APPENDICES

APPENDIX A

CULVERT RESOURCE INVENTORY TABLE

RESOURCE INVENTORY TABLE

The following six pages present a table of data pertaining to the 98 culverts inventoried in the field survey portion of this study. The resources are listed alphabetically first by county name and then by town name. The other column headings and abbreviations used in the table are as follows:

NHDHR #: This is the individual inventory number assigned by the New Hampshire Division of Historical Resources for each historic resource in a town.

Type: This refers to the type of culvert, box culvert (B), arch culvert (A), pipe culvert (P), or wood (W).

Work: This refers to the predominate type of stone masonry work used in the construction of the culvert, either fieldstone (F), or Ashlar (A). These terms were loosely defined for the purposes of speeding the fieldwork: fieldstone meaning of local uncut or roughly hammer split or shaped stone; Ashlar meaning cut stone, either quarry split and squared – the usual case of lintels or local stone fully squared-up with hammer and chisel or otherwise split and cut to provide multiple flat faces. In the case of pipe culverts with stone facewalls that lack integrity, the stone work was considered uninterruptable and therefore not applicable (n/a).

Span ft.: This refers to the distance in feet between the culvert channel walls, also called the width of the waterway. It is the unsupported span of the lintels or slabs that form the ceiling of the culvert, or the distance between the spring points of an arch.

Lgt. ft.: This refers to the distance in feet between the culvert inlet and outlet facewalls, also called the length of the waterway or length of the channel walls.

Cells: This refers to the number of separate culvert channels, also known as cells or barrels. A double box culvert, for example, has two cells.

Altered: This refers to whether the culvert shows evidence of being altered in some way – yes (Y) or no (N). Refer to the corresponding notes (on table pages 4-6) for explanation.

NR: This refers to the potential eligibility of the culvert for listing in the National Register of Historic Places: yes (Y), likely eligible, or no (N), not likely eligible. The assessment is the opinion of the project architectural historian only.

RESOURCE INVENTORY TABLE

	County	Town	NHDHR #	Street	Crossing	Type	Work	Span ft	Lgt ft	Cells	Altered	NR
1	Belknap	Gilford	GLF0069	Belknap Mtn. Rd	Unknown	B	F	2.6	20.8	1	N	Y
2	Carroll	Albany	ALB0045	Dugway Rd.	Big Br.	B	A	9.3	25.8	1	Y	Y
3	Carroll	Ossipee	OSS0028	Browns Ridge Rd.	Youngs Br.	B	A	9.2	25.6	1	Y	Y
4	Carroll	Ossipee	OSS0027	Browns Ridge Rd.	Unknown	P	n/a	2.0	40.3	1	n/a	N
5	Carroll	Tuftonboro	TUF0007	NH 109A	Twentymile Br.	B	F	2.9	32.6	1	N	Y
6	Carroll	Wakefield	WAK0010	Canal Rd.	Unknown	A	F	11.5	27.0	1	Y	Y
7	Carroll	Wolfeboro	WOL0026	Pleasant Valley Rd.	Unknown	B	F	3.6	30.0	2	Y	N
8	Cheshire	Fitzwilliam	FIT0015.	NH 119/Holman Rd.	Unknown	B	A	5.2	38.0	1	N	Y
9	Cheshire	Fitzwilliam	FIT0016	Royalston Rd.	Horseshoe Pond	P	n/a	3.5	33.0	1	Y	N
10	Cheshire	Fitzwilliam	FIT0017	Templeton Turnpike	Stone Pond	B	A	6.5	19.3	2	N	Y
11	Cheshire	Hinsdale	HIN0023	NH 119/ Canal Street	Kilburn Br.	A	A	12.5	62.6	1	Y	Y
12	Cheshire	Jaffrey	JAF0463	Dublin Rd.	Stoney Br.	B	A/F	6.0	38.8	1	Y	N
13	Cheshire	Jaffrey	JAF0464	Nutting Rd.	Unknown	A	A	11.5	20.0	1	Y	Y
14	Cheshire	Keene	KEE0210	Court Street	Trib. Ashuelot R.	B	F	3.0	n/a	1	N	Y
15	Cheshire	Marlborough	MAR0014	Frost Hill Rd.	Unknown	P	n/a	1.5	34.5	1	Y	N
16	Cheshire	Marlborough	MAR0015	Roxbury Rd.	Glen Br.	B	A	4.0	23.0	1	N	Y
17	Cheshire	Marlborough	MAR0016	Dilingham Rd.	Unknown	P	n/a	2.0	40.0	2	Y	N
18	Cheshire	Marlow	MRL0013	off Mansfield Rd.	Unknown	B	F	1.5	14.0	1	Y	N
19	Cheshire	Richmond	RIC0006	Martin Cook Rd.	Rice Br.	B	F	2.8	26.0	1	N	Y
20	Cheshire	Richmond	RIC0007	Sprague Rd.	Unknown	P	n/a	3.9	31.3	1	Y	N
21	Cheshire	Richmond	RIC0008	Sprague Rd.	Unknown	B	F	1.9	21.6	1	Y	Y
22	Cheshire	Richmond	RIC0009	Old Winchester Rd.	Unknown	P	n/a	1.5	25.5	1	n/a	N
23	Cheshire	Surry	SUR0003	Webster Rd.	Unknown	W	F	2.5	14.5	1	Y	N
24	Cheshire	Swanzey	SWA0019	Cobble Hill Rd. East	Unknown	P	n/a	3.0	31.6	1	Y	N
25	Cheshire	Troy	TRO0344	Old Keene Rd.	Unknown	P	n/a	3.0	48.0	1	Y	N
26	Cheshire	Winchester	WIN0017	Old Chesterfield Rd.	Unknown	P	n/a	3.5	37.5	1	Y	N
27	Coos	Errol	ERR0005	NH 16	Trib. Androscoggin	B	A/F	5.0	34.0	1	Y	Y
28	Coos	Erroll	ERR0006	NH 16	Trib. Androscoggin	B	A	8.8	37.5	1	N	Y
29	Grafton	Alexandria	ALX0003	Perkins Pond Hill Rd.	Unknown	P	n/a	2.0	42.0	1	n/a	N
30	Grafton	Alexandria	ALX0004	Gove Rd.	Unknown	B	F	2.0	29.0	1	Y	N
31	Grafton	Enfield	ENF0022	NH 4A	Knox River	B	A/F	8.5	?	1	N	Y
32	Grafton	Grafton	GRA0013	Wild Meadow Rd.	Hoyt Br.	B	F	4.2	19.0	1	N	Y
33	Grafton	Lebanon	LEB0012	Mill Rd.	Trib. Mascoma R.	P	n/a	2.0	28.0	1	Y	N

RESOURCE INVENTORY TABLE (continued)

	County	Town	NHDHR #	Street	Crossing	Type	Work	Span ft	Lgt ft	Cells	Altered	NR
34	Grafton	Lyme	LME0003	Smith Mountain Rd.	Grant Br.	B	F	3.2	17.0	1	Y	Y
35	Grafton	Orford	ORF0008	Tillotson Falls Rd.	Unknown	P	n/a	1.5	20.0	1	n/a	N
36	Hillsborough	Goffstown	GOF0059	Elm Street	Unknown	P	n/a	2.0	126.0	1	n/a	N
37	Hillsborough	Goffstown	GOF0060	Elm Street	Trib. Piscataquag	B	F	4.5	45.5	1	Y	N
38	Hillsborough	Greenville	GRV0007	Route 123	Trib. Souhegan R.	B	A/F	4.5	13.6	1	N	Y
39	Hillsborough	Hillsborough	HIL0019	Colby Rd.	Nelson Br.	B	A/F	10.5	14.2	1	N	Y
40	Hillsborough	Hillsborough	HIL0020	Concord End Rd.	Nelson Br.	B	A/F	7.0	19.3	1	Y	Y
41	Hillsborough	Hillsborough	HIL0021.	Beard Rd.	Beard Br.	B	A/F	3.0	31.0	1	N	Y
42	Hillsborough	Hillsborough	HIL0022	Gleason Falls Rd.	Beard Br.	A	A/F	12.0	19.5	1	N	Y
43	Hillsborough	Hillsborough	HIL0023	Gleason Falls Rd.	Beard Br.	A	A/F	29.5	23.2	1	N	Y
44	Hillsborough	Hollis	HLL0144	Depot Street	Sucker Br.	B	A	6.0	43.5	1	Y	Y
45	Hillsborough	Litchfield	LIT0009	NH 3A	Trib. Merrimack R.	P	n/a	1.3	68.0	1	Y	N
46	Hillsborough	Litchfield	LIT0010	NH 3A	Watts Br.	A	A/F	7.0	60.0	1	Y	Y
47	Hillsborough	Pelham	PEL0002	Old Gage Hill Rd. N.	Unknown	B	F/B	2.5	?	1	n/a	N
48	Hillsborough	South Weare	WEA0006	Deering Center Rd.	Unknown	B	A/F	4.0	100.0	1	Y	Y
49	Hillsborough	Temple	TEM0002	Memorial Highway	Unknown	A	A/F	9.2	16.0	1	Y	Y
50	Hillsborough	Temple	TEM0003	Fish Rd.	Unknown	B	F	2.0	21.5	2	Y	N
51	Hillsborough	Weare	WEA0002	Sawyer Rd.	Unknown	P	F	2.5	21.8	1	Y	N
52	Hillsborough	Weare	WEA0003	Deering Center Rd.	Unknown	P	F	2.5	47.0	2	Y	N
53	Hillsborough	Weare	WEA0004	off Oliver Rd.	Unknown	B	F	3.5	27.0	1	Y	N
54	Hillsborough	Wilton	WIL0006	King Br. Rd.	King Br.	A	A	9.9	31.0	1	Y	Y
55	Merrimack	Allenstown	ALL0009	Bachelder Rd.	Unknown	B	A	8.0	23.8	1	Y	Y
56	Merrimack	Bow	BOW0010	Br. Londonderry Tp	Unknown	P	A/F	3.0	25.0	2	Y	N
57	Merrimack	Bow	BOW0011	Page Rd.	Unknown	P	A/F	4.0	38.5	1	Y	N
58	Merrimack	Bradford	BRA0013	Forest Street	Unknown	B	F	2.6	19.0	1	N	Y
59	Merrimack	Bradford	BRA0014	Forest Street	Unknown	B	F	1.5	20.5	1	Y	N
60	Merrimack	Bradford	BRA0015	High Street	Unknown	B	F	3.1	132.0	1	N	Y
61	Merrimack	Bradford	BRA0016	West Main Street	Unknown	B	F	4.5	52.0	1	N	Y
62	Merrimack	Canterbury	CNT0005	New Rd.	Burnham Br.	P	F	4.0	32.5	1	Y	N
63	Merrimack	Canterbury	CNT0006	Scales Rd.	Burnham Br. (?)	B	F	4.0	31.0	1	N	Y
64	Merrimack	Canterbury	CNT0007	Abberton Rd.	Unknown	B	F	3.5	21.0	2	N	Y
65	Merrimack	Canterbury	CNT0008	off Shaker Rd.	Unknown	B	F	4.3	24.5	1	N	Y
66	Merrimack	Canterbury	CNT0009	off Hacklboro Rd.	Unknown	B	F	3.0	26.5	1	N	Y

RESOURCE INVENTORY TABLE (continued)

	County	Town	NHDHR #	Street	Crossing	Type	Work	Span ft	Lgt ft	Cells	Altered	NR
67	Merrimack	Newbury	NBR0003	Old Post Rd.	Unknown	P	n/a	1.2	34.8	1	n/a	N
68	Merrimack	Newbury	NBR0004	Old Post Rd.	Unknown	P	F	1.5	32.8	1	Y	N
69	Merrimack	Newbury	NBR0005	Old Post Rd.	Unknown	B	F	5.0	30.0	1	Y	Y
70	Merrimack	Pembroke	PEM0040	N. Pembroke Rd.	Unknown	P	F	2.0	41.8	1	Y	N
71	Merrimack	Pembroke	PEM0041	N. Pembroke Rd.	Unknown	P	F	2.0	46.0	1	Y	N
72	Merrimack	Warner	WAR0005	West Joppa Rd.	Trib. Bartlett Br.	B	F	3.9	18.6	1	N	Y
73	Merrimack	Warner	WAR0006	Lowd Rd.	Trib. Beard Br.	B	F	2.0	25.6	1	Y	N
74	Merrimack	Warner	WAR0007	Bade(r) Rd.	Unknown	B	F	2.0	30.8	1	Y	N
75	Merrimack	Warner	WAR0008	Colleague Pd. Rd.	Unknown	B	F	4.0	20.0	1	N	Y
76	Merrimack	Warner	WAR0009	Gore Rd.	Trib. Meadow Br.	B	F	4.0	15.2	1	Y	Y
77	Merrimack	Wilmot	WLM0004	Stearns Rd.	Unknown	B	F	3.0	20.0	2	Y	Y
78	Merrimack	Wilmot	WLM0005	Stearns Rd.	Unknown	B	F	4.5	22.0	1	N	Y
79	Merrimack	Wilmot	WLM0006	Stearns Rd.	Kimpton Br.	B	F	4.9	27.1	1	N	Y
80	Merrimack	Wilmot	WLM0007	Stearns Rd.	Unknown	B	F	4.2	22.0	1	N	Y
81	Rockingham	Atkinson	ATK0004	Main Street/ NH121	Unknown	B	F	1.0	53.0	1	n/a	N
82	Rockingham	Chester	CHE0006	Haverhill Rd/NH121	Unknown	B	F	4.1	39.2	1	N	Y
83	Rockingham	Danville	DAN0006	Main St./ 111A	Unknown	B	F	5.1	42.3	1	Y	N
84	Rockingham	Epping	EPP0010	Blake Rd.	Unknown	P	F	1.5	41.0	1	n/a	N
85	Rockingham	Exeter	EXE0022	Hampton Rd./Rt. 27	Unknown	B	F/A	3.3	43.8	1	Y	N
86	Rockingham	Hampstead	HMP0005	Walnut Hill Rd/NH121	Unknown	B	F	2.8	55.0	1	N	Y
87	Rockingham	Hampstead	HMP0006	Walnut Hill Rd/NH121	Unknown	B	F	4.0	?	1	Y	N
88	Rockingham	Hampton Falls	HMF0003	Kensington Rd./ RT84	Dodge R.	A	A	11.3	31.0	1	N	Y
89	Rockingham	Londonderry	LON0112	Mammoth Rd.	Chas Brook	B	F	7.0	33.0	1	Y	N
90	Rockingham	Newfields	NWF0004	Piscassic Rd./Rt. 87	Unknown	B	F	1.9	47.0	1	Y	N
91	Rockingham	Newmarket	NWM0023	Grant Rd.	Unknown	B	F	1.1	50.6	1	N	Y
92	Rockingham	Northwood	NOR0002	Old Turnpike Rd.	Flat Meadow Br.	B	F	3.3	35.0	1	N	Y
93	Rockingham	Portsmouth	POR0119	Woodbury Avenue	Hodgson Br.	B	A	11.5	250+	1	Y	Y
94	Rockingham	South Hampton	SHM0002	Burnt Swamp Rd.	Unknown	B	F	1.5	42.0	1	Y	N
95	Rockingham	Windham	WND0001	off Church Rd.	Golden Br.	B	F	4.1	27.5	1	N	Y
96	Sullivan	Acworth	ACW0008	Breier Rd.	Unknown	P	n/a	2.5	25.0	1	n/a	N
97	Sullivan	Acworth	ACW0009	NH 123A	Honey Br.	B	F	5.0	9.0	1	N	Y
98	Sullivan	Claremont	CLA0058	Maple Avenue	Meadow Br.	B	F	5.4	36.5	1	Y	N

RESOURCE INVENTORY TABLE NOTES

	Culvert Resource Table Notes [row numbers correspond to data row numbers]
1	Culvert is located on an abandoned road/causeway, which runs parallel to Belknap Mtn. Road
2	Large culvert. Interior joints pointed or re-pointed. Concrete floor added with drop spillway at outlet
3	Large culvert. Interior joints pointed or re-pointed. Fieldstone retaining walls.
4	Steel pipe culvert with fieldstone inlet/outlet retaining walls.
5	Some mortar present. Some ceiling stones have drill hole marks (plug & feather).
6	Associated with Great Falls Mfg. Co. mill power canal. Concrete curb beam added.
7	Second cell appears later addition, then altered later with addition of concrete pipe. Dimished integrity.
8	Secondary steel pipe culvert installed alongside
9	Concrete pipe with split stone face walls, possibly reused from pre-existing box culvert.
10	Good example of double box culvert
11	Widened with concrete box culvert as part of road widening.
12	Widened 10 feet with corrugated metal pipe on downstream side; upstream end reinforced with concrete lintel. Dimished integrity.
13	Excellent example of arch culvert. Joints reportedly pointed or re-pointed with epoxy mortar.
14	Small rudimentary box culvert. Steel pipe from street catch basin discharges near culvert outlet.
15	Steel pipe with split stone face walls. Stone possibly reused from preexisting box culvert. Upstream retaining wall failing.
16	Nice example of typical 4' box culvert.
17	Double steel corrugated pipe culvert with split and fieldstone facewalls. Stone possibly reused from preexisting box culvert.
18	Overgrown. Wood boards or beams present, possible curbing or decking. Common type with dimished integrity.
19	Small rudimentary box culvert or rough fieldstone; not readily visible, unable to determine integrity.
20	Steel corrugated pipe culvert with split and fieldstone facewalls. Stone possibly reused from preexisting box culvert.
21	Widened or repaired at inlet end with corrugated metal pipe. Stone box remains at outlet end.
22	Steel pipe culvert with fieldstone inlet/outlet retaining walls; outlet wall rebuilt with mortared fieldstone.
23	Timber stringer wood deck span on stone abutments. No stone lintels or slabs present to suggest this was a box culvert at one time.
24	Two steel pipes with stone facewalls, one 36," one 72". Split stone wall coping and road curbing may have been lintels of pre-existing box culvert.
25	Concrete pipe and concrete facewalls with split stone retaining walls above. Stone may have been from pre-existing box culvert.
26	42" steel pipe culvert with quarried stone and fieldstone facewalls. Split stones may have been from pre-exiting box culvert.
27	Culvert widened downstream about 8' with addition of concrete pipe. Facewalls repaired with fieldstone in mortar. Box section retains integrity.
28	Box built with very large dimension cut stone.
29	Concrete pipe culvert with fieldstone facewalls.
30	Box culvert appears widened or repaired with corrugated steel pipe; downstream facewall looks rebuilt, upstream may be original. Dimished integrity.
31	Large box, good workmanship; culvert extends under building; long stone-built channel; appears associated with other historic resources.
32	Example of small rudimentary box culvert.
33	Plastic pipe culvert with stone facewalls. Stone possibly reused from pre-existing box culvert.

RESOURCE INVENTORY TABLE NOTES (continued)

	Culvert Resource Table Notes [row numbers correspond to data row numbers]
34	Concrete and wood visible in ceiling of culvert.
35	Steel pipe culvert with fieldstone facewalls.
36	Concrete pipe culvert with fieldstone facewalls.
37	Box culvert apparently widened 16' with concrete pipe; outlet facewall fieldstone, inlet facewall appears original. Dimished integrity.
38	Good example of box culvert and skilled workmanship. Associated with stone channel and possibly other nearby historic mill resources.
39	Prime example of large box culvert of split lintel and fieldstone construction.
40	Same construction and workmanship to nearby HIL0019. Upstream facewall collapsed, stone fill repair added.
41	Good example of split stone box.
42	Rough-cut arch stones with fieldstone facewalls. Segmental but nearly semi-circular arch. Adjacent to HIL0023
43	Rough-cut arch stones with fieldstone facewalls. Segmental arch. Adjacent to HIL0022
44	Good example of 5' box culvert with split and cut lintels. Downstream lintels have collapsed into the stream.
45	Steel corrugated pipe culvert with split and fieldstone facewalls. Inlet facewall stone possibly reused split lintels from preexisting box culvert.
46	Cut arch stones with fieldstone facewalls. Semi-circular arch on tall fieldstone walls. Mortar present between voussoirs. Widened with concrete arch culvert.
47	Catch basin drainage culvert. Inlet is brick catch basin feeding small stone box culvert of fieldstone and split lintels.
48	Culvert may have been associated with former mill operation. Inlet altered and incorporated into concrete dam, circa 1920.
49	Road and fill washed away and facewalls collapsed. But arch ring remains and provides important information on construction of rare stone arch culvert.
50	One small box culvert with 3' concrete pipe bypass culvert recently added to the side. Pipe may have replaced second box culvert. Dimished integrity.
51	Plastic pipe culvert with fieldstone facewalls. Stone possibly reused from preexisting box culvert.
52	One concrete pipe, one steel pipe with integral mortared fieldstone facewalls. Facewall stone possibly reused from pre-existing box culvert.
53	Apparently former small box culvert on abandoned path, now completely washed out and collapsed. Dimished integrity.
54	Rare segmental arch culvert with ashlar ring stones and facewall. Concrete road curbs and pointing of inlet facewalls do not substantially diminish integrity.
55	Large cut stone box culvert widened downstream with concrete box.
56	Double concrete pipe culvert. Facewall stone, which includes long split lintels, possibly reused from pre-existing box culvert.
57	Concrete pipe culvert with cut and fieldstone facewalls. Facewall stone, which includes long split lintels, possibly reused from pre-existing box culvert.
58	Example of small rudimentary fieldstone box culvert. A corrugated metal pipe has been installed to the west to supplement capacity.
59	Example of small rudimentary fieldstone box culvert. The outlet facewall was rebuilt in 2006 using existing stone.
60	Example of small rudimentary fieldstone box culvert.
61	Downstream elevation is completely submerged.
62	Concrete pipe culvert with cut and fieldstone facewalls. Facewall stone possibly reused from pre-existing box culvert.
63	Good example of rare tall narrow fieldstone box culvert (4 feet by 8 feet.
64	Good example of rare double box culvert of slab and fieldstone construction.
65	Good example of slab and fieldstone box culvert.
66	Example of typical small slab and fieldstone box culvert.

RESOURCE INVENTORY TABLE NOTES (continued)

	Culvert Resource Table Notes [row numbers correspond to data row numbers]
67	Steel pipe culvert with fieldstone facewalls.
68	Steel corrugated pipe culvert with stone facewalls. Stone possibly reused from pre-existing box culvert.
69	Example of typical slab and fieldstone box culvert. Possibly reconstructed.
70	Concrete pipe culvert with cut and fieldstone facewalls. Facewall stone, which includes long split lintels, possibly reused from pre-existing box culvert.
71	Concrete pipe culvert with cut and fieldstone facewalls. Facewall stone, which includes long split lintels, possibly reused from pre-existing box culvert.
72	Example of typical small lintel and fieldstone box culvert. Lintels appear to be quarried, although there is no evidence of quarrying marks.
73	Example of small rudimentary fieldstone box culvert. Inlet facewall collapsing. Common type with diminished integrity.
74	Example of small roughly built fieldstone box culvert. Outlet facewall collapsing. Common type with diminished integrity.
75	Example of typical small slab and fieldstone box culvert.
76	Good example of medium size slab and fieldstone box culvert. The outlet facewall is partially collapsed.
77	Good example of rare small double box culvert of slab and fieldstone construction. Outlet lintel of east culvert is collapsing.
78	Example of typical small slab and fieldstone box culvert.
79	Example of typical small slab and fieldstone box culvert.
80	Example of typical small slab and fieldstone box culvert.
81	Small catch basin drain. May be pipe with box outlet. The culvert is an outlet to a catch-basin across the street. Common type with diminished integrity.
82	Good example of less common vertically rectangular box culvert. Mortared joints appear original.
83	Example of small roughly built fieldstone box culvert. Culvert appears mortared through; concrete lintel added. Common type with diminished integrity.
84	Steel pipe culvert with fieldstone facewalls.
85	Example of small roughly built fieldstone box culvert with cut lintels. Inlet partly reconstructed. Common type with diminished integrity.
86	Example of typical small fieldstone box culvert.
87	Typical rough fieldstone box culvert widened with addition of concrete pipe at upstream end. Common type with diminished integrity.
88	Outstanding semi-circular arch culvert/bridge and ashlar masonry. Associated with mill site and dam structures on upstream side.
89	Stone slab or lintels removed and concrete slab roadway span installed ca. 1917. Dimished integrity.
90	Small rough fieldstone box culvert. Outlet facewall integrated with roadway retaining wall. Inlet wall collapsed. Common type with diminished integrity.
91	Example of typical very small fieldstone box culvert.
92	Example of mid-size fieldstone box culvert. Two plastic pipe culverts added 100' northwest. Road washed out during a flood, but culvert survived intact.
93	Rare very large & long box culvert of large block ashlar construction. Carries stream under buildings, parking lot and road. Later added concrete inlet facewall.
94	Example of very small roughly built fieldstone box culvert. Inlet has collapsed. Common type with diminished integrity.
95	Good example of medium size slab and fieldstone box culvert.
96	Steel pipe culvert with fieldstone facewalls.
97	Good example of medium size slab and fieldstone box culvert. Carries portion of Tucker Road now abandoned.
98	Example of medium size slab and fieldstone box culvert. New outlet facewall of concrete construction 3'-10" thick. Common type with diminished integrity.

APPENDIX B

STONE CULVERT LOCATION MAIL-IN FORM

APPENDIX C

SAMPLE
STONE HIGHWAY CULVERT
MAINTENANCE INSPECTION FORM

APPENDIX D

SECRETARY OF THE INTERIOR'S STANDARDS FOR THE TREATMENT OF HISTORIC PROPERTIES

NOTES REGARDING APPENDICES D, E AND F:

Appendix D: The "Secretary's Standards" contained in this section were first developed in 1978, edited in 1983 and again in 1992 in the present form. They became federal law in 1995 (36CFR68). They are regulatory only for projects receiving federal grant-in-aid funds, but are the accepted standards recommended for the treatment of all historic properties.

Appendix E: Because the Secretary's Standards were written to apply to buildings, the Virginia Transportation Research Council modified the language of the Standards to better meet the needs of historic bridges by creating the *Guidelines for the Treatment of Historic Bridges.* These are presented since no guidelines exist for historic culverts.

Appendix F: *Secretary of the Interior's Standards for Rehabilitation – Building Masonry* are more specific standards for the treatment of individual building elements. Although directed at the masonry of buildings, the recommendations are generally applicable to the treatment of stone culverts.

The Secretary of the Interior's Standards for the Treatment of Historic Properties: Standards for Rehabilitation

REHABILITATION IS DEFINED AS *the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features that convey its historical, cultural, or architectural values.*

1. A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces, and spatial relationships.
2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize a property will be avoided.
3. Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.
4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.
5. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.
6. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.
7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.
8. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.
9. New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work will be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.
10. New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

REHABILITATION AS A TREATMENT: *When repair and replacement of deteriorated features are necessary; when alterations or additions to the property are planned for a new or continued use; and when its depiction at a particular period of time is not appropriate, Rehabilitation may be considered as a treatment.*

APPENDIX E

GUIDELINES FOR THE TREATMENT OF HISTORIC BRIDGES

THE *SECRETARY'S STANDARDS* INTERPRETED FOR BRIDGE REPAIR, REHABILITATION, AND REPLACEMENT SITUATIONS

(Adapted from Miller, A.B., K.M. Clark, and M.C. Grimes. 2001. *A Management Plan for Historic Bridges in Virginia.* VTRC 01-R11. Virginia Transportation Research Council, Charlottesville)

The *Secretary of the Interior's Standards for Treatment of Historic Properties* (Weeks and Grimmer, 1995) were first codified in 1979 in response to a federal mandate requiring the establishment of policies for all programs under the authority of the Department of the Interior. The *Secretary's Standards* are used in review of all federal projects involving historic properties listed on or eligible for listing on the National Register of Historic Places. Compliance with the *Secretary's Standards* provides for the preservation of the historic and architectural integrity of properties being rehabilitated. The *Secretary's Standards* were most recently revised in 1992. The Department of the Interior regulations (36 C.F.R. 67.7(b)) state that the *Secretary's Standards* are to be applied in a reasonable manner, taking into consideration economic and technical feasibility.

Since their identification, the *Secretary's Standards* have been interpreted and applied in response overwhelmingly to one type of historic resource: buildings. Although the philosophy of the *Secretary's Standards* can be applied to bridges, the fundamental differences between buildings and structures must be considered. Newlon (1985) argued that the purpose of buildings is the organization and control of space, providing for a wide and flexible range of functions. Engineering structures such as bridges are designed primarily to control loads and forces to accomplish more limited functions such as the transport of people and goods on roads and bridges, retention of water by dams, or support of cables by towers. The more restrictive function of engineering structures is reflected in their design and construction, and this imposes limitations on continued or alternative uses that do not apply in the same degree to buildings.

The following wording of the *Secretary's Standards* addresses the unique requirements of historic bridges. This text closely follows the similar section that appeared in *A Management Plan for Historic Bridges in Virginia* (Miller et al., 2001).

1. *Every reasonable effort shall be made to continue a historic bridge in useful transportation service. Primary consideration shall be given to rehabilitation of the bridge on site. Only when this option has been considered shall other alternatives be explored.*

Bridges are designed to carry roadways over obstructing conditions: ravines, waterways, and other roadways. Bridges are best suited for this type of use. The first priority should always be retention of a bridge in its existing location and in its existing function. In many instances, contemporary vehicular traffic demands may exceed the capacity of an old bridge, and programmatic modifications, such as reduced transportation service, should be considered. Limiting the loads and types of vehicles that may use a bridge will require minimal change to the defining characteristics of the bridge.

Under some circumstances, bridges may be suitable for adaptive re-use. Zuk, Newlon, and McKeel (1980) described some approaches for adapting metal truss bridges for alternative uses, including housing, commerce, etc. Alternative uses may be considered for bridges left in their original locations and for bridges that are re-located. Some metal truss bridge types were designed so that relocation would be readily achievable, and many smaller trusses have served at several locations in Virginia. One example is a Fink Truss located in Lynchburg. This bridge, when taken out of service, was relocated to a park, where it is visible, accessible, and presented in context with a locomotive and other transportation resources.

2. The original character-defining qualities or elements of a bridge, its site, and its environment should be respected. The removal, concealment, or alteration of any historic material or distinctive engineering or architectural features shall be avoided.

The character-defining features of a historic bridge must be identified so that these physical features can be retained and preserved. The bridge surveys completed by the Virginia Transportation Research Council (see, for example, Miller and Clark, 1997) are the primary means of identifying important bridges and their character-defining features.

3. All bridges shall be recognized as products of their own time. Alterations that have no historical basis and that seek to create a false historical appearance shall not be undertaken.

4. Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.

5. Distinctive engineering and stylistic features, finishes, and construction techniques or examples of craftsmanship that characterize a historic property shall be preserved.

Characteristic features, finishes, and construction techniques must be identified so that they can be preserved. In most bridges, the most important character-defining features will be the primary structural components: trusses, girders, T-beams, slabs, concrete arches, etc. Operating mechanisms for moveable spans should also be considered primary character-defining features. Secondary characteristic features may include Phoenix columns, pinned truss connections, lattice beams, cork rails, and curbs. Abutments, piers, approaches, and other features of the crossing may be identified as primary or secondary character-defining features. In many cases, decking and roadbeds will not be considered significant character-defining features.

6. Deteriorated structural members and architectural features shall be retained and repaired, rather than replaced. Where the severity of deterioration requires replacement of a distinctive element, the new element should match the old in design, texture, and other visual qualities and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.

The *Secretary's Standards* recommend retention and repair of existing historic features, rather than replacement. They also acknowledge the limited life-span of most building materials. When bridge components are deteriorated beyond a reasonable prospect of retention and repair, replacement can be considered. Although replacement in kind is generally recommended, alternative materials can be considered.

Modern metals with superior resistance to deterioration (stainless steel, for example) may be used to replace missing or severely deteriorated historic members provided they are galvanically compatible with the surviving original members.

7. Chemical or physical treatments that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.

Materials typically used in bridge construction are generally selected for their ability to resist harsh conditions. Aggressive chemical or physical treatments may be appropriate for cleaning of some common bridge materials and components. In *Metals in America's Historic Buildings,* Gayle, Look, and Waite (1992) describe appropriate measures for proper surface preparation of iron and iron alloys, including flame cleaning, pickling, sandblasting, and other abrasive processes. Dismantling of truss bridges and galvanizing or metallizing the component chords is suggested as a sound means of preserving the historic features and configuration without damage.

8. Significant archaeological and cultural resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.

Associated resources may include fords, abutments, piers, and other features associated with earlier crossings. They may also include structures that are adjacent to, but not culturally related to the bridge: canals, sluices, mills, raceways, shipwrecks, fish-traps, and power plants.

9. New additions, exterior alterations, structural reinforcements, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.

Structural reinforcement may be necessary to allow a historic bridge to continue in service. In extreme cases, new structural components that supersede the historic components may be necessary. Priority must be given, in all such cases, to retaining significant historic structural components, even if their load-carrying function is reduced or eliminated. New structural elements should be designed so that the historic components remain visible and so that the historic structural configuration remains evident. A valid approach is the method of superimposing structural steel arches in truss bridges, which relieves the critical historical connections and members of much of the stresses imposed by modern traffic (Kim and Kim, 1988).

10. New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

APPENDIX F

SECRETARY OF THE INTERIOR'S STANDARDS FOR REHABILITATION – MASONRY

Building Exterior

Masonry: Brick, stone, terra cotta, concrete, adobe, stucco and mortar

Recommended

Identifying, retaining, and preserving masonry features that are important in defining the overall historic character of the building such as walls, brackets, railings, cornices, window architraves, door pediments, steps, and columns; and details such as tooling and bonding patterns, coatings, and color.

Protecting and maintaining masonry by providing proper drainage so that water does not stand on flat, horizontal surfaces or accumulate in curved decorative features.

Cleaning masonry only when necessary to halt deterioration or remove heavy soiling.

Carrying out masonry surface cleaning tests after it has been determined that such cleaning is appropriate. Tests should be observed over a sufficient period of time so that both the immediate and the long range effects are known to enable selection of the gentlest method possible.

Not Recommended

Removing or radically changing masonry features which are important in defining the overall historic character of the building so that, as a result, the character is diminished.

Replacing or rebuilding a major portion of exterior masonry walls that could be repaired so that, as a result, the building is no longer historic and is essentially new construction.

Applying paint or other coatings such as stucco to masonry that has been historically unpainted or uncoated to create a new appearance.

Removing paint from historically painted masonry.

Radically changing the type of paint or coating or its color.

Failing to evaluate and treat the various causes of mortar joint deterioration such as leaking roofs or gutters, differential settlement of the building, capillary action, or extreme weather exposure.

Cleaning masonry surfaces when they are not heavily soiled to create a new appearance, thus needlessly introducing chemicals or moisture into historic materials.

Cleaning masonry surfaces without testing or without sufficient time for the testing results to be of value.

Recommended	*Not Recommended*
Cleaning masonry surfaces with the gentlest method possible, such as low pressure water and detergents, using natural bristle brushes.	Sandblasting brick or stone surfaces using dry or wet grit or other abrasives. These methods of cleaning permanently erode the surface of the material and accelerate deterioration. Using a cleaning method that involves water or liquid chemical solutions when there is any possibility of freezing temperatures. Cleaning with chemical products that will damage masonry, such as using acid on limestone or marble, or leaving chemicals on masonry surfaces. Applying high pressure water cleaning methods that will damage historic masonry and the mortar joints.
Inspecting painted masonry surfaces to determine whether repainting is necessary.	Removing paint that is firmly adhering to, and thus protecting, masonry surfaces.
Removing damaged or deteriorated paint only to the next sound layer using the gentlest method possible (e.g., handscraping) prior to repainting.	Using methods of removing paint which are destructive to masonry, such as sandblasting, application of caustic solutions, or high pressure waterblasting.
Applying compatible paint coating systems following proper surface preparation.	Failing to follow manufacturers' product and application instructions when repainting masonry.
Repainting with colors that are historically appropriate to the building and district.	Using new paint colors that are inappropriate to the historic building and district.
Evaluating the overall condition of the masonry to determine whether more than protection and maintenance are required, that is, if repairs to masonry features will be necessary.	Failing to undertake adequate measures to assure the protection of masonry features.
Repairing masonry walls and other masonry features by repointing the mortar joints where there is evidence of deterioration such as disintegrating mortar, cracks in mortar joints, loose bricks, damp walls, or damaged plasterwork.	Removing nondeteriorated mortar from sound joints, then repointing the entire building to achieve a uniform appearance.
Removing deteriorated mortar by carefully hand-raking the joints to avoid damaging the masonry.	Using electric saws and hammers rather than hand tools to remove deteriorated mortar from joints prior to repointing.

Recommended	*Not Recommended*
Duplicating old mortar in strength, composition, color, and texture.	Repointing with mortar of high portland cement content (unless it is the content of the historic mortar). This can often create a bond that is stronger than the historic material and can cause damage as a result of the differing coefficient of expansion and the differing porosity of the material and the mortar. Repointing with a synthetic caulking compound. Using a "scrub" coating technique to repoint instead of traditional repointing methods.
Duplicating old mortar joints in width and in joint profile.	Changing the width or joint profile when repointing.
Repairing stucco by removing the damaged material and patching with new stucco that duplicates the old in strength, composition, color, and texture.	Removing sound stucco; or repairing with new stucco that is stronger than the historic material or does not convey the same visual appearance.
Using mud plaster as a surface coating over unfired, unstabilized adobe because the mud plaster will bond to the adobe.	Applying cement stucco to unfired, unstabilized adobe. Because the cement stucco will not bond properly, moisture can become entrapped between materials, resulting in accelerated deterioration of the adobe.
Cutting damaged concrete back to remove the source of deterioration (often corrosion on metal reinforcement bars). The new patch must be applied carefully so it will bond satisfactorily with, and match, the historic concrete.	Patching concrete without removing the source of deterioration.
Repairing masonry features by patching, piecing-in, or consolidating the masonry using recognized preservation methods. Repair may also include the limited replacement in kind—or with compatible substitute material—of those extensively deteriorated or missing parts of masonry features when there are surviving prototypes such as terra-cotta brackets or stone balusters.	Replacing an entire masonry feature such as a cornice or balustrade when repair of the masonry and limited replacement of deteriorated or missing parts are appropriate. Using a substitute material for the replacement part that does not convey the visual appearance of the surviving parts of the masonry feature or that is physically or chemically incompatible.

Recommended

Applying new or non-historic surface treatments such as water-repellent coatings to masonry only after repointing and only if masonry repairs have failed to arrest water penetration problems.

Replacing in kind an entire masonry feature that is too deteriorated to repair—if the overall form and detailing are still evident—using the physical evidence as a model to reproduce the feature. Examples can include large sections of a wall, a cornice, balustrade, column, or stairway. If using the same kind of material is not technically or economically feasible, then a compatible substitute material may be considered.

Not Recommended

Applying waterproof, water repellent, or non-historic coatings such as stucco to masonry as a substitute for repointing and masonry repairs. Coatings are frequently unnecessary, expensive, and may change the appearance of historic masonry as well as accelerate its deterioration.

Removing a masonry feature that is unrepairable and not replacing it; or replacing it with a new feature that does not convey the same visual appearance.

The following work is highlighted to indicate that it represents the particularly complex technical or design aspects of **Rehabilitation** *projects and should only be considered after the preservation concerns listed above have been addressed.*

Recommended

Design for the Replacement of Missing Historic Features

Designing and installing a new masonry feature such as steps or a door pediment when the historic feature is completely missing. It may be an accurate restoration using historical, pictorial, and physical documentation; or be a new design that is compatible with the size, scale, material, and color of the historic building.

Not Recommended

Creating a false historical appearance because the replaced masonry feature is based on insufficient historical, pictorial, and physical documentation.

Introducing a new masonry feature that is incompatible in size, scale, material and color.

APPENDIX G

GRANITE SPLITTING TOOLS AND TECHNIQUES

NEW HAMPSHIRE DIVISION OF HISTORICAL RESOURCES
State of New Hampshire, Department of Cultural Resources 603-271-3483
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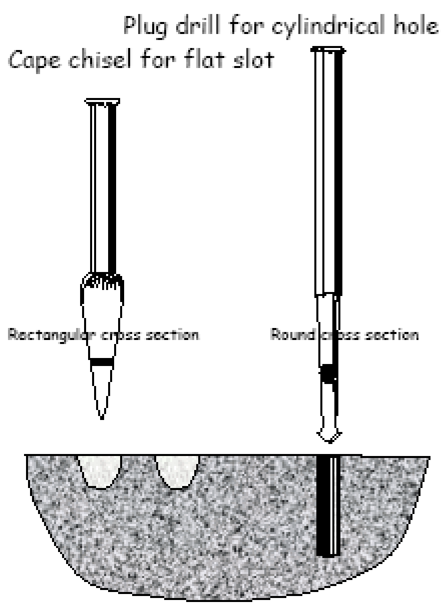
GRANITE SPLITTING TOOLS AND TECHNIQUES

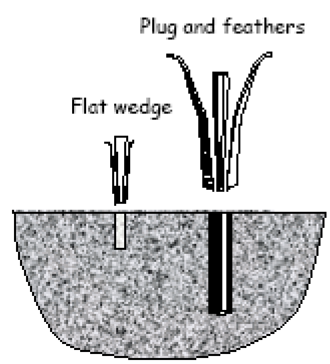
By about 1800, stonecutters in many parts of New England had perfected the basic techniques of finishing and shaping granite. These craftsmen were not only able to split large slabs and posts from boulders, but had also learned to use hammers and chisels to shape the stone to a wide variety of forms, including steps, thresholds, curbs, lintels, columns, watering troughs, and rainwater basins.

In the years just before 1830, a new granite splitting method was introduced. Each method of splitting granite leaves distinctive marks at the edge of the stone, and these marks reveal whether a given piece of granite was quarried or split before or after about 1830—useful knowledge in dating a building or a stone object.

Prior to about 1830, the procedure for splitting granite entailed the cutting of a line of shallow slots in the face of the stone, using a tool called a cape chisel, struck with a heavy hammer. Small, flat steel wedges were placed between shims of sheet iron and driven into these slots, splitting the stone. The new splitting method of circa 1830 used a "plug drill," which had a V-shaped point and was rotated slightly between each blow of the hammer, creating a round hole two or three inches deep.

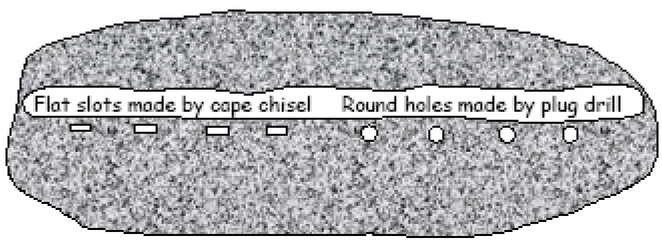


Into this hole were placed a pair of half-round steel shims or "feathers," and between these was driven a wedge or "plug" which exerted outward pressure and split the stone. The advantage of the "plug-and-feathers" method of splitting was the greater depth within the stone at which the wedges exerted their pressure, thus allowing larger pieces to be split more accurately.



The new splitting technology seems to have spread rather rapidly through the granite quarrying centers of New England, although one is likely to find evidence of both old and new methods being used concurrently in stonework of the 1830s, especially in rural areas. The technique employed on a given stone can usually be seen on the split face, and provides some aid in dating granite masonry. The old, flat-wedge method is marked by a series of slot-like depressions which extend inward an inch or so from the edges of the split stone. The plug-and-feathers method leaves a row of rounded holes, two or three inches deep and usually about six inches apart.

When seen on the surface of a stone that was prepared for splitting but never split, these slots or holes appear as shown below:



The use of the plug drill in combination with the plug-and-feathers provided greater force and control in splitting granite. Until the introduction of the new technique, most granite for buildings and posts was split from surface boulders that had been strewn across the New England landscape at the retreat of the glaciers. Such stone had been transported by the ice from many points of origin, and each boulder challenged the stonecutter with different grain and behavior when split.

The introduction of the plug drill and plug-and-feathers seems to have enhanced stonecutters' ability to quarry granite from ledges. Ledge stone was more uniform in nature and predictable in behavior than granite split from surface boulders. With the opening of early quarries at ledges in Quincy, Chelmsford, and Rockport, Massachusetts; Concord, New Hampshire; and many locations in Maine, Vermont, and Rhode Island, New England began to assume its prominent place in the American and international granite industry.

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