	Ag.	Au.	Total.	Ag.	Au.	Total.
White Bullion,	Nov. 15, 1873	6,400.7	430.55	0.65	431.2	2,755.8	4.2	2,760.0	.....	.....	.....
	Dec. 2, 1873	6,473.5	433.0	0.5	433.5	2,803.0	3.3	2,806.3	.....	.....	.....
	Dec. 22, 1873	5,511.2	477.75	0.55	478.3	2,633.0	3.0	2,636.0	.....	.....	.....
	Dec. 27, 1873	2,624.4	485.75	0.55	486.3	1,274.8	1.4	1,276.2	9,466.6	11.9	9,478.5
Base Bullion,	Dec. 9, 1873	9,389.5	67.15	1.95	69.1	630.5	18.3	648.8	.....	.....	.....
	Dec. 26, 1873	16,038.0	70.05	2.15	72.2	1,123.4	34.5	1,157.9	.....	.....	.....
	Jan. 1, 1874	11,066.2	69.55	1.75	71.3	769.7	19.4	789.1	.....	.....	.....
	Jan. 6, 1874	15,032.0	69.7	1.8	71.5	1,047.7	27.0	1,074.7	.....	.....	.....
	Jan. 9, 1874	10,242.5	68.55	1.75	70.3	702.1	17.9	720.0	4,273.4	117.1	4,390.5
									13,740.0	129.0	13,869.0

Return in Melted Bullion.

Bar.	Date.	Ozs.	Assay Fineness.			Ounces of Pure Metal.			Ounces of Pure Metal.		
			Ag.	Au.	Tot'l	Ag.	Au.	Total.	Ag.	Au.	Total.
868-869	Dec., 1873	2,120.0	960.3	24.7	985.0	2,035.8	52.4	2,088.2	.....	.....	.....
870	Jan., 1874	997.0	966.25	3.25	969.5	944.0	3.2	947.2	.....	.....	.....
871	Jan., 1874	715.0	885.5	32.6	918.1	633.1	23.3	656.4	.....	.....	.....
872-873	Jan., 1874	2,023.0	964.85	3.15	968.0	1,952.0	6.3	1,958.3	.....	.....	.....
1-2	Jan. 19, 1874	1,966.0	917.75	14.45	932.2	1,804.3	28.4	1,832.7	.....	.....	.....
3-4	Jan. 19, 1874	1,766.5	959.75	2.15	961.9	1,695.4	3.8	1,699.2	.....	.....	.....
5-6	Jan. 19, 1874	2,075.0	976.1	2.1	978.2	2,025.2	4.4	2,029.6	.....	.....	.....
7-8	Jan. 19, 1874	1,650.0	957.4	2.2	959.6	1,579.7	3.6	1,583.3	.....	.....	.....
9-10*	Jan. 19, 1874	1,812.0	584.2	1.4	585.6	1,058.6	2.5	1,061.1	.....	.....	.....
	Total of bullion returns								13,728.1	127.9	13,856.0
	Total by assay as above								13,740.0	129.0	13,869.0
	Difference (practically nothing)							ounces.	11.9	1.1	13.0
								per cent.	0.086	0.85	0.99

The process may be summarized as follows:

The base bullion is crushed and roasted dead in a reverberatory furnace to form oxide of copper and metallic silver (and gold).

The white bullion is treated with sulphur in a closed vessel at a low heat, forming sulphide of silver and of copper. This is crushed and roasted to form oxide of copper and sulphate of silver (Ziervogel-process).

The roasted products are treated (separately as a rule) with hot dilute sulphuric acid (chamber acid). All of the copper (oxide) is thus converted into soluble sulphate. The silver sulphate also

* Clean-up bars.

goes into solution. Moreover as dilute nitrogenous * sulphuric acid dissolves metallic silver to a considerable extent, an additional amount of silver sulphate is obtained in solution. Some of the silver apparently remains oxidized after roasting, and dissolves in common sulphuric acid; that is, acid which has been concentrated. The Omega Refinery used such acid (diluted), but the amount of silver sulphate obtained from the base bullion was much less than at Dayton, where chamber acid was used. A large part of the silver in the roasted products and all of the gold are left as residues in the dissolving tubs, and (after leaching, drying, etc.) are melted in black-lead crucibles to refined doré bullion.

All the sulphate solutions are removed to tanks containing metallic copper, where metallic silver is precipitated. This product melted gives fine-silver bars.

The copper-sulphate solutions, after being freed from silver, when of sufficient strength, as was almost always the case, are drawn into crystallizing vats whence is obtained a fine quality of merchantable bluestone. Weaker solutions are first concentrated and then crystallized. Very weak solutions (wash-waters, etc.), are run into vats holding iron, to recover the copper which is melted into bars and used to precipitate silver. The mother-liquor from the crystallizers is concentrated and recrystallized, the acid second mother-liquor being utilized in the dissolving tubs.

Inasmuch as I have found the correct details of any metallurgical operation, when obtainable, of great value in my practical work, I take the liberty of describing the process in full. If I have fallen into the error of too voluminous description, I have at least avoided the fault of giving favorable estimates in the place of actual working results—a fault not wholly unknown in the annals of the profession. In one place only am I open to the charge of "fudging." In the amount of fine silver produced in 1876 I have included quite a number of ounces which really contained a little gold—sufficient to compel its being noted when stamping the bars. This I have done to avoid injustice to the process and to the workmen employed who took a pride in turning out good work and who were sorely troubled at the time at the presence of gold in the "fine silver"—a thing due

* By this is meant sulphuric acid containing one or more of the nitrogen oxides. There is much difference of opinion, among those who have written on the theory of chamber-acid, concerning the precise oxides of nitrogen thus occurring; and it is not intended here to express any opinion on that point. The capacity of such sulphuric acid to dissolve silver, is an important matter, which has been ignored in almost all the text-books.

in the case in question *solely* to what might be included in the Spanish term *Fuerza Mayor;* to that Superior Power with which one does not contend willingly. I think my brethren of the profession who have worked under well-meaning and interested, but not always thoroughly-informed high officials, will understand without further explanation.

In all other cases, including the statement of costs, I have given not what might or ought to have been, but what actually was. The expenses of the refinery were increased by the fact that the retorted bullion from the mill was treated of necessity as it was produced,—in small and varying amounts. Again, the price of certain materials, as acid, for the year 1876, owing to various causes, was higher than usual. But having chosen this year simply because the full data for this period happen to be handy, while those of other years are temporarily beyond my reach, I feel bound by my limitations to record the exact case.

All data given are those of the Lyon Mill, unless otherwise specified.

The terms "white bullion" and "base bullion" are used in their local signification.

Each separate operation was controlled by a system of check tests and weights, which made it practically impossible for any error in working to escape detection.

Retorting.—The retorts were charged with about 1700 pounds each of amalgam. The fires were started about four o'clock in the morning, and the last fire was given about six o'clock in the evening. The temperature was raised gradually from the beginning until the quicksilver distilled freely, and was then kept as steady as possible until the distillation was nearly finished, gently increasing toward the end when a hot fire was made, and allowed to burn out. Variations in temperature are to be avoided after a proper degree of heat has been obtained; also a too hot fire in the earlier stages of the operation, when the charge seems to melt more easily than it does later.

When the retorts are opened (on the following morning) there are found a dense shell of white bullion, and a porous mass of base bullion as before mentioned. The proportions of these two classes (white and base) vary, partly according to the relative amount of silver in the amalgam, and partly according to the manner of retorting (firing). At first efforts were made to lessen the proportion of white metal, in order to diminish the amounts to be sulphurized. But thereby the proportion of fine silver, and the consequent con-

centration of the gold in the doré bullion, was diminished correspondingly. After considerable experience it was found pecuniarily advantageous to retort thoroughly, and produce as much fine silver as possible without sulphurizing the base metal.

The amalgam was weighed before, and the bullion, both white and base, after retorting. Averaging all the retorts during 1876 and 1877 we have the following figures:

100 *Pounds of Amalgam Yielded*

In 1877, from slime pans,	4.6 lbs. white,	9.0 lbs. base,	13.6 lbs. total bullion.
In 1877, from sand pans,	2.77 lbs. white,	11.97 lbs. base,	14.74 lbs. total bullion.
In 1877, from all pans,	3.24 lbs. white,	11.22 lbs. base,	14.46 lbs. total bullion.
In 1876, from all pans,	3.0 lbs. white,	12.2 lbs. base,	15.2 lbs. total bullion.
Average from all pans,	3.1 lbs. white,	11.7 lbs. base,	14.8 lbs. total bullion.

The expenses of retorting were charged to the mill.

Sampling.—The bullion was removed in one coherent cake from each retort to a low box lined with sheet-iron. From each cake 3 slices, one at the middle and one near each end, about three inches wide, were obtained by cutting the cake completely through with cold chisels in 6 lines across it. Care must be taken to get with each slice everything, dirt and all, belonging to it. This was secured by laying 6 bars of iron, in 3 pairs, under the 6 cutting-lines; everything falling between the two bars of each pair belonged to the corresponding slices. These slices formed the sample.

The samples were cut up into small pieces, the base and the white being kept separate, and sampled down to 6 pounds of white and 5 pounds of base, these amounts respectively forming a charge for the small black-lead crucibles in which the samples were melted and from which granulations were taken and treated as in the regular bullion-assays. All such assays were made fourfold.

Repeated tests, made at intervals during two years and checked in every possible manner, showed this method of sampling to be satisfactory when done carefully, and when the retorted bullion was substantially free from quicksilver. In order to control all operations of working the tailings, as well as those of the refinery, the bullion was sampled and assayed regularly during my stay at Dayton.

After sampling, the remainder of the retort was broken up into small pieces, and the base and the white carefully separated. All dirt went naturally with the base.

Assaying.—The fineness of the bullion from the various mills varied greatly, in accordance with the richness of the material amalgamated and the method of treatment. At the Lyon Mill, as before

stated, a comparatively steady grade of fineness was sought. The gold followed the copper in its separation in the retort to a great extent, but small fluctuations had no effect. I extract the following from my assay book for the 2 years already mentioned:

White Bullion.

Highest silver assay, . .	652 fine	(gold here 0.2 fine).
Lowest silver assay, . .	482 fine	(gold here 0.4 fine).
Highest gold assay, . .	1 3 fine	(silver here 571 fine).
Lowest gold assay, . .	trace	(silver here 606 and 616 fine).

Average assay, 565 silver, 0.4 gold.

Base Bullion.

Highest silver assay, . .	89 fine	(gold here 1.9 fine).
Lowest silver assay, . . .	17 fine	(gold here 1.3 and 0.7 fine.
Highest gold, ...	3.2 fine	(silver here 74 fine).
Lowest gold, ...	0.4 fine	(silver here 49 fine).

Average assay, 37 silver, 1.16 gold.

Total Bullion.

Average assay, 148 silver, 1.0 gold.

I found it quite impossible to get satisfactory results from testing the retorted bullion for quicksilver with the means at my disposal. At times there was a very considerable quantity of this metal, especially in bullion received from other mills, rising apparently up to 3 or 4 per cent., and perhaps higher. But on this point I am unable to speak with satisfaction to myself.

Preliminary Calcining.—The bullion in lumps from the retorts was thrown into the hot roasting furnace after a regular day's work therein, and left until the next morning. This was done for two reasons—primarily to facilitate the subsequent crushing, and subordinately to drive off any contained quicksilver, a thing generally unnecessary with our own material, but requisite usually when treating other bullion, in order to protect the roaster. As this entailed no special expense it grew to be the regular practice with all bullion. The hearth could be filled up to the top of the arch.

The base bullion thus treated was oxidized to a very considerable extent. The average gain in weight for each year, 1876 and 1877, happened to be exactly the same, viz., 17.4 per cent.

The white bullion underwent less change. The average gain in weight for 1876 was 2.8 per cent.; for 1877, 2.3 per cent. But there was a certain amount of mechanical effect produced, whereby a greater or less proportion was rendered brittle, so that it could be crushed.

Crushing.—All bullion was crushed in a Chili Mill, the castings of which were made from the following rough sketch (Fig. 1) given to the foundry. The pan is stationary, the wheels rolling around on it. The power was supplied *gratis* from one of the shafts of the

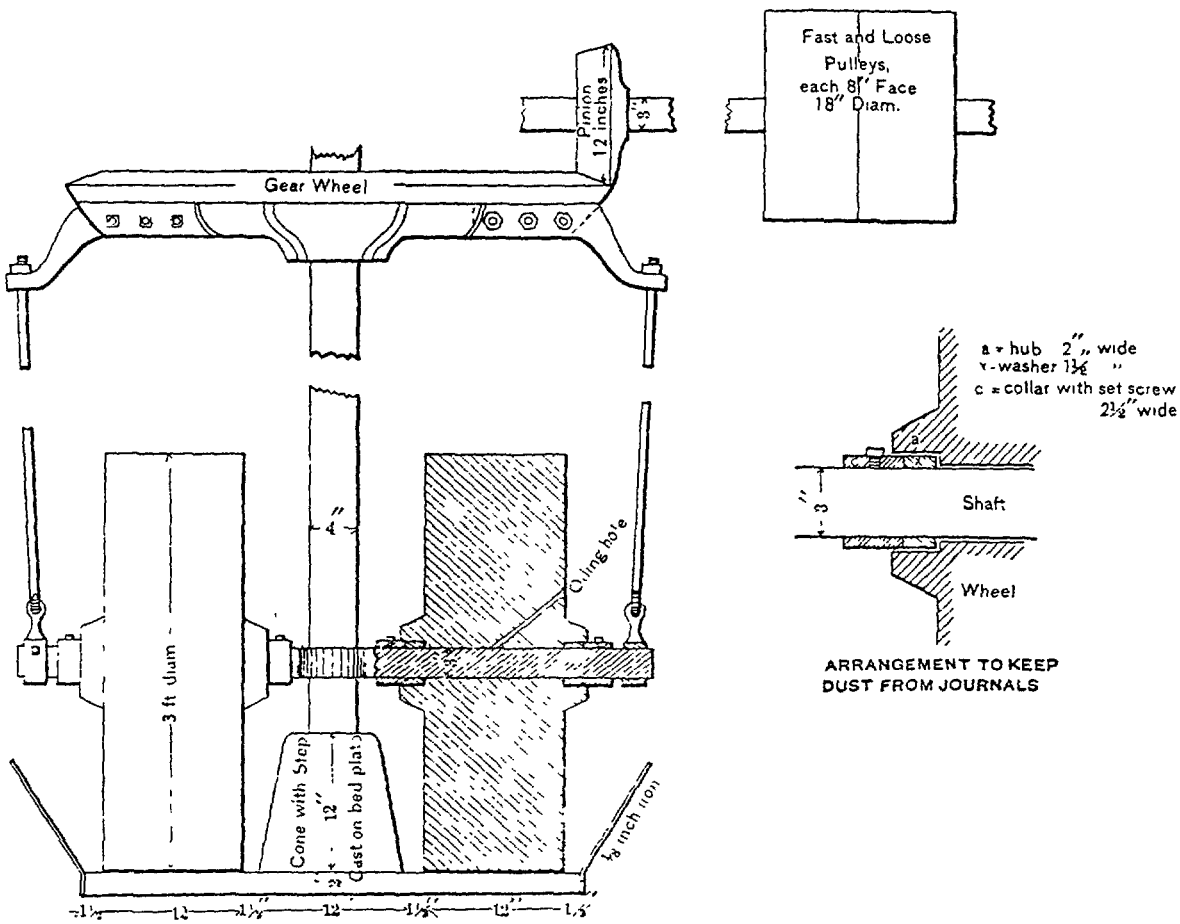


Fig 1. IRON CHILI MILL FOR CRUSHING BULLION.

tailings-mill. The Chili Mill was run in a small room, the floor of which was covered with sheet-iron plates, to prevent loss and insure cleanliness. It worked well, and needed no repairs or special attention. One man (Chinaman) did the crushing, sifting the pulverized material by hand through a No. 20 wire-screen.

As the mill was run very irregularly it is impossible to state its crushing capacity in exact terms. In my accounts I charged one-half shift for any work not exceeding this length of time (5 hours). According to these accounts the mill crushed about 100 pounds of sulphurized white, and 200 pounds of calcined base bullion (including sifting) per hour. Letting these figures stand (although the time charged was largely in excess), as including all items, the cost

of crushing, reduced to terms of retort-material, was 0.175 cents per pound for white bullion, and 0.088 cents per pound for base. The average would be (at 1 part white to 4 parts base) 0.105 cents per pound of retorted bullion.

The base bullion crushed almost completely, the average percentage of lumps left during 2 years being 0.55 per cent. The amount of lumps from crushing the (sulphurized) white bullion varied very considerably according to the manner of firing the sulphurizing kettle, and also according to the percentage of melted bars (from the crude-bullion assays, etc.) put in the kettle. The average for 2 years was 6.86 per cent.

The wear of the mill was very small. The returns from 138,634¼ pounds charged to the mill were 138,732 pounds, showing an apparent gain of 97¾ pounds (0.07 per cent.), which probably represents the wear of the wheels and pan.

Roasting Furnace.—The roasting furnace was a small reverberatory used only for bullion. Its construction is shown in Figs. 2 and 3. The hearth (see also Fig. 4) was composed of 2 cast-iron plates bolted together and bedded in sand. The furnace-walls were recessed on all sides for the plates, as indicated in the drawing. This construction allowed the expansion and contraction of the hearth, and prevented the charge from spilling over the edges of the plates. Iron plates were used, in order that no bullion should be left on the hearth after a charge had been drawn, a matter of importance in making tests and in refining for other companies, some of which, as the Bonanza firm, were very particular in their requirements. The space between the hearth and the chimney, served as a dust-chamber, and proved of ample capacity, the amount of "dust" formed being small.

Red bricks were used, except for the parts directly exposed to the flame. The mortar for all inside work was a mixture of sand and clay (materials, by the way, to be had for the hauling), lime being used only for the masonry not affected directly by the fire. The arch was built of one layer of brick set on end and covered with a bed of sand. Air-holes (not shown in the sketch) were originally provided for admitting air through the fire-bridge and the arch to the hearth, and also through the wall into the fire-place, but they seemed to serve no useful purpose, and in time became obliterated. The chimney was 9″x 15″ in section and 24 feet high.

The fireplace for the sulphurizing kettle was built against the chimney, into which its draft was led. When the kettle was in

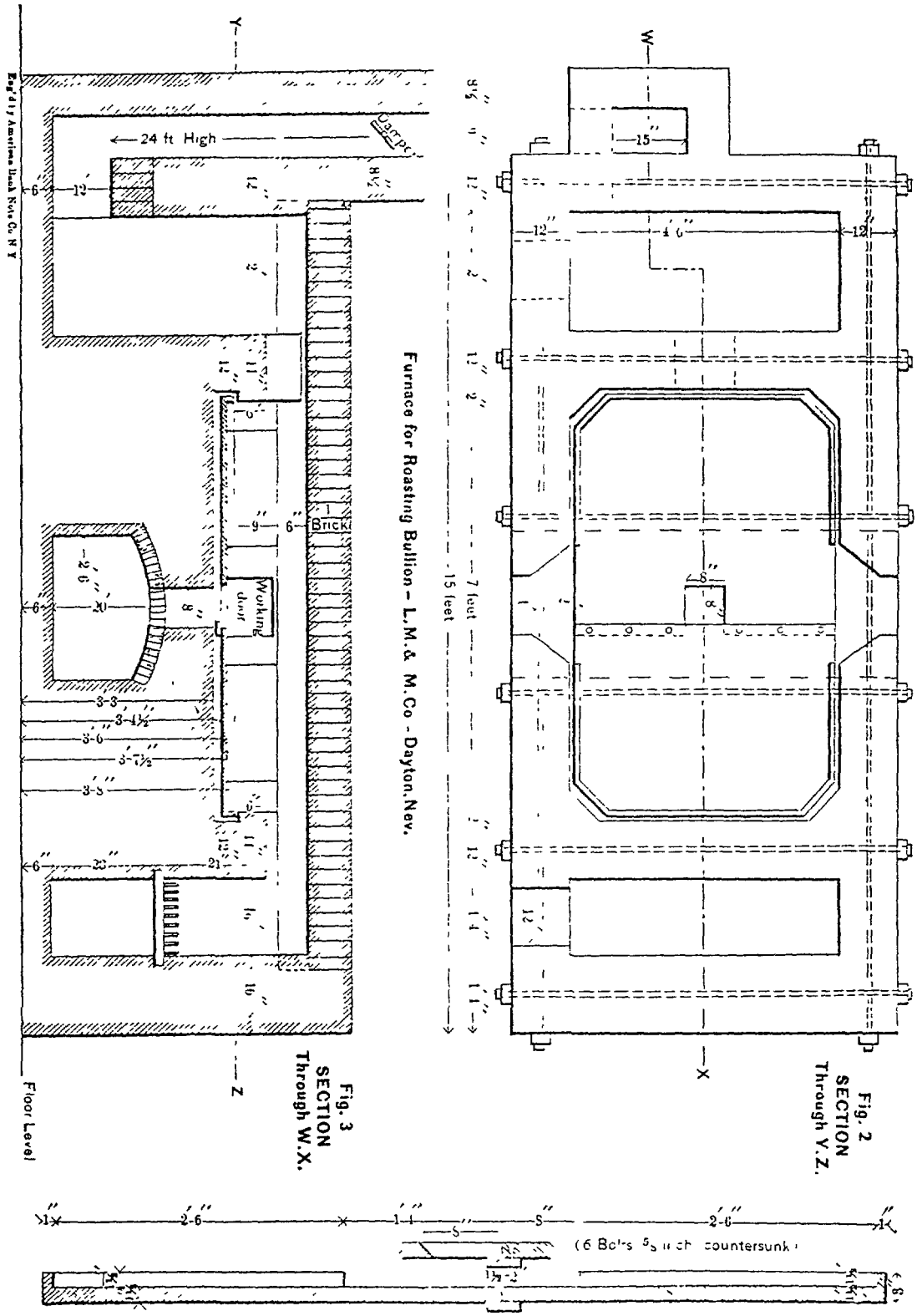


Fig. 4. Enlarged Longitudinal Sections Through HEARTH-PLATES

operation any escaping sulphur fumes were conducted into the chimney by means of an arrangement of hood and pipes of very light sheet-iron, which could be raised or lowered at pleasure.

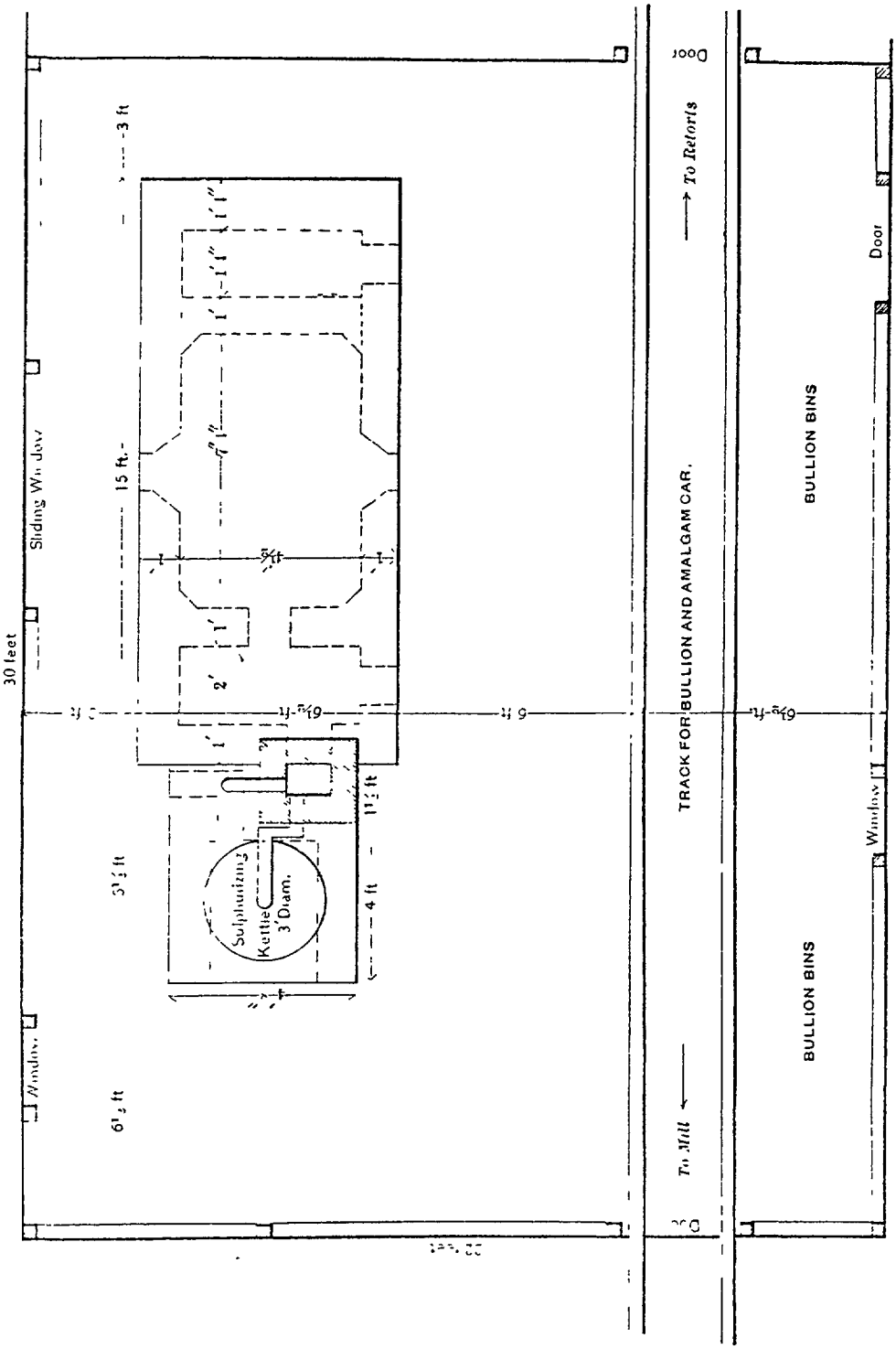


Fig 5. BULLION – FURNACE ROOM – L. M. & M. Co Dayton, Nev.

The furnace-house, Fig. 5. adjoined the retort-house. The floor in front of the furnace and around the sulphurizing kettle was

covered with sheet-iron plates; elsewhere it was of matched boards. A track for the bullion and amalgam car ran from the mill through the furnace-room into the retort-house.

The following amounts were paid out for constructing the furnace and the furnace-house (in 1875).

Cost of Furnace.

Foundation:		
Preparing ground, Chinaman, 1½ shifts, at $1.53,	$2 30	
Hauling stone, 2-horse team one day,	6 25	
Masons, 4 shifts, at $7.50 plus $1.75 fare,	31 75	
Masons' helpers, 6½ shifts, at $1.53,	9 94	
Lime, 250 pounds, at 2.652 cents,	6 63	
		$56 87
Superstructure:		
4980 common brick, at 1.972 cents,	98 20	
400 fire-brick, at 18.85 cents,	75 41	
819 pounds lime, at 2.679 cents,	21 94	
Hauling sand and clay, 2-horse team one day,	6 25	
Masons, 18½ shifts, at $7.58,	140 25	
Masons' helpers, 26 shifts, at $1.53,	39 78	
		381 83
Iron Work:		
2 frames and slip doors, 160 pounds,		
1 fire-door, 155 pounds,		
Hearth plates, 1695 pounds,		
Hearth-plate discharge cover, 23 pounds,		
2033 lbs., at 8 cents,	162 64	
Drilling and fitting doors and plates with bolts,	18 25	
Patterns for doors, frames, and plates.	22 00	
Blacksmithing and old iron,	25 00	
		227 89
		$666 59

Cost of Furnace Building.

Lumber:		
Rough, 4710 feet, at $35 per M,	$164 85	
Dressed, 487 feet, at $65 per M,	31 66	
Shingles, 6750, at $6.50 per M.	43 88	
		$240 39
Hardware:		
1 keg 10-d. nails,	6 75	
1 keg 12-d. nails,	7 00	
1 gross screws, 1¾ inch, No. 18,	3 00	
39 dozen screws, 1¾ inch, No. 13,	4 88	
10 sheets iron, ⅛″ x 3′ x 10′, 1708 lbs., at 7.05 cents,	120 47	
		142 10
Paint:		
White lead and oil, inside work,	5 50	
Copper paint, home-made, outside work, not charged,	....	
		5 50

Wages—Carpenters, Painter, and Helpers:

4 shifts at $6.00,	
1 shift at $4.50,	
10 shifts at $4.00,	
12 shifts at $3 50,	
5 shifts at $3.00,	
= 32 shifts, at $3.92, ...	125 50
	$513 49

Furnace and Building.

Labor, 88½ shifts, at $3.95, ...	$349 52 =	29.6 per cent.
Material, ...	830 56 =	70.4 per cent.
	$1180 08 =	100.0 per cent.

Roasting Base Bullion.—The usual charge of base bullion for this furnace was 400 pounds, but as much as 500 can be treated easily, while, owing to the way in which the bullion was supplied, the average charge for two years was actually only 384 pounds. Were the furnace running regularly, a normal charge would be about 450 pounds of calcined, corresponding to about 400 pounds of retorted base bullion.

The roasting process is conducted as usual, the manipulation requiring no special description. The bullion is brought to a bright red heat, stirred well, and moved several times from and towards the fire, so as to expose all parts equally to the heat.

When only one charge was roasted daily, the furnace being nearly or quite cold at the commencement, the operation occupied about 1 shift, or 10 hours. Two charges were roasted in 1½ shift, and 3, or even 4, charges in 24 hours, the last occurring when the furnace was hot at the start. The roaster was able (except in the last case), also, to sift the charge previously roasted, and to attend to other matters which did not take him away from the furnace building. The roasted material was passed through a No. 10 wire screen, the lumps averaging 1.29 per cent.

The average gain in weight by this operation was 5.4 per cent. of the charge, corresponding to 6½ per cent. of the retorted bullion.

The average gain in weight (2 years), by both calcining and roasting, reduced to terms of retort-bullion, and deducting all lumps, was:

By calcining, ...	17½ per cent.
By roasting, ...	6½ "
Total, ...	24 "

The oxidation of the last remaining percentage of metallic copper in this material would appear to be, in part, a function of time. Repeated attempts were made to shorten the operation by crushing finer, constant stirring, and the introduction of air through the fire-bridge and the arch and into the fireplace. But no material advantage, in this respect, was ever obtained, the last one or two per cent. of copper oxidizing only very slowly.

One man, per shift, selected carefully for the place, did all the work of roasting.

The fuel was wood; the average amount consumed was 0.271 cord, per shift of 10 hours; or 0.216 cord, per charge (of all kinds) actually roasted. These figures are derived from the work done in eight months in 1877, when 393 charges were treated in 313 shifts with a consumption of 85 measured cords of wood, or, 1 cord to 1493 pounds of retort-bullion.

In 1876 (an unfortunate year, in some respects) 86 cords were charged against the furnace, or, 1 cord to 1040 pounds of retort-bullion. Part of this wood was used elsewhere.

I resist the natural impulse to substitute the figures of 1877 for those of 1876 in the statement of expenses.

Although fuel was dear on the Comstock, it was used most wastefully everywhere. I found the easiest practical way to check this waste was to contract the size of the fireplace to the smallest allowable limits.

Sulphurizing.—To this process came the dense material of all kinds—the white bullion, the base lumps, and all the assay-bars.

The sulphurizing vessel was an old sulphuric-acid parting kettle of cast-iron, three feet in diameter, provided with a cast-iron cover which, when the kettle was charged, was luted, and bolted fast to the kettle-flange. The kettle was set in a low brick fireplace of the simplest construction.

The kettle was charged with whatever metal was on hand, as much as 450 pounds being put in; mixed with this was 18 per cent. of sulphur. For the sake, simply, of facilitating the removal of the mass when sulphurized, layers of thin wood (generally old barrel-staves) were placed throughout the charge. The cover was fastened down, and a small fire of chips or any refuse fuel was maintained under the kettle for four or five hours. No particular attention was paid to the length of time of firing (the fuel costing nothing) as the roaster generally charged and fired the kettle during his work on the bullion furnace, and the whole operation of removing the cooled

charge and sulphurizing the new one was done in one shift. After the process was finished, the cover was removed and the charge left to cool until the next morning.

The sulphurized material formed a black or grayish-black mass, the lowest part fused, the upper and larger part retaining the general form of the pieces put in, often showing pretty needlelike crystals on the surface. It was removed with hammers and cold chisels—being ductile while warm, but brittle when cold—weighed, and sent to the Chili Mill to be crushed. The amount of lumps, after crushing, which would not pass through a No. 20 screen, varied according to the method and length of firing, and the size and density of the pieces charged into the kettle. With only retort-bullion or small base lumps, and a gentle and long-continued fire, the whole charge was sulphurized so completely as to crush in its entirety. On the other hand, owing to the repeated melting of samples for assays and tests, solid bars weighing five and six pounds or more were frequent, and these were sulphurized only after passing several times through the kettle. All lumps from crushing were put in the next kettle.

A small, varying amount of sulphur escaped during the process. On an average, 16.7 lbs. of sulphur combined with 100 lbs. of bullion. The total amount of sulphur used was 21 per cent. of the original weight of the bullion at the Lyon Mill (1876 and 1877), and 20 per cent. at the Omega Mill (1878).

The expense of sulphurizing at Dayton consisted simply of the one item of sulphur, as the labor employed, being so small, was charged for in other work, and any extra fuel possibly used was charged up to roasting.

Roasting White Bullion.—A charge was generally about 300 pounds, the actual amount being determined at any one time by the quantity on hand, the furnace having treated as much as 400 pounds.

The sulphurized material roasted quite easily and no special difficulties were encountered in working up to a certain degree of excellence. But it seemed practically impossible to sulphatize all the silver, or to prevent the formation of a very large percentage of lumps. No matter how gently the temperature was raised or how diligently the material was rabbled and pounded, the mass was in the beginning so sticky that about the same proportion of lumps were found at the end of the operation as when the process was conducted more hurriedly.

The fire was increased gradually from the beginning, but the furnace was, at no time very hot. For some two hours, the charge

was stirred constantly and vigorously, to expose all parts equally to the heat, and to prevent the formation of lumps, or to crush up those already formed as much as possible. About three hours after the roasting had fairly commenced, the first test was made of the condition of the silver. The test consisted simply in putting a small quantity of the hot charge into a porcelain saucer, partially filled with water, and adding a dilute salt-solution. The color of the solution, the appearance of the charge and the relative quantity of silver-chloride formed, show the condition of affairs. The eye is soon trained by experience. The "spangle-reaction," mentioned by Professor Egleston, in his paper on the "Boston and Colorado Smelting Works," * that is, the reduction of the sulphate to bright, glittering spangles of metallic silver by suboxide of copper, was often seen in great beauty.

When the sulphate of copper was almost entirely or even quite decomposed, that is, the test solutions had become nearly or quite colorless, the amount of sulphate of silver (or of chloride in the test) was at its maximum, and the charge was drawn. When the roaster lighted his fire in a cold furnace at 7 A.M., the charge was usually out of the furnace about 2 P.M. If the furnace was warm in the beginning, the time was often reduced materially.

As before mentioned, it seemed impossible to get all the silver into the state of sulphate. The highest proportion ever noted was 75 per cent., while the yearly average attained was about 60 per cent.

The roasting process was conducted essentially according to the directions given in the text-books, and in its action conformed to the descriptions given. But, at times, a phenomenon was observed which, as far as I have been able to learn, has not been described before in print.

Several times, perhaps a dozen or even more, when, according to the tests, the charge had passed through the condition of maximum sulphatization of the silver, and beyond this, so that the silver sulphate had been decomposed to a large extent, that is, the tests had yielded decreasing amounts of chloride; by continued hot firing, the charge has been brought back to its usual proportion of silver sulphate, that is, the tests have shown an amount of chloride gradually increasing up to the usual point. For instance, when a charge has been ready for drawing at 1 or 2 o'clock P.M, but has remained in the furnace until, say, 4 o'clock, the tests, at this last hour, show

* *Transactions*, vol. iv., p. 288.

very little sulphate; but, by firing strongly and stirring the charge with moderate vigor, the amount is increased according to the tests, until about 6 o'clock, the average proportion of silver sulphate, so far as the eye can judge, is again reached.

This state of affairs was brought about commonly by some accident; for instance, my detention from the furnace at the time for making tests. But I have also caused it deliberately, although with fear and trembling each time.

Mr. C. A. Stetefeldt has suggested to me a possible explanation of the apparent regeneration of the sulphate of silver in the over-roasted charges. At the Mansfield Works, in Germany, the roasted copper matte in the Ziervogel-process is leached first with pure water and then with water acidified with sulphuric acid. This, it was said, favors the solution of sulphate of silver, a part of which may be present as a *basic* salt insoluble in pure water. While the text-books on chemistry do not record the existence of a basic silver-sulphate, there are indications that such a salt occurs; and it would seem very possible that, in over-roasting the sulphurized bullion at Dayton, the common sulphate was partially decomposed to a basic sulphate, and this, in turn, on continued treatment, was changed back to the ordinary sulphate through the action of the sulphides in the undecomposed lumps, a comparatively small quantity of sulphuric acid being required to effect the regeneration.

The original charge in the furnace consisted. in round figures, of about 500 parts silver, 500 parts copper, and 17 parts sulphur, with very small amounts of gold and of iron. I am not aware of the presence of any other metals.

The roasted bullion was sifted through a No. 8 wire screen. The average amount of lumps in 1876 was 17½ per cent. of the original charge. I have no notes showing anything as to the percentage of lumps from overworked charges. The highest amount ever recorded was 22.3 per cent The lumps contained copper oxides, copper and silver sulphates, and copper and silver sulphides principally. By vigorous manipulation, a considerable part could be rubbed through the screen, but this was not permitted.

When possible, the lumps were allowed to accumulate, until amounting to enough for a furnace charge, when after crushing) they were roasted by themselves, the operation requiring only two or three hours.

Dissolving.—The roasted bullion passed next to the bluestone works, where it was treated with hot dilute sulphuric acid (chamber

acid), the base and the white being manipulated separately (as a rule), but in exactly the same manner.

The dissolving tubs (Fig. 6) are 6 feet in diameter and 4 feet deep, clear dimensions. The sides are composed of 45 staves, 3″ x 6″ x 4′6″ long, dressed to the proper shape, and hooped with 3 iron bands, $\frac{3}{8}$″ thick x $2\frac{1}{4}$″ wide, provided with angle-irons and bolts for tightening. The bottom planks are 3″ x 12″ lumber, dapped into the sides, with 2 cross-pieces, 2″ x 12″, nailed below them.

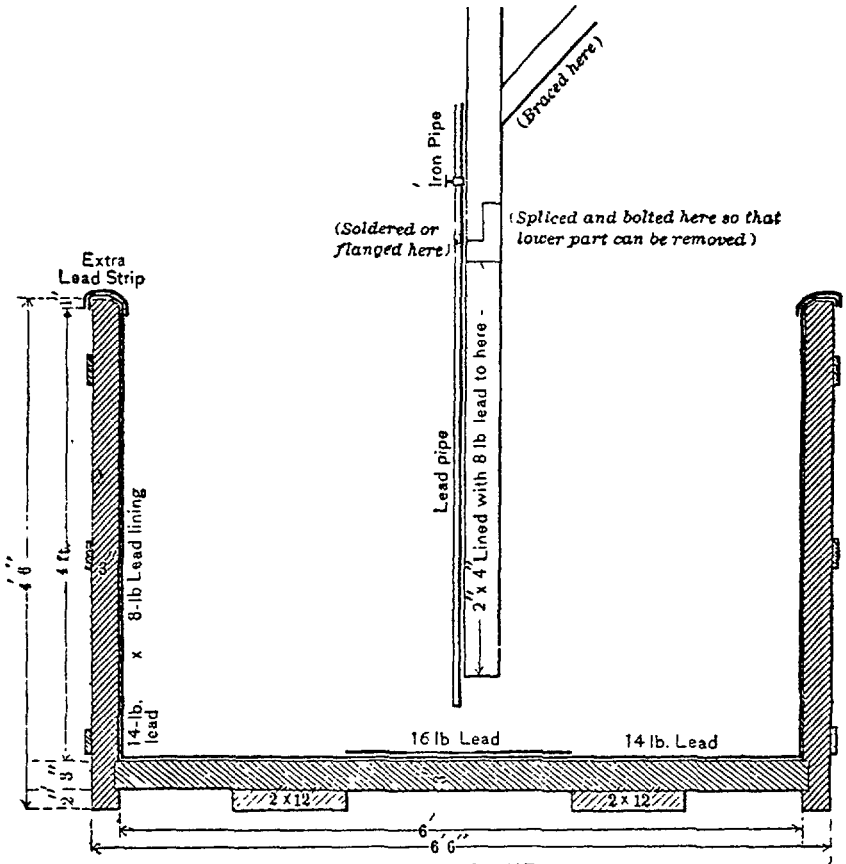


Fig. 6 – DISSOLVING TUB – (Section)

The bottom of the tubs and the sides, for a height of 12 inches above the bottom are lined with 14-pound lead; the rest of the sides with 8-pound lead. Directly under the steam-pipe in the centre of the tub, a piece of 16-pound lead, 2 feet in diameter, is laid on the bottom-lining, and "burned" to it, as a protection, in case the steam-pipe should blow-out. A strip (or strips) of old lead are bent over the upper edges of the sides to protect the lining against the wear of the paddles.

The steam-pipe is of $\frac{3}{4}$-inch A A lead-pipe, soldered to iron-pipe above the level of the top of the tub. It is closed at its lower end, which reaches within a few inches of the tub-bottom, but has four holes bored in its sides, near the end, so that the steam issues in a horizontal direction, instead of impinging vertically on the lead. The steam-pipe is stiffened by clamping to a central timber, 2″ x 4″, hung from and braced to the ceiling, and lined with 8-pound lead where in contact with the bath. Water- and acid-pipes are provided.

Cost of Dissolving Tubs.

Labor—Carpenter, 4 shifts, at $5.00, . . .			
Blacksmith, 1 shift, at $5.00, . . .			
Lead burner, 3 shifts, at $4.50, . .			
Helper, 3 shifts, at $3.00 . . .			
11 shifts at $4.32, ...		$47 50	= 17 per cent.
Material—*Lumber:*			
Staves, 16 pieces, 3″ x 6″ x 14′, .			
Bottom, 3 pieces, 3″ x 12″ x 12′, .			
Cross pieces, 1 piece, 2″ x 12″ x 12′,			
478 feet at $35, . .	$16 73		
Iron:			
3 hoops, $\frac{3}{8}$″ x $2\frac{1}{4}$″ x 21′6″ with angle irons and bolts, 186 pounds, at $12\frac{1}{2}$ cents, ...	23 25		
Lead:			
1 p. 14-lb. lead, 6′ square, bottom, .			
1 p. 14-lb. lead, 1′ x 20′, sides, .			
1 p. 8-lb. lead, $3\frac{1}{2}$′ x 20′, sides, .			
1 p. 8-lb. lead, 1′ x 20′ edges, . .			
1504 lbs. at 12 cents, . .	180 48		
Extras, 5 per cent., . . .	12 04	232 50	= 83 per cent.
		$280 00	= 100 per cent.

The normal charge was 1200 pounds of base, or 1000 pounds of white bullion; but the common charge was 1000 pounds of base, or 800 pounds of white. The amounts were regulated by the exigencies of each occasion.

The amount of acid used could not be limited to the exact theoretical quantity requisite to form CuO,SO_3, although the men on the tubs were kept within certain limits. For instance, in treating 1000 pounds of material, assaying 75 per cent. of copper, theoretically 2083.4 pounds of acid of 45° Beaumé (specific gravity = 1.4493, containing 44.99 per cent. SO_3) would be requisite; this corresponded exactly to $11\frac{1}{2}$ inches in depth of the acid tank. In

order to be sure of dissolving out all the copper (and iron), and because a moderate excess of acid did no special harm, being utilized afterwards in dissolving ore charges, and as some metallic silver was always dissolved, the men were allowed to use 1 inch more, or 8.7 per cent. Any amount beyond this limit caused an investigation.

Again, in leaching the charges and in other operations extra acid is necessarily used, at the lowest figures over 10 per cent. Moreover, accidents seem practically unavoidable at times.

The result in practice was that, instead of only 2.8 pounds of 45° acid being used for each pound of metallic copper, an average of nearly 3.7 pounds was purchased by the refinery at Dayton during the year 1876. An unknown proportion of this excess was regained in the other department of the bluestone works, but no allowance was made in the books.

The acid was measured out of a tank whose contents were known. The measuring was by twentieths of an inch. A table was prepared for the men showing how many inches of each degree of strength were necessary for 100 pounds of charges of given percentage in copper.

Two men were employed at each tub.

The tubs were partially filled with the acid needed for a charge, diluted with water to about 20° Beaumé and boiled by live steam. The charge was then fed slowly with a small scoop by one man while his partner vigorously stirred the bath with a wooden paddle, both men paddling from time to time. The chief requisite for good work was to keep the material suspended in the solution until it was substantially free from copper. When the bath reached a strength of over 42° Beaumé, it was weakened with water so long as any more bullion was to be charged. Sufficient steam was used to keep the solution hot. At the end of the process the undissolved residue should be white or grayish-white, and the bath should be from 40° to 42° Beaumé in strength. When the charge was finished, the tub was covered with boards and sacking, to retain the heat, and left undisturbed for about four hours, or until the charge had settled. The solution was then siphoned into the precipitating tanks.

The bullion remaining in the dissolving tub was leached once or twice with dilute acid, and then several times with water, being stirred and boiled each time. The leachings, so long as they contained silver, were drawn into the precipitating tanks. The bullion was put into small lead-lined filtering tubs, 2 feet in diameter and 3 feet high, and washed with hot water until completely free from

acid. It was then dried in iron pans and melted in black-lead crucibles. The bars produced averaged, in round numbers, about 950 fine in silver and 17 fine in gold, including all clean-up material which reduced the fineness several points.

Precipitating Fine Silver.—The precipitating tanks were old settlers from the mill, about 10 feet in diameter and 4 feet high. They were lined with lead and furnished with a steam-pipe arranged as for the dissolving tubs, and were provided with bars of copper laid on the bottom.

The solutions were boiled with steam in these tanks to an extent sufficient to prevent crystallization, and were stirred with wooden paddles occasionally. The silver was precipitated usually in four or five hours, but occasionally trouble was experienced in throwing down the metal completely, and once in a great while the operation was prolonged for twenty or twenty-four hours before the tests with salt solution showed no chloride precipitate. This seemed to occur only when the solution from the tubs contained but a small amount of silver and but little free sulphuric acid. Fortunately extreme cases happened so seldom that the exact cause was never ascertained with certainty. The remedial measures applied were dilution and addition of acid.

The bluestone solution, after being freed from silver, usually had a strength of 36° or 37° B., and after settling was siphoned into crystallizing vats in the cellar. In the extreme exceptional cases above-mentioned, it needed a previous concentration in open lead pans.

The fine-silver precipitate was leached with acid and water, and filtered and washed until free from acid in the same manner as the dissolving-tub residues. All wash-waters were tested for silver.

The washed precipitate was pressed into cakes, dried and melted. The resulting bullion varied in fineness from 994 to 999.5, averaging 997.

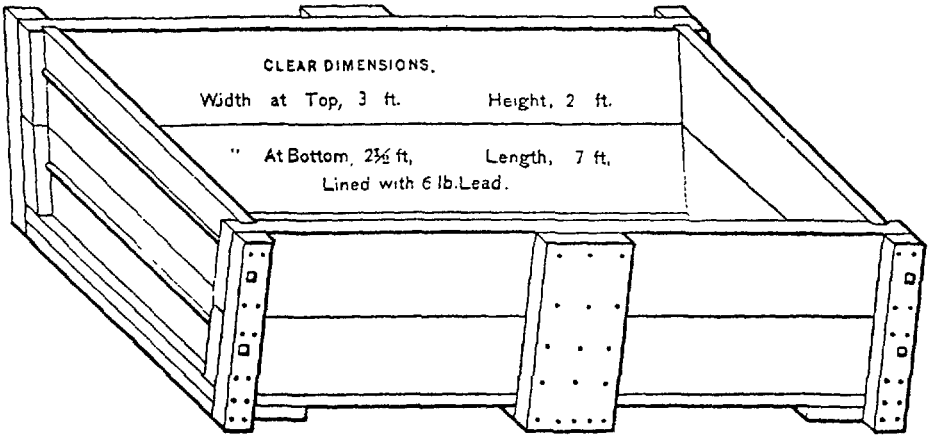
In 1876, the refinery (in addition to the bullion treated for other mills) produced from the Lyon company's retort-bullion 121,841 ounces of refined metal, of which 54,854 ounces, or 45 per cent., was in the shape of fine silver, and 66,987 ounces, or 55 per cent., was doré bullion.

The cost of running the bullion into bars was charged to the mill; that of assaying, to the refinery and the bluestone works.

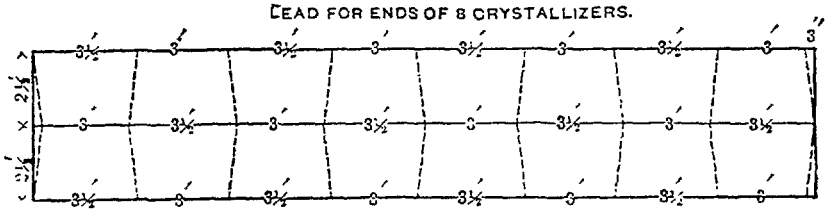
Crystallizing.—The crystallizers were wooden vats with flaring sides, and were 7 feet long, 3 feet wide at the top and 2½ feet wide

at the bottom, and 2 feet high, clear dimensions. They were constructed of 2-inch plank, braced and strongly nailed. The ends were dapped into the sides, which were bolted together with 4 rods. They were lined with 6-pound lead, one piece 7′×7′ forming the sides and bottom, while one-half of another sheet, 3½′ × 5′ formed each end. Considerable economy in lead can be effected by cutting the sheets properly. (See Fig. 7.)

Fig. 7. BLUESTONE CRYSTALLIZERS, L. M. & M. Co.



LEAD FOR ENDS OF 8 CRYSTALLIZERS.



The material (as bought) for a crystallizer consisted of

Lumber, 6 pieces, 2″ × 12″ × 16′, for sides, ends, bottom, bottom-braces, and middle side-braces.
1 piece, 2″ × 4″ × 12′, for end braces.
Lead, as above, 400 pounds.
Iron, 2 bolts, ½″ round iron, 3′ 8″ head to nut.
2 bolts, ½″ round iron, 3′ 2″ head to nut.
5 pounds 12*d.* nails.

The life of such a crystallizer averaged over 3 years of constant use while I was at Dayton.

The crystallizers, after being filled, were covered with boards and

sacking for three or four days, in order that the solution might cool off slowly and gradually and thus the formation of larger crystals be promoted. Further than this there was no financial advantage in attempting to obtain fine crystals, for which reason no lead strips were used.

In 6 to 8 days the strength of the liquor in the vats was reduced to 23° to 25° B., when the crystallizers were emptied. The mother-liquor was concentrated and again crystallized, the liquor from this second crystallization being used in dissolving ore charges.

The bluestone, which crystallized on the bottom, sides, and ends of the vats, was taken out, washed, and dried on shelves for several days, and then broken up and packed in barrels for the market. A crystallizer yielded about 1000 pounds of bluestone of excellent quality; often as much as 1200 pounds. Specimens sent to the Nevada State Agricultural Fair, in 1875, received a silver medal—the first prize. The *same* specimens were forwarded by the managers of the Fair (without the knowledge of the company) the next year to the Centennial Exhibition at Philadelphia, and, as part of an exhibit, received favorable mention.*

Too great an excess of acid in the solutions retarded the process of crystallization, increased the proportion of bluestone of too inferior appearance to put on the market, and gave a greater strength of mother-liquor remaining after crystallization.

Treatment of Residues.—These consist of leachings and wash-waters, freed from silver, but containing sulphate of copper in solution; and of concentrated mother-liquor from the crystallizers.

The former, if above 15° B. (the financial limit at Dayton, as determined by experience) were concentrated. Otherwise they were run (much diluted) through a series of vats (old crystallizers arranged so as to overflow from one into another) which contained scrap wrought-iron. The copper thus obtained was washed, dried, and melted into bars for use in the silver-precipitating tanks. As the leachings from all the bluestone works was run into these vats, sufficient copper was obtained to supply the wants of the refinery.

The mother-liquor left after crystallizing concentrated solutions contained an excess of free acid, and was used in dissolving copper ore in the bluestone works. No credit was given in the accounts to the refinery for this material.

* It was a trade secret that nearly all of the "imported English bluestone" in the Comstock market, which commanded at least two cents per pound higher price than the best home-made article, was manufactured at Dayton.

Cost of Refining.—The following figures are for the year 1876, when prices were very high.

Sheet-lead cost (delivered) a small fraction over 12 cents per pound.

The refinery was charged, at the rate of 15 cents per pound, for the copper contained in the "base bullion" produced by the mill of the Lyon Company. The copper in the "white bullion" and in the bullion received from other companies was taken as payment for refining, outside companies being bound, in addition, to purchase at prevailing market rates a fixed amount of bluestone for each hundred pounds of bullion refined for them.

The price charged for acid was unusually high, owing to expensive repairs and construction at the acid chambers, which items were always included in the running expenses.

The refinery, which was in operation only a part of the time, conformed in its work to the requirements of the mill and the bluestone works.

The rate of wages, per shift of 10 hours, was as follows: Masons, $7.50; carpenters, $5.00 and $6.00; blacksmith and mechanic, $5.00 each; lead-burner, who was permanently engaged, worked wherever he was needed, and was, in fact, foreman of the chemical department, $4.50; head men on crystallizers and dissolving tubs, $4.00; watchmen and outside men, $3.00; Chinamen, $1.53; all others, $3.50.

The refinery treated 89,394 pounds of retorted bullion (part of which was received from other mills), and produced 285,224 pounds of crystallized bluestone, and, also, on special order from purchasers, solution containing the equivalent of 16,400 pounds of crystals. From 1 pound of copper about 3.6 pounds of $CuO,SO_3 + 5HO$ were obtained.

The following statement is *not an estimate*, but a record taken from the books of the expenses actually incurred. It should be remarked that, in figuring the cost per pound of making bluestone, the items of *roasting*, *dissolving*, and *concentrating* are divided by 301,624, the total number of pounds of $CuO,SO_3 + 5HO$ and its equivalent manufactured; the other items by 285,224, the number of pounds produced in the shape of crystals.

Under *dissolving* are included all expenses of handling the bullion after roasting; also the cost of making steam.

The figure given for *repair-material* is the net amount after deducting old material (pig lead, etc.) sold; that for *repair-wages* is

the sum remaining after charging, so far as possible, to each of the other items, the amounts belonging to it. Thus, a very large proportion under *crystallizing* is for repairs. The wages of the lead-burner, who was permanently employed, are divided according to his work, among all the items except that of *general.*

The blue-tone establishment, it should be noted, had been running for years, and most of the plant was well worn.

The item of *general* includes superintendence, office expenses, watchmen, insurance, taxes, interest, and freight on material delivered.

Cost of Refining 89,394 *lbs. Retorted Bullion.*

				Per cent.	Per pound bullion.	Per pound bluestone.
					Cents.	Cents.
Roasting, Crushing and Sulphurizing	Wages, 525 shifts @ $3.10	$1629.96				
	Fuel, 86 cords @ $7.85	676.14				
	Sulphur	60.94	$2367 04	15.1	2.65	0.79
Dissolving	Wages, 586 shifts @ $3.70	$2166.50				
	Fuel, 240 cords @ $7.85	1883.63				
	Acid, 302,053 lbs. @ 1.33 cts.	4038.15	8088 28	51.7	9.05	2.68
Concentrating	Wages, 27½ shifts @ $3.50	$96.25				
	Fuel, 77 cords @ $7.85	604.62	700.87	4.5	0.78	0.23
Crystallizing and packing	Wages, 160 shifts @ $3.58		572.09	3.7	0.64	0.20
Cooperage	Wages, 76 shifts @ $3.61	$275 03				
	Material	115 20	390 23	2.5	0.43	0.14
Repairs	Wages, 76½ shifts @ $4.17	$319 65				
	Material	243.22	562 87	3.6	0.63	0.20
General			2951.19	18 9	3.30	1.03
Total Manufacturing Cost			$15,632.57	100.0	17.48	5 27
Copper, 48,039 lbs., paid for @ 15 cents			7,205 85		8.06	2.38
Total amounts charged			$22,838.42		25.54	7.65
Wages, 1451 shifts @ $3 49			$5059.48	32 4	5.66	1.70
Material			7621.90	48.7	8.52	2.54
General			2951.19	18 9	3.30	1.03
			$15,632.57	100.0	17 48	5.27

Of the total cost, including copper, ($22,838.42); wages constituted 22 per cent.; material, 65 per cent., general, 13 per cent.

Omega Mill Refinery.—After repeated tests of refining methods, including a year's trial at Dayton, the Bonanza firm adopted this

process, and built a refinery (Fig. 8) at the Omega Mill, near Virginia City, where was treated all of the base bullion produced by

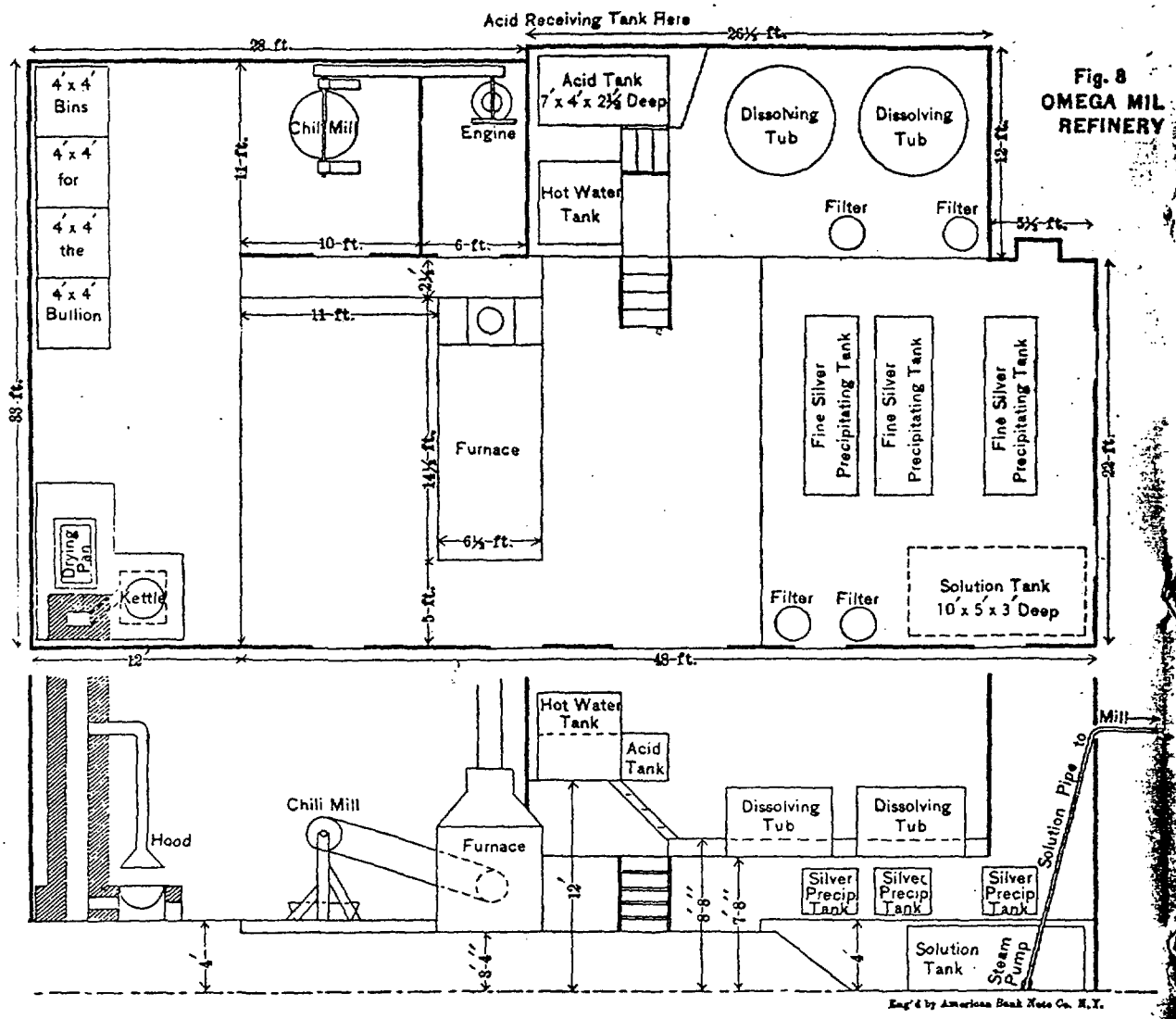


Fig. 8
OMEGA MIL
REFINERY

the mills owned by the Pacific Milling Company. I have no statistics of this refinery, but have been informed by the manager, that the financial results obtained were beyond their most sanguine expectations.

Other mills on the Comstock have since made use of this process.

At the Omega refinery the bluestone was not crystallized,* but the sulphate of copper solutions were weakened to 20° B., and run into a stock tank, whence they were pumped by means of a lead

* I understand that later the solutions were crystallized.

injector (called, locally, a "steam pump") to the mill for use in the amalgamating pans. Steam was furnished to the refinery from the

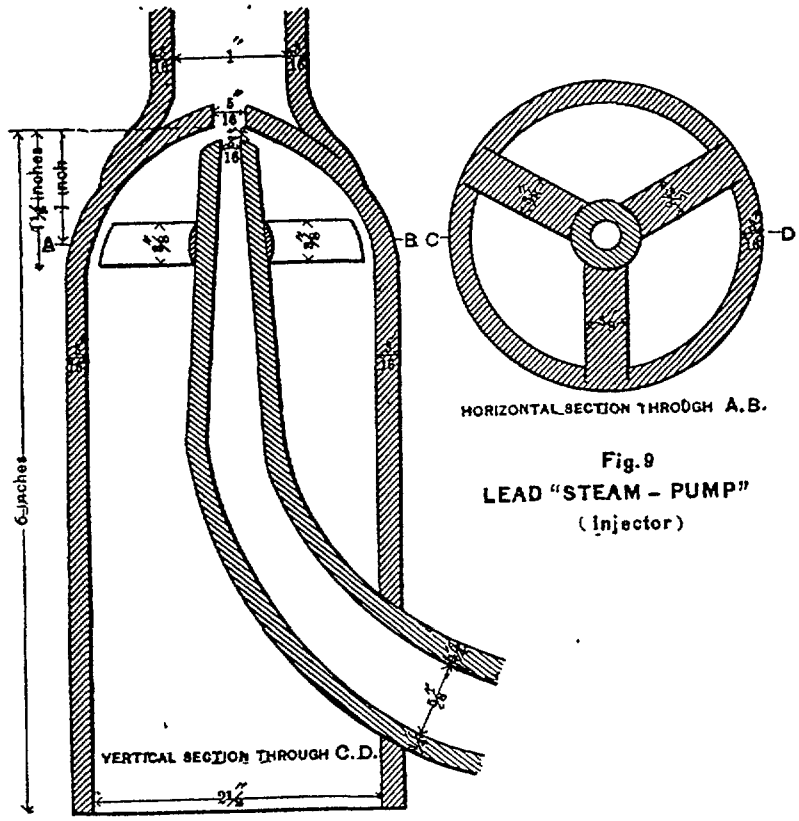


Fig. 9
LEAD "STEAM - PUMP"
(Injector)

mill boiler. The "steam pump" used (Fig. 9) was devised by my former lead-burner, J. L. Robertson, and was very simple, durable, and effective.

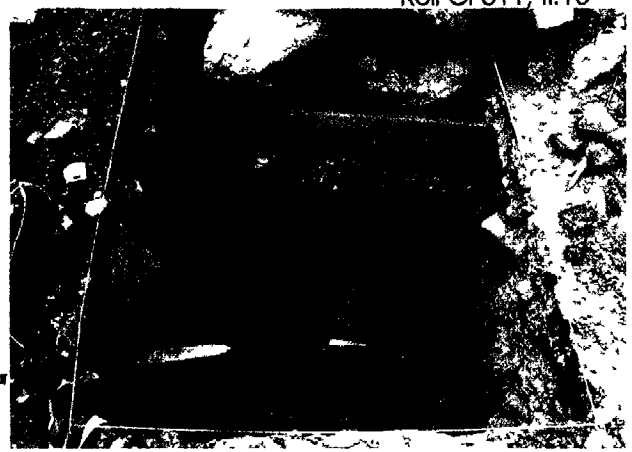
APPENDIX E

Supplementary Excavation Profiles for the Birdsall Mill, MS004

Photograph of South Profile

Period	Matrix	Description
Post Abandonment	1	Recent Slopewash
Last Demolition-Some Burning	2	Slopewash/Fill Behind C-1 Wall Some Burned Material
Possible Latest Use	2A	Yellow Tails on Str 2B Surface
Construction of Upper Wall & Terrace	2B	Wood - Horizontal & Vertical Wall Parts Hold Up Upper Str C-1 Stone Walls
	2C	Colluvium, Fill
Demolition Deposits	3B – 3 – 3A	Colluvium, Demolition of Str 3B Kiln Area with Slag Covered Brick (Fill for Str 2B Surface)
Base of Demolition	3C	Top of Demolition of Brick & Mortar Floors & Walls
Mill Construction Early Use	4	Mortar & Brick Walls & Floors Surviving Demolition
Mill Construction	5	Dressed Stone Foundation Under C-1 Lower Brick Wall

Harris Matrix



Photograph of West Profile

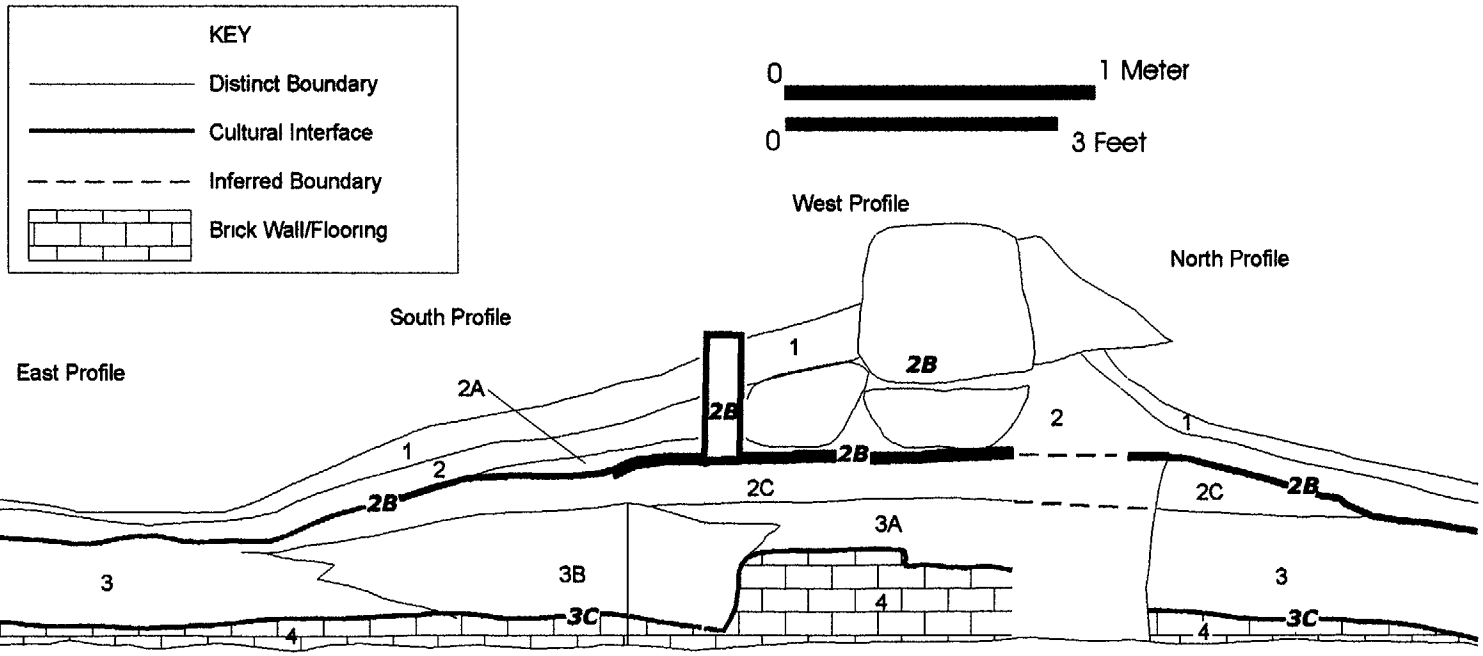
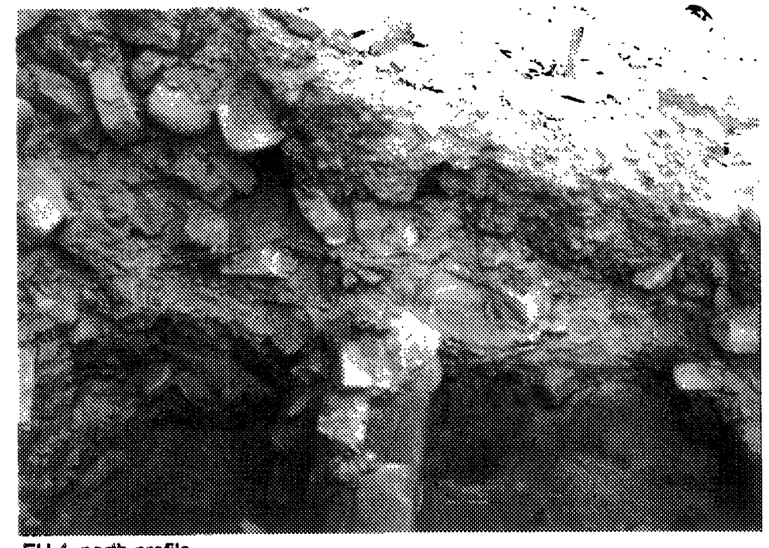


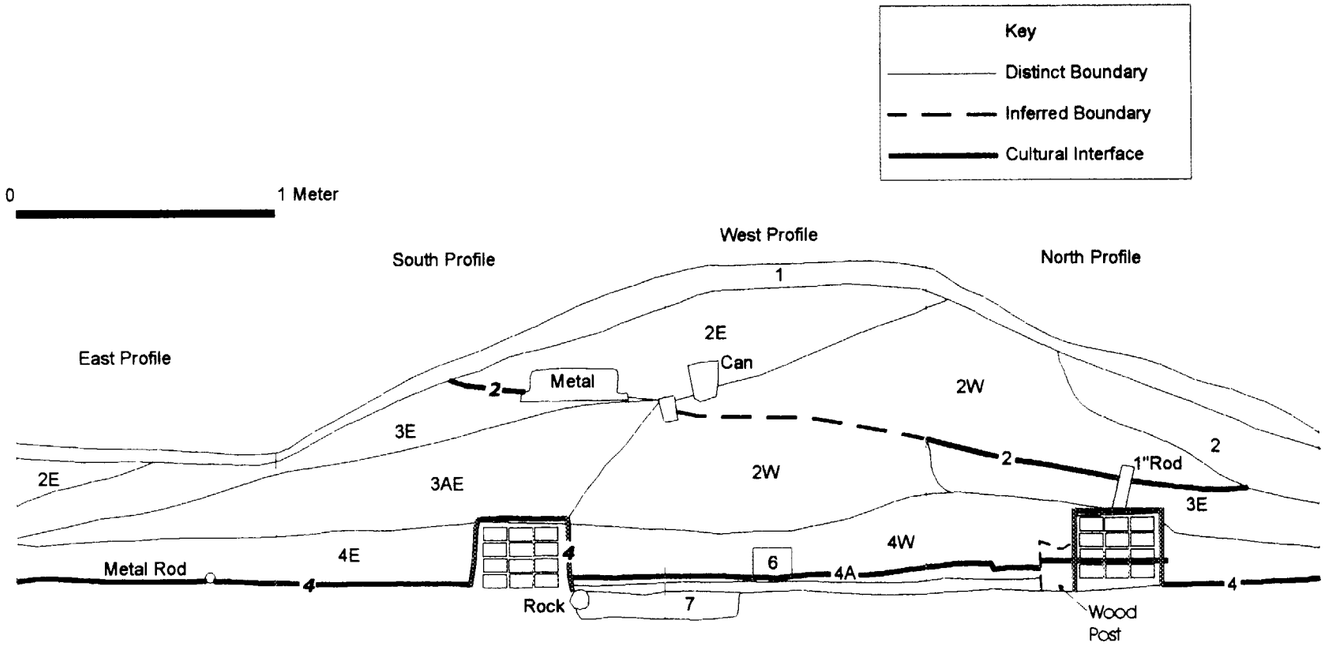
Figure E-1. Photographs, Harris matrix and stratigraphic profile of EU 3 in Loc C, MS004.

EU 4,south profile.

EU 4, floor.



EU 4, north profile.



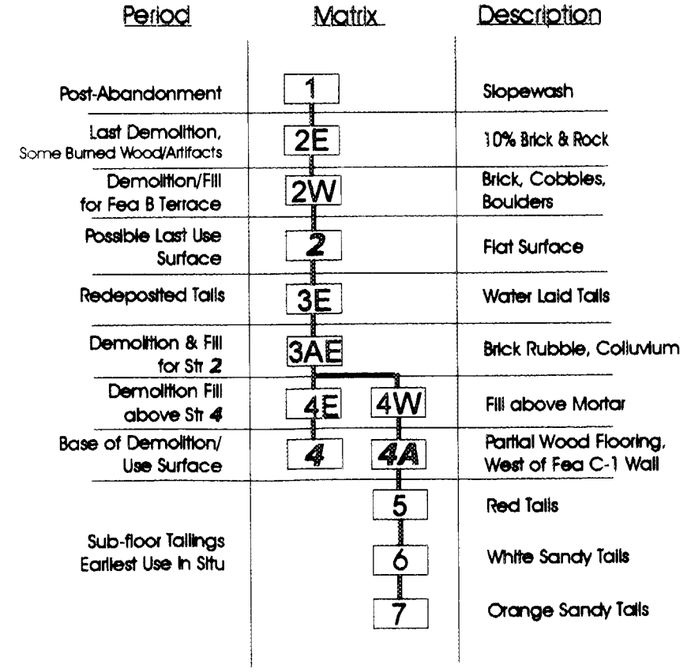
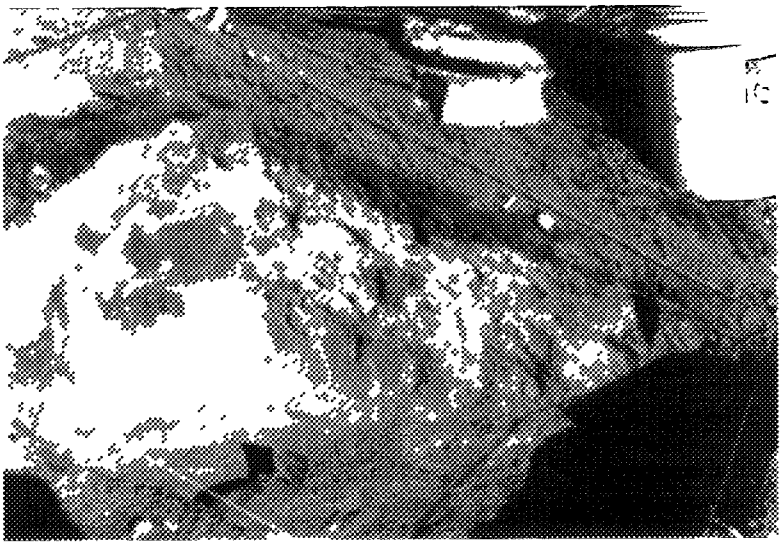
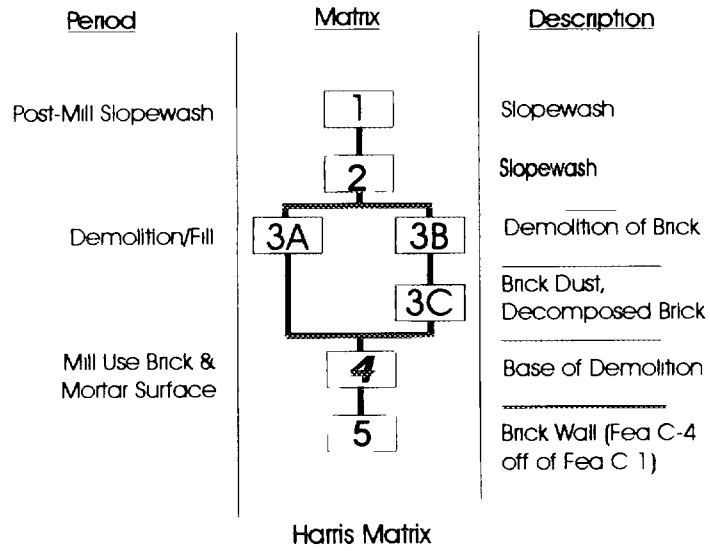
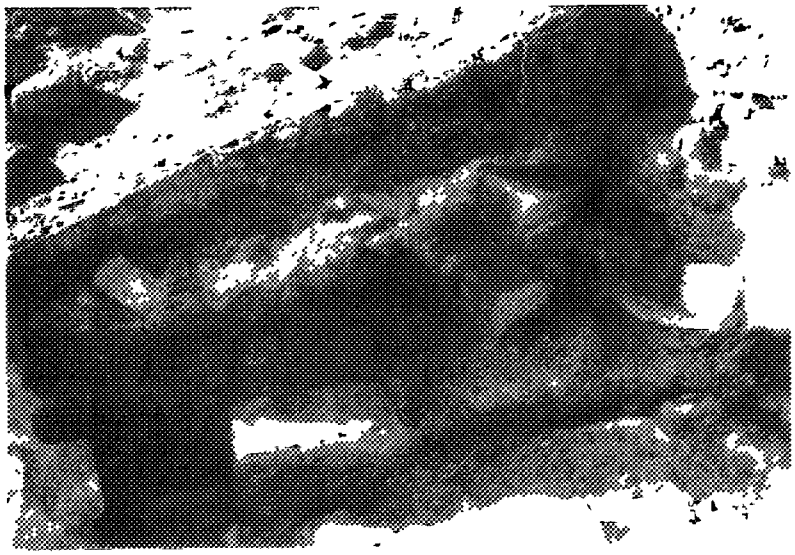


Figure E-2. Photographs, stratigraphic profile and Harris matrix for EU 4 in Loc C, MS004.

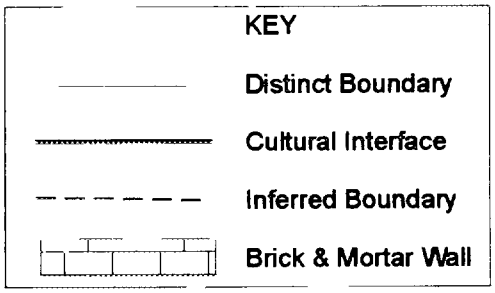


Photograph of north profile (Roll 978-2, fr 8)





Photograph of south profile (Roll 978-2, fr.9)



0 1 Meter

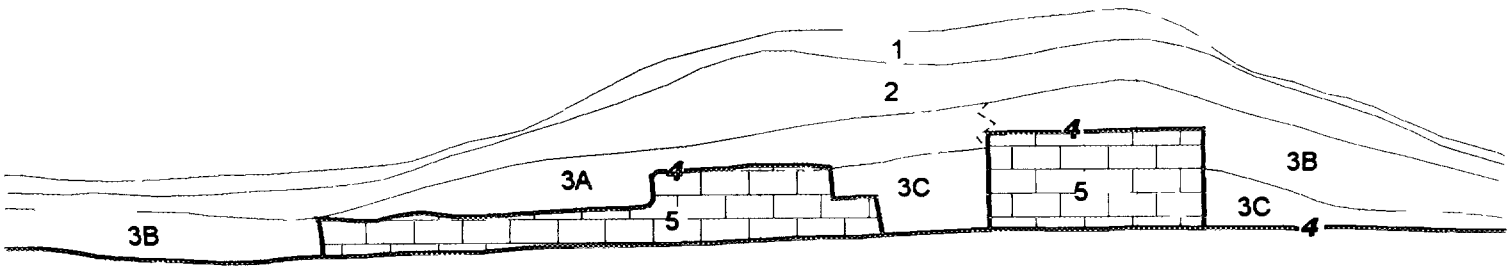


Figure E-3 Photographs, Harris Matrix and stratigraphic profile for EU7 in Locus C, MS004

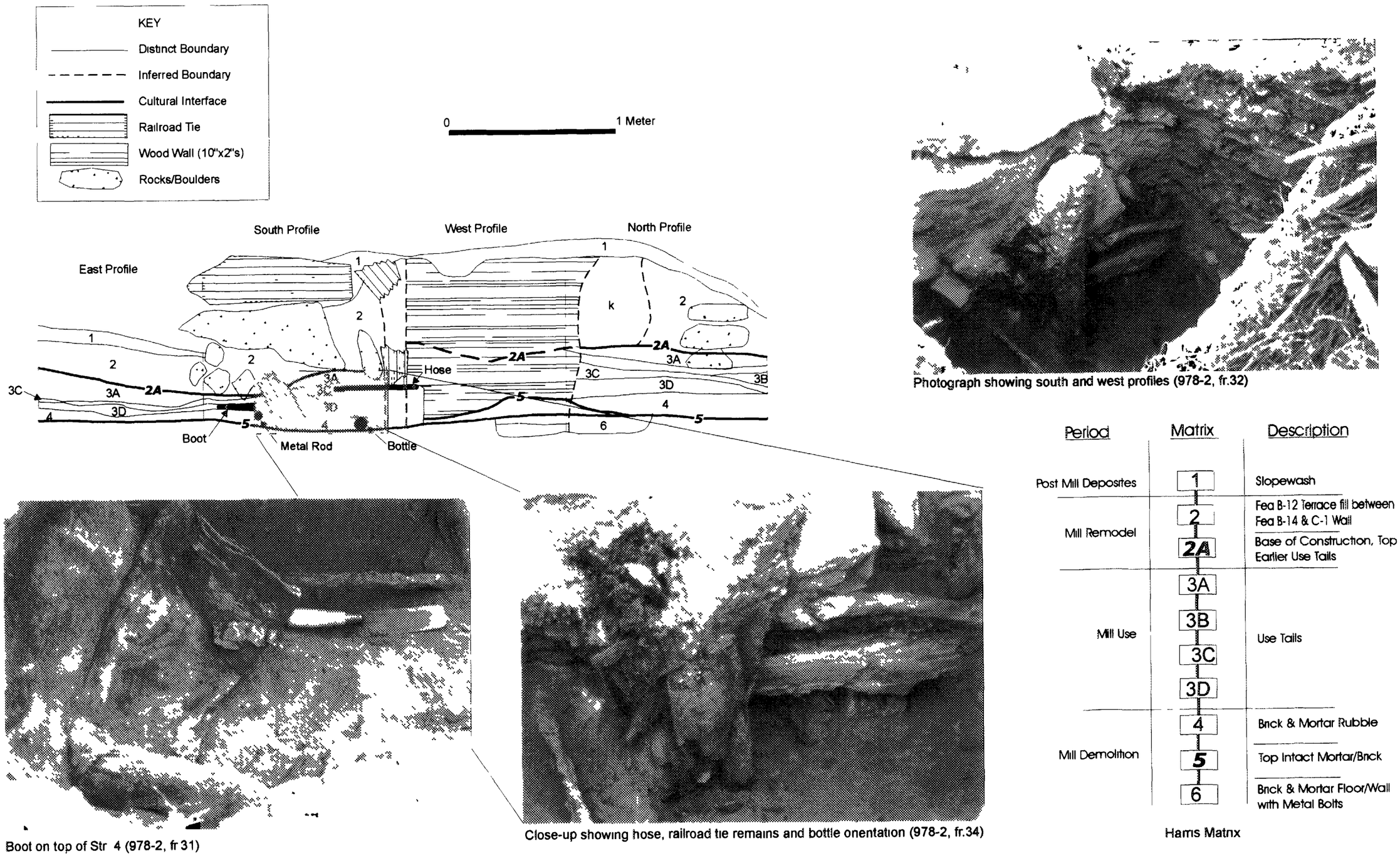


Figure E-4 Stratigraphic profile, photographs and Harris matrix for EU 8 in Loc B/C, MS004

West profile of TP 1 and Fea C-3 stone wall (Roll 970-2, fr.2).

Period	Matrix	Description
Post mill	1	Slopewash
	1A	Fea C 3 Retaining Wall
Remodel	1B	Latest Surface of Fea D-1 Terrace
	2	Construction Fill for Final Fea D 1 Terrace
	3	
	4	Structure Use/Demolition Debris
Early Mill Use/ Demolition	4A	Ash (buried Str 4A)
	4B	Early Mill Surface Fea D 1
Mill Terrace/ Construction	5	D 1 Terrace Fill Using Redeposited Tailings
	6	Lower Fea D 1 Terrace Fill

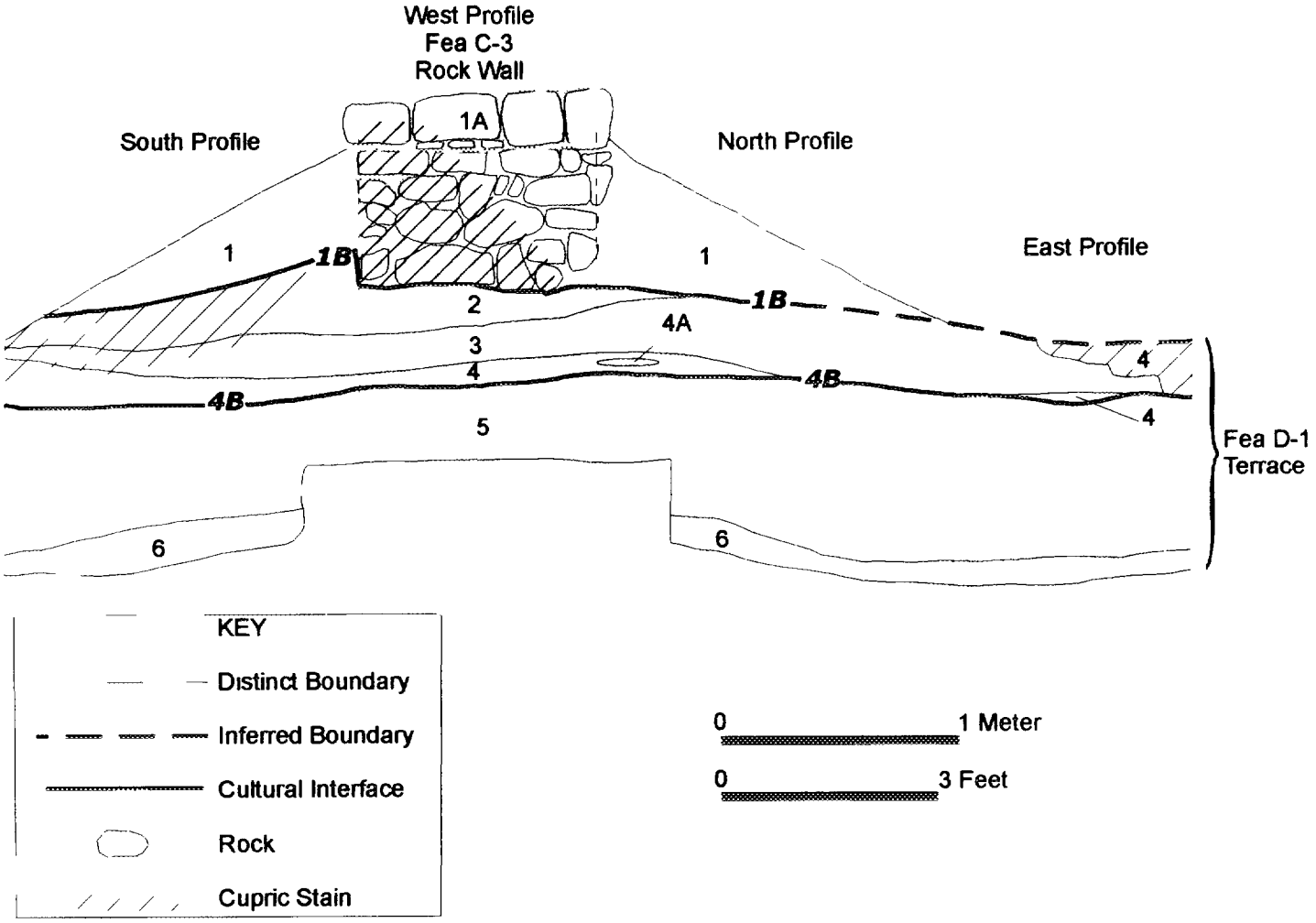


Figure E-5 Photograph, Harris matrix and stratigraphic profile for TP 1, Fea C-3 retaining wall and Fea D-1 terrace, MS004, Birdsall Mill

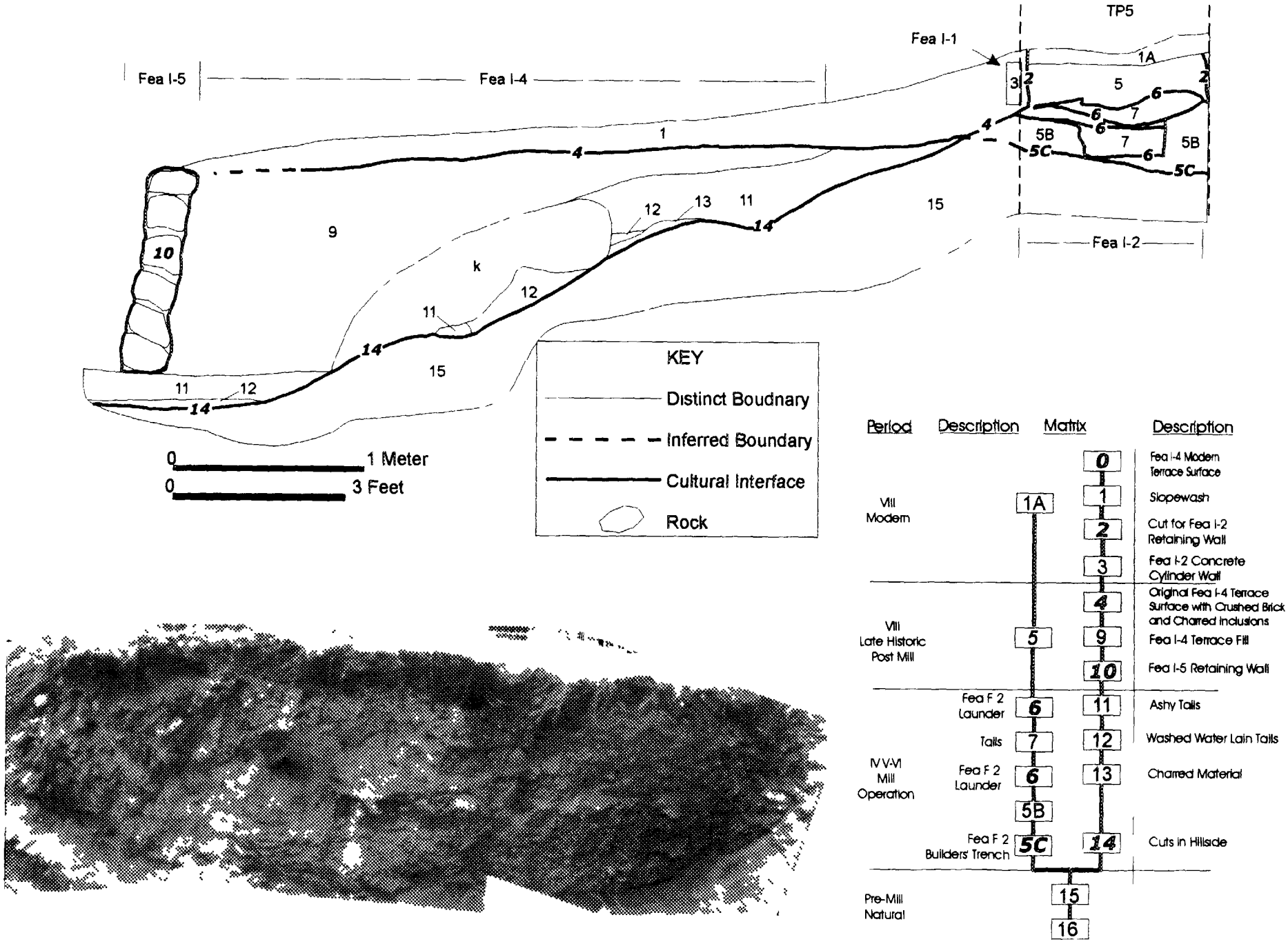


Figure E-6 Stratigraphic profile, photographs and Harris matrix for Tr 1, Loc I, MS004

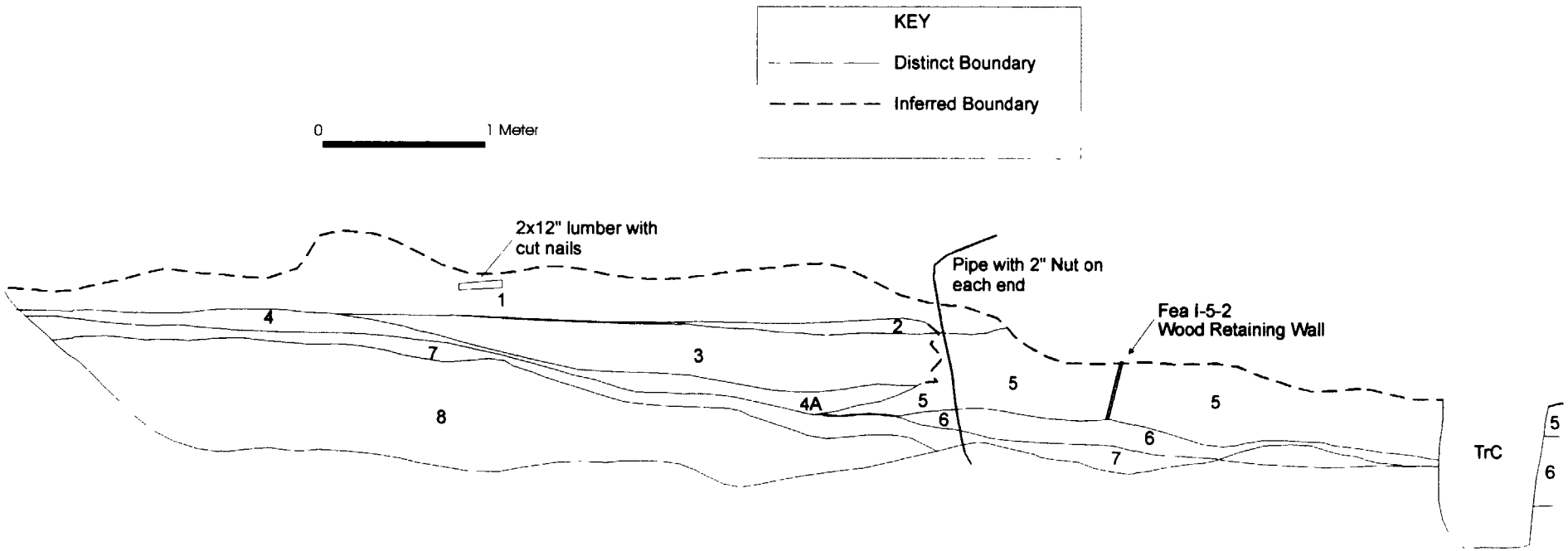
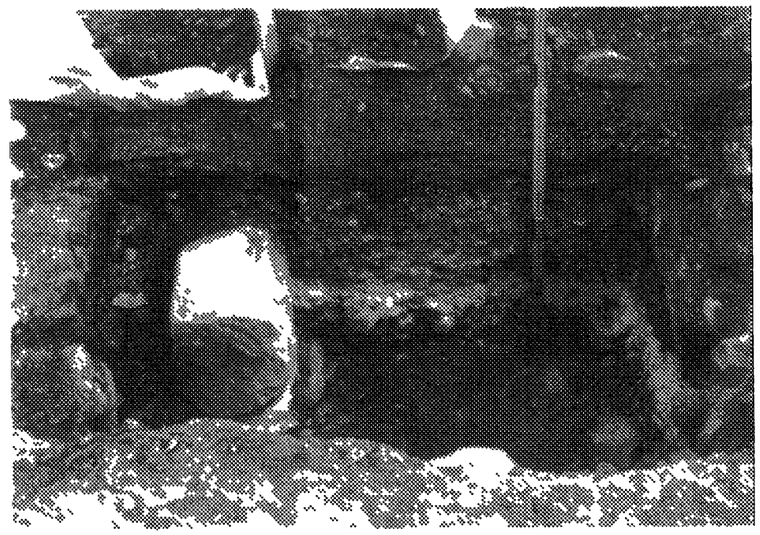


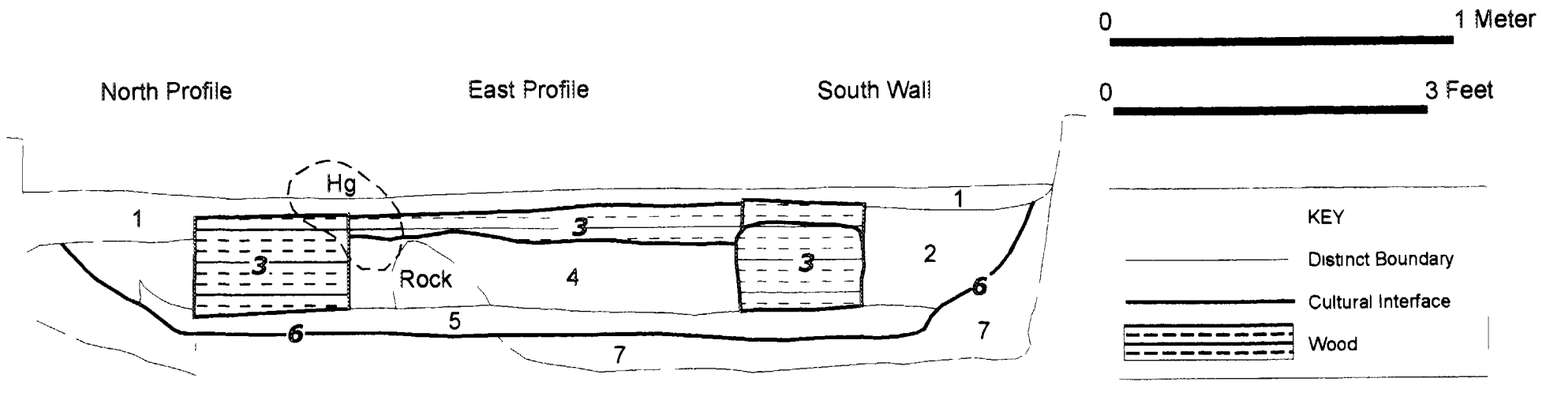
Figure E-7 . Stratigraphic profile for Tr B in Loc I, MS004.

Photograph of north profile (978-4, fr 4)



Photograph of east profile (978-4, fr 2)

Photograph of south profile! (978-4, fr.3)



Period	Matrix	Description
	1	Fill, modern?
	2	Fill Adjacent to Foundation
Mill Construction & Use	3	Wood Mill Foundation
	4	Construction Fill
Use Tails	5	Use/Construction
	6	Construction Cut
	7	Natural Alluvium

Harris Matrix

Figure E-8 Photographs , stratigraphic profile and Harris matrix for EU 12 in Loc L, MS004