



Scour Critical Bridge
Plan of Action (POA) Report

Form with checkboxes for Full POA and Abbreviated POA

Town: Bingham
Bridge Number: 2027
Bridge Name: Austin
Feature Carried: Rt. 201
Waterway Crossed: Austin Stream



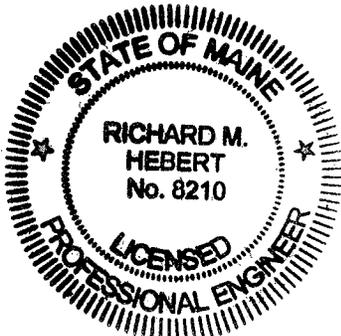
Final Recommended Action section with checkboxes for inspection frequency, flood monitoring, closure triggers, and countermeasures.

The Following Materials Are Being Submitted With This Report: List of attachments with checkboxes.

Scour Critical Bridge Plan of Action

I. GENERAL INFORMATION				
Structure: Austin		City, County: Bingham, Somerset County		Bridge Number: 2027
Feature On: Rt. 201		Waterway Crossed: Austin Stream		Owner: State Highway Agency
Year Built: 1969	Year Reconstruction: 1988 channel repair. D/S left bank gabions. 2000 channel repair		Structure Size and Description: 200' length, 80' max span, 3-span continuous steel girder supported on stub abutments founded on spread footings and solid shaft piers founded on timber piles	
Foundation Details <small>(Looking Downstream L to R)</small> KNOWN <input checked="" type="checkbox"/> UNKNOWN <input type="checkbox"/>	Left Abutment: Right Abutment: Pier 1: Pier 2: Pier 3:	Spread footing Spread footing Pile cap Pile tip Pile cap Pile tip N/A	Embedment (ft): Embedment (ft): Embedment (ft): Embedment (ft): Embedment (ft):	5 6 5 35 5.5 35 N/A
Reference Datum		U/S Right Top of Curb 365.7		
Scour Critical Elevations(s): <small>(Bottom of Footing/Pile Cap/Pile Exposure)</small>		Left Abutment: Pier 1: BOC Pile Exposure to Pier 3:	353.71 344.0 341.0 N/A	Right Abutment: Pier 2: BOC Pile Exposure to
				352.55 344.0 341.0

2. RESPONSIBLE FOR POA	
Author(s) of POA (name, title, agency/organization, telephone, email): Rick Hebert, T.Y. Lin International, (207) 781-4721, rick.hebert@tylin.com	
Signature: <u><i>Rick Hebert</i></u>	Date: <u>7/25/11</u>
Concurrences on POA (name, title, agency/organization, telephone, email): Assistant Bridge Maintenance Engineer, Date: _____ MaineDOT Bridge Maintenance Division, 207-624-3580	
POA Updated by (name, title, agency/organization): Assistant Bridge Maintenance Engineer, MaineDOT Bridge Maintenance Division, 207-624-3580	
Date of Update: _____ Items Updated: _____	
Reason for Update: <input type="checkbox"/> Inspection Cycle <input type="checkbox"/> Monitoring Event <input type="checkbox"/> Post Flood Inspection	
POA Updated Every _____ months by (name, title, agency, organization): Next Update: _____ months	



STATE OF MAINE
RICHARD M. HEBERT
No. 8210
LICENSED PROFESSIONAL ENGINEER

Assistant Bridge Maintenance Engineer,
MaineDOT Bridge Maintenance Division,
207-624-3580

3. SCOUR VULNERABILITY				
Current Item 113 Code:	<input checked="" type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> Other:
Source of Scour Critical Code:	<input checked="" type="checkbox"/> Observed	<input checked="" type="checkbox"/> Assessment	<input checked="" type="checkbox"/> Calculated	<input type="checkbox"/> Other
Scour Evaluation Summary: High contraction, abutment, and pier scour potential. Highly scourable historically mobile bed. Abutments at bank. Migrating thalweg below top of pile cap. Inadequately protected abutments and piers. High potential for debris accumulation. Significant observed scour and bed profile changes. The HEC-RAS calculated scour results indicate critical scour under flows less than the 10-year event, but based on historic performance this is considered overly conservative. Bridge considered unstable for calculated scour for a storm event with a recurrence interval of 50-years, a discharge of 7569 cfs, and corresponding bridge upstream water surface elevation of 354.1 corresponding to the calculated scour critical condition for the bridge.				
Scour History: History of bed and bank instability, significant scour at piers, exposure of Pier 1 pile cap, scour holes at Pier 1 side and nose, and significant debris accumulation. Quality of historical flood data poor. Plans note 1936 Flood water surface ~ 2 ft below low chord. Historic gage flow data for Austin Stream indicates this event < Q25. Based on review of basin historical flood data, bridge not likely subject to Q100 event, but likely subject to two events >Q50 since built in 1969.				

4. NBI CODING INFORMATION			
		<u>Current</u>	<u>Previous</u>
	Inspection Date	8/24/10	7/13/06
Item 113	Scour Critical	3	3
Item 60	Substructure	5	7
Item 61	Channel & Channel Protection	5	6
Item 71	Waterway Adequacy	9	7

5. RECOMMENDED ACTION(S)					
	<u>Recommended</u>		<u>Implemented</u>		<u>Date</u>
a. Increased Inspection Frequency:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
b. Fixed Monitoring Device(s):	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
c. Flood Monitoring Program:	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
d. Post Flood Inspection:	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
e. Hydraulic/Structural Countermeasures:	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No	

6. MONITORING PROGRAM RECOMMENDATION

<p>6a. Regular Inspection Cycle</p> <p><input checked="" type="checkbox"/> Biennial</p> <p><input checked="" type="checkbox"/> Riverbed Profile Readings - Upstream face</p> <p><input checked="" type="checkbox"/> Riverbed Profile Readings - Downstream face</p> <p><input type="checkbox"/> Surveyed Cross-section(s)</p>	<p>Items to Watch:</p> <p>Changes in streambed section. Changes in pier pile cap embedment. Local scour at upstream pier noses and sides of piers. Condition of riprap at piers. Condition of riprap at left abutment and gabions at right abutment.</p>
<p>Underwater Inspection Required:</p> <p><input type="checkbox"/> 4 Year Cycle</p> <p><input type="checkbox"/> 2 Year Cycle</p> <p><input type="checkbox"/> 1 Year Cycle</p>	<p>Items to Watch:</p>

<p>6b. Fixed Monitoring Device(s) <input checked="" type="checkbox"/> Not Applicable</p>
<p>Type of Instrument:</p>
<p>Installation Location(s):</p>
<p>Routine Sample Interval: <input type="checkbox"/> 30 minute <input type="checkbox"/> 1 hour <input type="checkbox"/> 6 hours <input type="checkbox"/> 12 hours <input type="checkbox"/> Other</p>
<p>Frequency of Data Download and Review: <input type="checkbox"/> Daily <input type="checkbox"/> Weekly <input type="checkbox"/> Monthly <input type="checkbox"/> Other</p>
<p>Event Sample Interval: <input type="checkbox"/> Continual <input type="checkbox"/> 10 min <input type="checkbox"/> 30 min <input type="checkbox"/> 1 hour <input type="checkbox"/> Other</p>
<p>Frequency of Data Download and Review <input type="checkbox"/> 1 hour <input type="checkbox"/> 3 hour <input type="checkbox"/> 6 hour <input type="checkbox"/> Other</p>
<p>Action(s) Required if Scour Critical Elevation Detected:</p>
<p>Criteria for Termination For Fixed Monitoring:</p>

6c. Flood Monitoring Program		During Inspection Event Look For:	
Type:	<input checked="" type="checkbox"/> Visual Inspection	Water surface above Elev. 355.2 (within ~5.6 ft of low chord) or discharge above Q50 = 7,520 cfs at USGS Gaging Station #01046000. Movement of piers (monitor joint openings and top of rails for signs of movement/settlement). Displacement of abutment or pier revetment.	
	<input checked="" type="checkbox"/> Instrument	<i>(Check all that apply)</i>	
		<input checked="" type="checkbox"/> Portable	<input type="checkbox"/> Geophysical <input type="checkbox"/> Sonar <input type="checkbox"/> Other:
Flood Monitoring event defined by:		<i>(Check all that apply)</i>	
<input type="checkbox"/> Stage (Water Surface Elevation)	(ft)	<input type="checkbox"/> USGS Gage Station	
<input type="checkbox"/> Discharge	(cfs)	Station #:	
<input checked="" type="checkbox"/> Notified by Public		<input type="checkbox"/> Other	
<input checked="" type="checkbox"/> Flood Warning Issued by National Weather Service			
<input checked="" type="checkbox"/> DOT Situation Report			
Scour Monitoring event defined by:		<i>(Check all that apply)</i>	
<input checked="" type="checkbox"/> Stage (Water Surface Elevation)	354.1 (ft)	<input checked="" type="checkbox"/> USGS Gage Station	
<input checked="" type="checkbox"/> Discharge Q10 = 4840 (cfs)	at USGS Gage Station	Station #: 01046000	
<input type="checkbox"/> Flood Warning Issued by National Weather Service			
Frequency of Flood Monitoring:	<input type="checkbox"/> Continual <input type="checkbox"/> 3 hours <input checked="" type="checkbox"/> 12 hours <input type="checkbox"/> Daily		
Criteria to End Flood Monitoring:	<input checked="" type="checkbox"/> Revisit Bridge <input checked="" type="checkbox"/> Recommended Post Flood Inspection		
(check all that apply)	<input checked="" type="checkbox"/> Close Bridge <input checked="" type="checkbox"/> Conditions Stable / Water Receding		
Action(s) required if Scour Critical Elevation Detected: Detour traffic (see Section 7). Close bridge (see Section 8). Post-flood Inspection (see Section 6.d.).			

6d. Post-Flood Inspection Tasks Required	Items to Watch:
<input checked="" type="checkbox"/> Visual Inspection	Changes in streambed section. Changes in pier pile cap embedment. Local scour at upstream pier noses and sides of piers. Condition of riprap at piers. Condition of riprap at left abutment and gabions at right abutment.
<input checked="" type="checkbox"/> Riverbed Profile Readings – Upstream & downstream face	
<input checked="" type="checkbox"/> Profile at Substructure	
<input type="checkbox"/> Underwater Inspection	
<input checked="" type="checkbox"/> Probing	
Agency and Department Responsible for Monitoring:	
Bridge Maintenance Engineer, MaineDOT Bridge Maintenance Division, (207) 624-3580	
Contact Person (name, title, agency/organization, telephone, email):	
Assistant Bridge Maintenance Engineer, MaineDOT Bridge Maintenance Division, (207) 624-3580	

7. DETOUR ROUTE						
Detour Route Description: Rte 16, Stream Rd, Frith Rd, Donigan Rd						
Bridges on Detour Route:						
Bridge Number	Feature On	Feature Under	Item 113	Load Posting/Weight (tons)	Vertical Clearance (feet)	Width Restrictions (feet)
5675	Stream Road	Austin Stream	8	-	-	-
Traffic Control Equipment and Storage location(s):						
Additional Considerations or Critical Issues:						
News Release, Other Public Notice Information to be provided and limitations: Public Information Officer, Office of Communications, (207) 624-3030						

8. BRIDGE CLOSURE PLAN	
Criteria For Consideration of Bridge Closure: <i>(Check all that apply)</i>	
<input type="checkbox"/> Water Surface Elevation Reaches Low Chord	<input type="checkbox"/> Overtopping Road or Structure
<input checked="" type="checkbox"/> Water Reaches Closure Elevation 355.2 ft 5.6 ft below Low Chord (50-yr WSE), Placard	<input checked="" type="checkbox"/> Scour Measurement Results / Monitoring Devices
<input type="checkbox"/> USGS Gage Station #	<input checked="" type="checkbox"/> Observed Structure Movement / Settlement
<input type="checkbox"/> Stage (WSE) ft	<input type="checkbox"/> Discharge cfs
<input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Debris Accumulation <input checked="" type="checkbox"/> Movement of Riprap / Other Armor Protection
	<input checked="" type="checkbox"/> Loss of Road Embankment <input checked="" type="checkbox"/> Ice Jam
Agency and Department Responsible for Closure:	
<input checked="" type="checkbox"/> DOT	<input type="checkbox"/> Municipality <input type="checkbox"/> Other
Contact Person(s) (name, title, telephone, e-mail):	
MaineDOT Radio Operations, (207) 624-3339	

9. BRIDGE REOPENING PLAN

9a. Criteria for Consideration to Complete Interim Bridge Reopening: (Check all that apply)

- Water Surface Levels Dropping
- Reasons for Closure Have Abated
- Critical Elevation Marker Is Visible

Agency and Person Responsible for Interim Bridge Reopening After Inspection:

- Region Manager
- Region Engineer
- Region Superintendent

9b. Criteria for Completing Bridge Reopening Process: (Check all that apply)

- Riverbed Elevation Verified (drop line readings)
- Post Flood Inspection Completed
- Streambed Elevation Drops Less Than 4.0 ft
- Diving Inspection Completed

Agency and Person Responsible for Completing Bridge Reopening:

Bridge Maintenance Engineer, MaineDOT Bridge Maintenance Division, 207-624-3580
Assistant Bridge Maintenance Engineer, MaineDOT Bridge Maintenance Division, 207-624-3580

10. COUNTERMEASURE RECOMMENDATIONS

Include Information on Hydraulic, Structural, or Monitoring Countermeasures

Conceptual Structural / Hydraulic Countermeasures:

	Priority	Estimated Cost
(1) Heavy riprap or concrete cable mat at piers	<input type="checkbox"/> High <input checked="" type="checkbox"/> Medium <input type="checkbox"/> Low	
(2) Repair riprap slope at left abutment using heavy riprap or grout bags and at right abutment using gabion mats.	<input type="checkbox"/> High <input checked="" type="checkbox"/> Medium <input type="checkbox"/> Low	
(3) Monitoring	<input checked="" type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low	

Basis for the Selection of the Preferred Scour Countermeasure: Relative cost. Shallow water at low flow at piers. Adequate clearance at piers. Low clearance at upper slopes of abutment at low flow.

Recommended Countermeasure to be Performed by:

- Maintenance
- Bridge Program
- Highway Program
- Other:

Recommended Completion Date:

Contact Person(s): (name, title, telephone, e-mail):

Bridge Maintenance Engineer, MaineDOT Bridge Maintenance Division, (207) 624-3580
Assistant Bridge Maintenance Engineer, MaineDOT Bridge Maintenance Division, (207) 624-3580

ATTACHMENT A

Maine Department of Transportation

Bridge Scour Evaluation

Hydraulic, Scour & Structural Stability Analysis Summary

Town: Bingham Bridge Name: Austin Bridge #: 2027
 Feature Carried: Rt. 201 Stream: Austin Stream
 By: ASN Date: 7/12/10 Check By: RMH Date: 8/24/10
 MDOT PIN: 15631.10 TYLI Project No.: 411588.00

Hydrology & Hydraulic Analysis:

Discharge data for the 10, 50, 100 & 500 year recurrence intervals (Q10, Q50, Q100 & Q500) provided by MaineDOT Hydraulics Unit. The U.S. Army Corps of Engineers HEC-RAS River Analysis System computer program (ver. 4.0) was used to perform all of the backwater calculations. All elevations are based on an assumed datum (reference bridge datum elevation and location: El. 365.7 at U/S Right TOC).

Critical hydraulic discharge conditions for the existing bridge are summarized as follows:

Discharge Event	Discharge (cfs)	Headwater El. At Bridge (ft) (1)	Maximum Discharge Velocity At Abutment (ft/sec) (2)	Maximum Discharge Velocity At Pier (ft/sec) (2)
500-year	<u>12222</u>	<u>357.38</u>	<u>12.8</u>	<u>17.0</u>
100-year	<u>8848</u>	<u>355.88</u>	<u>11.5</u>	<u>15.5</u>
50-year	<u>7569</u>	<u>355.25</u>	<u>10.8</u>	<u>14.8</u>
10-year	<u>4870</u>	<u>354.13</u>	<u>8.4</u>	<u>11.8</u>

(1) Headwater elevation at bridge reported for contracted cross section located at the upstream side of the bridge.

(2) Largest of discharge velocities at abutment and at pier reported for contracted cross section located at the upstream inside or downstream inside section of the bridge.

Scour Analysis:

Scour computations were performed according to the FHWA Hydraulic Engineering Circular No. 18 (HEC-18), Evaluating Scour at Bridges, 4th edition (2001). The U.S. Army Corps of Engineers HEC-RAS River Analysis System computer program (ver. 4.0) was used to perform the scour calculations. Top and bottom of footing (TOF and BOF) elevations and estimated total scour elevations at the abutments and piers are summarized as follows:

	Left Abut.	Pier 1	Pier 2	Right Abut.
TOF El. (ft)	<u>356.71</u>	<u>348.5</u>	<u>348.5</u>	<u>355.55</u>
BOF El. (ft)	<u>353.71</u>	<u>344.0</u>	<u>344.0</u>	<u>352.55</u>
Critical Discharge Events / Estimated Scour Elevations:				
500-year	<u>348.0</u>	<u>336.1</u>	<u>336.9</u>	<u>342.5</u>
50-year	<u>350.4</u>	<u>338.2</u>	<u>339.0</u>	<u>344.0</u>
10-year	<u>358.6</u>	<u>340.1</u>	<u>340.9</u>	<u>351.4</u>

Conclusion: Bridge determined to be unstable for calculated scour for a storm event with a recurrence interval of 50-years, a discharge of 7569 cfs, and corresponding inside bridge upstream water surface elevation of 355.25 feet which corresponds to the calculated scour critical condition for the bridge. The HEC-RAS calculated scour results indicate critical scour at the right abutment under flows less than the 10-YR event, but this is considered overly conservative. Based on a review of the historic flood data for the basin (Kennebec River), the bridge has likely been subject to two flood events greater than 50-YR since built and has a history of notable embankment damage and scour, but no evidence of movement. No events greater than a 10-YR event have occurred since 1988. The bridge site is susceptible to contraction scour to calculated depths ranging from 2.2 ft to 4.8 ft for the 10-Yr event up to the 500-YR event. Combined calculated contraction plus pier scour depths range from 9.0 ft to 13.0 ft for the 10-Yr event up to the 500-YR event. These depths extend below the bottom of the existing pier pile caps and expose up to 3.9 to 7.9 ft of the existing timber pile foundation. Abutment scour is anticipated, but not to the conservative depths calculated by HEC-RAS based on Froelich's equations.

The left abutment is protected by riprap and the right abutment is protected by gabions which were placed in conjunction with other channel repairs in 1988. Revetment at the abutments is not adequately designed. The Plans indicate the toe of the riprap slope at the left abutment and the toe of the gabion protected slope at the right abutment are both embedded 3 feet below the streambed. The bottom of the revetment should be placed below the calculated contraction scour depth. The calculated contraction scour depth for a 50-YR event is 3.30 feet. Events greater than the 50-YR event are anticipated to undermine the toe of the abutment revetment slopes likely resulting in significant damage to the countermeasures and possible failure of the abutment slope and possible undermining at the abutments.

Both piers are protected by riprap that is in poor condition and which appears to have been placed in 2000 based on a review of available inspection files. The riprap revetment at the piers is not adequately designed, and there are areas of missing riprap. This riprap is assessed to be in poor condition. The extent of coverage of the riprap around the piers is also not consistent with the recommendations of HEC-23.

Recommendations:

a. Scour Vulnerability (Long term, Contraction, Abutment and Pier): High contraction, abutment, and pier scour potential. Highly scourable mobile bed. Abutments at bank. Migrating thalweg below top of pile cap. History of significant debris accumulation. Significant observed scour and bed profile changes. Inadequate protection at abutments and piers.

Rehabilitation of existing scour countermeasures or installation of new scour countermeasures is recommended at both abutments. Installation of properly designed pier scour countermeasures is recommended at the piers. A revetment consisting of cable concrete is recommended at the piers. It is further recommended the flood monitoring begin when a Flood Warning is Issued by the National Weather Service; scour monitoring begin at the 10-YR event (4870 cfs, WSE 354.1); and that the bridge be closed at the 50-YR event (7569 cfs, WSE 355.2).

b. Recommended NBI Ratings:

Item 60: 5

Item 61: 5

Item 71: 9

Item 113: 3

c. POA Recommended (Y/N): Yes

ATTACHMENT B

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 7/23/2009

Site Investigation Pictures



Photo 1.
Left Approach



Photo 2.
Right Approach

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 12/18/08 & 7/23/09

Site Investigation Pictures

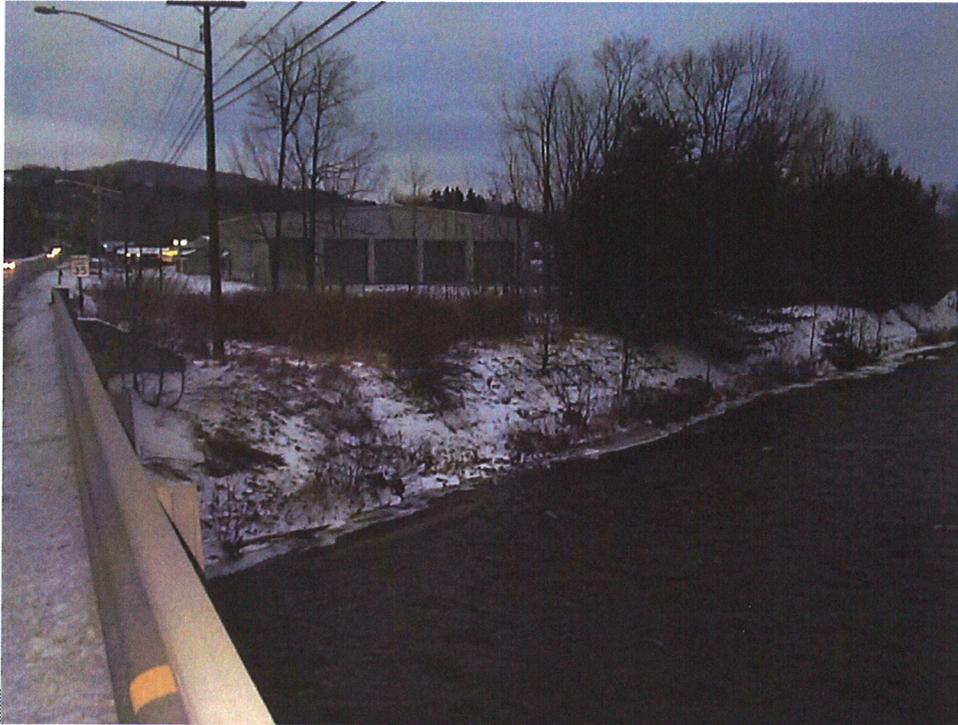


Photo 3.
U/S Right Gabion
Lined Bank

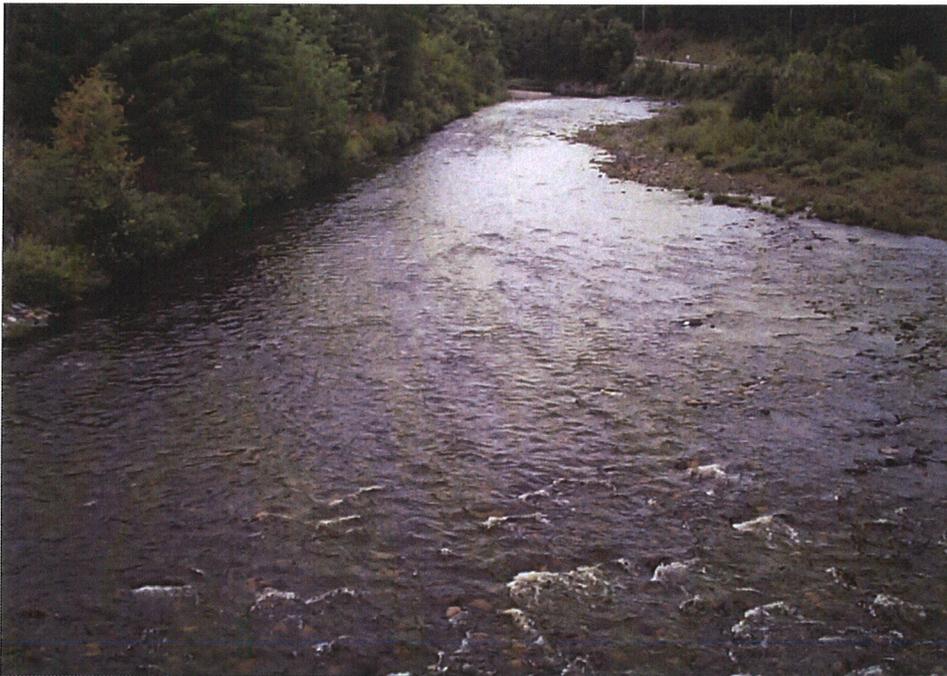


Photo 4.
U/S Right Channel

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 12/18/08 & 7/23/09

Site Investigation Pictures



Photo 5.
U/S Left Channel
& Gravel Bar



Photo 6.
U/S Left Bank &
Bank Erosion

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: **Austin**

Town: **Bingham**

Bridge #: **2027**

Feature Carried: **Rt. 201**

Stream: **Austin St.**

Review Date: **12/18/08 & 7/23/09**

Site Investigation Pictures

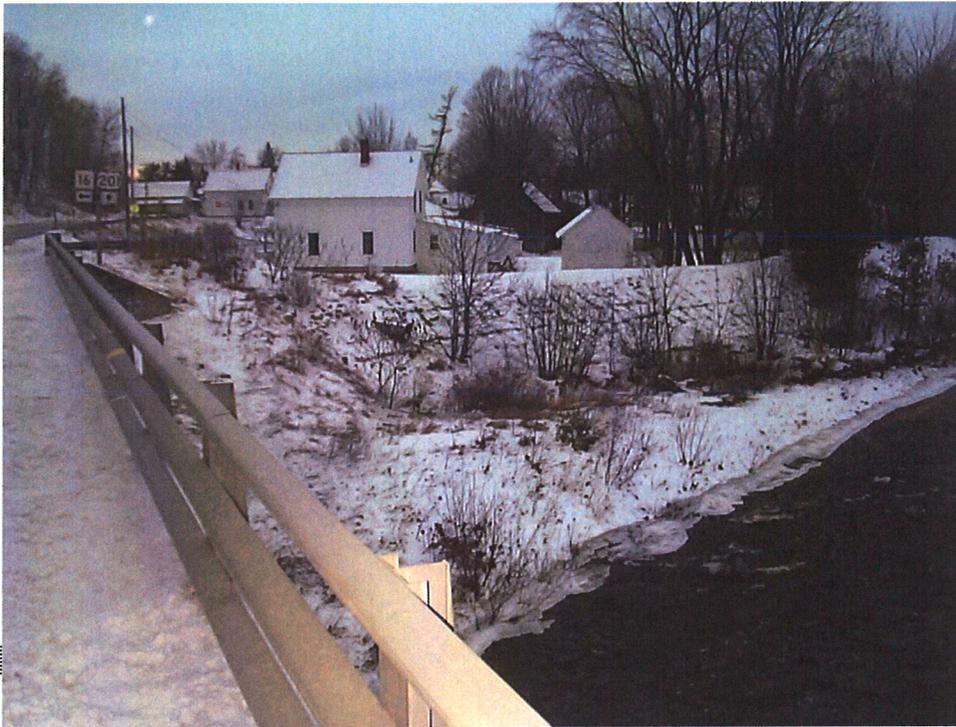


Photo 7.
D/S Left Gabion
Lined Bank

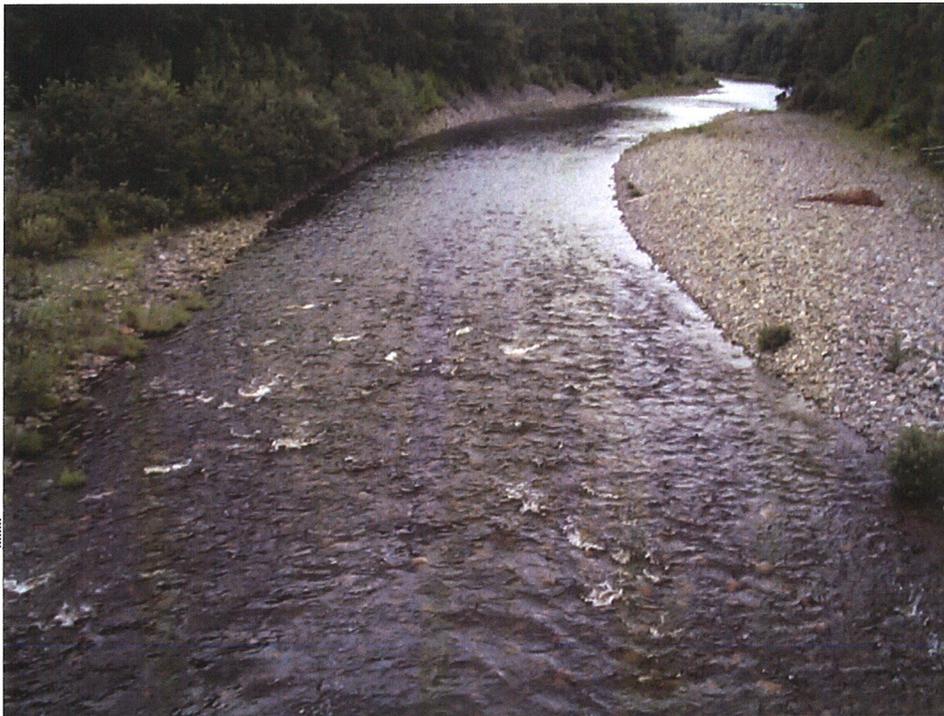


Photo 8.
D/S Channel

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 7/23/2009

Site Investigation Pictures



Photo 9.
D/S Right Gravel
Bar



Photo 10.
D/S Right Gabion
Lined Bank

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 7/23/2009

Site Investigation Pictures



Photo 11.
Left Side of Left Pier
(Pier 1).
Bed Dry at Normal
Water.
No Riprap.



Photo 12.
D/S Fascia &
Riprap Along
Left Side of Right
Pier (Pier 2)

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 7/23/2009

Site Investigation Pictures



Photo 13.
Right Side of Left
Pier (Pier 1).
Riprap Along
Right Side of Left
Pier (Pier 1)



Photo 14.
Right Abutment
Gabion Slope.
Right Side of Right
Pier (Pier 2).
Riprap Along
Right Side of Right
Pier (Pier 2)

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 7/23/2009

Site Investigation Pictures



Photo 15.
Right Side of Right
Pier (Pier 2).
Riprap Along
Right Side of Right
Pier (Pier 2)



Photo 16.
Right Side of Right
Pier (Pier 2).
Riprap Along
Right Side of Right
Pier (Pier 2)

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 7/23/2009

Site Investigation Pictures



Photo 17.
D/S Fascia
Riprap at U/S Pier
Noses

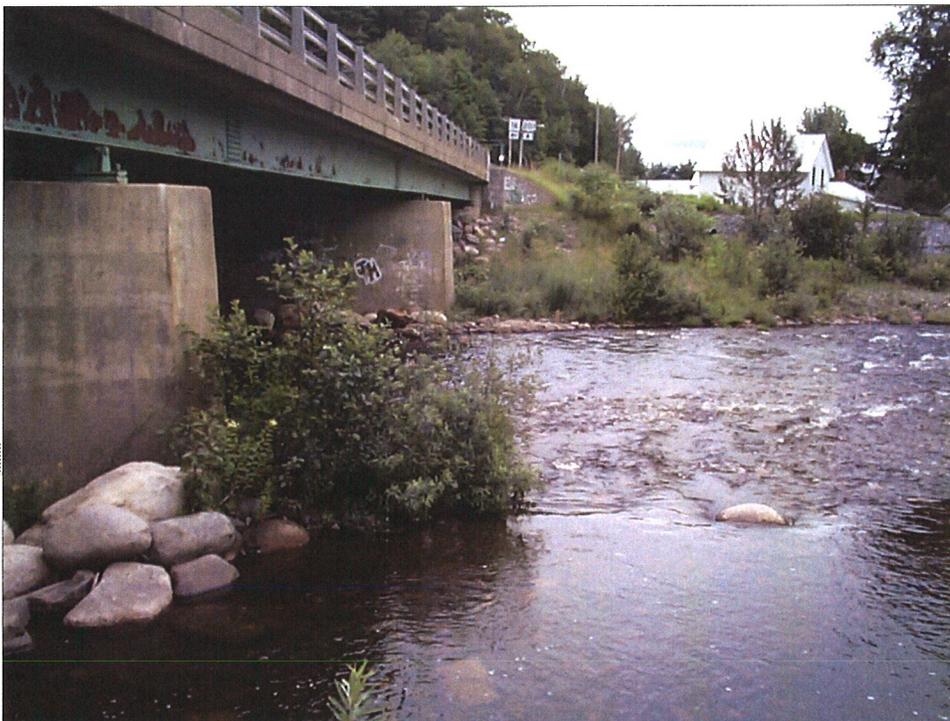


Photo 18.
D/S Fascia

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 7/23/2009

Site Investigation Pictures



Photo 19.
Riprap
Slope at Left
Abutment



Photo 20.
D/S Fascia

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 12/18/08 & 7/23/09

Site Investigation Pictures



Photo 21.
U/S Fascia

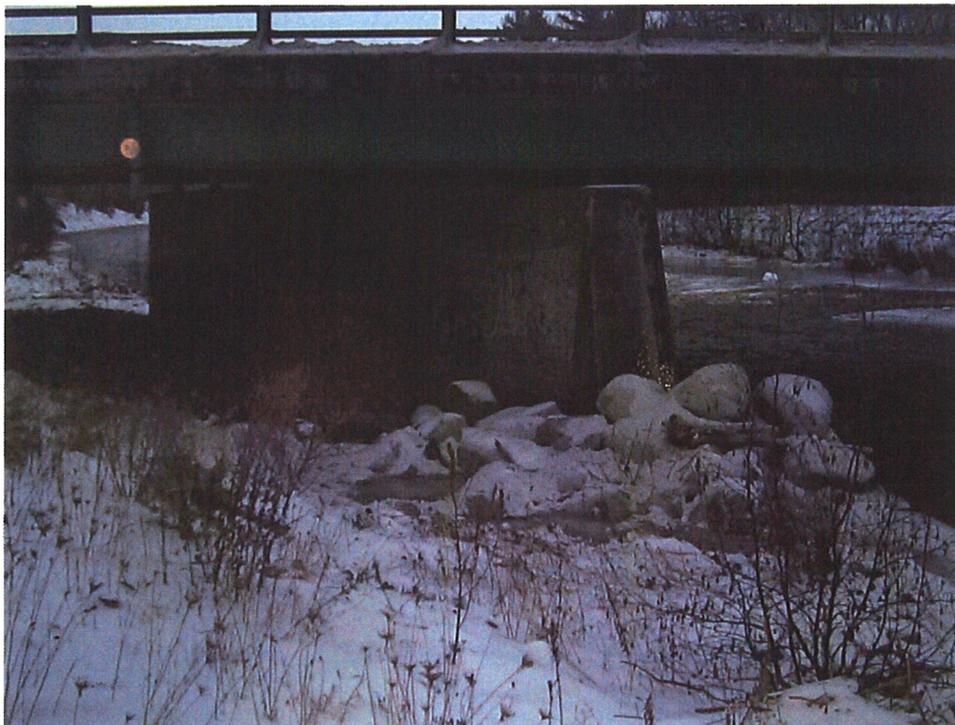


Photo 22.
Riprap at U/S End
of Left Pier
(Pier 1)



South span general view



pier condition

2027

Bingham



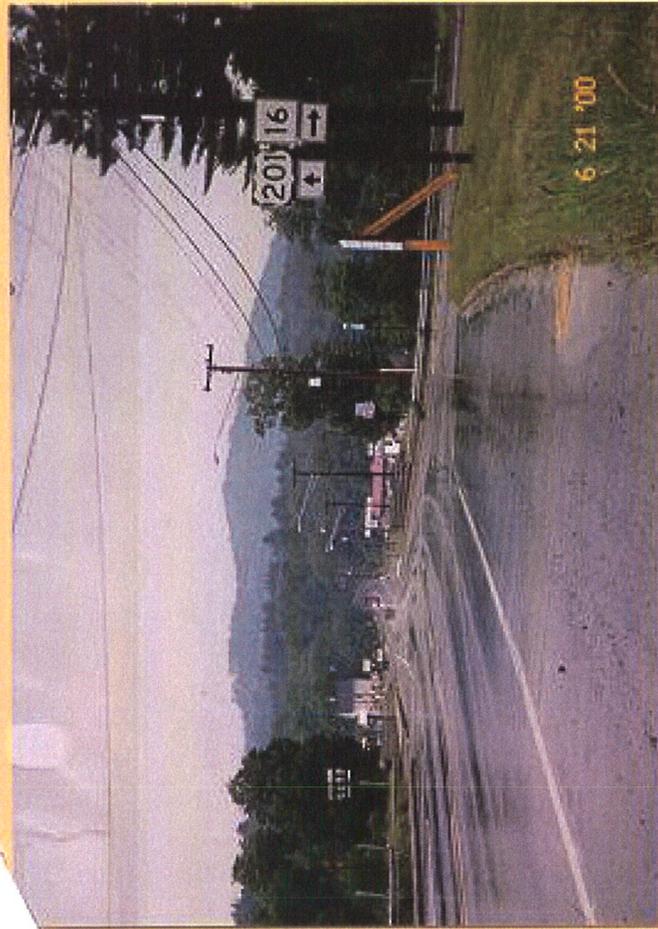
Inlet end east side view



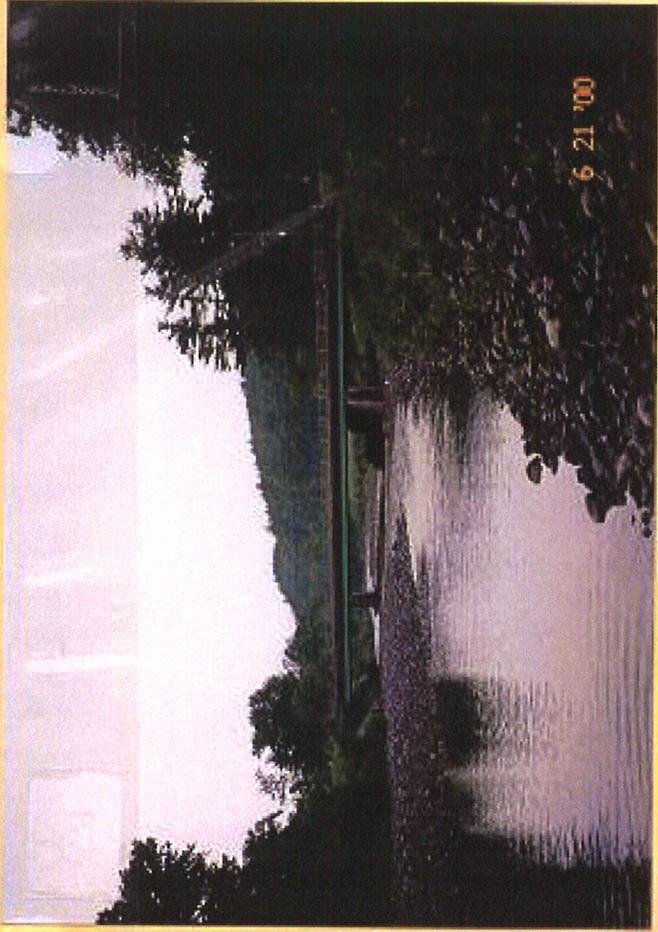
Lots of delaminating WFS

Austin

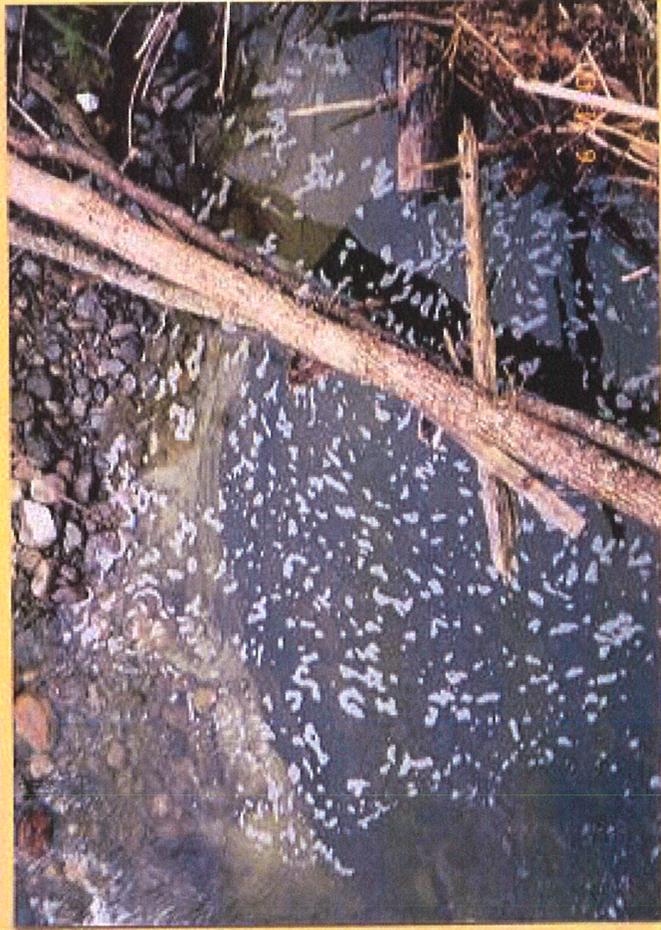
7-14-2004



Looking N'ly.



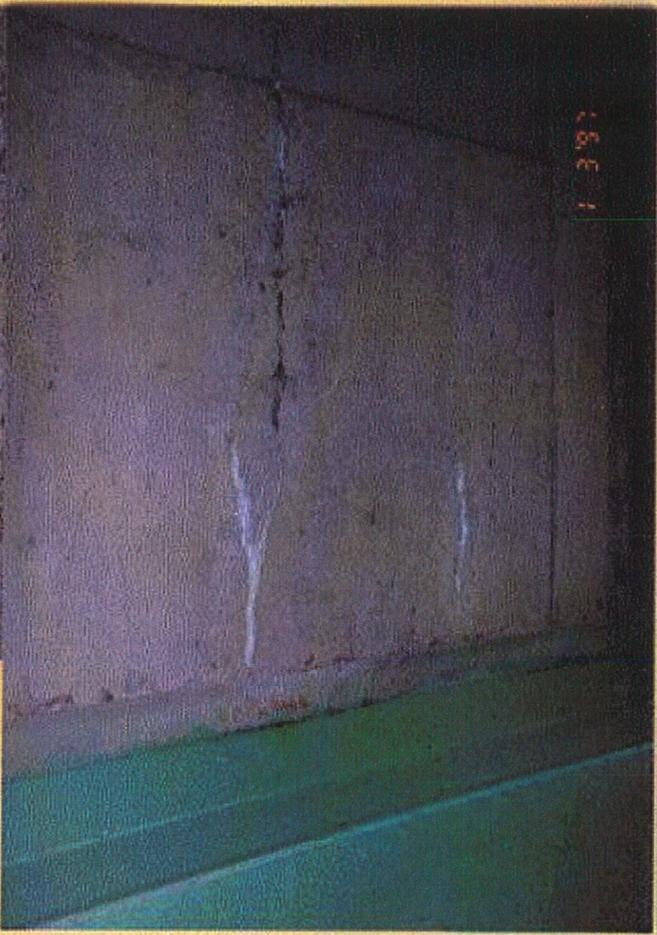
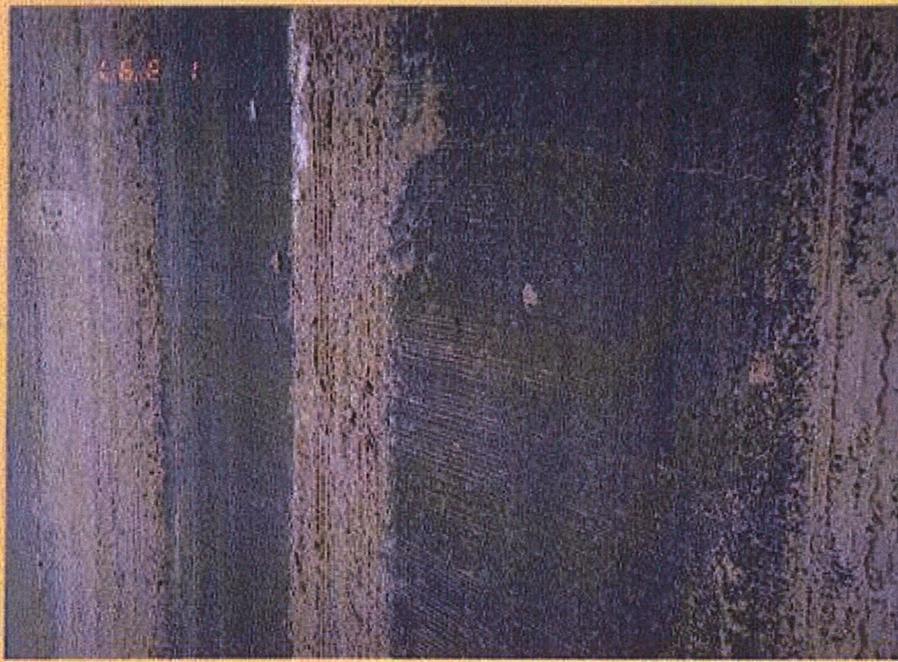
Looking upstream.



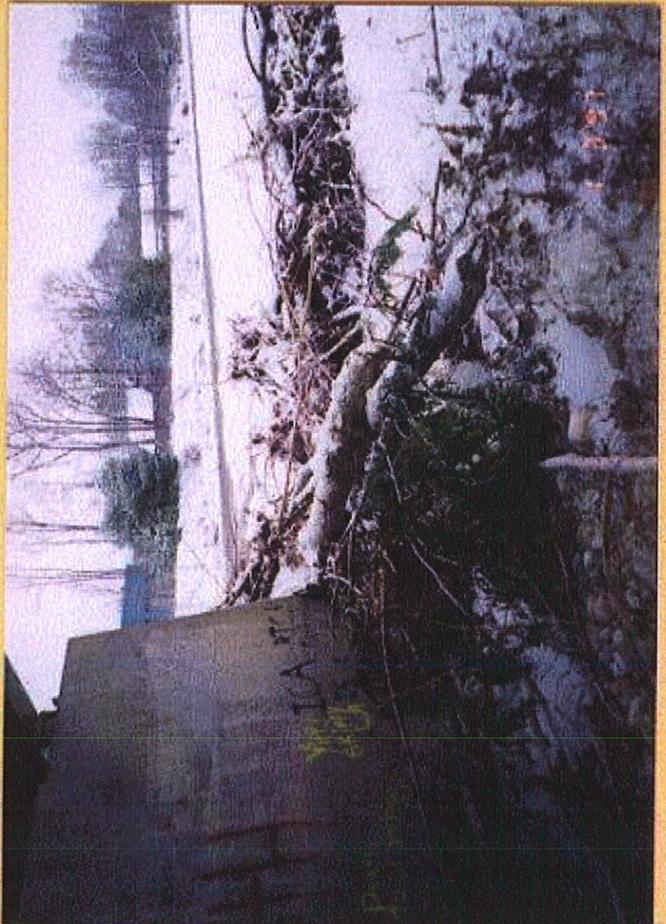
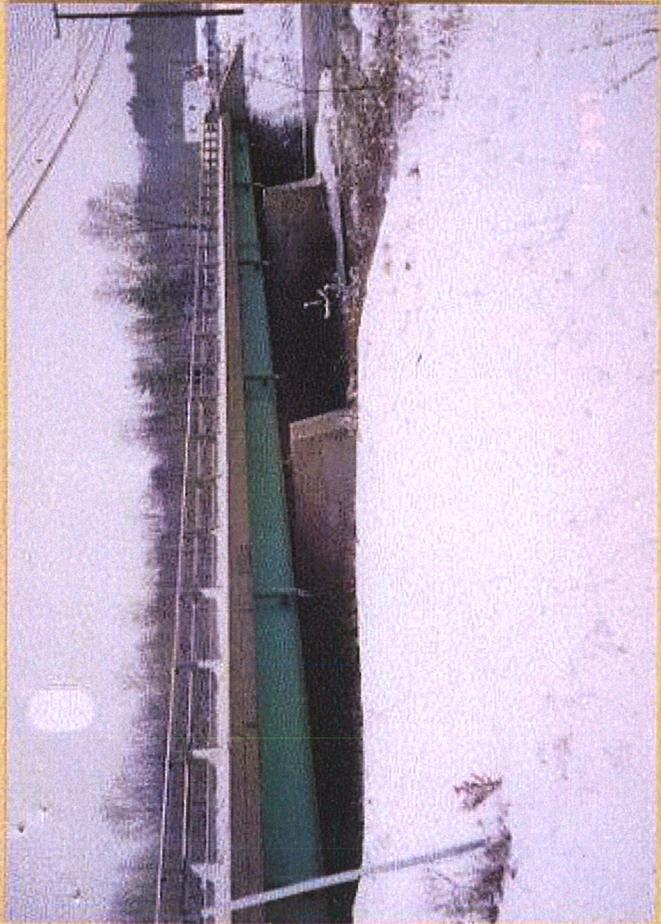
Upstream from nose of S'ly pier. Scour hole incised into clay layer 4' est. vertical face.

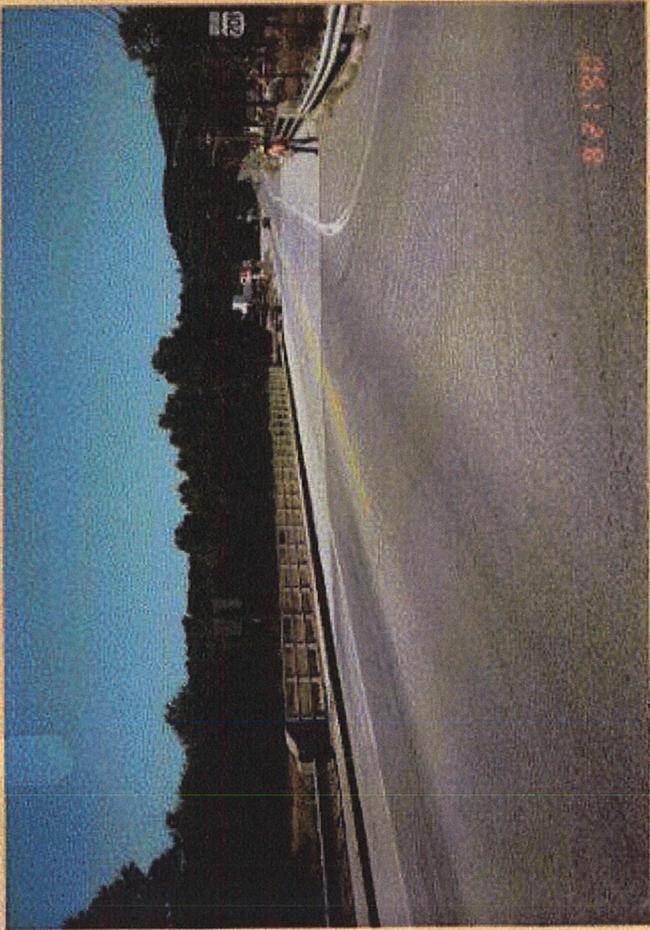


Drift accumulation @ nose of S'ly pier. Scour hole present adj. to S'ly pier.

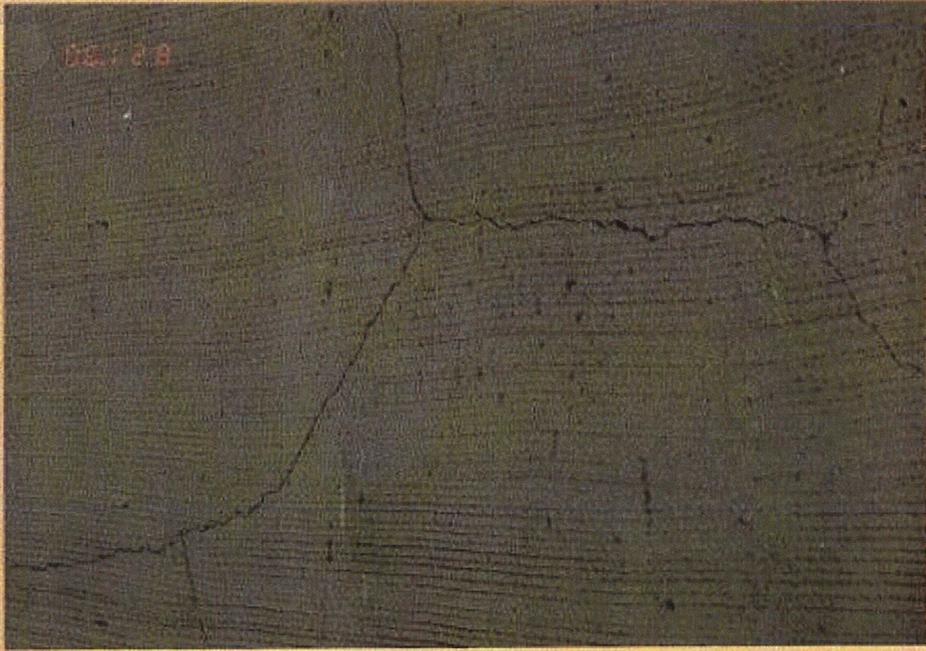


Bingman Austin
A2027 1-3-97





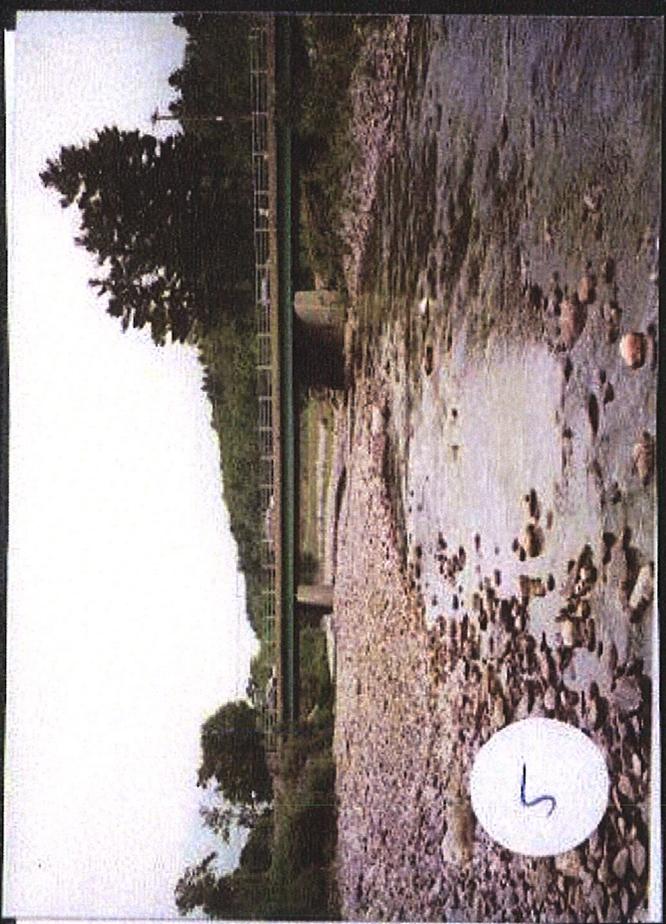
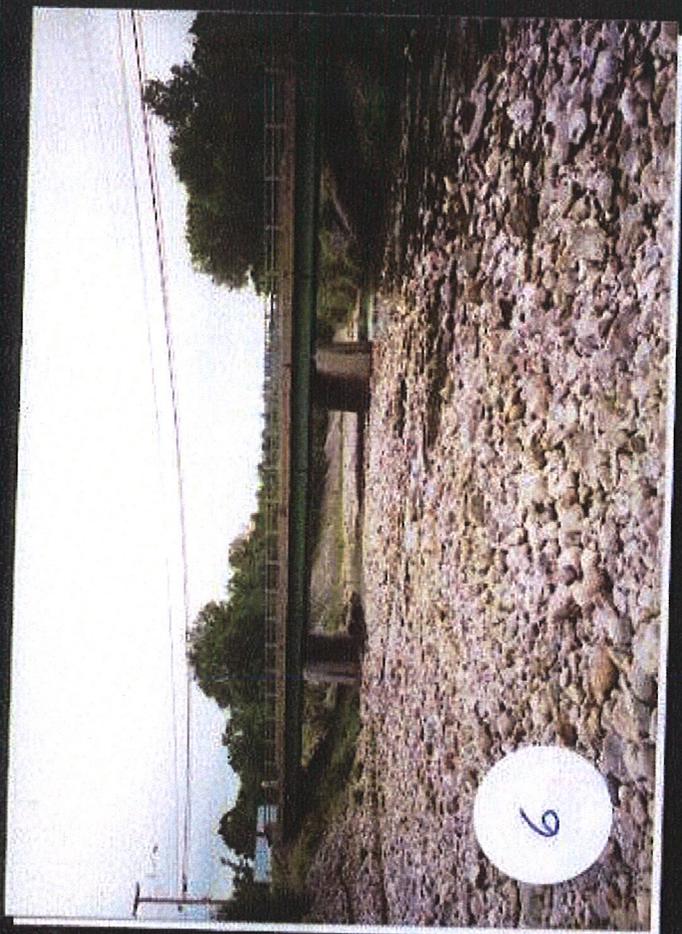
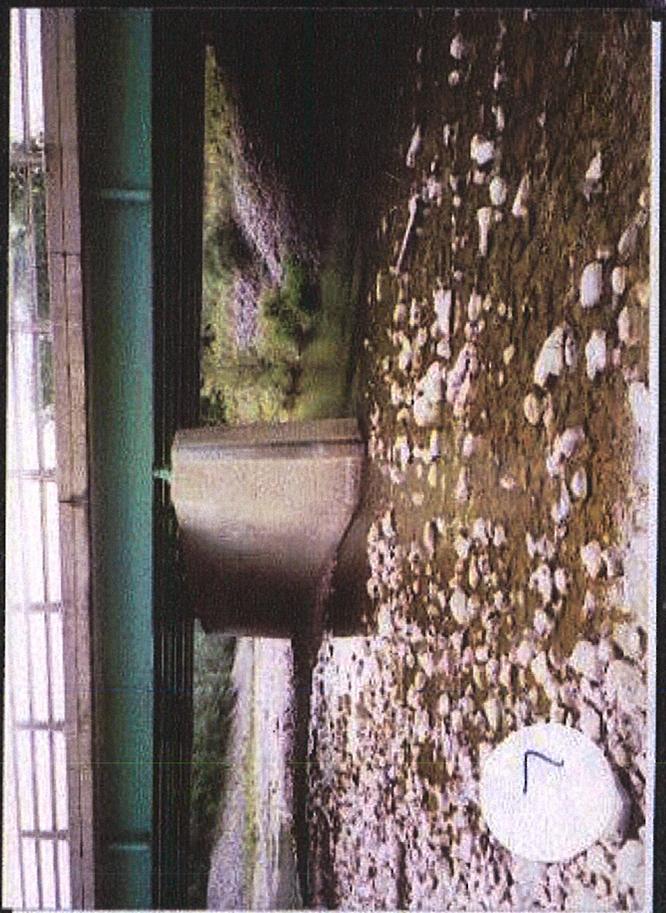
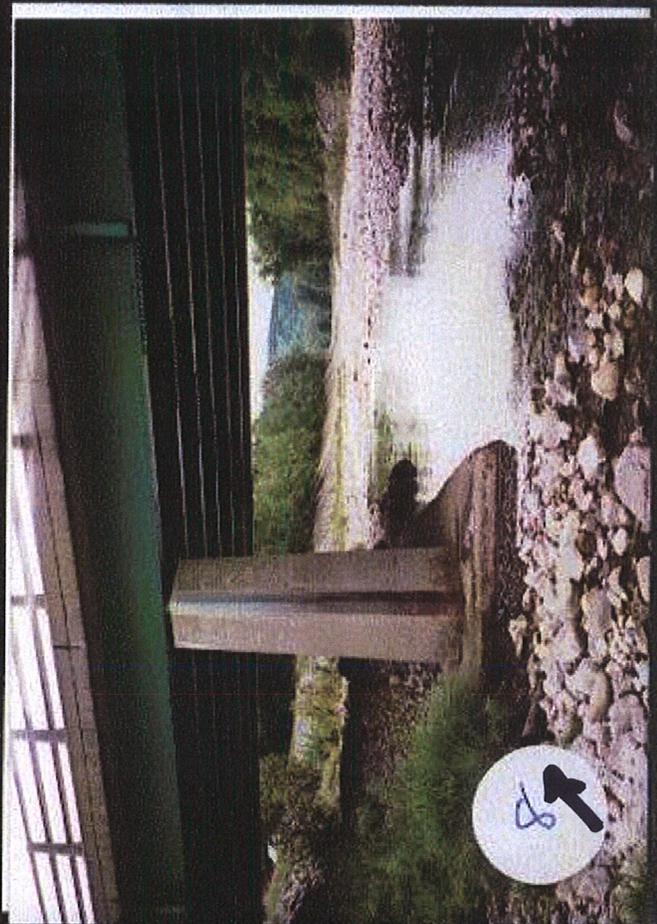
Looking north



Cracks in wearing surface

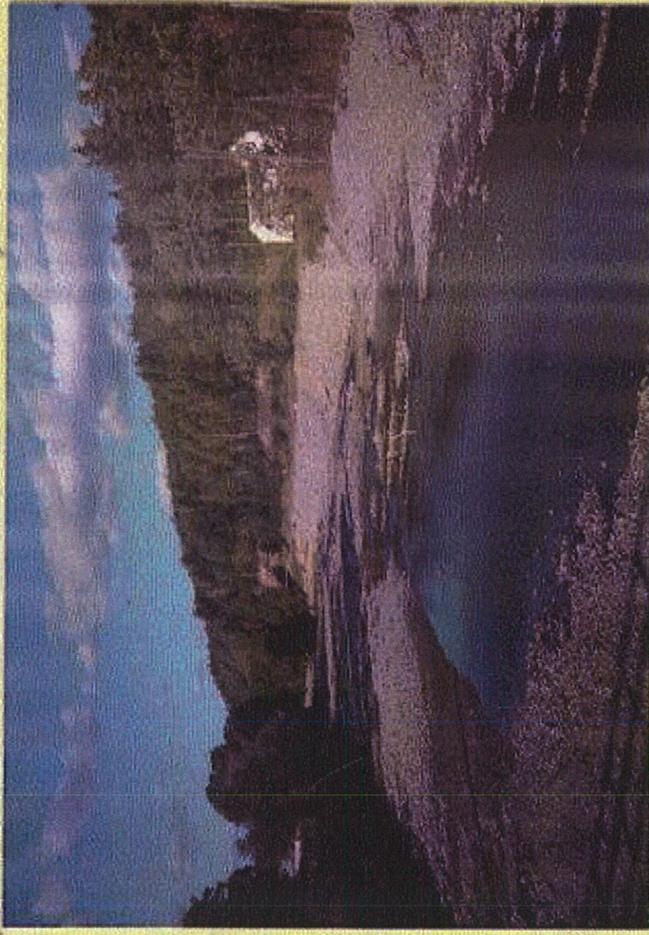


Scour @ north pier downstream end

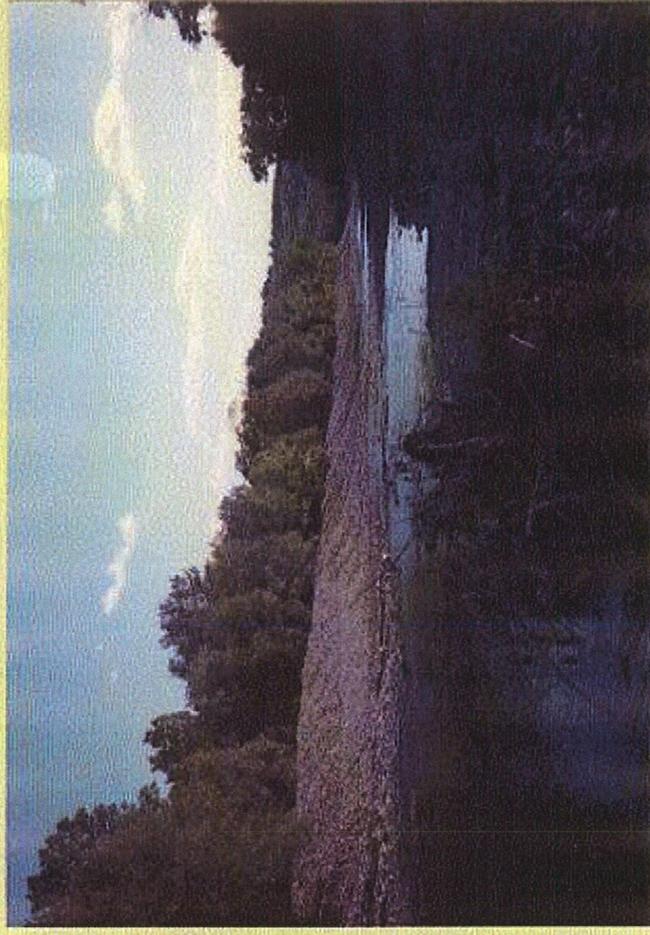


9/3/87

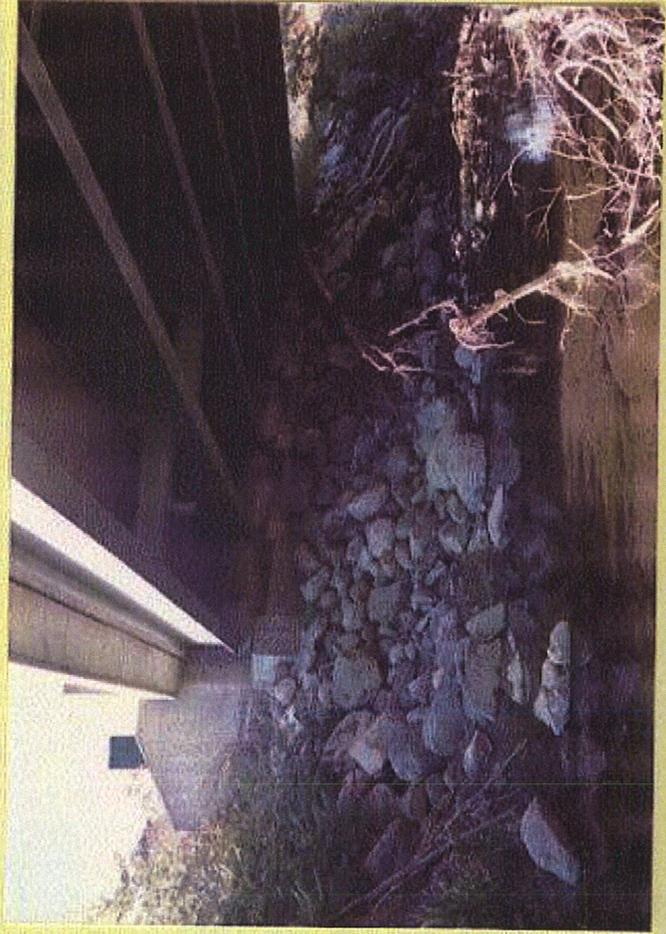
Bingham Austin Stream



VIEW UPSTREAM



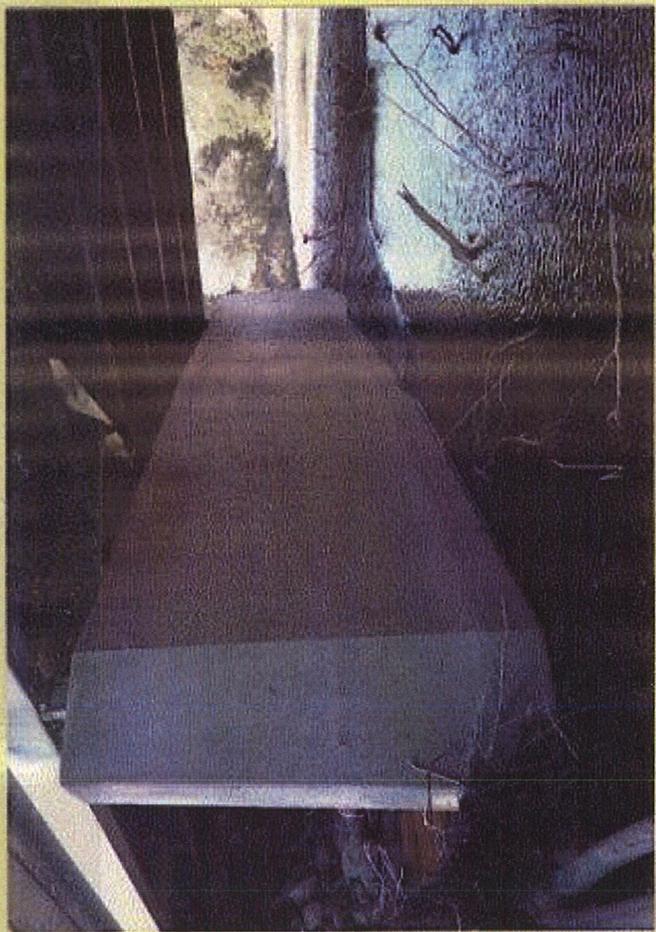
VIEW DOWNSTREAM



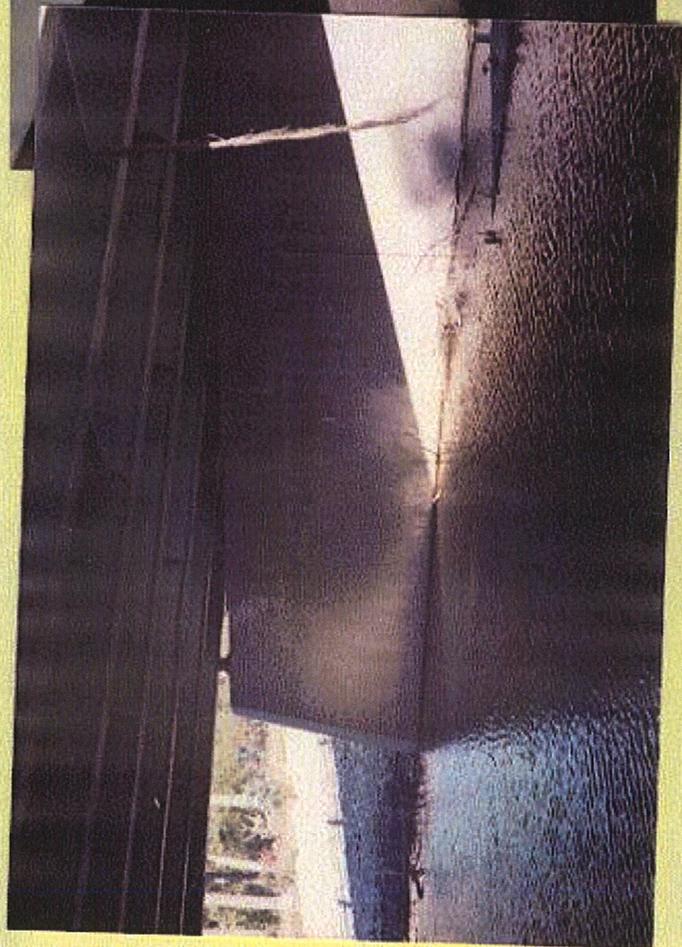
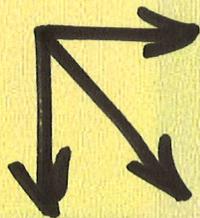
North ABUT



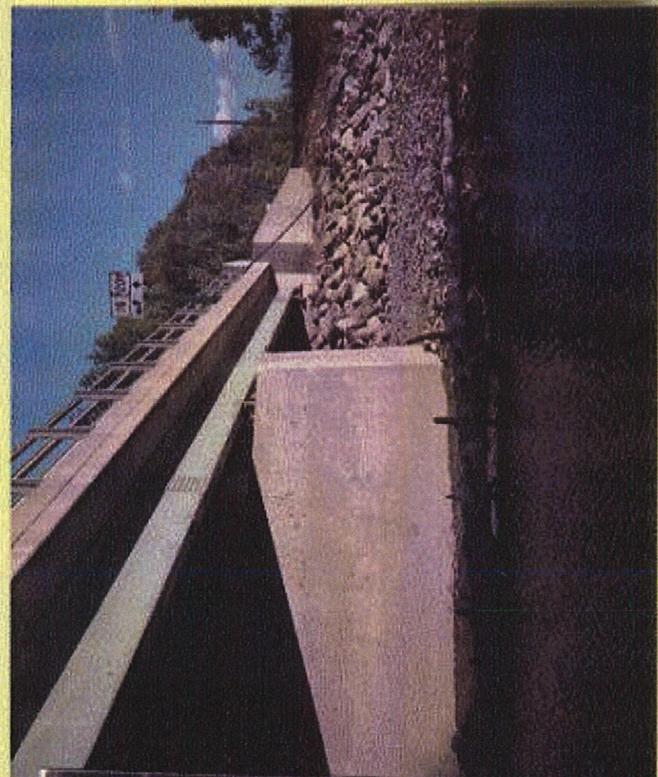
No. side No. RIER VIEW UPSTREAM



VIEW UPSTREAM - No. PIER

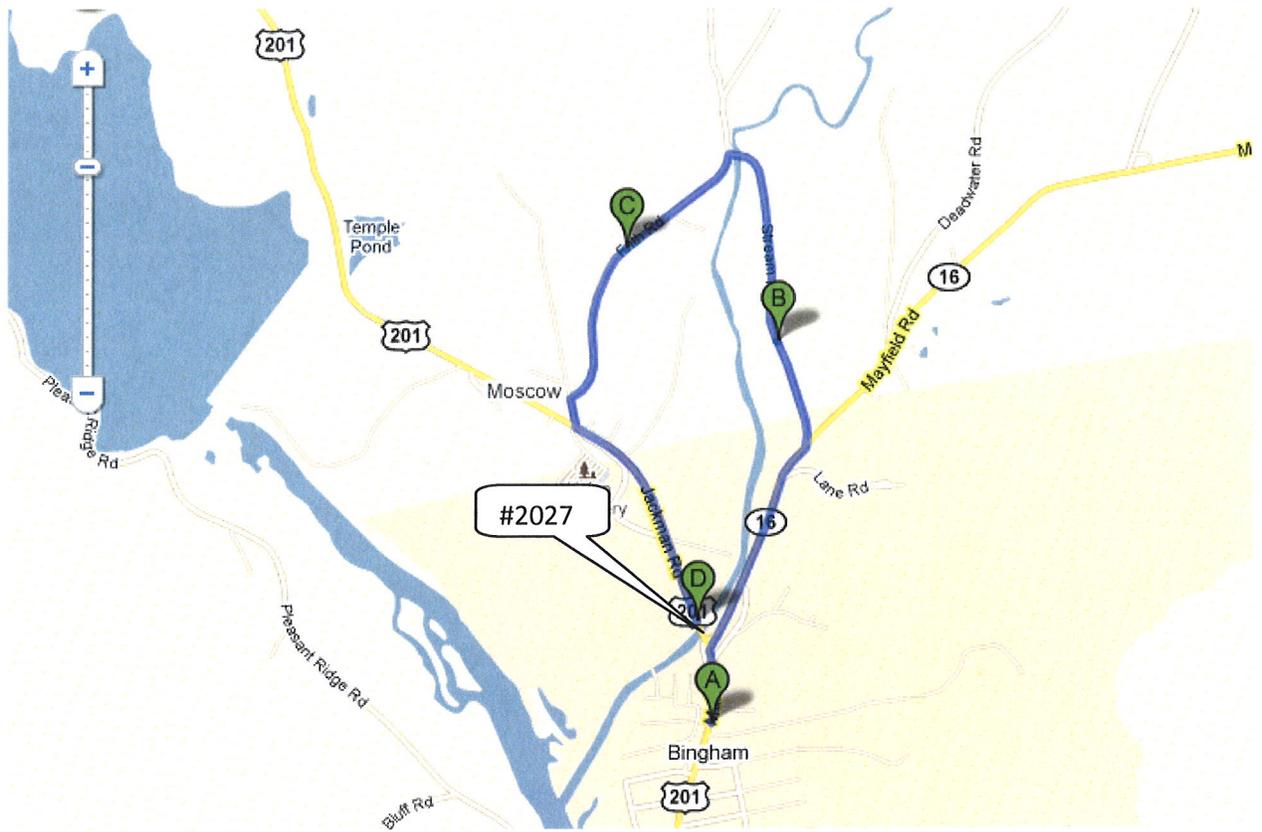


VIEW SOUTHERLY - SOUTH PIER & ABUT.



VIEW UPSTREAM - SOUTH PIER & ABUT.

ATTACHMENT C



Detour Map – Bingham #2027

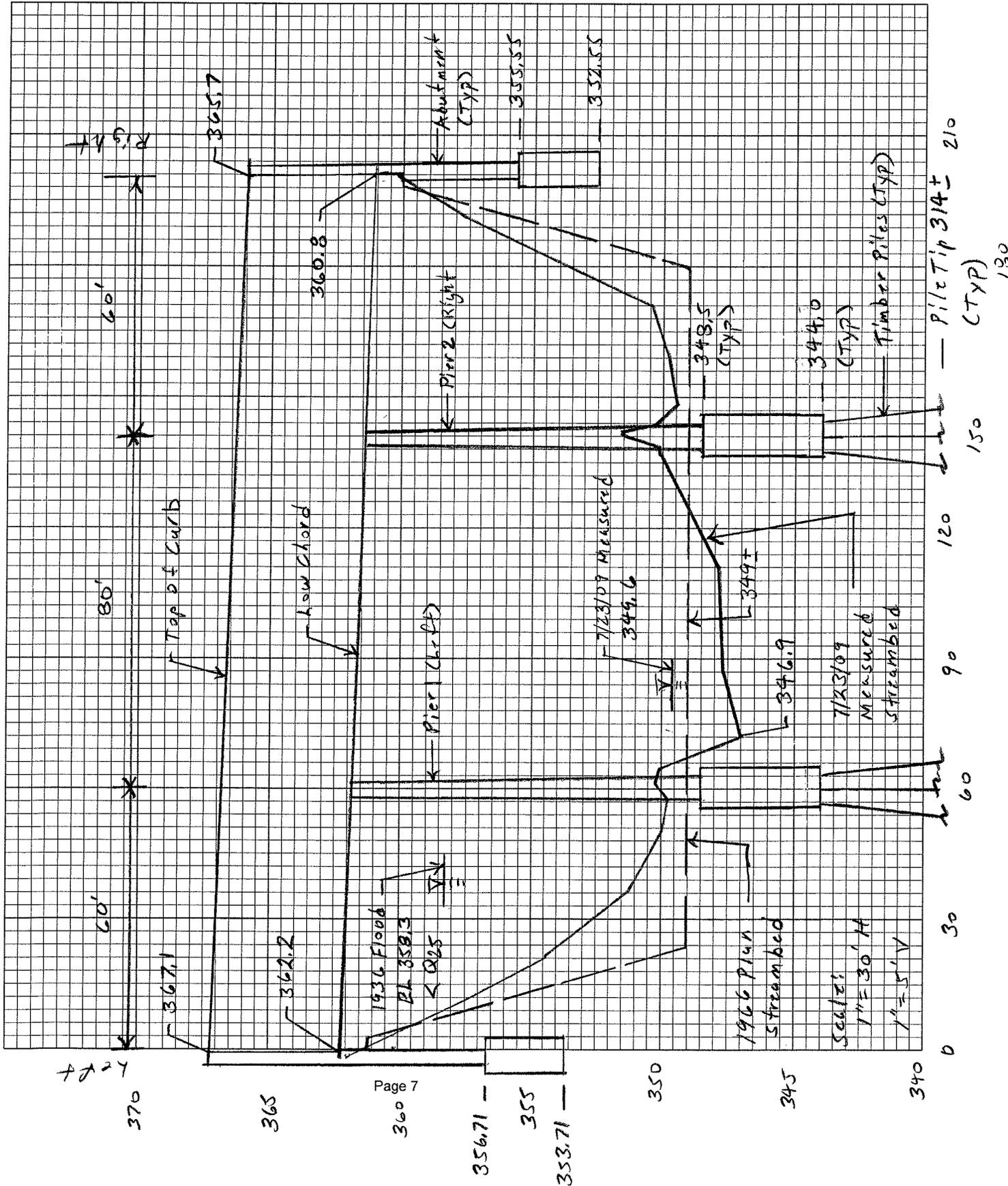
Detour Route Description: Rte 16, Stream Rd, Frith Rd, Donigan Rd

ATTACHMENT D

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: <i>Austin</i>	Town: <i>Bingham</i>	Bridge #: <i>2027</i>
Feature Carried: <i>Rt. 201</i>	Stream: <i>Austin Str.</i>	Review Date: <i>7/23/09</i>

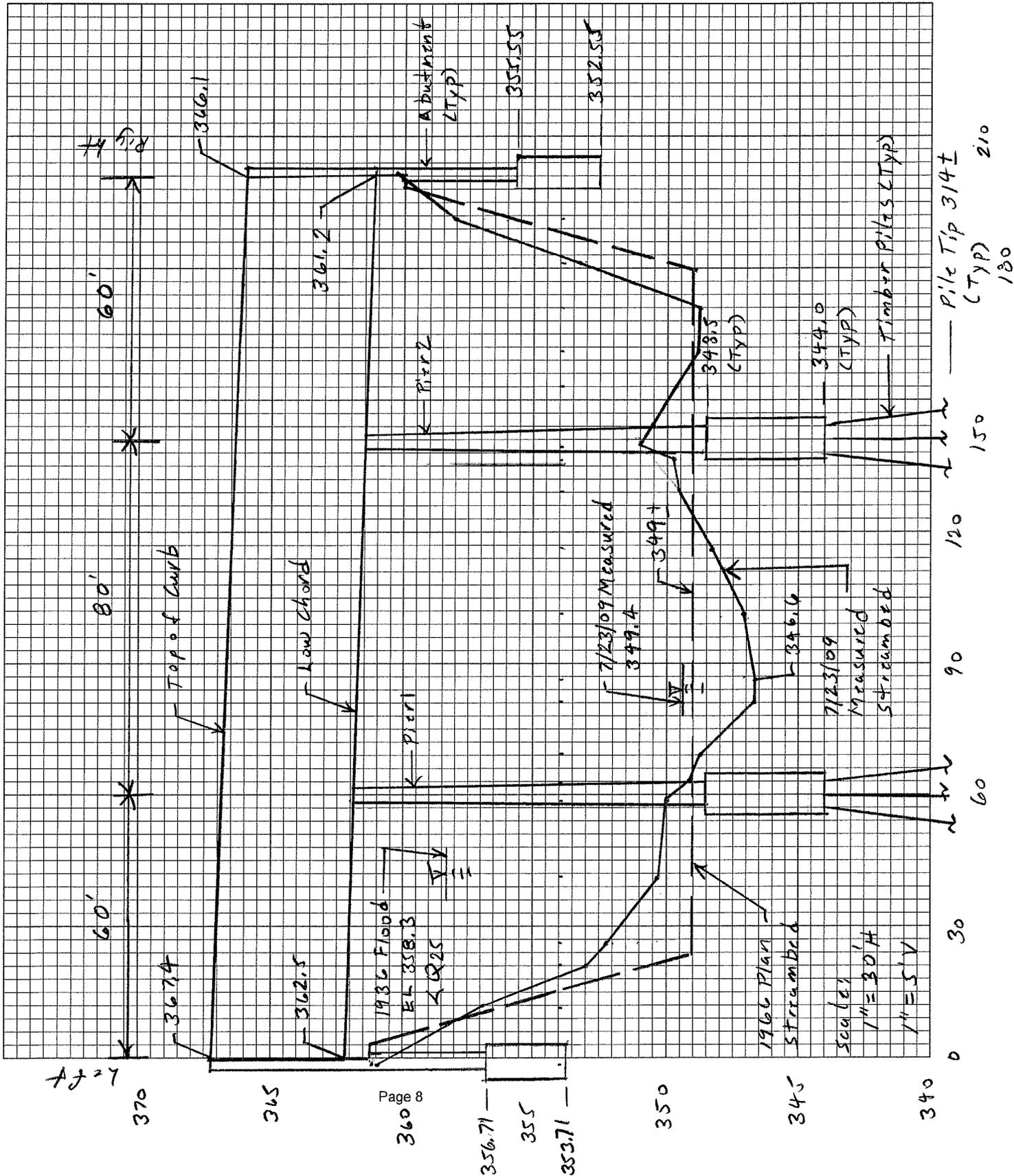
Stream Cross Section at Bridge (Upstream Side - Facing Downstream)



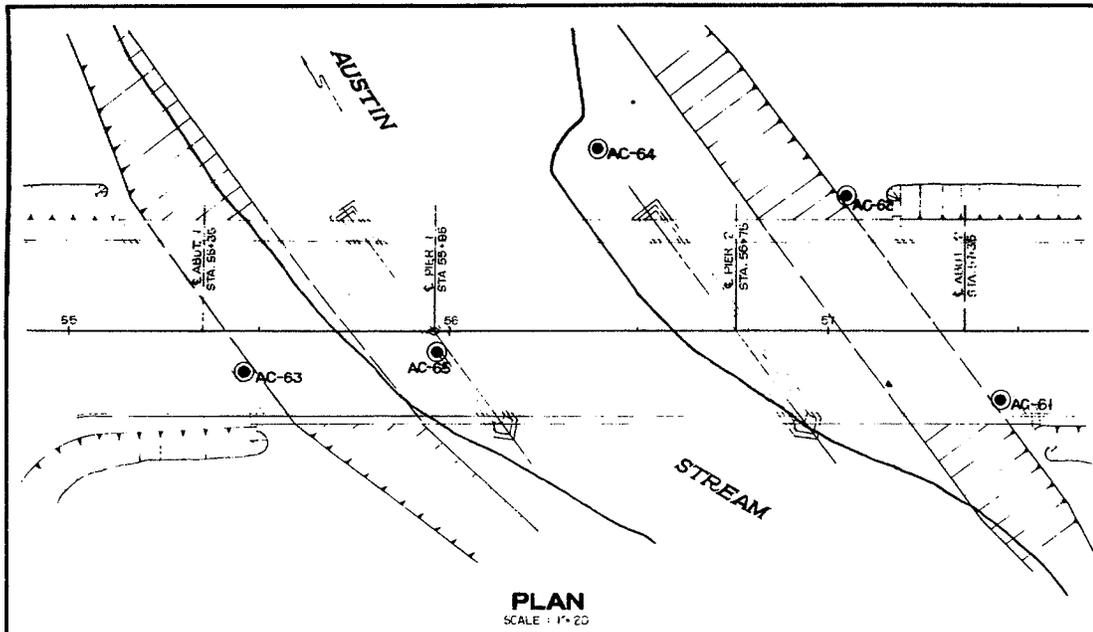
OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: <i>Austin</i>	Town: <i>Bingham</i>	Bridge #: <i>2027</i>
Feature Carried: <i>Rt. 201</i>	Stream: <i>Austin Str.</i>	Review Date: <i>7/23/09</i>

Stream Cross Section at Bridge (Downstream Side - Facing Downstream)



ATTACHMENT E



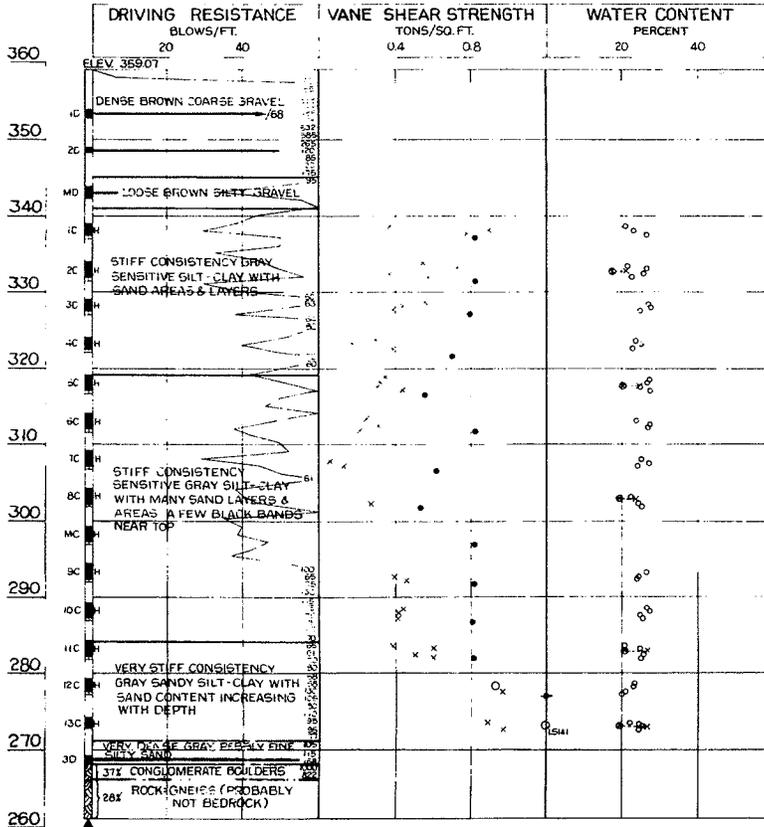
PLAN
SCALE: 1" = 20'

370
360
350
340
330
320
310
300
290
280
270
260

ELEVATION

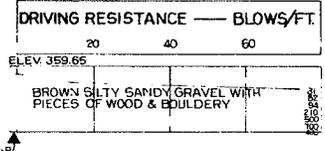
BORING AC-63

STATION 55+46 11/2" R.T. 2 1/2" CASING



BORING AC-62

STATION 57+05 35' L.T. 2 1/2" CASING



BORING NOTES

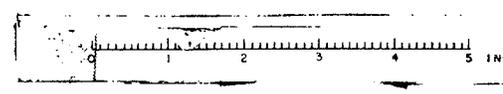
- All samples and vane are made ahead of casing
- Number of blows required to drive extra heavy casing one foot with 400 ft. lbs. of energy per blow
- Location of sample or sample attempt
- Number and type of dry sample
- ID S & H Sampler #1290's
- IC 2" O.D. 16 ga. seamless tubing
- IU 3 1/2" O.D. 16 ga. seamless tubing
- MD Unsuccessful sample attempt and type of sampler
- Number of blows required to drive spoon or tubing one foot with 350 ft. lbs. of energy per blow
- H Sampling spoon or seamless tubing driven by static weight of drill rods and hammer
- P Piston sampler
- Field vane test
- Bottom of boring (may not be bottom of soil strata)
- Refusal of drill rods or casing (may not be ledge)
- Locations cored by diamond bit and percent recovery of rock

SHEAR NOTES

- Field vane shear strengths
- Laboratory vane shear strength
- Shear strengths in excess of capacity of equipment
- One half unconfined compressive strengths

WATER CONTENT NOTES

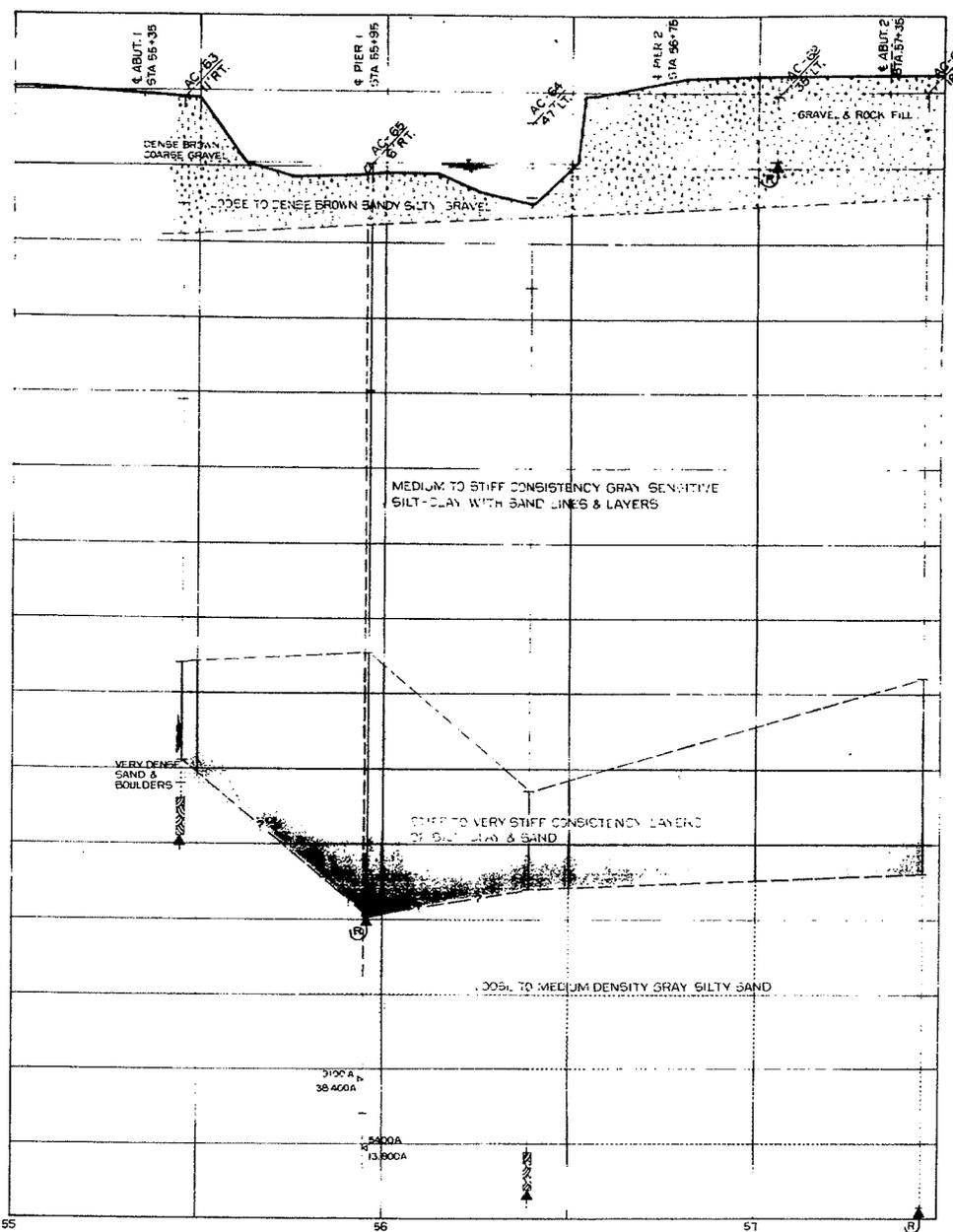
- Natural water contents given as percent of dry weight
- Plastic and liquid limits



D.P.R. REG. NO.	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
1	MAINE	2-15-51	3	14

ELEVATION

370
360
350
340
330
320
310
300
290
280
270
260
250
240
230
220
210



1/2" CASING
FOOT

1" CASING
FOOT

3" CASING
FOOT

Symbol of casing
on heavy casing one foot with
Symbol of sampler
on or tubing one foot with
driven by static weight of drill

Symbol of soil strata
not be ledge
percent recovery of rock

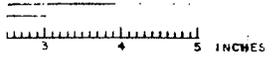
Symbol of equipment
lengths

percent of dry weight

PROFILE
SCALE: 1" = 10' VERT.
1" = 20' HORIZ.

DESIGN— TRACE— CHECK—	BRIDGE NO. SURVEY— PLOT—
STATE HIGHWAY COMMISSION BRIDGE DIVISION	
AUSTIN BRIDGE OVER AUSTIN STREAM IN THE TOWN OF BINGHAM SOMERSET COUNTY FOUNDATION SURVEY	
SHEET 3 OF 14 AUGUSTA, MAINE	

M-2501



OFFICE/FIELD REVIEW DATA REPORT

Bridge #: 2027

b. Contraction Scour Potential (due to encroachment)

1) Potential for Overbank Flow (Y/N/Unk.): Y Left Y Right
 2) Relief Structure (X): Bridge — Culvert 2-5'Ø Location (ft. L/R) ±1000'R
 3) Potential for Over Topping (Y/N/Unk.): Y

c. Long Term Potential for: Aggradation (Y/N): N Degradation (Y/N): N

Source of Sediment (X): N/A Bed Load — Other bed is cobbles

d. Bed Material (Circle):

Silt/Clay Sand Gravel
Cobbles/Boulder Rounded Bedrock Other

Bed Material D50 (Visual Classification): Per Plan substructure profile: Foundation = silt-clay with sand lines & layers. Bed = sandy silty gravel. Apparent armorings D50 ≈ 0.2"

BRIDGE SITE CONDITIONS

5. STREAM CROSS SECTION (X) (See sheets 7 & 8): X Upstream Face X Downstream Face

6. FLOW CONDITIONS

a. Obstructions/Beaver Dams/Etc... (Describe): None

b. Confluences (L/R, ft. upstream or downstream): Confluence w/ Kennebec River ~0.5mi D/S

c. High Water Mark USGS Gaging STA ~1000' U/S

1) Date/Estimated Flood Frequency: March 12, 1936 (Flood) / HW at bridge (< Q25 per Historic streamflow Gage Record)
 2) Approx. Elev. (Based on bridge datum): 367.97 / 358.3
 3) Source/Reliability: 1967 Plans

d. Feasibility of Adding Riprap or Other Scour Countermeasures (Explain): Steep gabion banks except @ U/S left water flow, flow under left two spans. Adequate under clearance.

7. BRIDGE DESCRIPTION

a. Description of Bridge/Bridge Type (Single/Multi Span, Continuous/Non-continuous, Superstructure Type):

3-span, continuous steel girder bridge

b. Bridge Length (ft): 198'-T 80'-max span Bridge Width (ft): 52' Number of Spans: 3

c. Date Built: 1969

d. Reconstruction/Scour Repairs (Date/Description): 1938 Channel Repair & Deck Rehab - placement of gabions along D/S left bank ~50'-250' from bridge. 2000 Channel Repair - Apparent placement of riprap at piers.

e. Bridge datum (NGVD/Assumed): 1966 Plan Elev. 365.7 Location: Top of curb, U/S Right

f. Low Chord Elev., (ft): 360.8

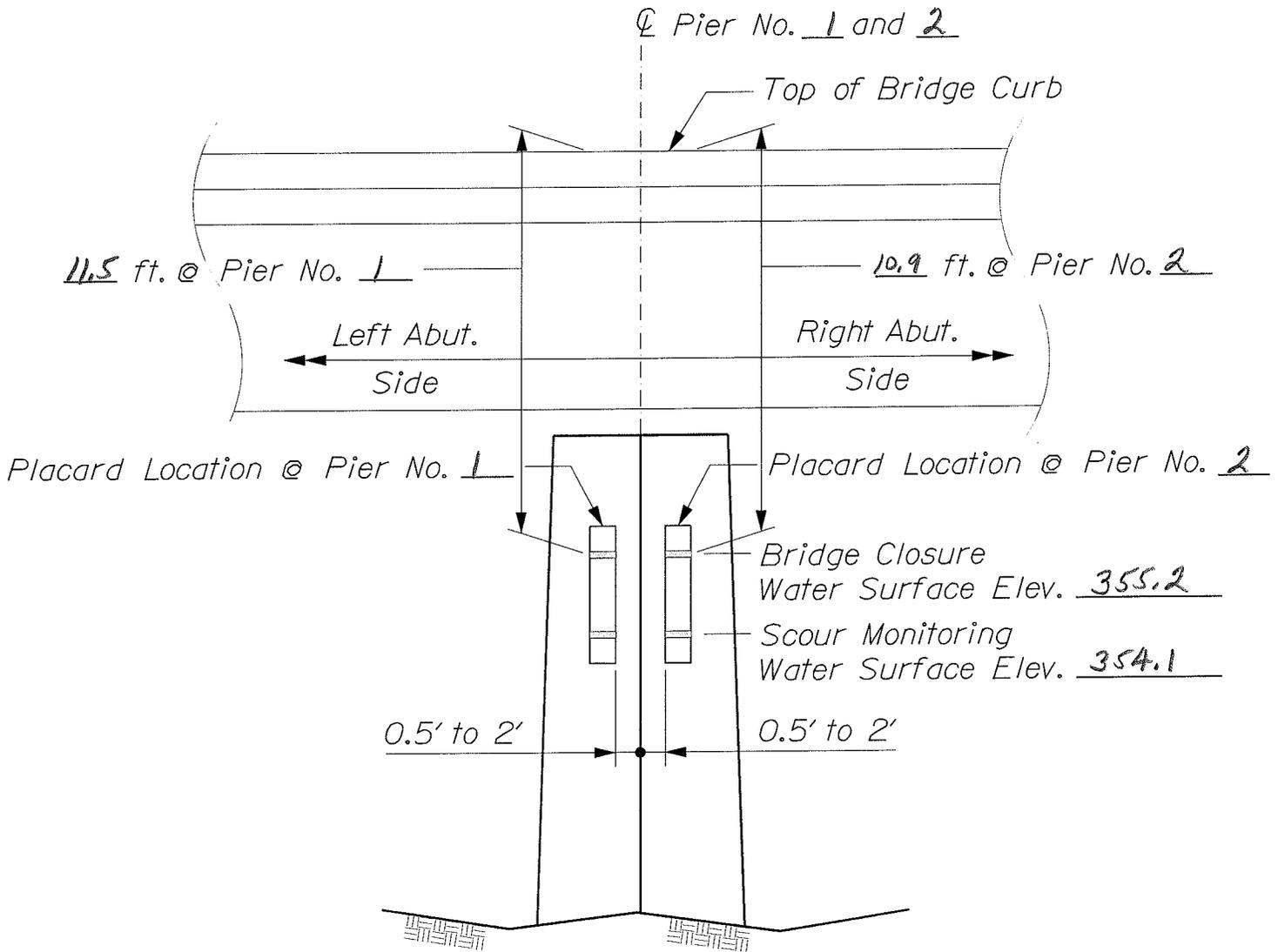
g. Bridge Deck Elev., (ft): ~366.9 L to ~365.6 R

h. Upstream Top of Bank Elevation at Bridge, (ft): ~361 (Near low chord)

i. Overtopping Elev., (ft): ~365.5 At Bridge (Y/N): — Approaches (ft. L/R): R-100'

ATTACHMENT F

TOWN: Bingham
BRIDGE No: 2027



PIER SIDE ELEVATION

N.T.S.

NOTES:

1. Bridge shall be monitored for scour for water surface above Elev. 354.1 corresponding to a discharge Q₁₀ year event.
2. Bridge shall be closed for water surface above Elev. 355.2 corresponding to a discharge Q₅₀ year event.
3. Two placards shall be located on the upstream side of the pier nose. One placard shall be located on the left side of the left most pier and one placard shall be located on the right side of the right most pier as noted and in the locations shown.

PLACARD INSTALLATION LOCATION

S
CJP
1/24/06

Supplemental Scour Inspection After 04/05 Flooding

Date: Apr. 18/05

BrNo.: 2027

Bridge Name: AUSTIN STREAM

Town: BINGHAM

- no evidence of any scour problems
- sag in deck or rail
- abutment or pier tilting, moving, settlement
- cracks in pier or abutment
 - o if so, where and how big
- undermining, footing exposure (take measurements)
- probe around abutment, check for deposits of fines
- if countermeasures installed, condition of countermeasures
- debris
 - o if so, where *tree on northernmost pier.*
- footing orientation with respect to flow direction
- scour hole up or downstream
- deposits
- roadway overtopping
- flood plain width compared to bridge opening
 - o Circle one 1X 2X 3X 4X
- settlement, erosion of approaches

Draw a sketch of the site indicating scour locations or other pertinent information (use back if necessary).

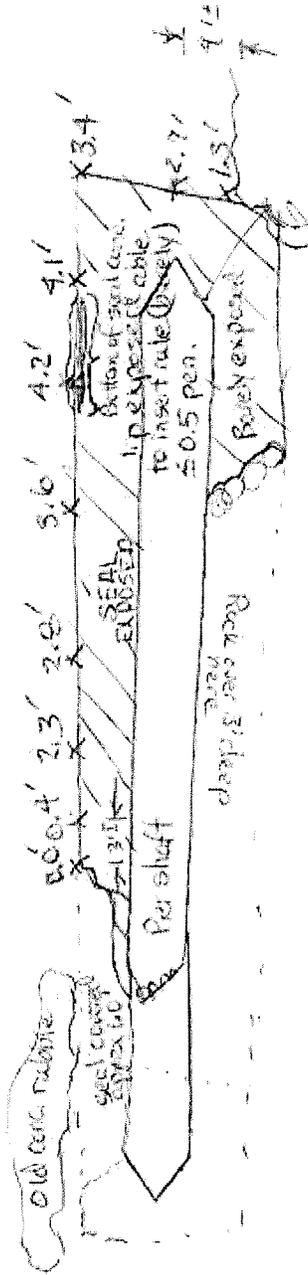
*Large stone protection working well, change item
113 = 5.*

Initial *AM*

SKETCH: N.T.S. by P. Verrill

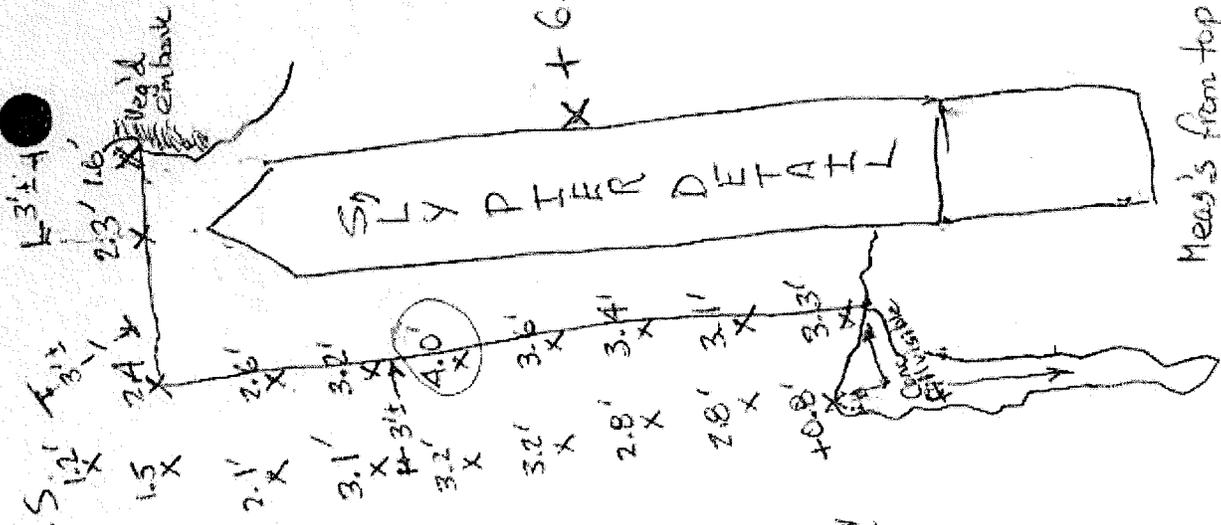
Meas's taken @ 6' increments unless noted otherwise.
Meas's from top of seal.

Pen horizontally under seal in area indicated.

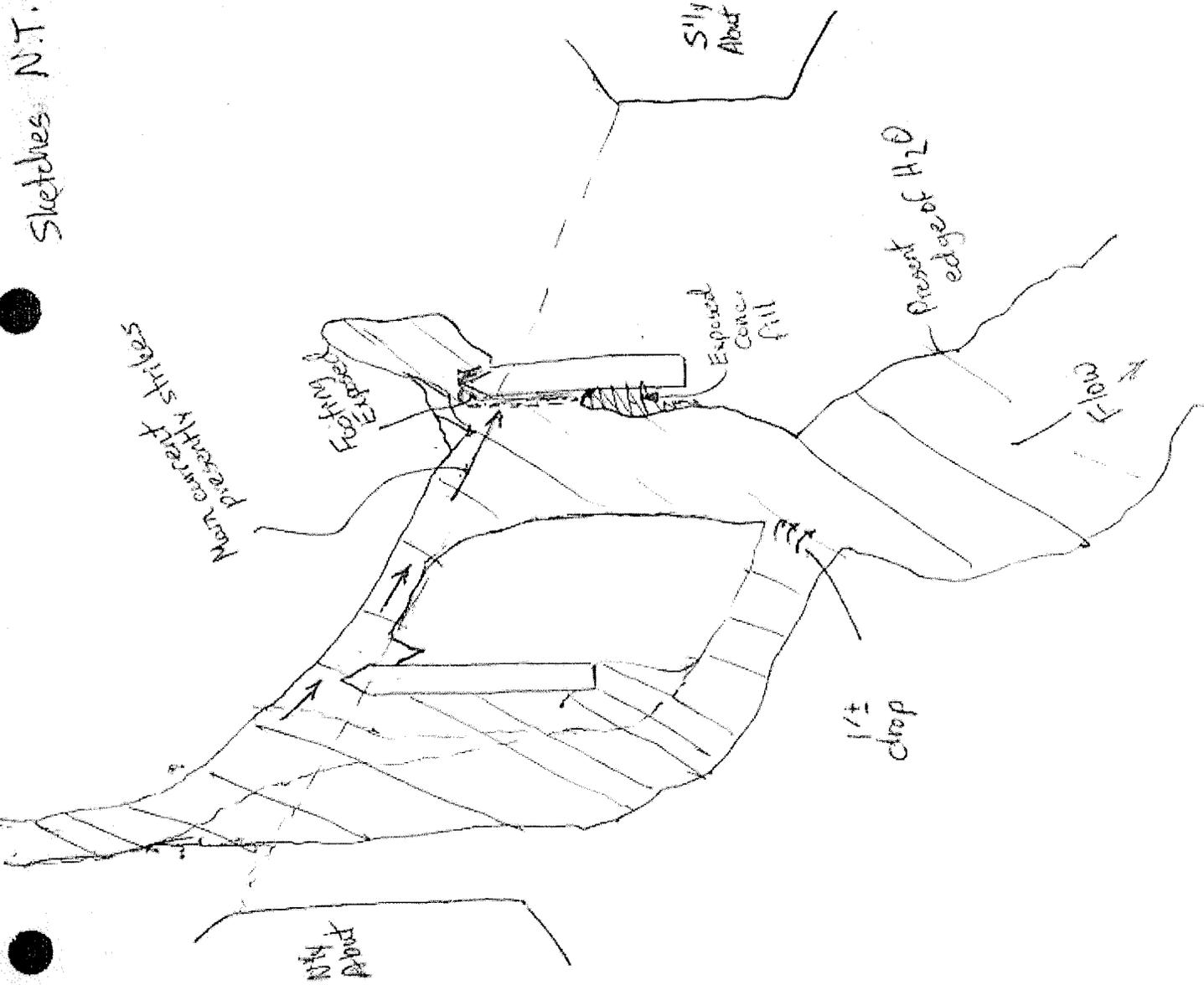


CHANNEL
Refer to previ reports for changes &
addt'l details

Sketches N.T.S.



Meas's from top of soil
 Center to even w. H₂O
 this date
 Log. soundings @
 6' ± intervals



Main current strikes
 Hoisting Exposed

Exposed
 Conc.
 fill

Present H₂O

Flow

1' ±
 drop

Flow

Silly
 About

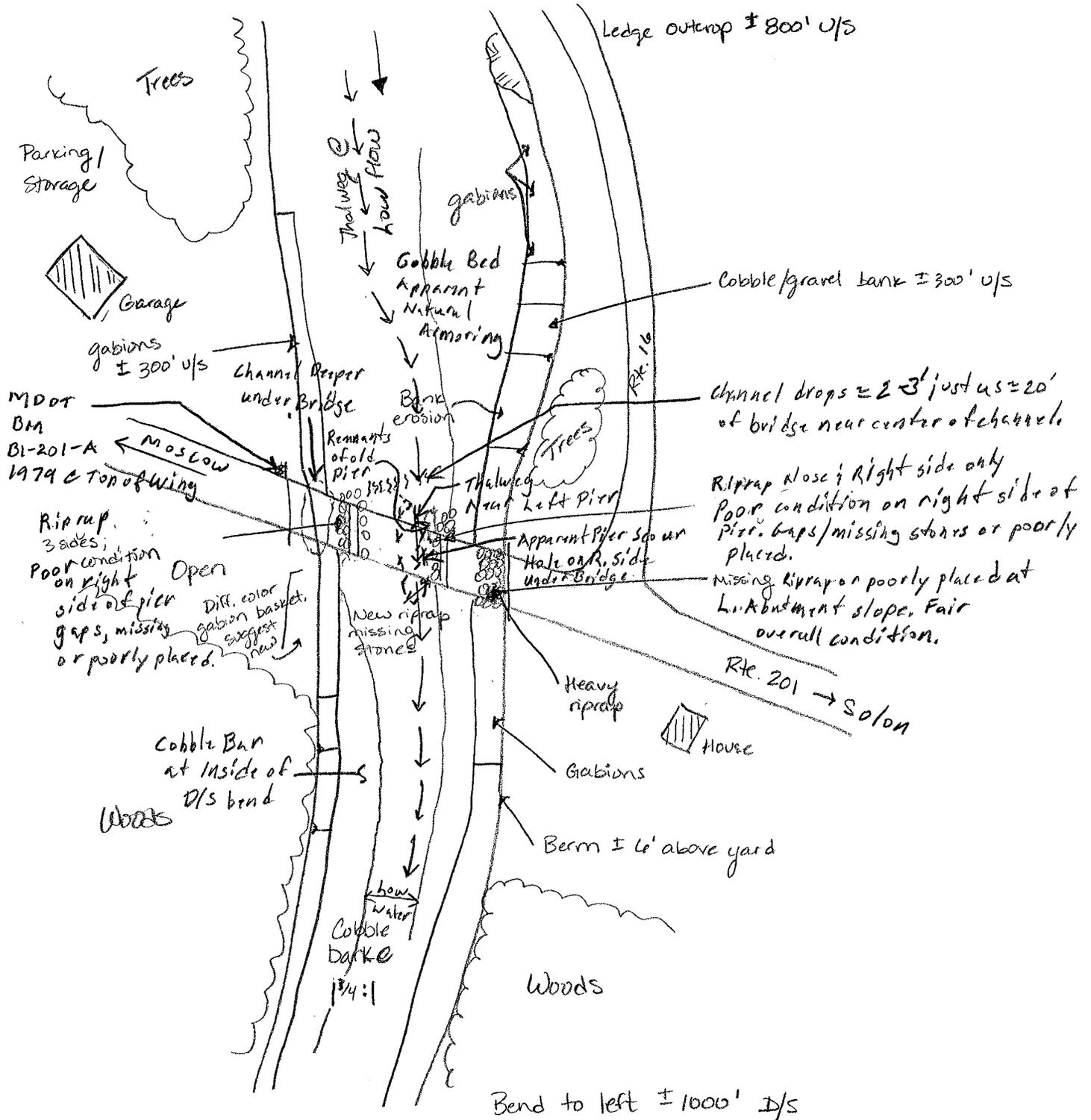
ATTACHMENT G

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: <i>Austin</i>	Town: <i>Bingham</i>	Bridge #: <i>2027</i>
Feature Carried: <i>201</i>	Stream: <i>Austin Stream</i>	Review Date: <i>12/20/08 & 7/23/09</i>

Sketch (Plan view)

Bridge plans supplemented by field sketch.



ATTACHMENT H

ATTACHMENT I

ATTACHMENT J

Underwater Inspection Report

Bridge Number

2027

Town

Bingham

Bridge Name

Austin

Location

Feature On

Rt 201

Feature Under

Austin Stream

Division

04

Insp. Cycle

Equip./Add. Insp.

Tidal

Tide Information

Problems and/or Hazards

Dive Entry Loc.

Photos (taken or recommended)

062800 U.W. Insp. Date

Wentworth Team Leader

Falls Diver 1

Edwards Diver 2

Foster Safety Diver

Tender 1

Tender 2

3 Substr. / Culvert Cond.

7 Channel Cond.

21837 Rec. Repair 1

Rec. Repair 2

Signature

Jim D. Wentworth

1:30 Time: Entry

1:50 Time: Exit

65° Water Temp. (F)

5 Visibility (feet)

8 Max. Depth (feet)

slight Current

Sunny Weather

Structure Type

Foundation

Shaft Type

Streambed Description

Cobbles, sand & gravel over clay. Very mobile stones.

Channel Comments

Retainment flat, small cobbles, sand, gravel.

Clear. Gabions have been installed along both embankments to stabilize the streambed. Sideroad (Rte. 16) was washed out in 1987 flood.

Structure Comments

Pier on South side undermined & at St. Anthony Sec. along 25' b'. Timber piles exposed. Piles have localized scouring 2' deep, about 6" from pile base.

Scouring PIER

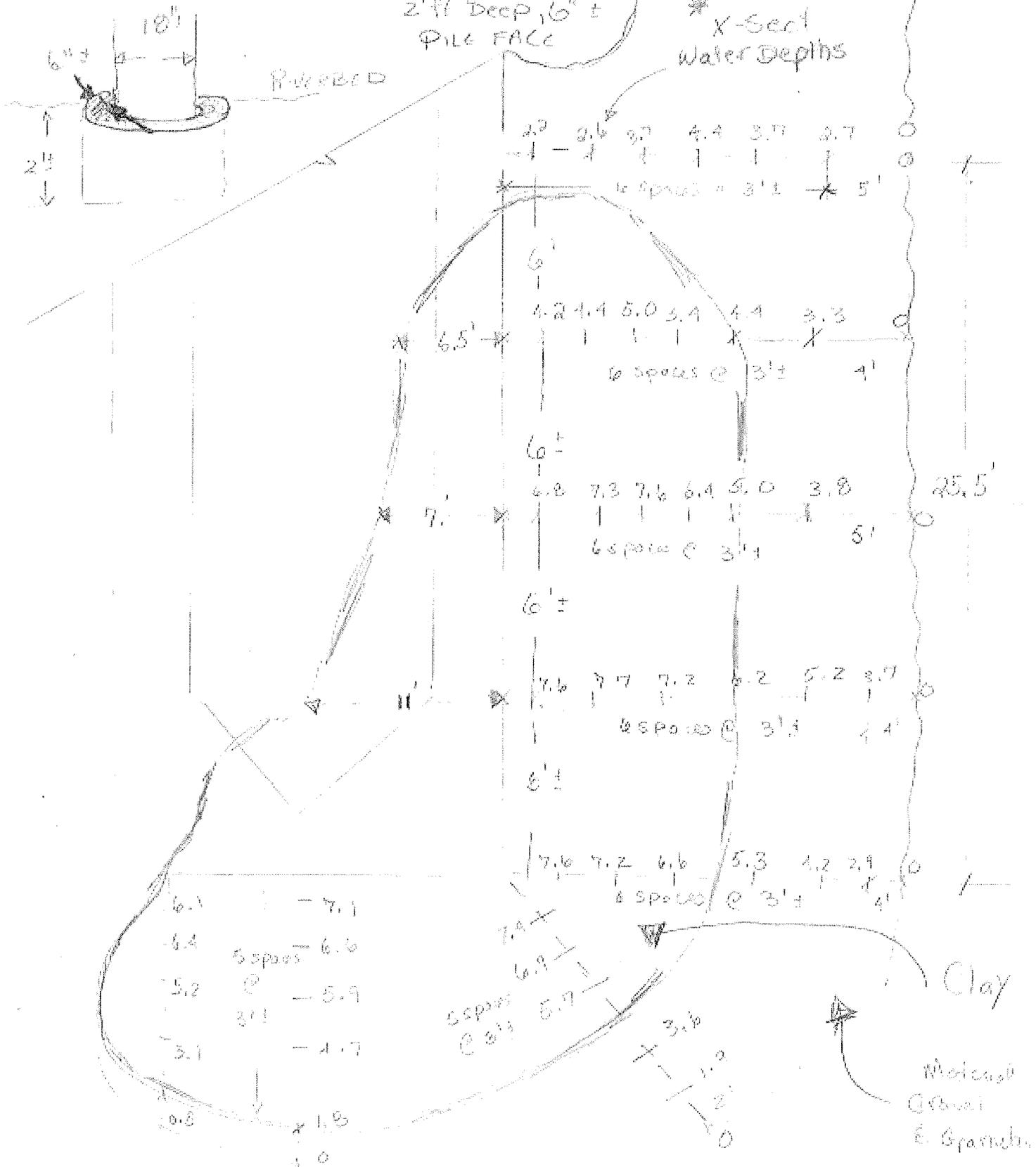
PIER ON WOODEN PILLS

Depth of scouring is 4.6' ±

PIER ON WOODEN PILLS 18-24" Ø
 AREA AROUND PILLS LOCALIZED SCOUR RING

2'ft Deep, 6" ±
 PILE FACE

* X-Section
 Water Depths



1/29/90

NCH TIN314

UNDERWATER INSPECTION REPORT

TOWN(S) BINGHAM BR. NAME AUSTIN

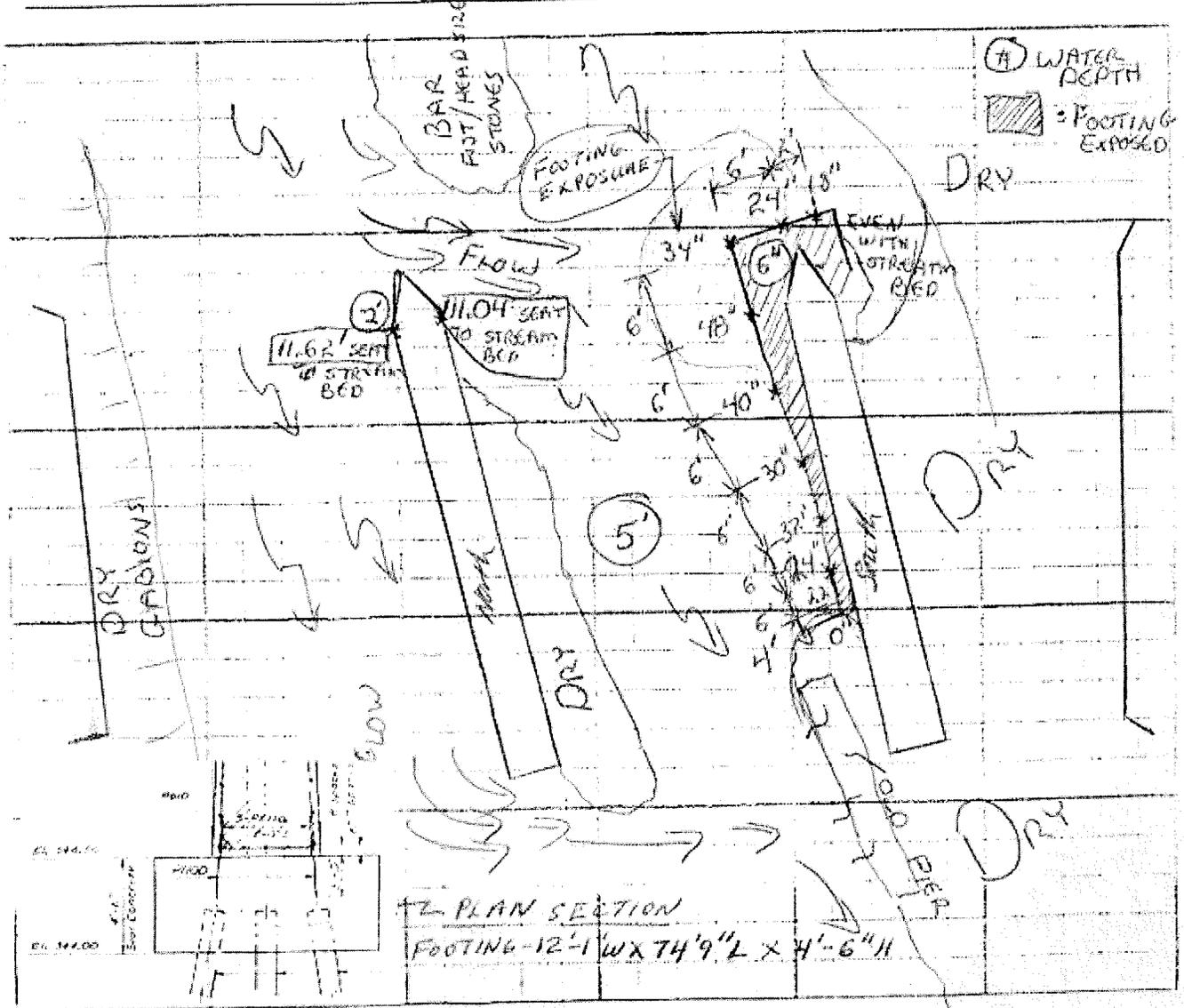
193	<u>2101217</u>	BRIDGE NO.	TEAM LEADER <u>M. ELDRIDGE</u>
493	<u>0723916</u>	DATE	DIVERS <u>C. EDWARDS, M. ELDRIDGE</u>
460	<u>7</u>	EQUIP/ADD. INSP	TIME: ENTRY <u>10:35</u>
461	<u>5</u>	SUBST. COND.	EXIT <u>11:05</u>
697		CHAN. COND.	WEATHER <u>CLOUDY 60°</u>
698		SHAFT TYPE	WATER: TEMP: <u>75°</u>
		FOUNDATION	MAX. DEPTH <u>5'</u> FT
			VISIBILITY <u>5'</u> FT
			CURRENT <u>SWIFT</u>
			INSP. SIGN <u>M. Eldridge</u>

RECOM. REPAIRS 7 scout repair

685	<u>40</u>	<u>45</u>	<u>8</u>
686			

STREAMBED DESC. Head sized boulders
COMMENTS/PROBLEMS/HAZARDS

INSPECTION REPORT Note Scour @ US South pier. Prior report (1991)
Stated no footings were exposed. Measured 48" vertical footing face (See sketch)
Plans show 4'-6" footing on TIMBER piles.



UNDERWATER INSPECTION REPORT

TOWN(S) Bingham BR. NAME Austin

193	<u>2027</u>	BRIDGE NO.	TEAM LEADER <u>M. J. Judge</u>
493	<u>090691</u>	DATE	DIVERS _____
460	<u>7</u>	EQUIP/ADD. INSP	TIME: ENTRY _____
461	<u>7</u>	SUBST. COND.	EXIT _____
697	<u>7</u>	CHAN. COND.	WEATHER _____
698	<u> </u>	SHAFT TYPE <input checked="" type="checkbox"/>	WATER: TEMP: _____
		FOUNDATION <input checked="" type="checkbox"/>	MAX. DEPTH _____ FT
			VISIBILITY _____ FT
			CURRENT _____
685	<u> </u>	RECOM. REPAIRS	INSP. SIGN <u>M. J. Judge</u>
686	<u> </u>		

STREAMBED DESC. _____
COMMENTS/PROBLEMS/HAZARDS _____

INSPECTION REPORT
Verified foundation visually - no footings exposed.

Clear water, very low water this year.

BINGHAM
AUSTIN

ATTACHMENT K

MAINE DEPARTMENT OF TRANSPORTATION

BRIDGE SCOUR ASSESSMENT

SUMMARY REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin Stream	River Basin: Kennebec River
Assessment By: Rick Hebert	Assessment Date: 11/19/2009	
Check By: <i>D. Reynolds</i>	Check Date: <i>11/20/09</i>	
MDOT PIN: 15631.10	TYLI Project No: 411588.10	

NOTES

- Observations left and right are facing downstream -
- Elevations refer to bridge plan datum unless otherwise noted -
- The information shown in this report is obtained from available MDOT bridge plans and records, supplemented by field review -

1. SUMMARY AND CONCLUSIONS

Negative factors influencing recommendations:

- 1966 plan cross section compared to measured 1995 and 2009 cross sections indicate significant deepening of channel (~2-2.5 ft) adjacent to Pier 1 within span 2.
- Moderately steep channel profile & noted thalweg migration. Low flow thalweg directed towards side of pier 1 at an attack angle of ~20°. Thalweg ~2' below bottom of pier pile caps.
- Highly scourable bed material. Plans note silt-clay with some sand foundation material and sandy silty gravel bed.
- Moderate contraction scour potential. Narrow upstream floodplain with high bank. Potential for pressure flow. High velocity potential.
- Inspection reports dating back to 1982 document history of bed and bank instability, significant scour at piers, exposure of Pier 1 pile cap, scour holes at Pier 1 side and nose, and significant debris.
- Stub abutments on spread footings. Piers on non- end bearing relatively short timber pile foundations.
- Based on review of basin flood data, bridge not likely subjected to Q100 event since built in 1969.
- Recently installed (2000) pier riprap consists of rounded stones in generally poor condition.

Positive factors influencing recommendations:

- Left abutment riprap in fair condition, and right abutment gabions in good condition.
- Piers supported on pile foundations and continuous redundant superstructure.

Conclusions:

- Piers and abutment slopes can be accessed during low flow. Shallow low flow easily diverted. Headroom adequate.
- Heavy riprap or concrete cable mat likely cost effective countermeasure alternatives at piers.
- Structure length > 150' and cost of replacement would be significant.
- Scour evaluation recommended. Installation of properly designed countermeasure required to improve Item 113 rating.

2. RECOMMENDATIONS

a. Scour Vulnerability (Long term, Contraction, Abutment, Pier):

Moderate contraction scour, low abutment scour, and high pier scour potential. Highly scourable mobile bed. Potential for pressure flow. Abutments at bank. Narrow upstream floodplain with high banks. Migrating thalweg below top of pile cap. Inadequately protected piers. History of significant debris accumulation. Significant observed scour and bed profile changes.

b. Recommended NBI Ratings:

Item 60 : 5

Item 61 : 5

Item 71 : 7

Item 113 : 3

c. POA Recommended (X):

Full X

Abbreviated _____

Abbreviated Scour POA Checklist

Town: Bingham Bridge Name: Austin Bridge #: 2027

Pass / Fail Criteria

Detour Length	< 25 miles	<u>Yes</u>	No
Roadway Classification	Less than Arterial	Yes	<u>No</u>
Traffic Count	< 5000 AADT	<u>Yes</u>	No
Structure Length	< 150 feet	Yes	<u>No</u>
Scour Critical Bridge on Detour		Yes	<u>No</u>
Detour Roadway Condition / Width	Adequate	<u>Yes</u>	No

Judgment Criteria

Hydraulics:			
Lateral stream stability	Low	<u>Medium</u>	High
Channel vertical stability	Low	Medium	<u>High</u>
Degree of constriction	Low	<u>Medium</u>	High
Angle of attack	Low	<u>Medium</u>	High
Potential for pressure flow	Low	<u>Medium</u>	High
Geotechnical:			
Stream bed erodibility	Low	Medium	<u>High</u>
History:			
Scour history	Low	Medium	<u>High</u>
Flood	Low	Medium	<u>High</u>
Ice / Debris	Low	Medium	<u>High</u>
Structural:			
Substructure Condition	<u>Low</u>	Medium	High

Other Comments: *Based on existing conditions, pier riprap appears to not be appropriately designed and inadequate.*

Recommended POA: Full Abbreviated

Submitted by: Rich Debut Date: 11/19/09

MAINE DEPARTMENT OF TRANSPORTATION

BRIDGE SCOUR ASSESSMENT

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: <u>Austin</u>	Town: <u>Bingham</u>	Bridge #: <u>2027</u>
Feature Carried: <u>201</u>	Stream: <u>Austin St.</u>	River Basin: <u>Kennebec</u>
Review By: <u>R. Hebert, J. Olund</u>	ASN	Review Date: <u>12/18/09</u>
Checked By: <u>D. Reynolds</u>		Check Date: <u>11/20/09</u>
MDOT PIN: <u>15631.10</u>		TYLI Project No: <u>411588.10</u>

NOTES

- Observations left and right are facing downstream -
- Elevations refer to bridge plan datum unless otherwise noted -
- The information shown in this report is obtained from available MDOT bridge plans and records, supplemented by field review -

STREAM STABILITY ASSESSMENT

1. CHANNEL	Upstream	Downstream	At Bridge
Mannings 'n' :	<u>0.035</u>	<u>0.035</u>	<u>0.035</u>
2. FLOOD PLAIN			
Mannings 'n' , (L/R):	<u>0.035/0.04</u>	<u>DTL/DBR</u>	<u>—</u>
3. CHANNEL LATERAL STABILITY			
a. Bends (see sketch plan)			
1) Bridge Location: <u>~1,000</u> ft/Upstream of Bend <u>900</u> ft/Downstream of Bend <u>—</u> On Bend			
2) Migration Potential (Describe): <u>Moderate/slight</u> <u>channel moves between L & R banks.</u> <u>Gabions placed to stabilize banks, U/S & D/S.</u> <u>Bank erosion U/S L. extending 200' where gabions not in-place</u>			
b. Bank Condition			
	Upstream	Downstream	At Bridge
1) Vegetation (Describe):	<u>L-gravel/cobble; then gabions</u> <u>R-gabions ± 300 U/S</u>	<u>gabions L&R</u>	<u>same</u>
2) Material (Describe):	<u>rounded cobbles/gravel</u>	<u>same</u>	<u>same</u>
3) Eroding or Stable (see sketch-plan):	<u>U/S - Eroding</u>	<u>stable - w/gabions</u>	<u>stable w/gab.</u>
4) Bank Slope (X Horiz.:1 Vert.):	<u>3/4:1</u>	<u>3/4:1</u>	<u>3/4:1</u>
5) Bank Protection (Describe):	<u>gabions L&R (300' U/S)</u>	<u>gabions</u>	<u>gabions</u>
c. (Islands/Bars/Deposits): <u>(Gravel Bar) 200-400 ft./Upstream</u> <u>—</u> ft./Downstream <u>—</u> At Bridge			
4. CHANNEL VERTICAL STABILITY			
a. Channel Profile (X):			
	Pool	Riffle	
Upstream:	<u>✓</u>	<u>—</u>	
at Bridge:	<u>✓</u>	<u>—</u>	
Downstream:	<u>✓</u>	<u>—</u>	

OFFICE/FIELD REVIEW DATA REPORT

Bridge #: 2027

j. Pressure Flow Potential (Y/N): Y

k. Functional Class: 02

l. ADT: 4253 Year of ADT: 2007

m. Detour Length (mi): 3 Scour Critical Bridge on Detour (Y/N): N

Detour Roadway Condition / Width (Poor, Adequate): Adequate

n. Sufficiency Rating: 84.8 Posting (Y/N): N

8. ABUTMENTS

Left

Right

a. Type (Stub abut. on slope, Vertical wall, Vertical wall w/wingwalls

Dry Laid Granite, Granite Masonry):

X

X

b. Support (Fix./Exp.):

Exp.

Exp.

c. Angle of Inclination (Degrees):

37°

-

d. Foundation:

1) Spread Footings (X):

X

X

2) Piles (X):

-

-

3) Other (Type):

-

-

4) Footing Exposed (Y/N):

N

N

5) Top of Footing Elev., (ft):

356.71'

355.55'

6) Footing Height, (ft):

3'

3'

7) Exposure, (ft) (See Sounding Sheet):

-

-

8) Piles Exposed (Y/N):

-

-

9) Pile Tip Elev., (ft):

-

-

10) Rock Elev., (ft):

-

-

11) Source of Data (Field review, Design plans, As-built drawings,

Pile driving records, Inspection reports, Other):

X

X

e. Location from bank (Set back, At bank, In channel, In floodplain):

X

X

f. Protection:

1) Riprap Location (Describe):

X

-

2) Riprap (Type/Size):

3' Avg. (stones missing @ b/s end)

3) Riprap Condition (Good, Fair, Poor):

Fair

4) Other Protection:

-

gabions (R. Abut. Slope)

5) Condition (Good, Fair, Poor):

-

good

OFFICE/FIELD REVIEW DATA REPORT

Bridge #: 2027

b. Contraction Scour Potential (due to encroachment)

1) Potential for Overbank Flow (Y/N/Unk.): Y Left Y Right

2) Relief Structure (X): Bridge — Culvert 2-5' d Location (ft. L/R) ±100' R

3) Potential for Over Topping (Y/N/Unk.): Y

c. Long Term Potential for: Aggradation (Y/N): N Degradation (Y/N): N

Source of Sediment (X): N/A Bed Load — Other bed is cobbles

d. Bed Material (Circle):

Silt/Clay Sand Gravel
Cobbles/Boulder Rounded Bedrock Other

Bed Material D50 (Visual Classification): Per Plan sub surface Profile: Foundation = silt-clay with sand lines & hayres. Bed = sandy silty gravel. Apparent armoring D50 ≈ 0.2"

BRIDGE SITE CONDITIONS

5. STREAM CROSS SECTION (X) (See sheets 7 & 8): X Upstream Face X Downstream Face

6. FLOW CONDITIONS

a. Obstructions/Beaver Dams/Etc... (Describe): None

b. Confluences (L/R, ft. upstream or downstream): Confluence w/ Kennebec River ~ 0.5 mi D/S

c. High Water Mark USGS Gauging Sta ~ 1000' U/S

1) Date/Estimated Flood Frequency: March 12, 1936 (Flood) / HW at bridge (< Q25 per Historical Streamflow Gauge Record)

2) Approx. Elev. (Based on bridge datum): 367.97 / 358.3

3) Source/Reliability: 1967 Plans

d. Feasibility of Adding Riprap or Other Scour Countermeasures (Explain): Steep gabion banks except @ U/S left water flow, flow under left two spans. Adequate under clearance.

7. BRIDGE DESCRIPTION

a. Description of Bridge/Bridge Type (Single/Multi Span, Continuous/Non-continuous, Superstructure Type):

3-span, continuous steel girder

b. Bridge Length (ft): 198' ± 80' max span Bridge Width (ft): 52' Number of Spans: 3

c. Date Built: 1969

d. Reconstruction/Scour Repairs (Date/Description): 1988 Channel Repair & Deck Rehab - placement of gabions along D/S left bank ~ 50'-250' from bridge. 2000 Channel Repair - apparent placement of riprap at piers.

e. Bridge datum (NGVD/Assumed): 1966 Plan Elev. 365.7 Location: Top of curb, U/S Right

f. Low Chord Elev., (ft): 360.3

g. Bridge Deck Elev., (ft): ~366.9 L to ~365.6 R

h. Upstream Top of Bank Elevation at Bridge, (ft): ~361 (Near low chord)

i. Overtopping Elev., (ft): ~365.5 At Bridge (Y/N): — Approaches (ft. L/R): R-100'

OFFICE/FIELD REVIEW DATA REPORT

Bridge #: 2027

9. PIERS

	Pier #	1	2	3	4	5
a. Type (Solid shaft, Single Column, Multi-column, Pile bent, Dry Laid Granite, Granite Masonry):		X	X			
b. Support (Fix./Exp.):		FIX	EXP			
c. Channel/Floodplain (Chan/Fld):		Chan	Chan			
d. Shape (square, round nose, sharp nose)						
Upstream:		Sharp	Sharp			
Downstream:		Sharp	Sharp			
e. Width x Length, (ft):		~9.6' x 66'	~4.6' x 66'			
f. Angle of Attack, (Degrees):		~10-15°	~10-15°			
g. Foundation:						
1) Spread Footings (X):		-	-			
2) Piles (X):		X	X			
3) Other (X):		-	-			
4) Footing Exposed (Y/N):		N	N			
5) Top of Footing Elev., (ft):		348.5	348.5			
6) Footing Height, (ft):		4.5	4.5			
7) Exposure, (ft) (See Sounding Sht):		-	-			
8) Footing Width x Length, (ft):		~9.5' x 74'	~9.5' x 74'			
9) Piles Exposed (Y/N):		N	N			
10) Pile Tip Elev., (ft):		± 314	± 314			
11) Rock Elev., (ft):		-	-			
12) Source of Data (Field review, Design Plans, as-built drawings, Pile driving records, Inspection reports, Other):						
h. Protection:						
1) Riprap Location (Describe):		Up Nose & Along Both Sides both Piers				
2) Riprap (Size/Type):		Plain Riprap 1.5-3' φ				
3) Riprap Cond. (Good, Fair, Poor):		Poor (Large gaps between stone, missing stone, OK e Pier Nose, but abstracts channel. Round stones not well interlocked)				
4) Other Protection:						
5) Condition (Good, Fair, Poor):						
10. EVIDENCE OF SCOUR						
a. Existing NBI Rating:		7 Item 60	6 Item 61	7 Item 71	(Bridge records)	
b. Previous MDOT Underwater Inspection (Y/N Date):		10/11/00		Frequency (Months): None		
a. Abutments		Left	Right			
1) Tilt / Settlement * (Y/N):		N	N			
2) Cracks * (Y/N):		N	N			
3) Adjacent Roadway Settlement * (Y/N):		N	N			
* Describe Cause, If not scour :						

OFFICE/FIELD REVIEW DATA REPORT

Bridge #: 2021

Left Right

4) Max. Depth Undermining, (ft) (See sketch-plan):

5) Scour Holes (Y/N) (See sketch-plan):

N N

6) Comments (Expansion Joints, Rockers, etc.): *Comparison of inspection photos from 2005 indicate much of pier riprap has washed away. No significant flood events since 2000 on record. Riprap on sides of piers between piers not holding up well. History of significant channel movement.*

b. Piers Pier # 1 2 3 4 5

1) Tilt / Settlement (Y/N):

N N _____

2) Max. Depth Undermining, (ft)

(see sketch-plan):

3) Scour Holes (Y/N) (sketch-plan):

Y Y (Both minor)

4) Comments (Expansion Joints, Rockers, etc.):

c. Contraction Scour Potential (Low Moderate, High):

1) Bed Deposits Downstream (Y/N):

N Distance, (ft): _____

2) Blowhole (Y/N):

N

3) Comments (Channel/Floodplain Contraction, Scour Holes, etc.): *Narrow U/S floodplain with high bank. Bridge matches channel width.*

11. DEBRIS

a. Potential for Debris Accumulation (See sketch-plan):

Low: _____ Moderate: _____ High: X

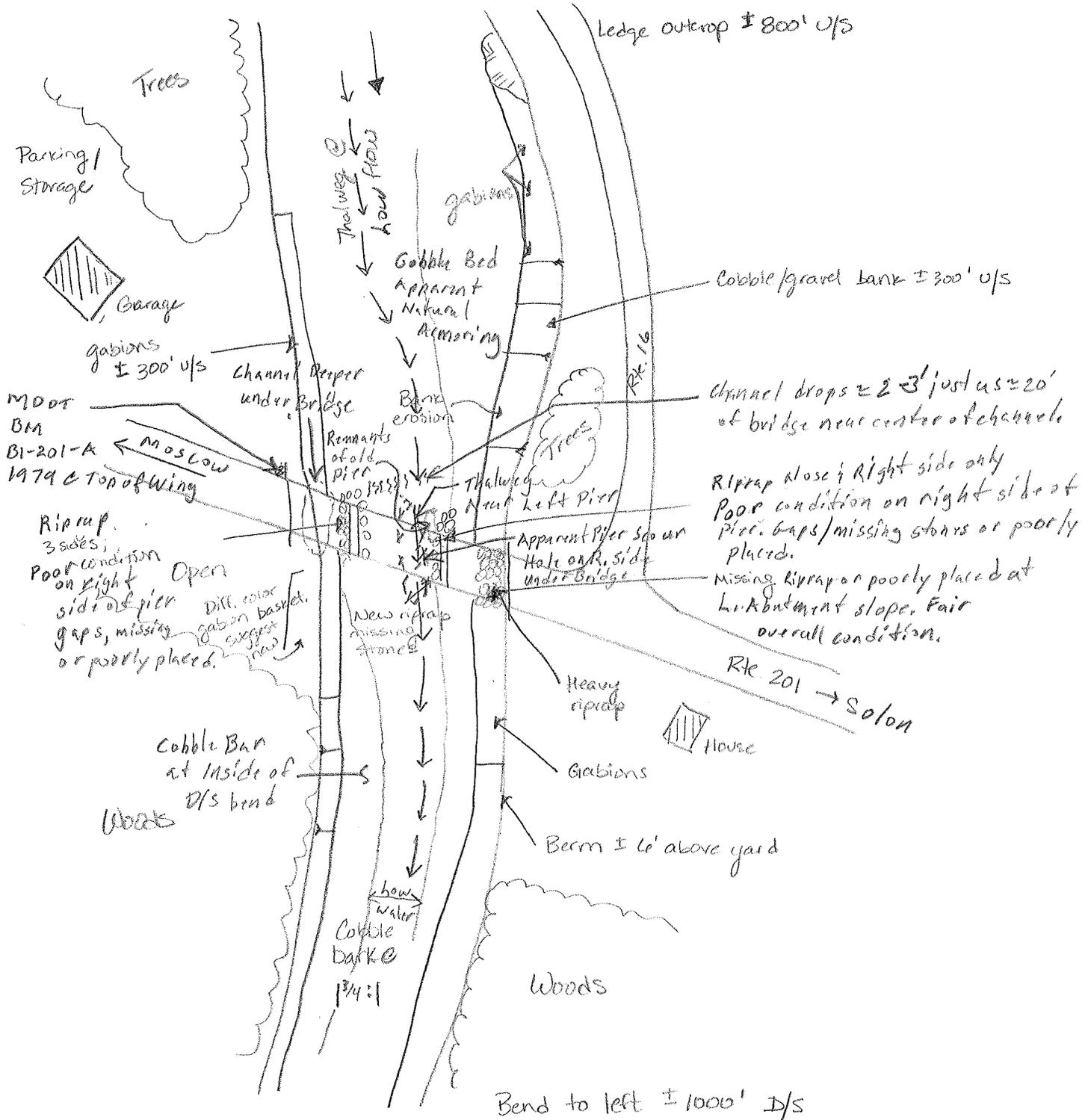
b. Comments (Location, Type, Size, Etc.): *History of debris accumulation*

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: <u>Austin</u>	Town: <u>Bingham</u>	Bridge #: <u>2027</u>
Feature Carried: <u>201</u>	Stream: <u>Austin Stream</u>	Review Date: <u>12/20/08 & 7/23/09</u>

Sketch (Plan view)

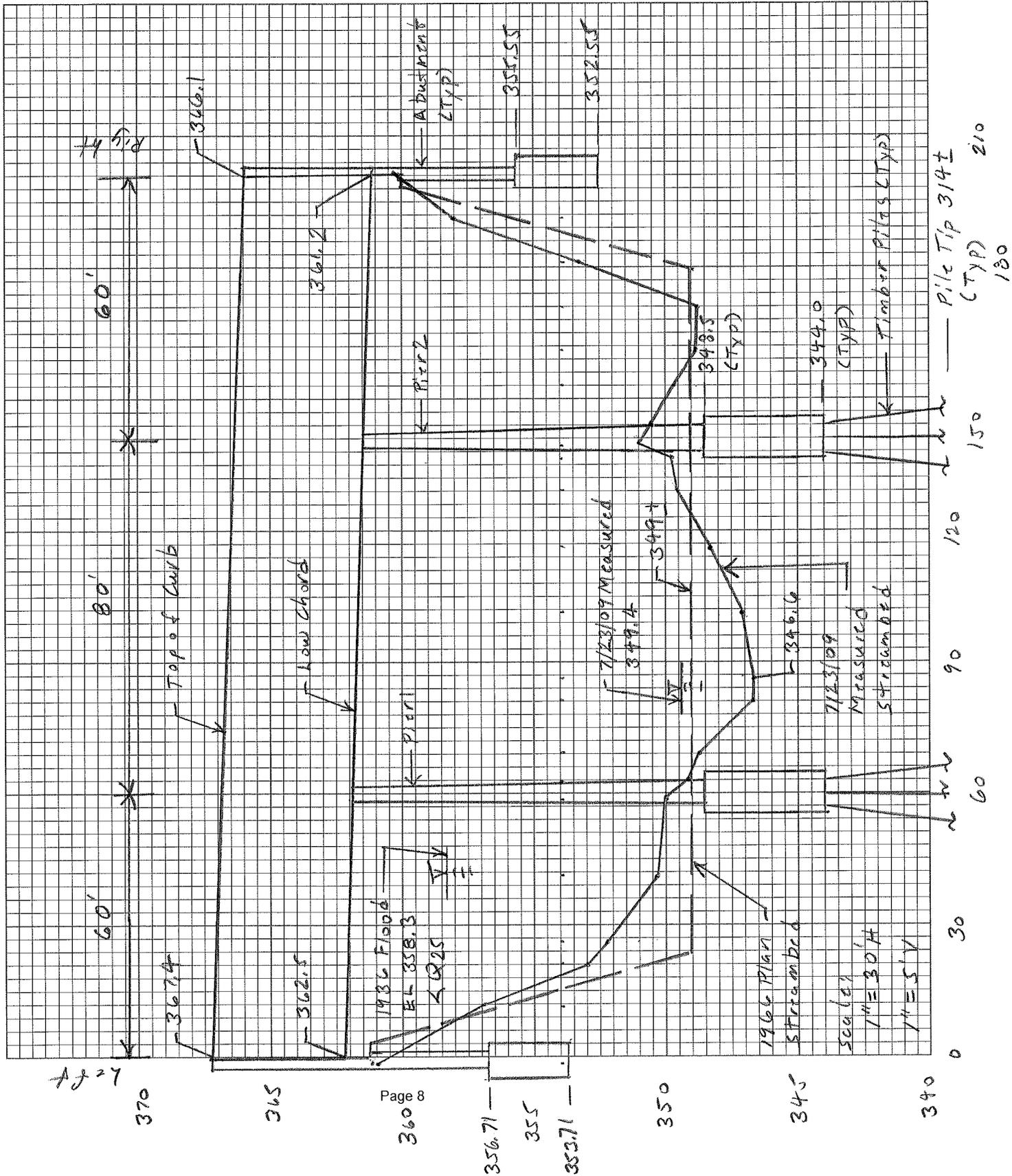
Bridge plans supplemented by field sketch.



OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: <i>Austin</i>	Town: <i>Bingham</i>	Bridge #: <i>2027</i>
Feature Carried: <i>Rt. 201</i>	Stream: <i>Austin Str.</i>	Review Date: <i>7/23/09</i>

Stream Cross Section at Bridge (Downstream Side - Facing Downstream)



OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 7/23/09

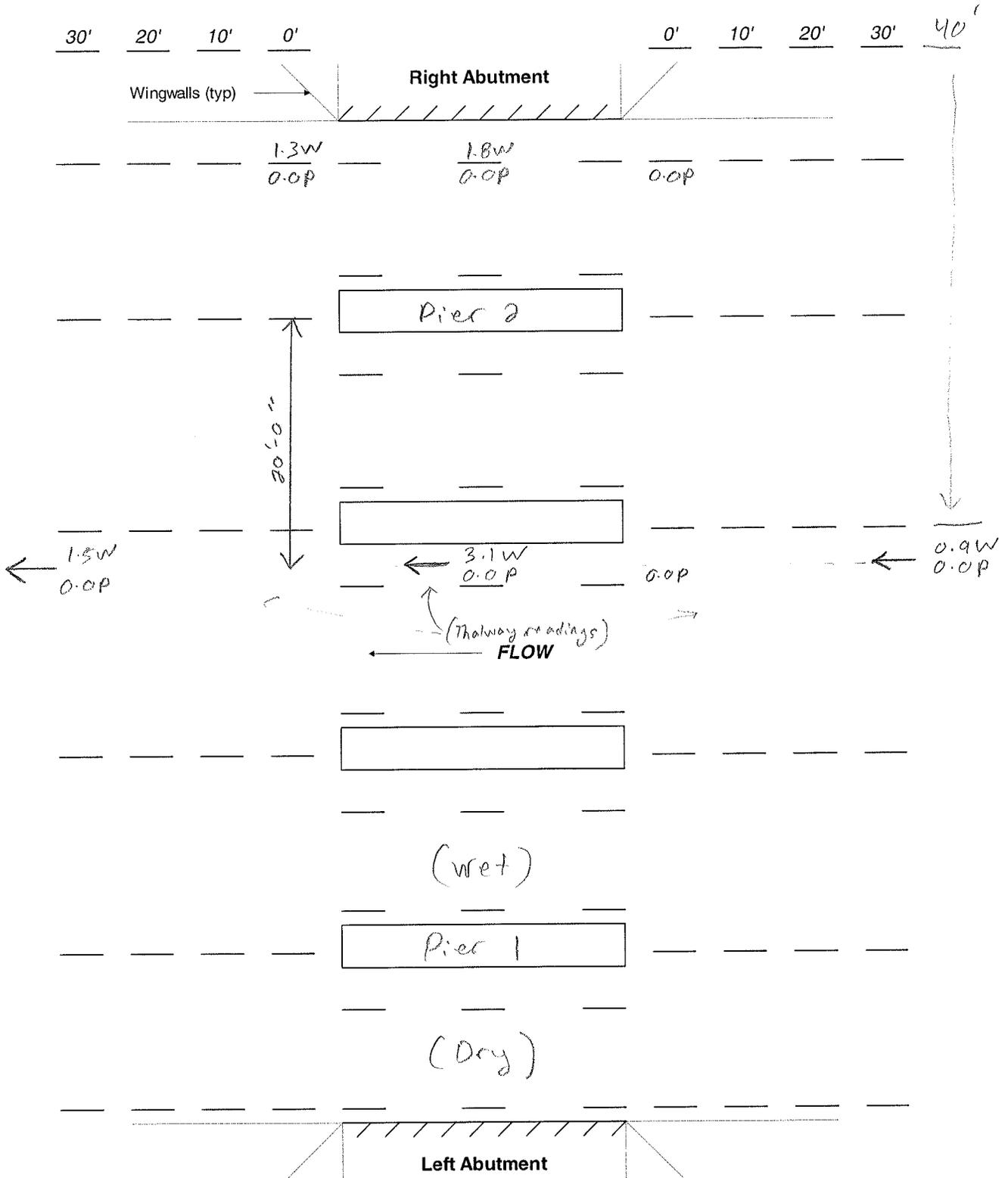
Soundings/Probings

W - Water Depth

E - Footing Exposure

P - Depth of Rod Probe

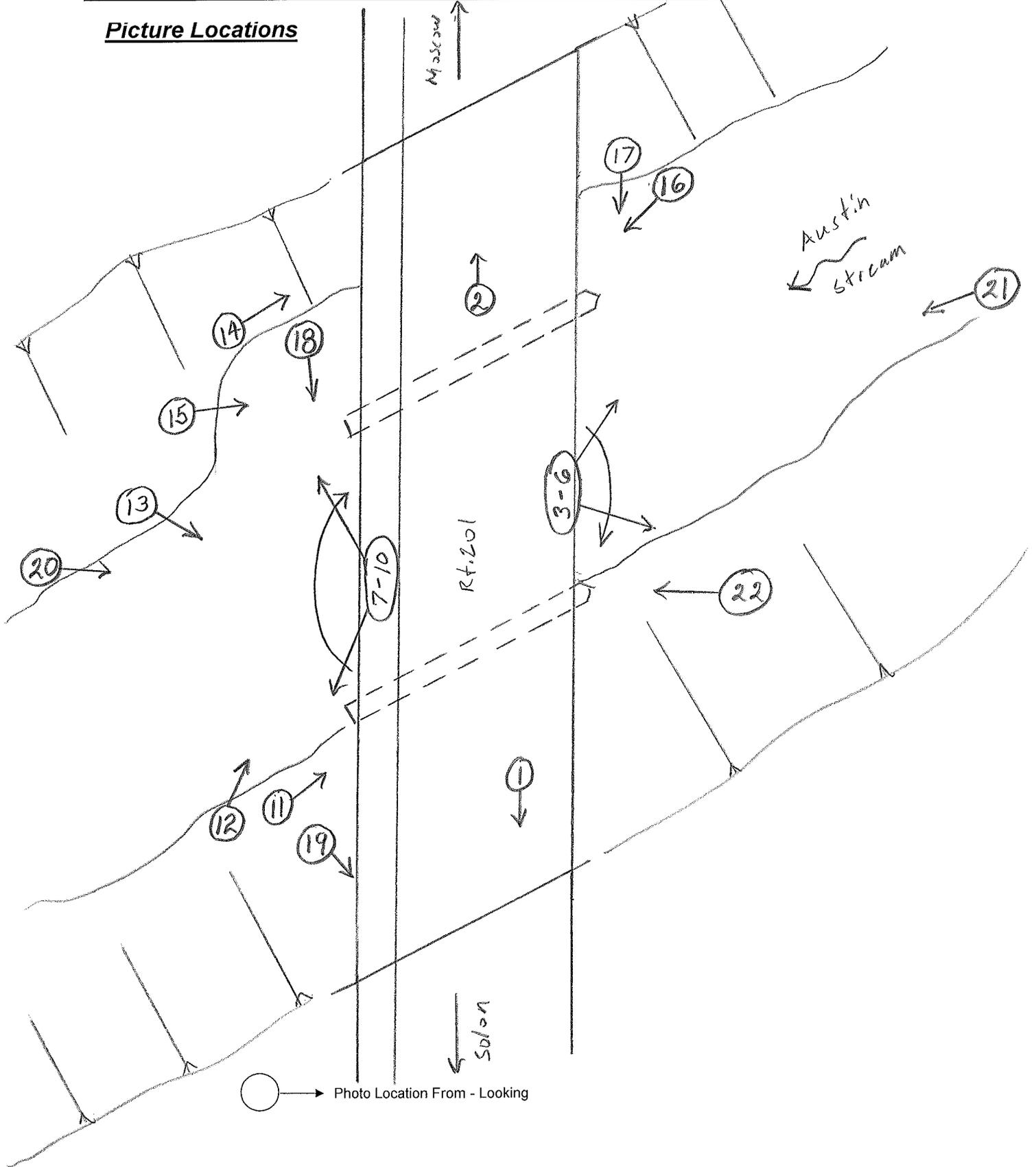
U - Depth of Undermining



OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: <i>Austin</i>	Town: <i>Bingham</i>	Bridge #: <i>2027</i>
Feature Carried: <i>Rt. 201</i>	Stream: <i>Austin Str.</i>	Review Date: <i>7/23/09/11/18/08</i>

Picture Locations



OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 7/23/2009

Site Investigation Pictures



Photo 1.
Left Approach



Photo 2.
Right Approach

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 12/18/08 & 7/23/09

Site Investigation Pictures

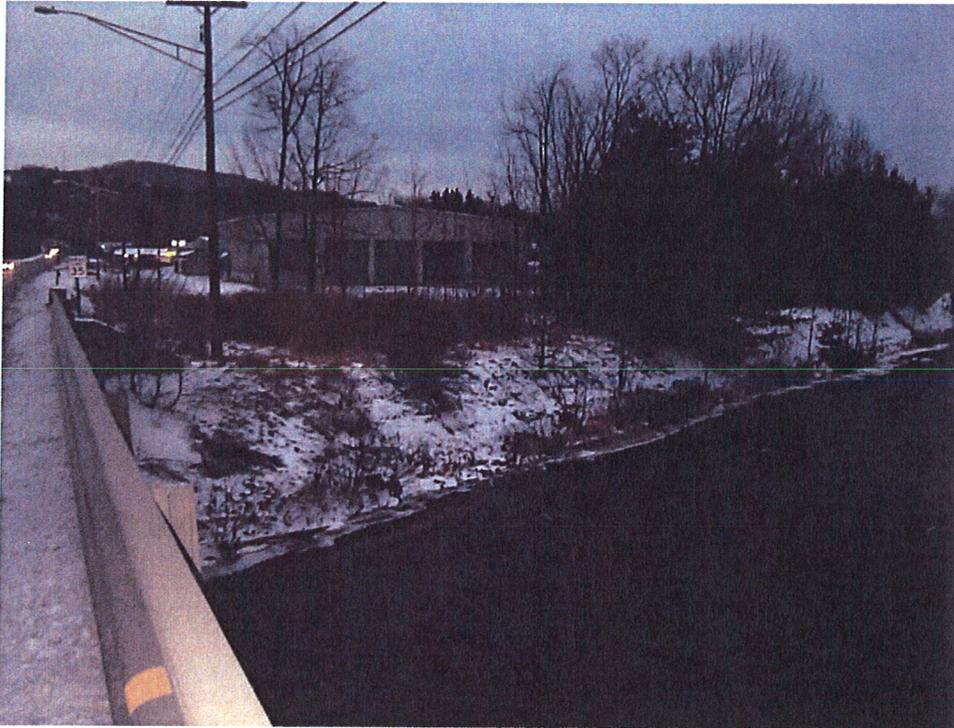


Photo 3.
U/S Right Gabion
Lined Bank



Photo 4.
U/S Right Channel

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 12/18/08 & 7/23/09

Site Investigation Pictures



Photo 5.
U/S Left Channel
& Gravel Bar

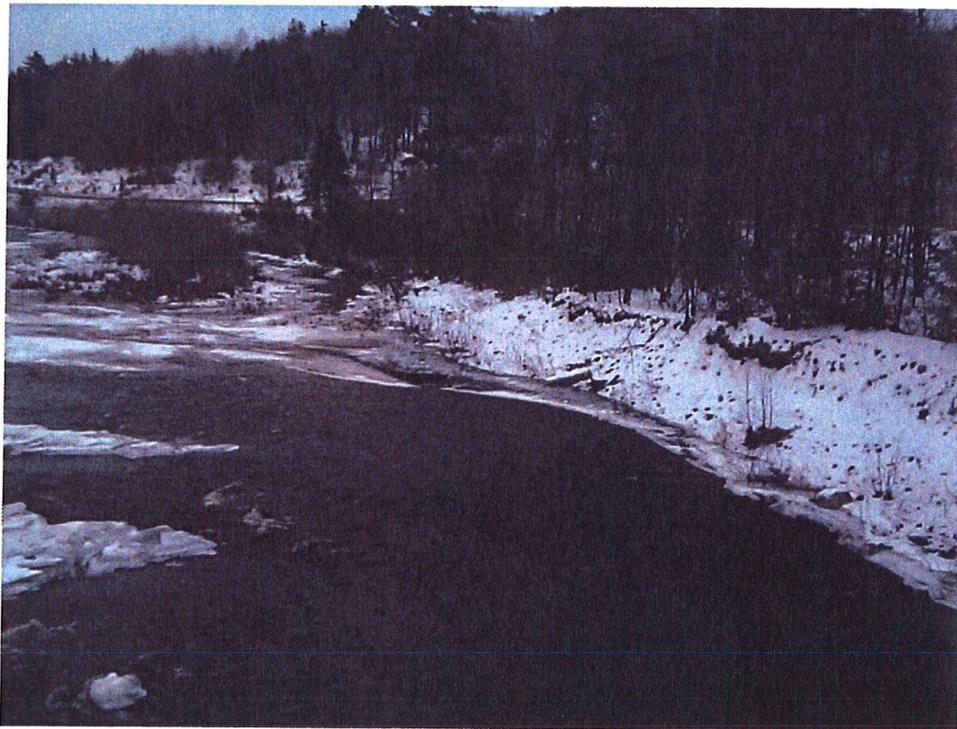


Photo 6.
U/S Left Bank &
Bank Erosion

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 12/18/08 & 7/23/09

Site Investigation Pictures

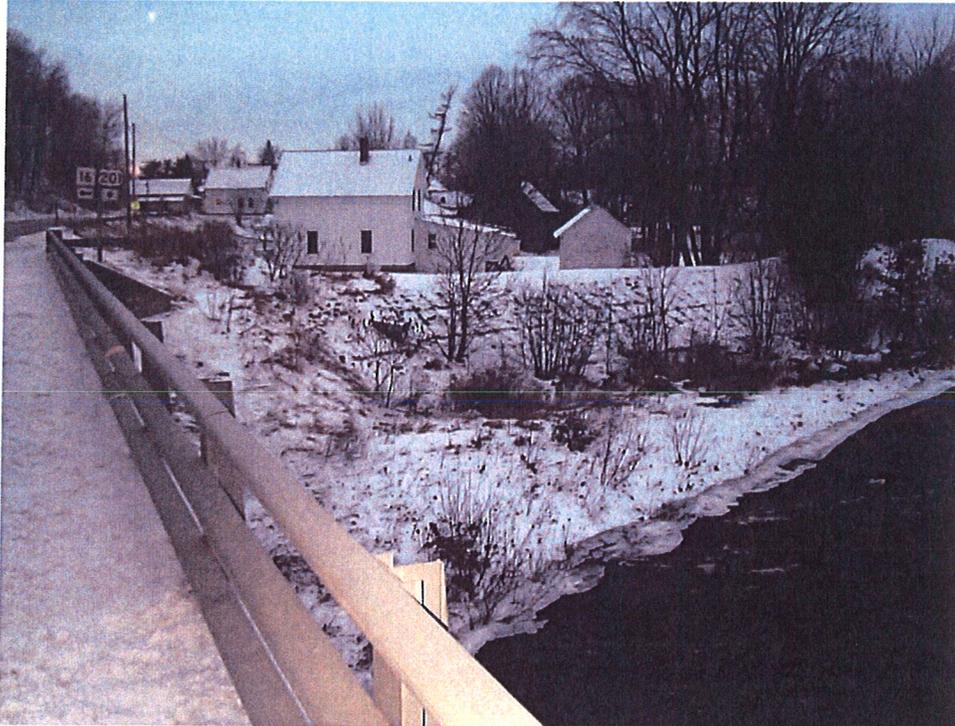


Photo 7.
D/S Left Gabion
Lined Bank



Photo 8.
D/S Channel

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 7/23/2009

Site Investigation Pictures



Photo 9.
D/S Right Gravel
Bar



Photo 10.
D/S Right Gabion
Lined Bank

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 7/23/2009

Site Investigation Pictures

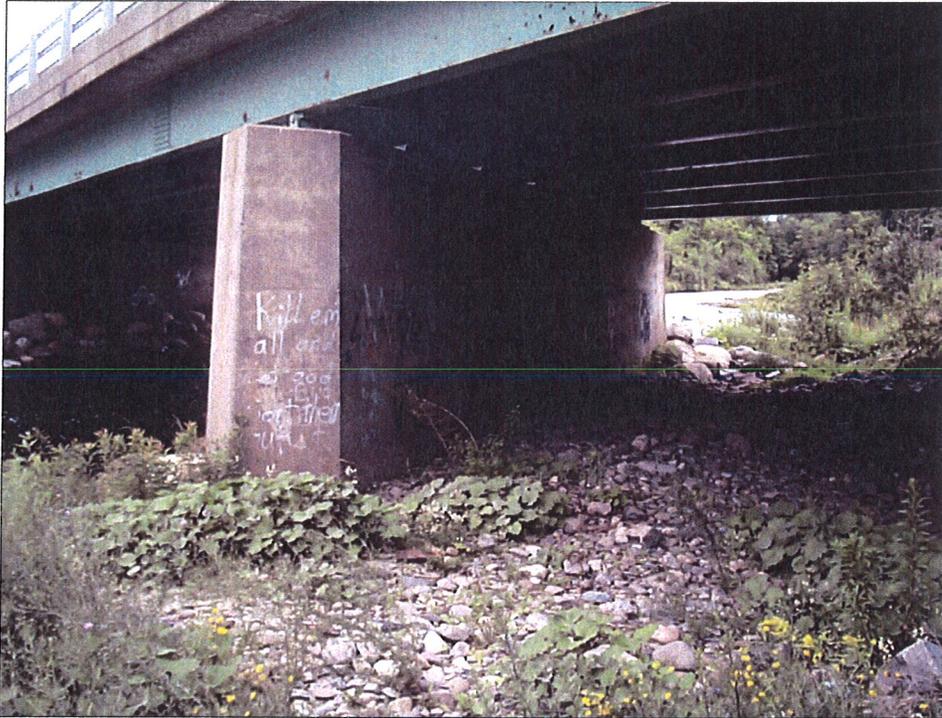


Photo 11.
Left Side of Left Pier
(Pier 1).
Bed Dry at Normal
Water.
No Riprap.

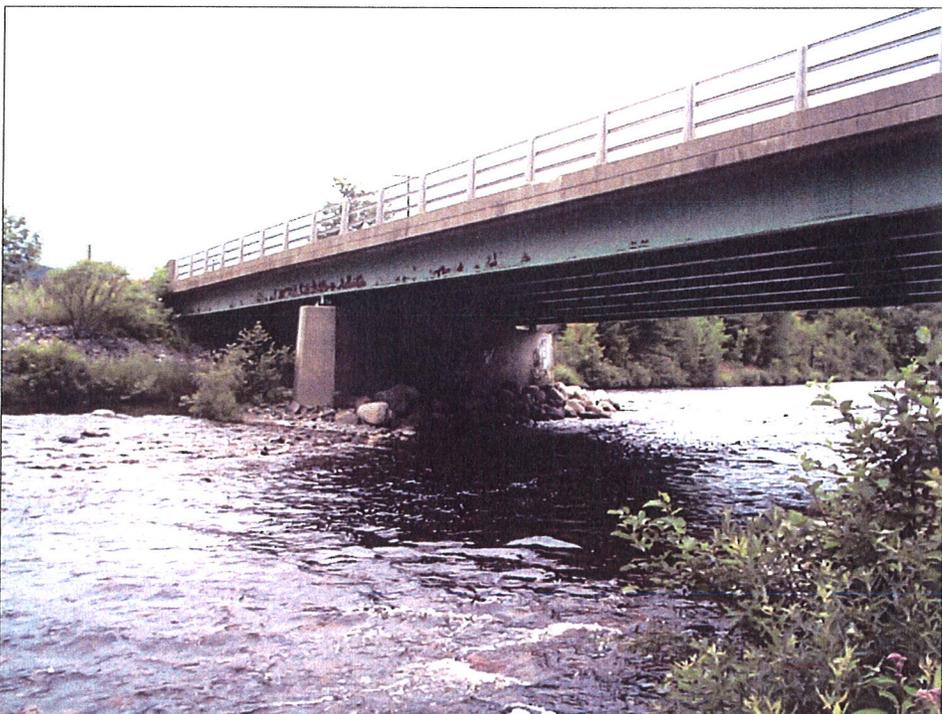


Photo 12.
D/S Fascia &
Riprap Along
Left Side of Right
Pier (Pier 2)

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 7/23/2009

Site Investigation Pictures



Photo 13.
Right Side of Left
Pier (Pier 1).
Riprap Along
Right Side of Left
Pier (Pier 1)



Photo 14.
Right Abutment
Gabion Slope.
Right Side of Right
Pier (Pier 2).
Riprap Along
Right Side of Right
Pier (Pier 2)

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 7/23/2009

Site Investigation Pictures



Photo 15.
Right Side of Right
Pier (Pier 2).
Riprap Along
Right Side of Right
Pier (Pier 2)

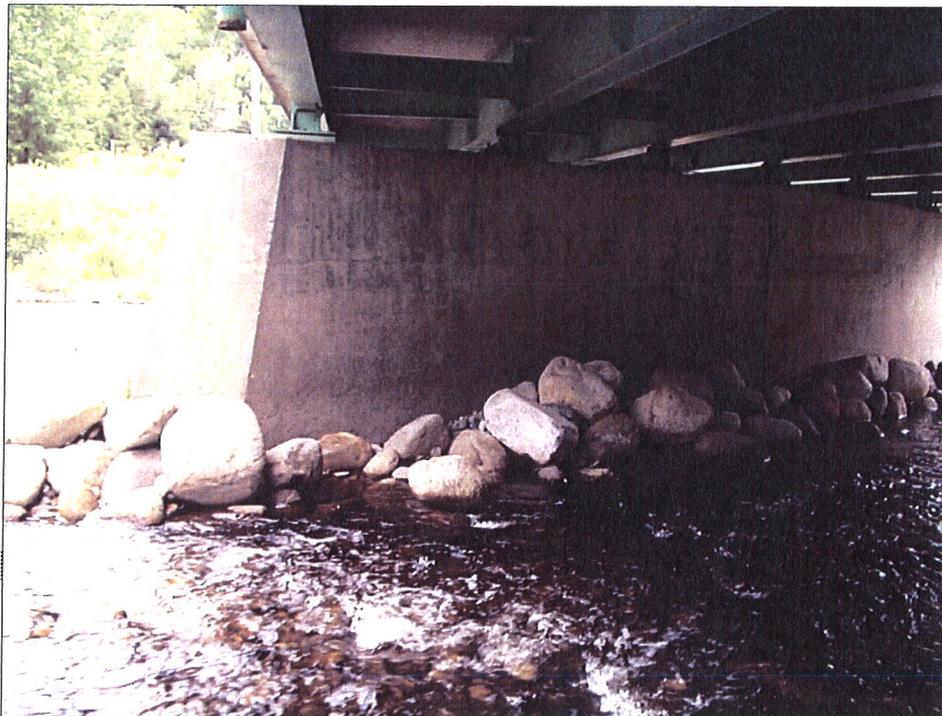


Photo 16.
Right Side of Right
Pier (Pier 2).
Riprap Along
Right Side of Right
Pier (Pier 2)

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 7/23/2009

Site Investigation Pictures

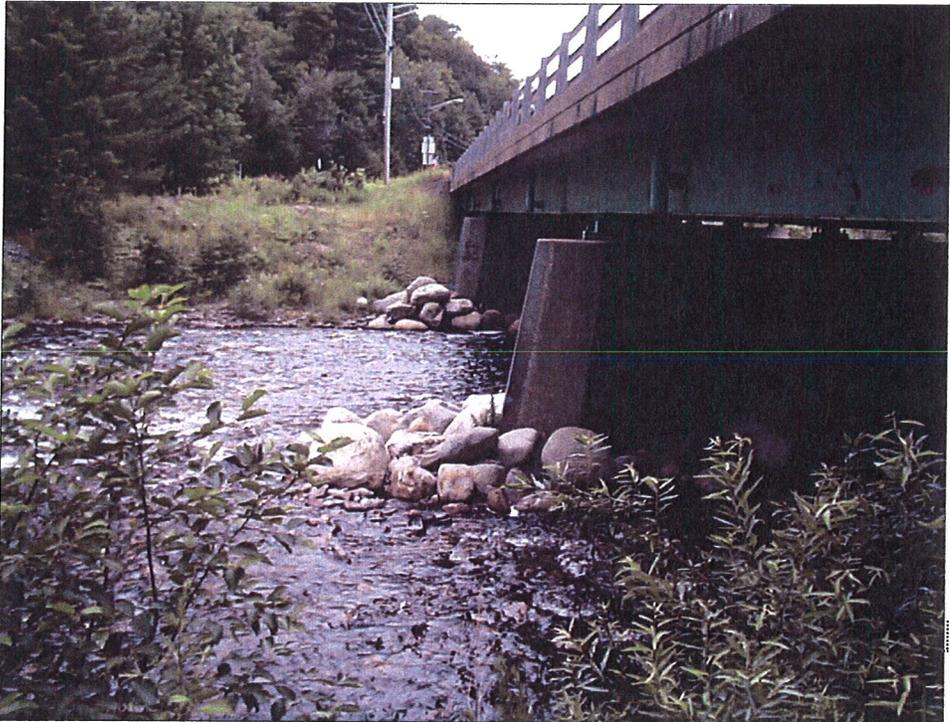


Photo 17.
D/S Fascia
Riprap at U/S Pier
Noses



Photo 18.
D/S Fascia

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 7/23/2009

Site Investigation Pictures



Photo 19.
Riprap
Slope at Left
Abutment

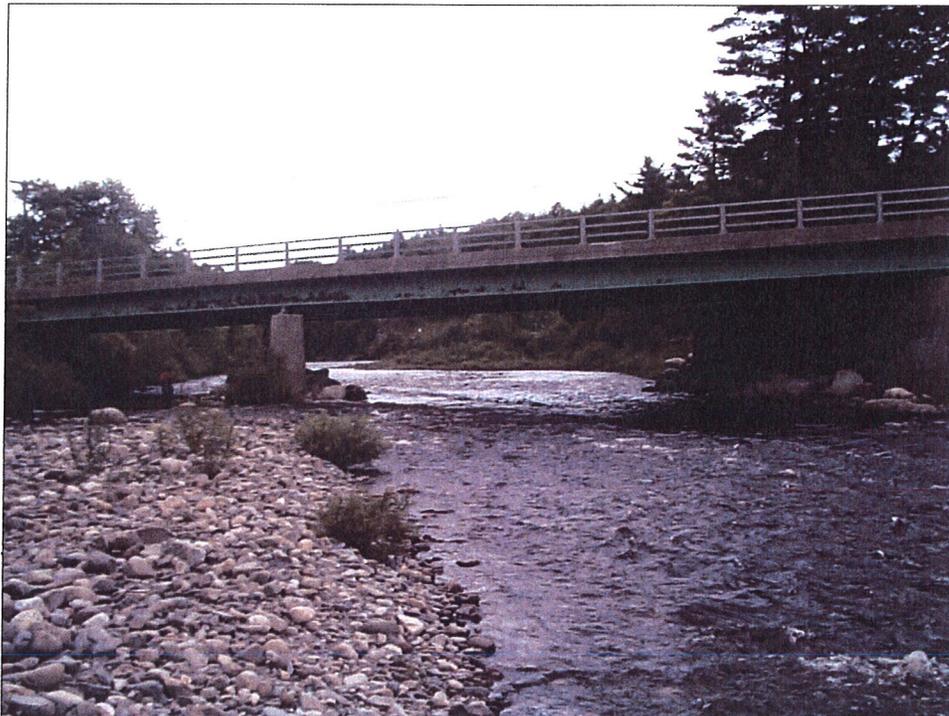


Photo 20.
D/S Fascia

OFFICE/FIELD REVIEW DATA REPORT

Bridge Name: Austin	Town: Bingham	Bridge #: 2027
Feature Carried: Rt. 201	Stream: Austin St.	Review Date: 12/18/08 & 7/23/09

Site Investigation Pictures

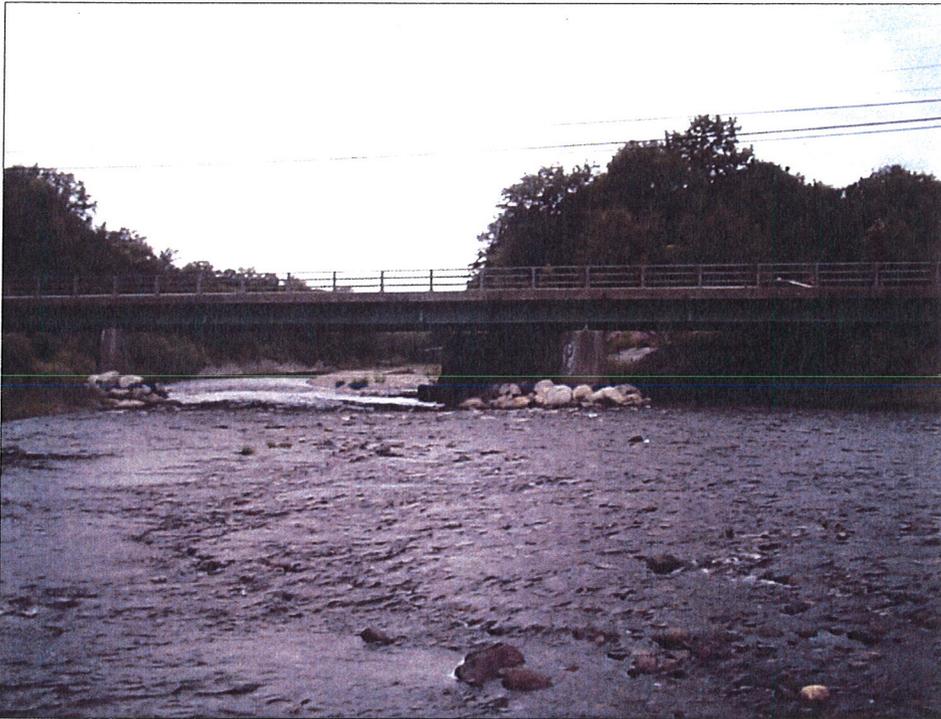


Photo 21.
U/S Fascia



Photo 22.
Riprap at U/S End
of Left Pier
(Pier 1)

SCOUR EVALUATION; COMMITTEE REVIEW

Date: 10/04/95

TOWN: Bingham
BRIDGE NAME: Austin Stream Bridge
BRIDGE NUMBER: 2027

SCOUR EVALUATION REPORT RECOMMENDATIONS: Item 113
Rating 3B

- Monitoring
- Level Two Analysis
- _____
- _____

COMMITTEE RECOMMENDATIONS: Item 113 Rating 3B

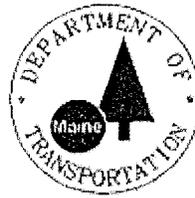
- Defer Level Two Analysis
- _____
- _____
- _____

REASONS FOR COMMITTEE RECOMMENDATIONS:

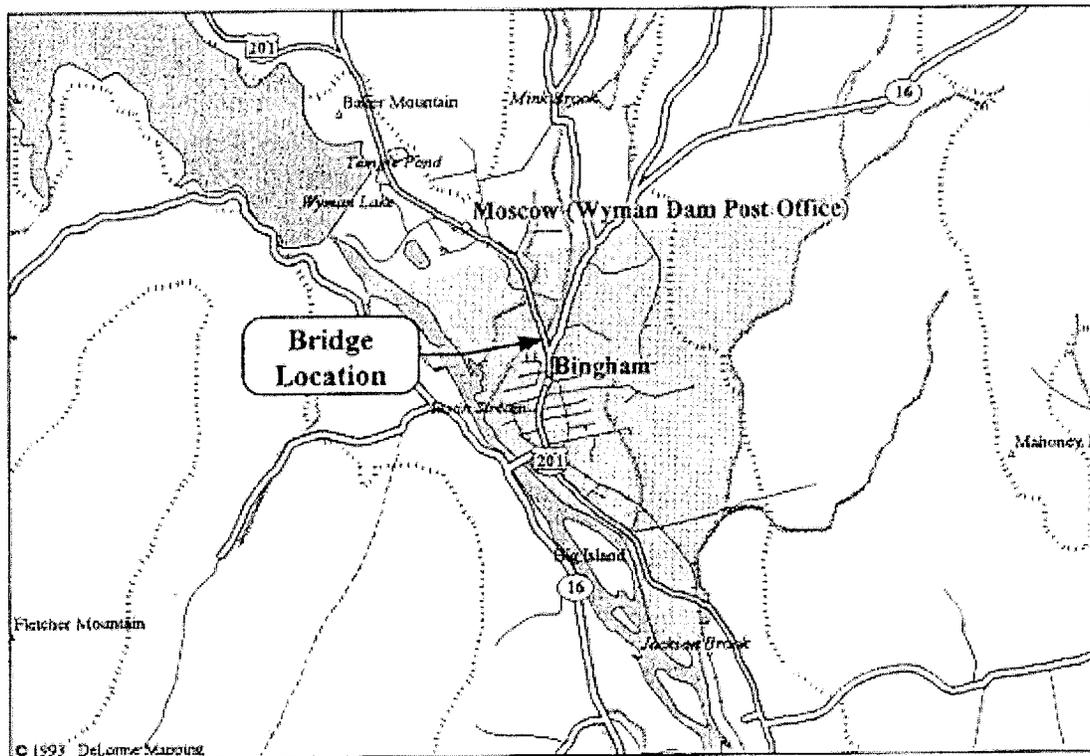
- wait for results of UMO instrumentation
- for their scour research project
- _____
- _____
- _____
- _____

The committee consists of Norman Baker, Gary Hoar, and Tracy MacDonald.

BRIDGE SCOUR EVALUATION REPORT



Name: Austin Bridge
County: Somerset
Town: Bingham
Route: Route 201
Stream: Austin Stream
Bridge #: 2027
Date: August 1995



Prepared by: T.Y. Lin International
5 Fundy Road
Falmouth, Maine 04105

TY LIN INTERNATIONAL

GH
OM

BRIDGE SCOUR EVALUATION SUMMARY

Bridge Name:	Austin	Town:	Bingham	Bridge #:	2027
Route No./Name:	201	Stream:	Austin Stream	River Basin:	Kennebec
Review Date:	August 15, 1995	MDOT PIN:	5259.00	TYLI Project no:	1022.10

Note : See Office/Field Review Report for Additional Data.

SUMMARY AND CONCLUSIONS

The streambed at the bridge has been highly movable in the past and has required bank protection at the bridge, upstream and downstream. The streambed is cobble/boulder over sandy gravel with silt/clay soils below. Abutments are on spread footings and piers are on timber piles. The streambed channel has moved laterally within the banks (vs. earlier photos and inspection reports). The streambed material, rounded stone, is highly movable. There is a low potential for overtopping at the bridge but pressure flow is possible with ice jamming. Relief flow is provided by roadway overtopping and a double (5' dia.) culvert structure about 1000 feet away on the right approach. There is a low potential for contraction scour due to the limited overbank flow. There is a slight contraction through the bridge.

The left abutment is armored with heavy riprap in good condition. The right abutment has gabions which replaced the original riprap after the flood in 1987. The gabions are in good condition but should be monitored for damage from rock impact. The left pier has a scour hole to the bottom of the footing on the right side. The nose has scoured and deposition is found on the left side of the pier. The right pier top of footing is covered approximately 2 feet but has likely scoured below the footing per MDOT inspection reports.

Based on the existing and past evidence of scouring below the footing, highly movable streambed material and past abutment slope and streambank repairs, an Item 113 rating of 3B (moderate risk) is recommended.

A scour analysis is recommended to estimate pier scour and assess foundation stability because of sandy gravel foundation soils and unknown pile lengths. Abutments are presently well protected but require monitoring.

RECOMMENDATIONS

Countermeasures: Take soundings around piers, measure footing exposure and scour and review the condition of the abutments and bank protection every 24 months and after full bank flood flow. Monitor condition of gabion baskets.

Recommended Repair Code	NA	Element:	Work:	Priority:	Effort:
-------------------------	----	----------	-------	-----------	---------

Level Two Analysis: Required

RECOMMENDED SCOUR VULNERABILITY RATING (PER FHWA)

Scour Vulnerability (See coding guide) 3B

Recommended NBI Rating

Item 61:	5	Item 71:	7	Item 113:	3B (medium risk)
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**MAINE DEPARTMENT OF TRANSPORTATION
BRIDGE SCOUR EVALUATION
OFFICE/FIELD REVIEW REPORT**

Bridge Name: <u>Austin</u>	Town: <u>Bingham</u>	Bridge #: <u>2027</u>
Route No./Name: <u>201</u>	Stream: <u>Austin St</u>	River Basin:
Reviewed By: <u>Steve Bradstreet</u>		Review Date: <u>8/15/95</u>
<u>Larry Bastian</u>		MDOT PIN: <u>5259.00</u>
		TYLI Project No: <u>1022.10</u>

Weather:

NOTES

- Observations left and right are facing downstream -
- Elevations refer to bridge plan datum unless otherwise noted -
- The information shown in this report is obtained from available MDOT bridge plans and records, supplemented by field review -

STREAM STABILITY ASSESSMENT

1. CHANNEL	Upstream	Downstream	At Bridge
a. Mannings 'n' :	<u>0.035</u>	<u>0.035</u>	<u>0.035</u>
b. Bottom Width, ft:	<u>200' (bed)</u>	<u>200' (bed)</u>	<u>200' (bed)</u>
2. FLOOD PLAIN	<u>50' (water)</u>	<u>50' (water)</u>	<u>50' (water)</u>
a. Mannings 'n' , (L/R):	_____	_____	_____
b. Description (Upstream L/R):	<u>Road, woods, few houses / Trees, buildings</u>		
(Downstream L/R):	<u>Houses, woods / Woods</u>		
3. CHANNEL LATERAL STABILITY			
a. Bends (see sketch plan)			
1) Bridge Location	___ ft./Upstream of Bend	___ ft./Downstream of Bend	<u>Not On Bend</u>
2) Migration Potential (Describe):	<u>High - Channel moves between L & R banks. Gabions placed to stabilize banks, u/s & d/s. Other areas banks are bulldozed</u>		
	Upstream	Downstream	At Bridge
b. Bank Condition			
1) Vegetation (Describe)	<u>L - Gravel/Cobble; then gabions + 200' u/s</u>	<u>Gabions L & R</u>	<u>Same</u>
2) Material	<u>Rounded Cobble / Gravel</u>	<u>Same</u>	<u>Same</u>
3) Eroding or Stable (See sketch-plan)	<u>u/s L eroding</u>	<u>Stable - u/s/gabions</u>	<u>Stable u/s</u>
4) Bank Angle	<u>1 1/2:1</u>	<u>1 1/2:1</u>	<u>1 1/2:1</u>
5) Bank Protection (Describe)	<u>Gabions L & R (300' u/s)</u>	<u>Gabions</u>	<u>Gabions</u>
c. Islands/Bars/Deposits	<u>Cobble/Gravel bed u/s & d/s</u>	___ ft./Downstream	At Bridge
d. Hydraulic and Location Factors - See Checklist A	<u>Not Used</u>		

OFFICE/FIELD REVIEW REPORT

Bridge #: 2027

4. CHANNEL VERTICAL STABILITY

a. Channel Profile Pool Riffle (Upstream) Pool Riffle (Downstream)

b. Exposed Footings (Y/N) Abutments N Piers Y - Left pier

c. Exposed Piles (Y/N) Abutments N/A Piers N

d. Contraction Scour Potential (due to encroachment)

1) Evidence of Overbank Flow (Y/N) Left N Right Y - Bank ht ± 10'

2) Relief Structure Yes - ± 1000' Rt. @ Road L.P. Bridge 2 - 5' φ culverts Culvert Location (ft. L/R)

3) Evidence of Over Topping (Y/N): Y - on Road L.P. ± 1000' Rt. Unknown:

4) NBI Rating: 7 Item 60 5 Item 61 7 Item 71 (Bridge records)

e. Long Term Potential for: Aggradation (Y/N) N Degradation (Y/N) Possible

Source of Sediment: N/A - Road Bed Load Other Bed is cobbles

f. Bed Material

Silt/Clay Sand Some coarse sand Gravel

Cobbles/Boulder Rounded Bedrock Other

Bed Material D50 (Visual Classification) 3"

5. GEOMORPHOLOGY (see checklist B) Not Used

BRIDGE SITE CONDITIONS

6. STREAM CROSS SECTION (See sheet 11) Upstream Face Downstream Face

7. FLOW CONDITIONS

a. General Description/Estimated velocity/Avg. depth: Low flow, < 6" deep, 2 ft/s @ thalweg

b. Wadeable Boat Required

c. Previous MDOT Underwater Inspection (Y/N Date): NA Frequency (Months):

d. Obstructions/Beaver Dams, Etc... (Describe) None

e. Blowhole (Y/N): N ft. Wide _____ ft. Long _____ ft. Downstream _____

f. Confluences (L/R, ft. upstream or downstream) Kennebec R. ± 1/2 mi d/s

g. High Water Mark Unknown

1) Location

2) Date/Estimated Flood Frequency

3) Approx. Elev. (Based on bridge datum)

4) Source/Reliability

8. BRIDGE DESCRIPTION

a. Description of Bridge/Bridge Type (simple/continuous span): 3 span - simple concrete deck on steel stringers

b. Date Built: 1969 Date on Bridge Plans: -

OFFICE/FIELD REVIEW REPORT

Bridge #: 2027

c. Widening or Other Major Repairs (description/date) None

d. Bridge datum: Elev. 367.11 Location U/S Lt top of curb @ abut

e. Low Chord Elev., ft.: 361.5 L - 360.1 R

f. Bridge Deck Elev., ft.: 366.5 L - 365.1 R

g. Top of Bank Elevation at Bridge, ft.: u/s L - 6' below deck; u/s R - 6' below deck; d/s L - 5' below deck; d/s R - 6' below deck

h. Overtopping Elev., ft.: 362± At Bridge (Y/N) N Approaches (ft. L/R) R - ±1000'

i. Water Elev., ft.: See X Sec.

j. Thalweg Elev., ft.: See X Sec Depth of Flow, ft.: ± 6"

k. Pressure Flow Potential (Y/N): Y - check road profile

9. ABUTMENTS

Left

Right

a. Type

1) Stub Abut. on Slope P/A to 1 ✓ ✓

2) Vertical Wall - -

3) Vertical Wall w/Wing Walls/Wingwall Angle ____ deg. - -

b. Length of Road Embankment Normal to Flow (at overtopping) NA NA

c. Angle of Flow Attack, degrees:

1) Normal Flow - -

2) Flood Flow 0 0

d. Foundation

1) Spread Footings ✓ ✓

2) Piles - -

3) Other - -

4) Footing Exposed (Y/N) N N

5) Top of Footing Elev., ft. 356.71 355.55

6) Footing Height, ft. 3 3

7) Exposure, ft. (See Sounding Sheet) N N

8) Piles Exposed (Y/N) NA NA

9) Pile Tip Elev., ft. NA NA

10) Rock Elev., ft. NA NA

11) Source of Data (Field review, Design plans, As-built drawings,

Pile driving records, Inspection reports, Other) ✓ ✓

e. Location from bank (Set back), At bank, In channel, In floodplain ✓ ✓

f. Protection

1) Riprap (Type/Size) Crane laid / 3' Avg size ✓ ✓

2) Other - Gabions - Ft.

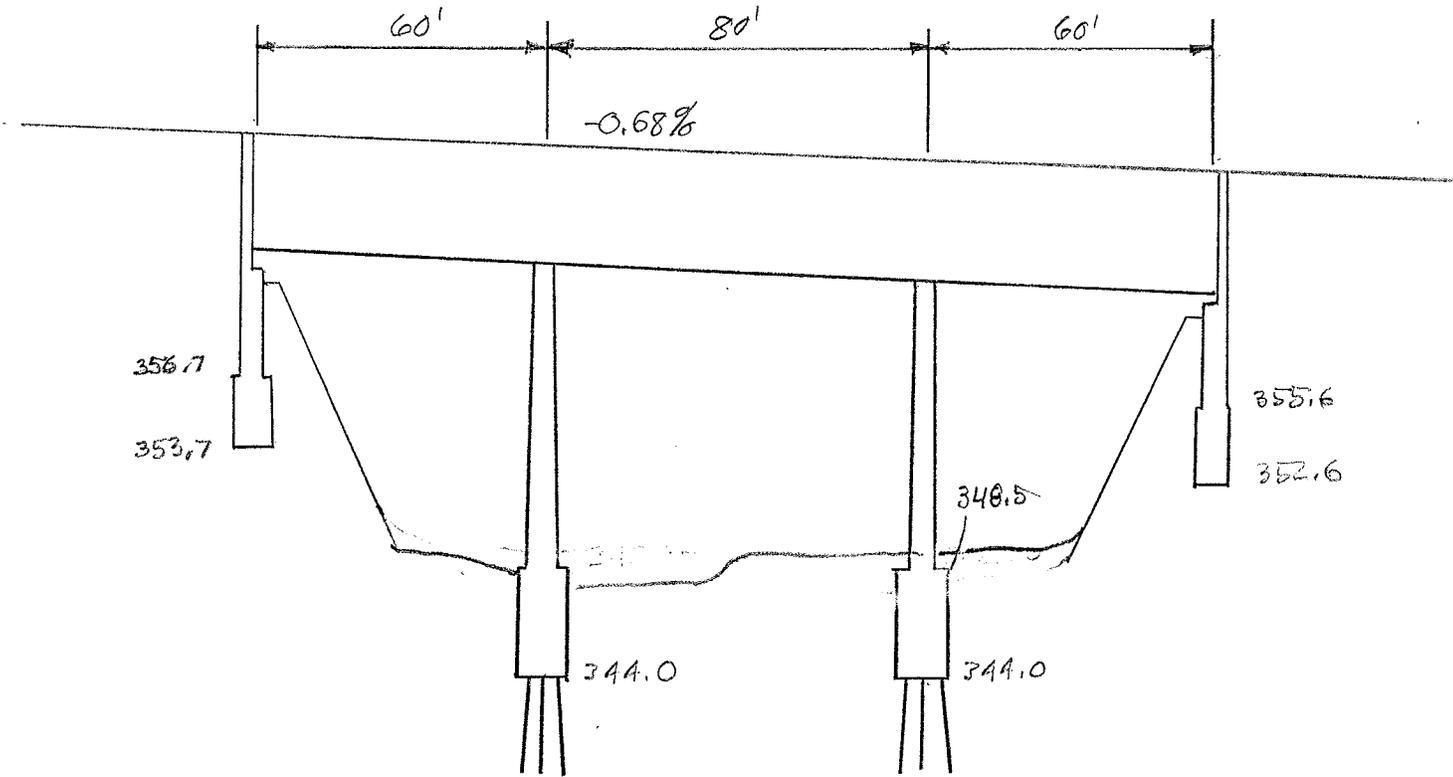
3) Condition (Good, Fair, Poor) Good Good

Gabions good condition at bridge (R. Abut) & u/s, d/s banks.

OFFICE/FIELD REVIEW REPORT		
Bridge Name: <i>Austin</i>	Town: <i>Bingham</i>	Bridge #: <i>2027</i>
Route No./Name: <i>201</i>	Stream: <i>Austin Stream</i>	Review Date: <i>8/15/95</i>

Sketch (Profile)

Bridge plans supplemented by field sketch.



1" = 40'

OFFICE/FIELD REVIEW REPORT

Bridge #: 2027

10. PIERS

a. Number:	L	R				
	Pier #	1	2	3	4	5
b. Type (Concrete/Pile Bent)		✓	✓			
c. Column Type		—	—			
d. Channel/Floodplain		✓	✓			
e. Shape - square-round nose-sharp nose (upstream/downstream)		sharp	V/S & d/S			
f. Width x Length, ft.	5' x 69'	✓	✓			
g. Angle of Flow Attack, degrees:						
1) Normal Flow		—	—			
2) Flood Flow		0	0			
h. Foundation						
1) Spread Footings		✓	✓			
2) Piles <i>wooden - 142</i>		✓	✓			
3) Other		—	—			
4) Footing Exposed (Y/N)		Y	N			
5) Top of Footing Elev., ft.		348.5	348.5			
6) Footing Height, ft.		4.5	4.5			
7) Exposure, ft. (See Sounding Sheet)						
8) Footing Width x Length, ft.	12' x 75'	✓	✓			
9) Piles Exposed (Y/N)		N	N			
10) Pile Tip Elev., ft.		314	314			
11) Rock Elev., ft.		NA	NA			
12) Source of Data (Field review, Design Plans, as-built drawings, Pile driving records, Inspection reports, Other)						
g. Protection						
1) Riprap (Size/Type)		None	None			
2) Other		—	—			
3) Condition (Good/Fair/Poor)		—	—			

11. EVIDENCE OF SCOUR

a. Abutments	Left	Right
1) Rotation / Settlement *	No	No
2) Cracks *	No	No
3) Slope Erosion *	No	No
4) Adjacent Roadway Settlement *	No	No
* Describe Cause, if not scour :		
5) Max. Depth Undermining, ft. (See sketch-plan)	None	None

OFFICE/FIELD REVIEW REPORT

Bridge #: 2027

	Left	Right
6) Scour Holes Y/N (See sketch-plan)	<u>No</u>	<u>No</u>
Location	<u>—</u>	<u>—</u>
Approximate Dimensions	<u>—</u>	<u>—</u>
Average Depth of Rod Probe	<u>—</u>	<u>—</u>

7) Comments:

		L	R			
b. Piers	Pier #					
		1	2	3	4	5

1) Rotation / Settlement (Y/N)		<u>N</u>	<u>N</u>			
2) Max. Depth Undermining, ft. (see sketch-plan)		<u>Scour to bot. of footing - see sketch</u>	<u>None</u>	<u>—</u>	<u>—</u>	<u>—</u>
3) Scour Holes Y/N (see sketch-plan)		<u>Y</u>	<u>N</u>	<u>—</u>	<u>—</u>	<u>—</u>
Location		<u>u/s At. Side & u/s of Footing</u>	<u>None</u>	<u>—</u>	<u>—</u>	<u>—</u>
Approximate Dimensions		<u>See sketch</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Average Depth of Rod Probe		<u>Not able to probe</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>

4) Comments: Footing exposed @ u/s half of pier 1, scour hole at left pier.

c. General Observations (Describe and Correlate with Scour)

1) Bed Deposits Downstream (Y/N)		<u>Y</u>				Distance, ft.
2) Bridge Rail Sagging (Y/N)		<u>N</u>				
3) Comments:	<u>Smooth rounded stone, indicates bed movement</u> <u>No evidence of pier rotation or settlement</u>					

12. DEBRIS

a. Potential (qualitative)		Low <input checked="" type="checkbox"/>	Moderate <input type="checkbox"/>	High <input type="checkbox"/>
b. Debris Accumulation Locations (see sketch-plan)	<u>None observed</u>			
Distance From Face of Bridge, ft.				
1) Upstream	Left Bank :	<u>—</u>	Right Bank :	<u>—</u>
2) Downstream	Left Bank :	<u>—</u>	Right Bank :	<u>—</u>
3) At Bridge	Left Bank :	<u>—</u>	Right Bank :	<u>—</u>

c. Cause of Flow Deflection/Debris accumulation (Describe) NA

d. Type and Size (Brush, trees, trash, combination) Limited tree/brush possible

OFFICE/FIELD REVIEW REPORT

Bridge #: 2027

13. SUPPLEMENTAL HYDRAULIC ASSESSMENT (IF REQUIRED)

a. Estimated Overtopping Q, ft.³/s: _____ and recurrence interval:

b. Stage Rise to Overtopping (from normal water elevation), ft.:

Not Done

c. Depth Through Bridge at Overtopping, ft.:

d. Estimated Velocity Through Bridge at Overtopping, ft/sec.:

14. CONCLUSIONS

- Streambed channel has moved laterally within banks (vs. earlier photos & insp. reports)
- Highly movable streambed material - rounded stone
- Low potential for overtopping. Pressure flow possible, especially with ice jamming
- Contraction Scour - Low potential, due to limited overbank flow, slight contraction thru bridge from u/s to d/s.
- Abutments - L Abut. heavy riprap, good condition. R Abut. - Gabions, good condition - replaced by riprap from orig const. (1987-88) - after '87 Flood. L Abut riprap stable thru '87 flood (± 100 yr). R Abut was stable thru '87 flood (per insp. reports)
- Piers - Left Pier: Scour hole to bot. of footing @ rt. side (same as 94 MDOT inspection) u/s end of pier scoured, deposition d/s L. side of pier. Right Pier: footing covered ± 2 ft. Pier footing cover has varied per earlier inspections. Likely scour below footings
- Armor Layer over sandy/silty gravel.

check
freq.
& Elev

15. RECOMMENDATIONS

a. Countermeasures - Describe:

1) Riprap

2) Scour Monitor

3) Inspection (Y/N)

4) Other

5) Recommended Repair Code (See selected codes from MDOT list 04-19-90):

Element: _____ Work: _____ Priority: _____ Effort: _____

b. Feasibility of Adding Riprap or Other Scour Countermeasures (explain):

Good access to piers

c. Level Two Analysis

Limited WS PRO, if data available

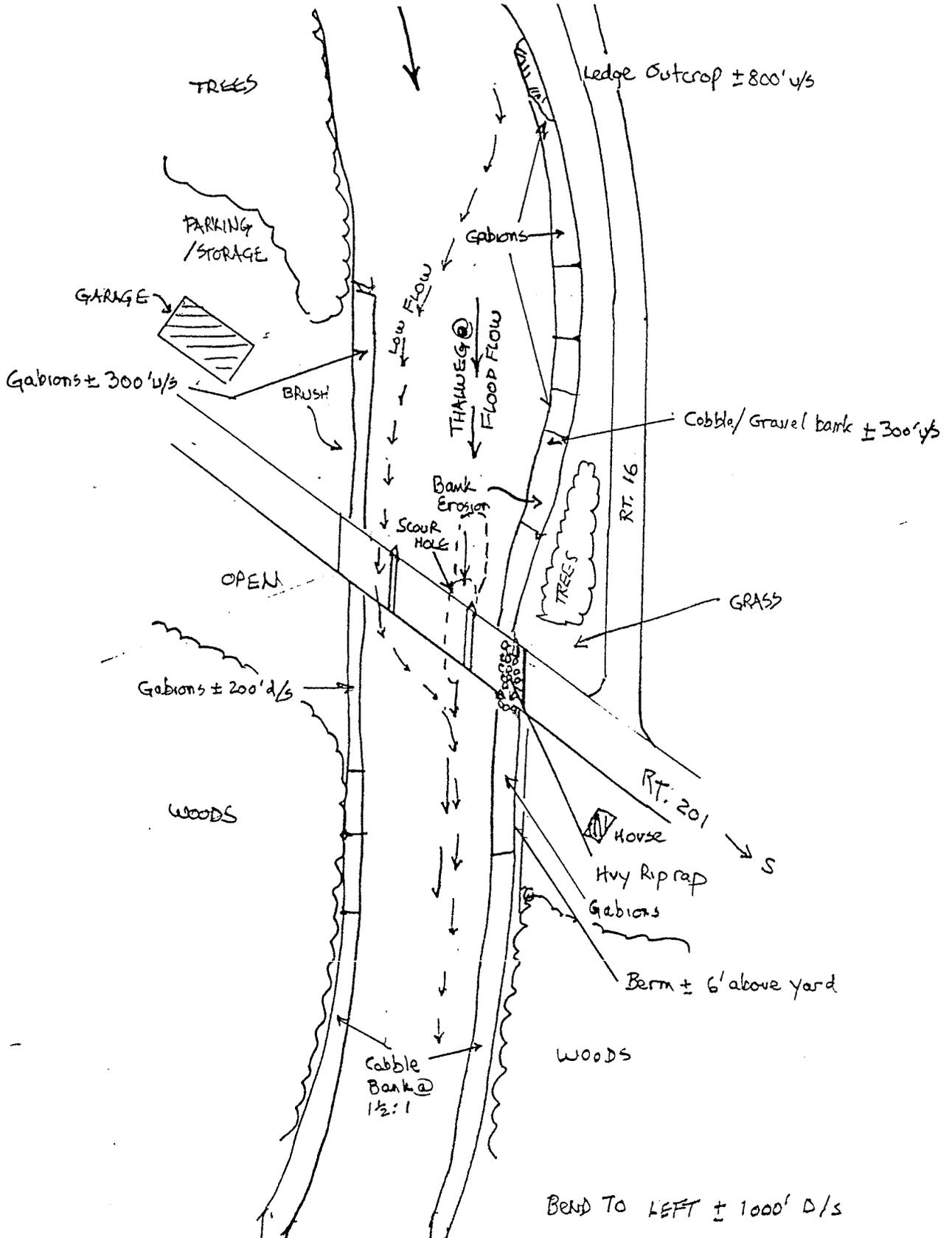
d. General Comments:

Monitoring includes: Cross Section u/s & d/s, pier footing, exposure and cover, condition of abutment riprap/gabion

OFFICE/FIELD REVIEW REPORT

Bridge Name: <i>Austin</i>	Town: <i>Bingham</i>	Bridge #: <i>2027</i>
Route No./Name: <i>201</i>	Stream: <i>Austin Stream</i>	Review Date: <i>8/15/95</i>

Sketch (Plan view) Bridge plans supplemented by field sketch.

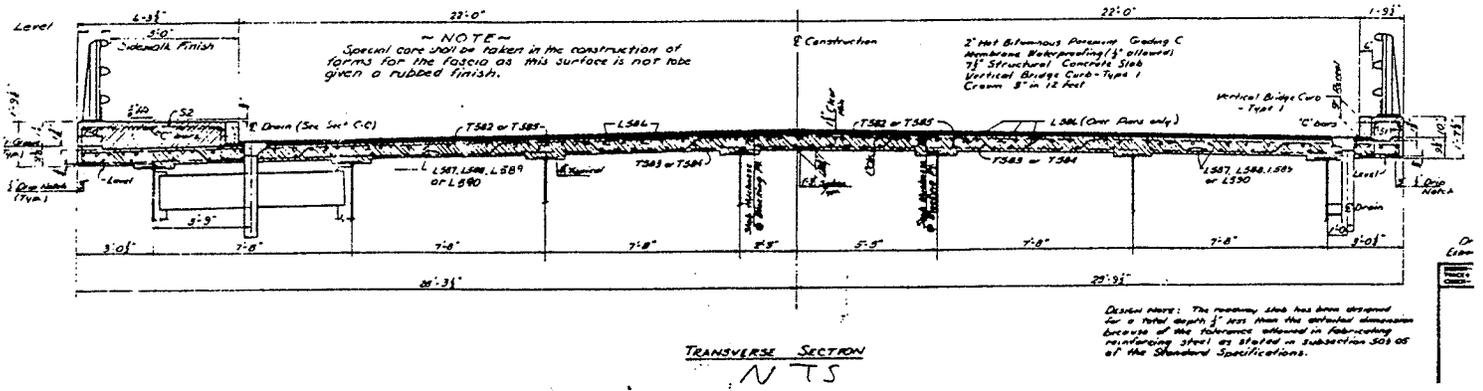


OFFICE/FIELD REVIEW REPORT

Bridge Name: <i>Austin</i>	Town: <i>Bingham</i>	Bridge #: <i>2027</i>
Route No./Name: <i>2.01</i>	Stream: <i>Austin Stream</i>	Review Date: <i>8/15/95</i>

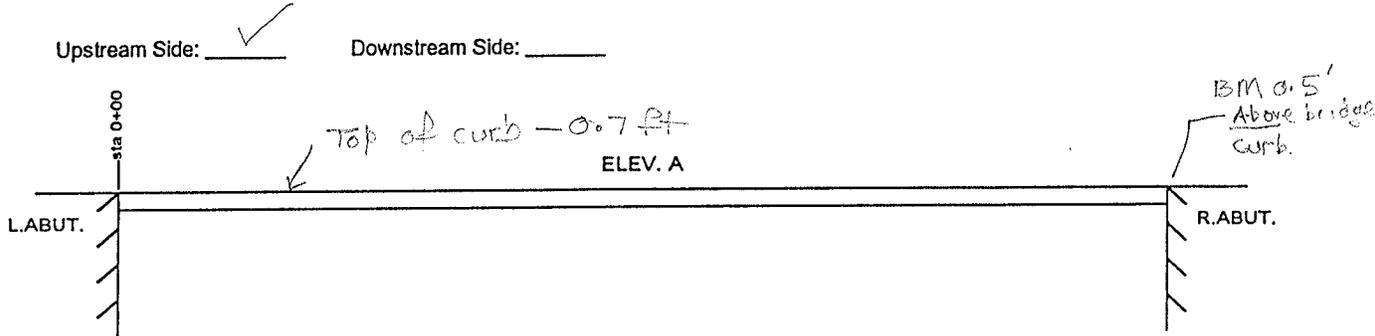
Sketch (Typical Section)

Abutment, pier or other views as required.



OFFICE/FIELD REVIEW REPORT			
Bridge Name: <u>Austin</u>	Town: <u>Bingham</u>	Bridge #: <u>2027</u>	
Route No./Name: <u>201</u>	Stream: <u>Austin Stream</u>	Review Date: <u>8/15/95</u>	

Stream Cross Section at Bridge (Facing Downstream)



Upstream Side: Downstream Side:

Datum: Elev: 367.1 Location: Top of curb @ Lt v/s abut Water Surface Elev., ft.: _____

Location	Station	a Elev A, ft.	b H1, ft	c H2, ft.	d Elev B, ft.	Wet (W) Dry (D)	Comments
L. ABUT	0+00	367.1		5.5			Face of Abut.
Post 1	+6.7			6.9			Post 1
2	14.5			10.9			2
3	22.5			13.3			Post-3
4	30.4			14.1			4
5	38.2			15.3			5
6	46.1			15.7			6
7	54.0			17.9			7
	59.0			18.2			Top footing @ Face of Pier, L Side
8	62.0			18.2			Post 8
9	69.8		18.8	20.9			9 - Streambed @ Face of Exp. Footing
10	77.8			19.5			10
11	85.6			18.4			11
12	93.5			17.7			12
13	1+01.4			17.2			13
14	1+09.3			17.1			14
15	1+17.2			16.5			15

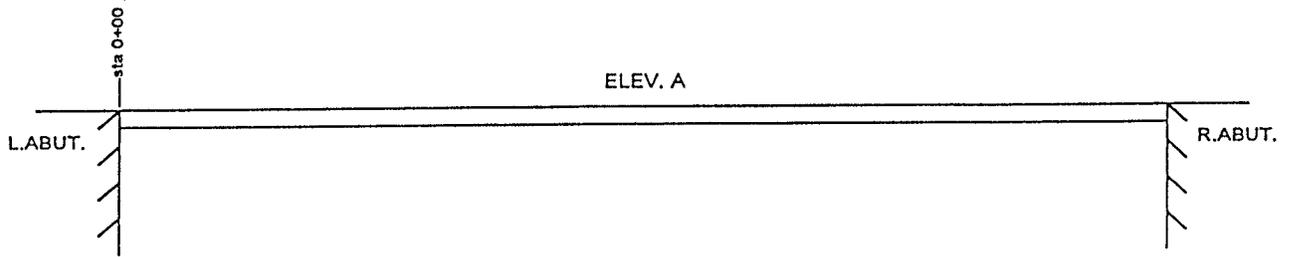
- a. Top of bridge parapet* (From bridge plans)
 - b. Distance from top of bridge parapet* to water surface.
 - c. Distance from top of bridge parapet* to streambed or ground.
 - d. Streambed or ground elevation.
- * Unless noted otherwise

OFFICE/FIELD REVIEW REPORT

Bridge Name: <u>Austin</u>	Town: <u>Bingham</u>	Bridge #: <u>2027</u>
Route No./Name: <u>201</u>	Stream: <u>Austin Stream</u>	Review Date: <u>8/15/95</u>

Stream Cross Section at Bridge (Facing Downstream)

Upstream Side: Downstream Side:



Datum: Elev: 367.1 Location: Top of curb @ Lt v/s abut Water Surface Elev., ft.: _____

Location	Station	Elev A, ft. ^a	H1, ft. ^b	H2, ft. ^c	Elev B, ft. ^d	Wet (W) Dry (D)	Comments
L. ABUT	0+00						
Post 16	1+25.1			16.2			Post 16
17	1+33.0			16.9			17
	1+40.			16.8			Face of Pier, L side
18	1+40.9			16.8			Post 18
	1+44			17.0			Face of Pier, R side
19	1+48.8			16.1			19
20	1+56.7			16.2			20
21	1+64.6			16.0			21
22	1+72.5			15.8			22
	1+77		15.5	15.5			Water Edge, dist. of Gab. Slope
23	1+80.4			14.4			23
24	1+83.3			10.2			24
25	1+86.2			7.0			25
R. Abut	2+02.8			5.3			Face R Abut

- a. Top of bridge parapet* (From bridge plans)
- b. Distance from top of bridge parapet* to water surface.
- c. Distance from top of bridge parapet* to streambed or ground.
- d. Streambed or ground elevation.

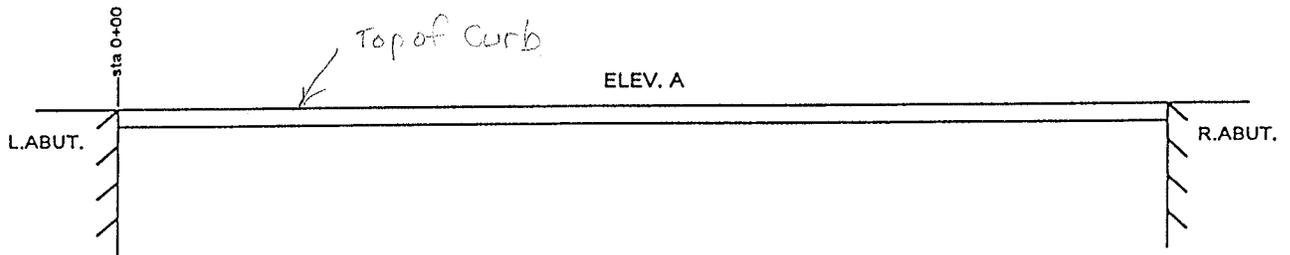
* Unless noted otherwise

OFFICE/FIELD REVIEW REPORT

Bridge Name: <i>Austin</i>	Town: <i>Bingham</i>	Bridge #: <i>2027</i>
Route No./Name: <i>201</i>	Stream: <i>Austin Stream</i>	Review Date: <i>8/15/95</i>

Stream Cross Section at Bridge (Facing Downstream)

Upstream Side: _____ Downstream Side: _____



Datum: Elev: 367.3 Location: @ Lt d/s abut Water Surface Elev., ft.: _____

Location	Station	^a Elev A, ft.	^b H1, ft	^c H2, ft.	^d Elev B, ft.	Wet (W) Dry (D)	Comments
L. ABUT	0+00			6.7			Face 1/2
Post 1	+6.7			8.7			Post 1
2	+14.5			11.0			2
3	22.5			14.6			3
4	30.4			15.3			4
5	38.2			15.2			5
6	46.1			15.4			6
7	54.0			15.6			7
	59.0			15.8			D/s tail of Pier Nose
8	62.0/63.0			16.9/17.5			CL Post 8 / Rt. Side of pier
9	69.8			17.6			9
10	76.0/77.8		19.2	17.8/20.7			Top old concrete / Bot. Conc., Post 10
11	85.6			20.9			11
12	93.5			20.6			12
13	110.4			20.0			13
14	140.3			18.0			14
15	177.2			17.3			15

- a. Top of bridge parapet* (From bridge plans)
- b. Distance from top of bridge parapet* to water surface.
- c. Distance from top of bridge parapet* to streambed or ground.
- d. Streambed or ground elevation.

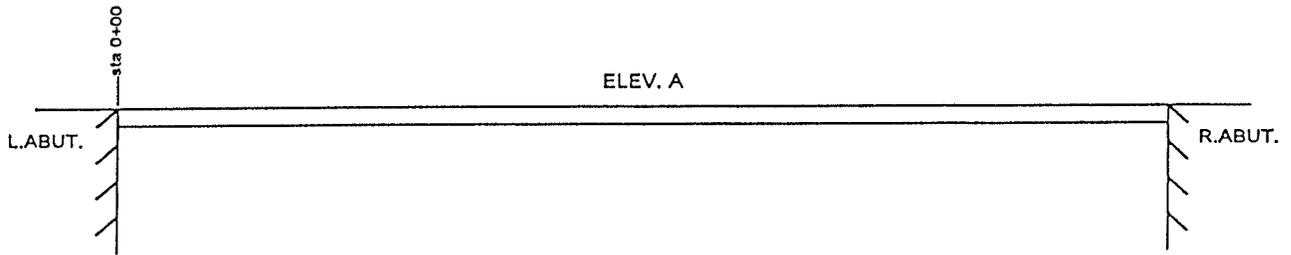
* Unless noted otherwise

OFFICE/FIELD REVIEW REPORT

Bridge Name: <i>Austin</i>	Town: <i>Bingham</i>	Bridge #: <i>2027</i>
Route No./Name: <i>201</i>	Stream: <i>Austin Stream</i>	Review Date: <i>8/15/95</i>

Stream Cross Section at Bridge (Facing Downstream)

Upstream Side: _____ Downstream Side: _____



Top of curb

Datum: Elev: 367.3 Location: @ LT d/s abut Water Surface Elev., ft.: _____

Location	Station	Elev A, ft. ^a	H1, ft. ^b	H2, ft. ^c	Elev B, ft. ^d	Wet (W) Dry (D)	Comments
L.ABUT	0+00						
Post 16	+25.1			16.8			post 16
17	+33.0			16.7			17
18	+40.9			16.9			18 @ tail of Pier
19	+48.8			16.3			19
20	+56.7			16.7			20
21	+64.6			17.0			21
22	+72.5			17.2			22
23	+80.4			13.7			23
24	+88.3			10.3			24
25	+96.2			7.4			25
Rt. Abut	2+02.8			6.0			Rt. Abut.

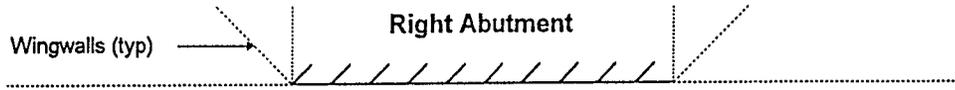
- a. Top of bridge parapet* (From bridge plans)
- b. Distance from top of bridge parapet* to water surface.
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- d. Streambed or ground elevation.

* Unless noted otherwise

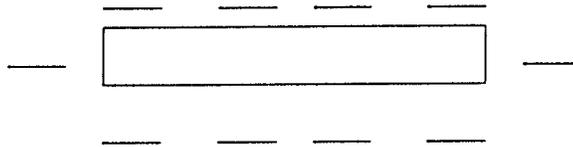
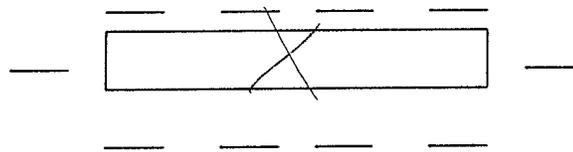
OFFICE/FIELD REVIEW REPORT

Bridge Name: <i>Austin</i>	Town: <i>Bingham</i>	Bridge #: <i>2027</i>
Route No./Name: <i>201</i>	Stream: <i>Austin Stream</i>	Review Date: <i>8/15/95</i>

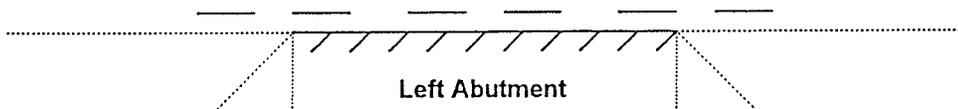
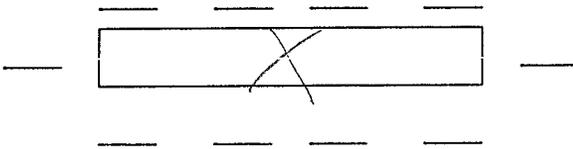
Footing Exposure/Undermining *SEE SHEET 13*



Height of footing exposure (E) or depth of undermining (U) at face of abutment or pier and directly u/s and d/s



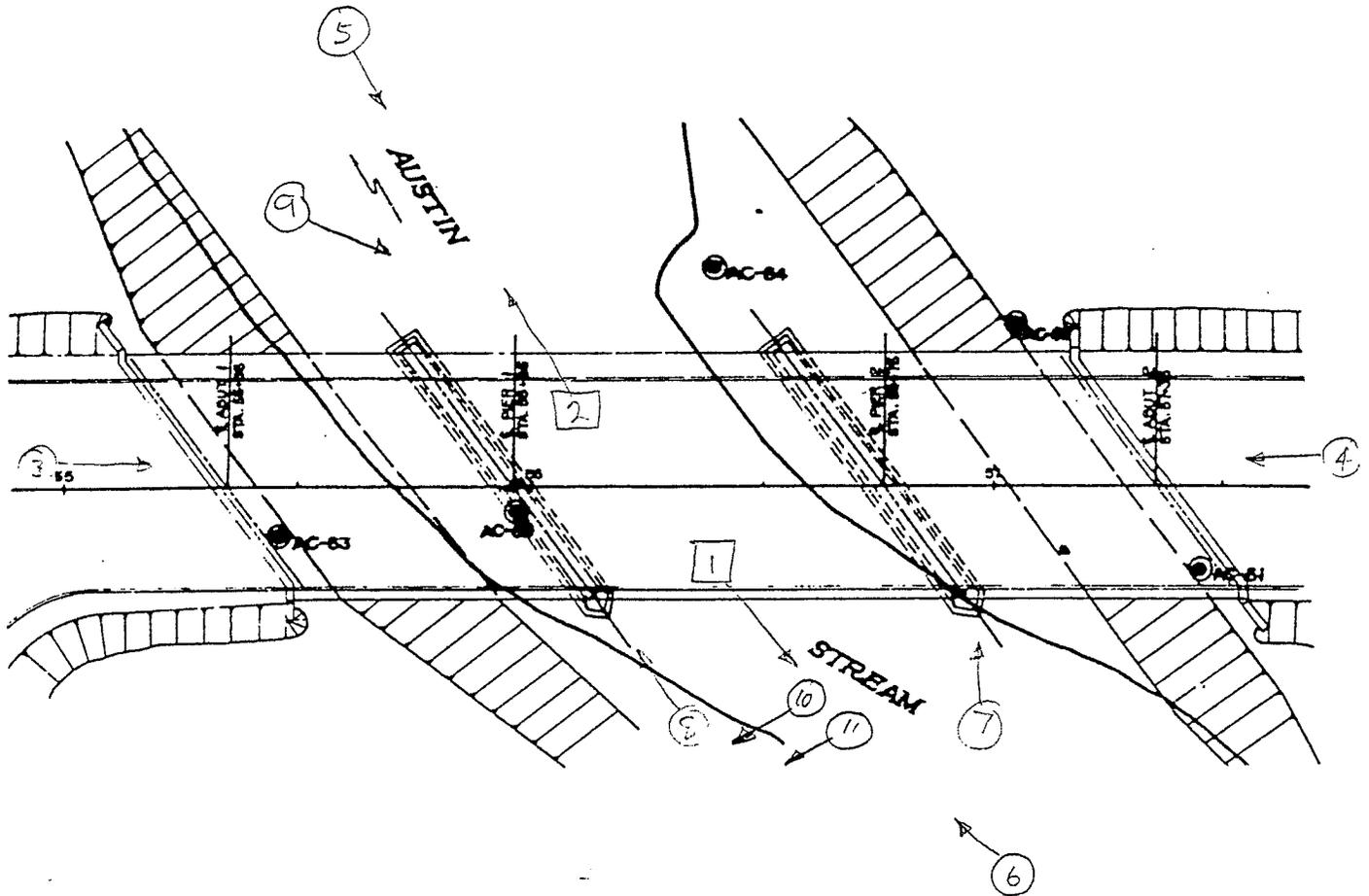
← FLOW



OFFICE/FIELD REVIEW REPORT

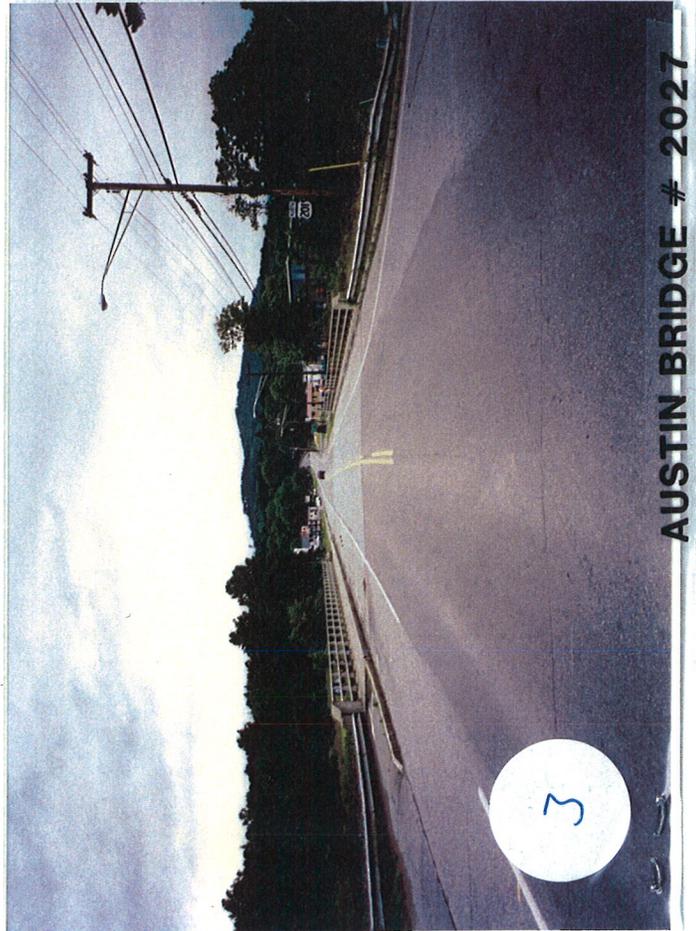
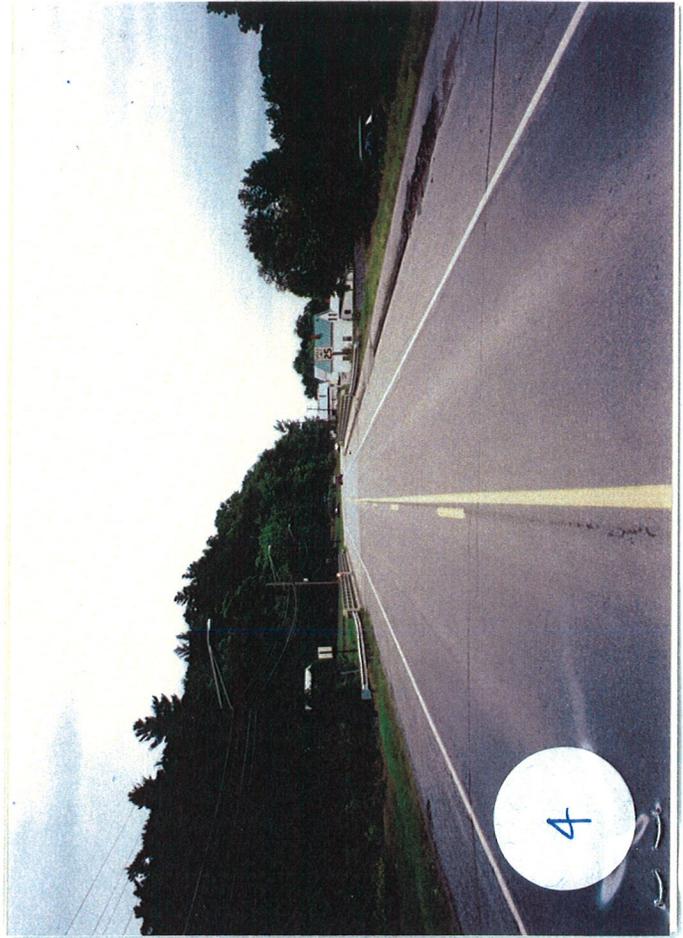
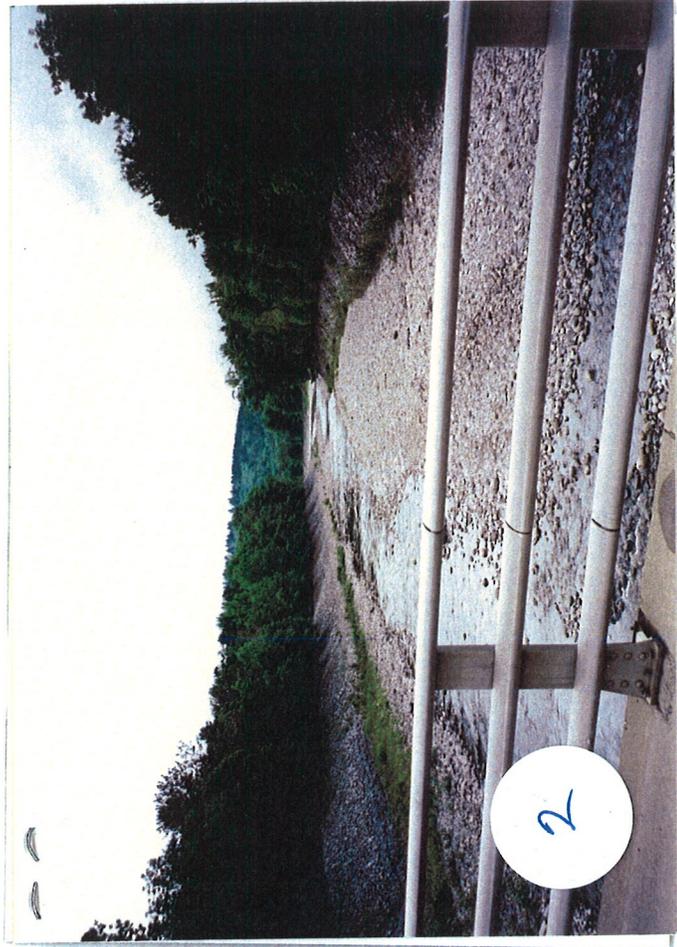
Bridge Name: <i>Austin</i>	Town: <i>Bingham</i>	Bridge #: <i>2027</i>
Route No./Name: <i>201</i>	Stream: <i>Austin Stream</i>	Review Date: <i>8/15/95</i>

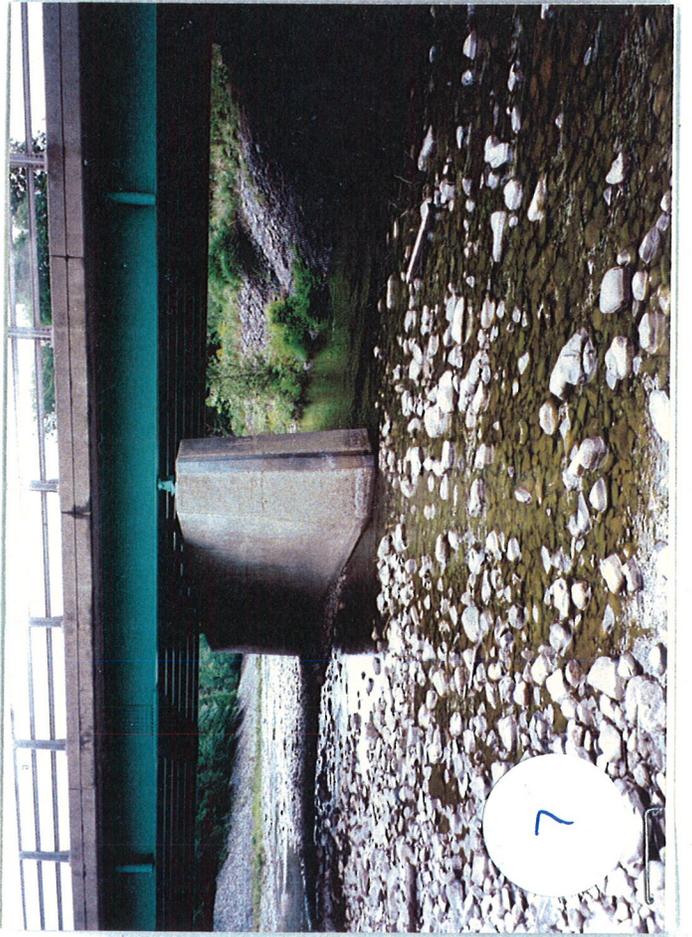
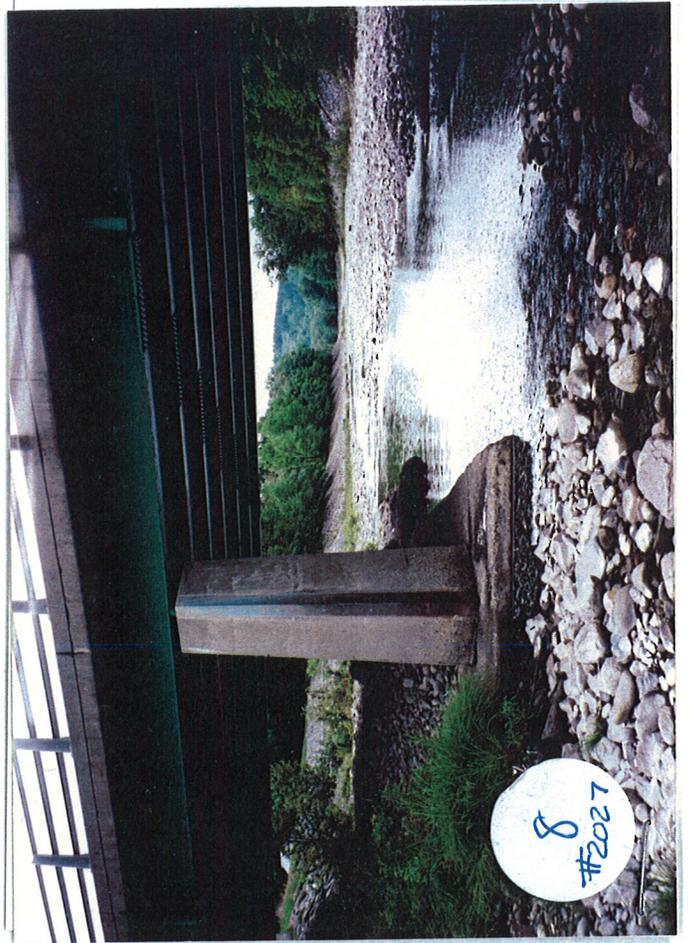
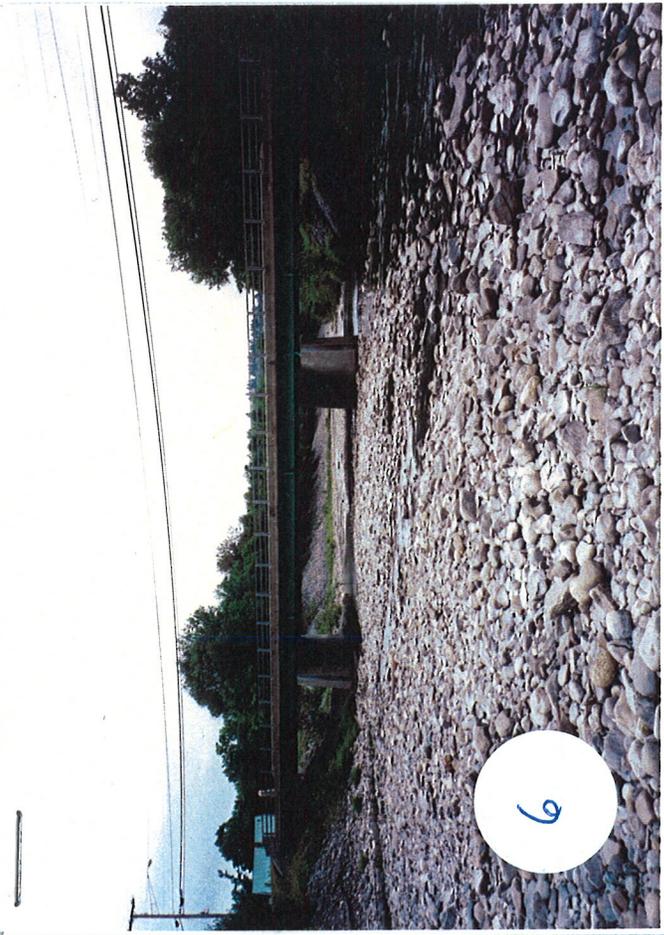
Picture Locations

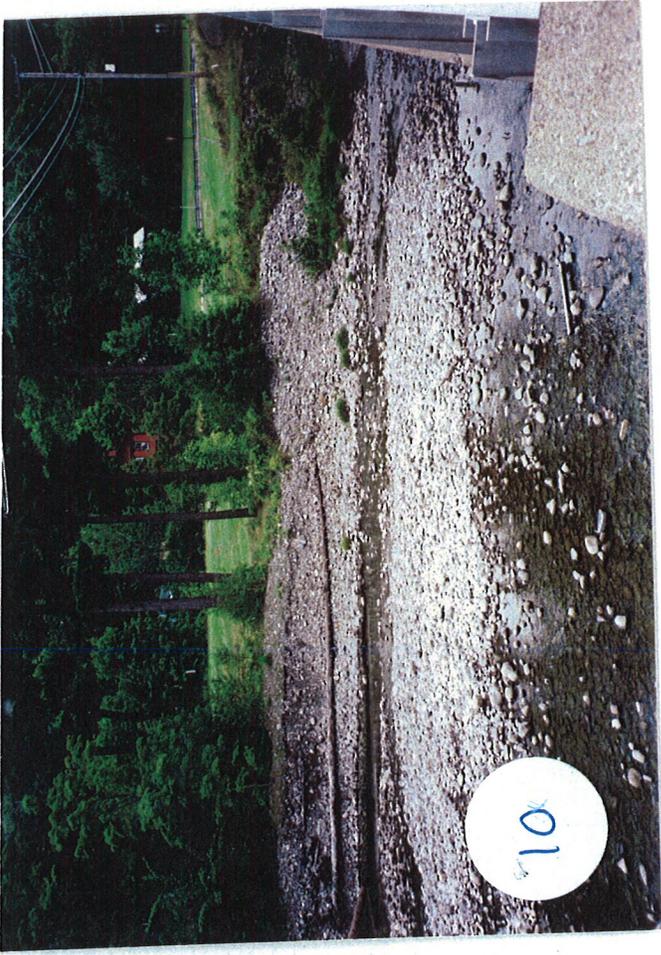


○ → From Ground

□ → From Bridge Deck







ATTACHMENT L

ATTACHMENT M

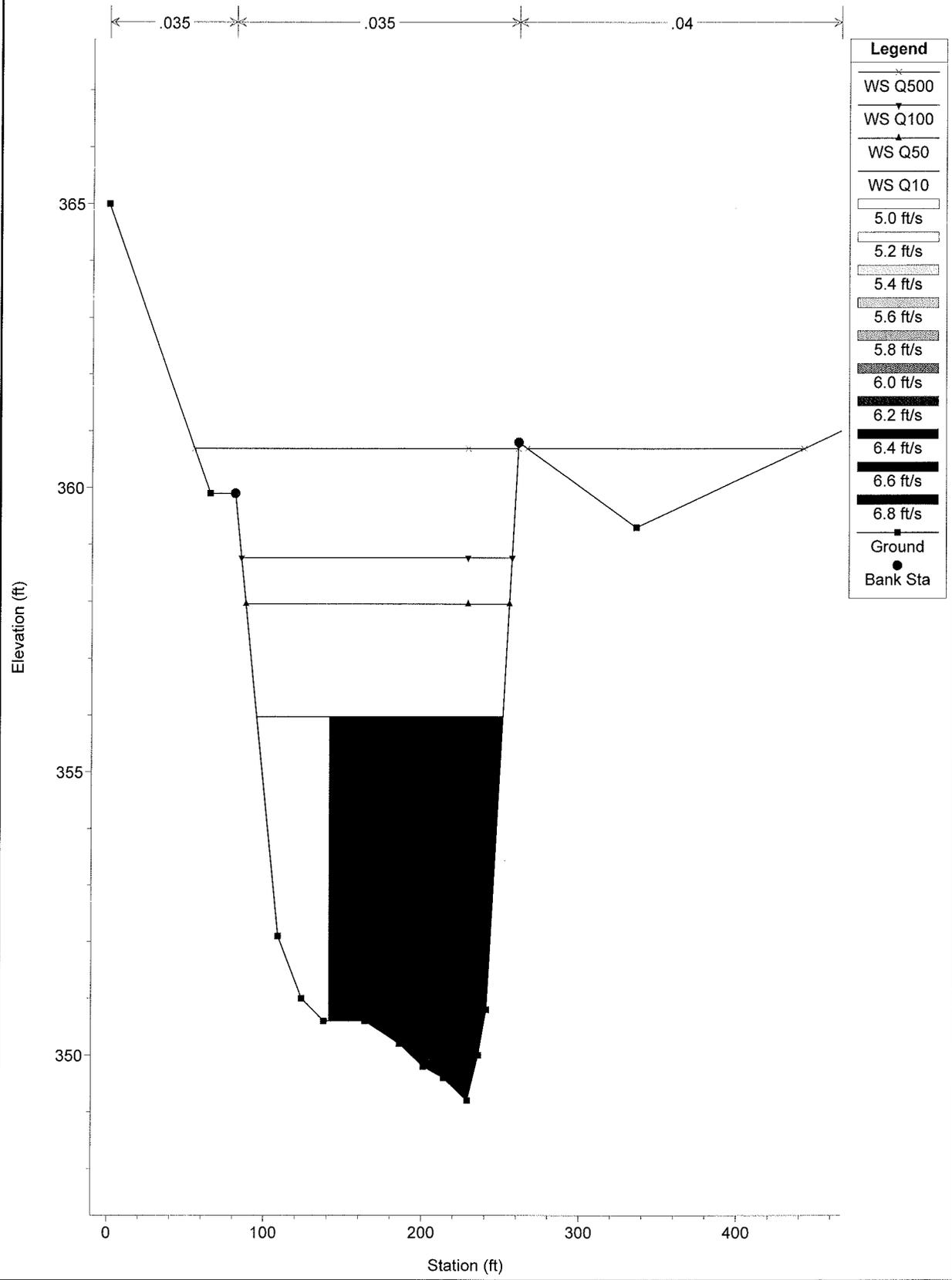
HEC-RAS Plan: Plan 01 River: Austin St Reach: Austin St

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Austin St	4082	Q10	4870.00	362.20	367.45	366.26	368.02	0.003861	6.04	806.54	232.42	0.57
Austin St	4082	Q50	7569.00	362.20	368.82	367.17	369.51	0.003326	6.65	1137.75	253.36	0.55
Austin St	4082	Q100	8848.00	362.20	369.40	367.55	370.13	0.003158	6.88	1286.70	262.23	0.55
Austin St	4082	Q500	12222.00	362.20	370.78	368.44	371.62	0.002826	7.33	1677.68	305.06	0.53
Austin St	2373	Q10	4870.00	349.30	357.92		359.38	0.006757	9.67	503.67	106.56	0.78
Austin St	2373	Q50	7569.00	349.30	359.43		361.41	0.007005	11.29	670.17	115.03	0.82
Austin St	2373	Q100	8848.00	349.30	360.08		362.26	0.006977	11.85	746.57	118.72	0.83
Austin St	2373	Q500	12222.00	349.30	361.51	360.71	364.24	0.006892	13.29	926.73	134.23	0.85
Austin St	1693	Q10	4870.00	349.20	355.97		356.55	0.002396	6.11	797.20	156.26	0.48
Austin St	1693	Q50	7569.00	349.20	357.95		358.67	0.002066	6.77	1117.58	167.33	0.46
Austin St	1693	Q100	8848.00	349.20	358.77		359.54	0.001989	7.05	1255.53	171.87	0.46
Austin St	1693	Q500	12222.00	349.20	360.69		361.56	0.001770	7.56	1733.89	382.06	0.45
Austin St	1600	Q10	4870.00	349.00	355.70	353.31	356.33	0.002310	6.39	762.63	135.04	0.47
Austin St	1600	Q50	7569.00	349.00	357.61	354.59	358.45	0.002223	7.36	1028.36	154.31	0.48
Austin St	1600	Q100	8848.00	349.00	358.42	355.10	359.33	0.002176	7.70	1178.06	222.33	0.48
Austin St	1600	Q500	12222.00	349.00	360.41	356.42	361.38	0.001858	8.09	1622.76	276.93	0.46
Austin St	1523.5		Bridge									
Austin St	1383	Q10	4870.00	346.60	353.48		354.34	0.004169	7.40	658.06	146.89	0.62
Austin St	1383	Q50	7569.00	346.60	355.02		356.14	0.003965	8.51	889.71	154.69	0.63
Austin St	1383	Q100	8848.00	346.60	355.65		356.90	0.003924	8.95	988.73	185.64	0.63
Austin St	1383	Q500	12222.00	346.60	356.89		358.53	0.004291	10.29	1192.08	345.95	0.67
Austin St	1287	Q10	4870.00	345.22	352.20	351.91	353.69	0.009357	9.82	496.14	132.48	0.89
Austin St	1287	Q50	7569.00	345.22	353.15	353.15	355.43	0.011036	12.14	623.62	136.73	1.00
Austin St	1287	Q100	8848.00	345.22	353.64	353.64	356.18	0.010894	12.78	692.34	138.96	1.01
Austin St	1287	Q500	12222.00	345.22	355.26	355.26	357.88	0.008342	13.06	1040.34	333.36	0.92
Austin St	0	Q10	4870.00	342.31	347.75	346.31	348.14	0.002261	5.46	1385.03	688.39	0.45
Austin St	0	Q50	7569.00	342.31	348.80	347.23	349.23	0.002262	6.09	2147.33	772.85	0.47
Austin St	0	Q100	8848.00	342.31	349.21	347.48	349.66	0.002261	6.33	2476.50	806.59	0.47
Austin St	0	Q500	12222.00	342.31	350.17	348.47	350.66	0.002263	6.85	3283.74	883.89	0.48

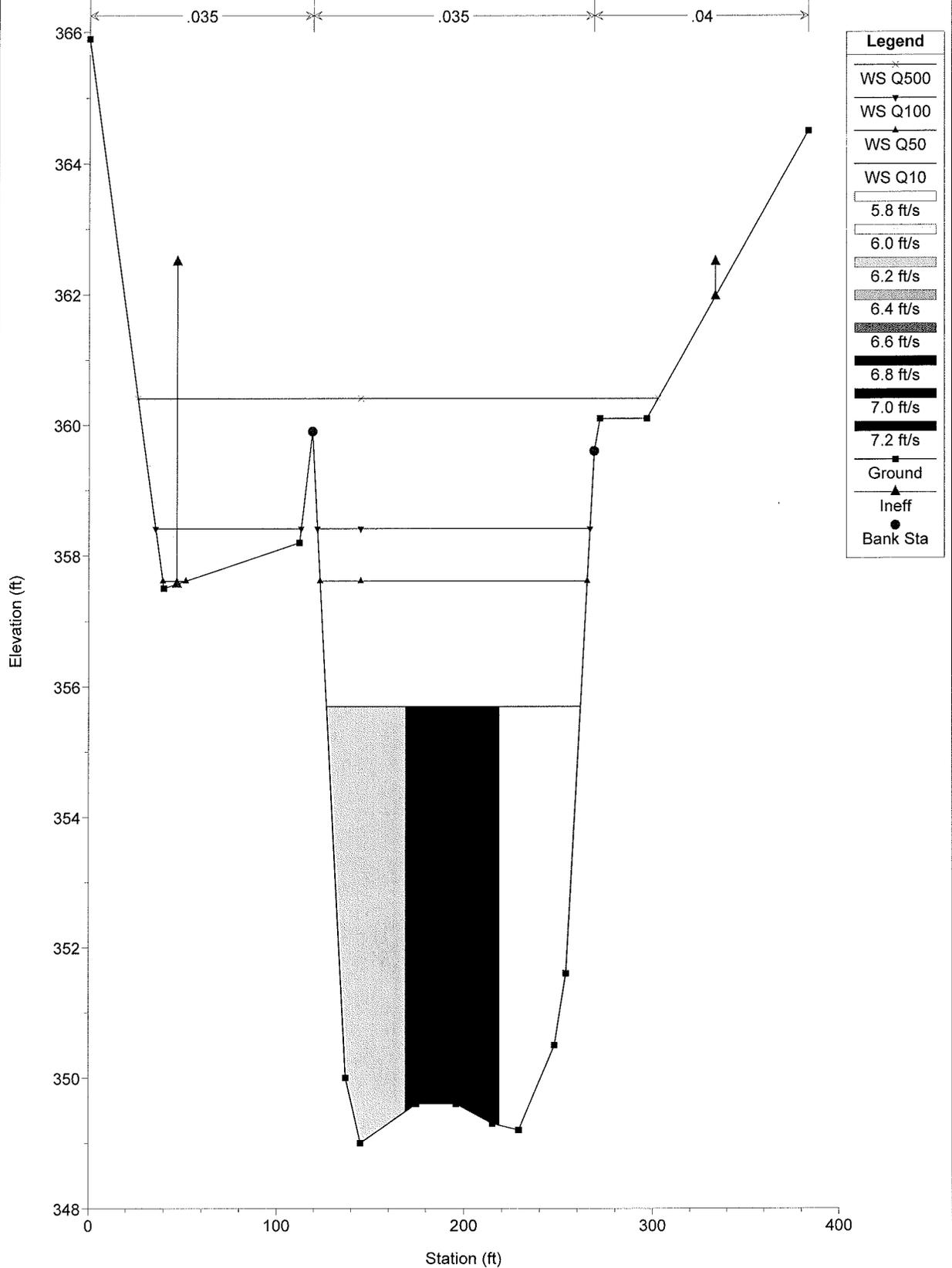
HEC-RAS Plan: Plan 01 River: Austin St Reach: Austin St

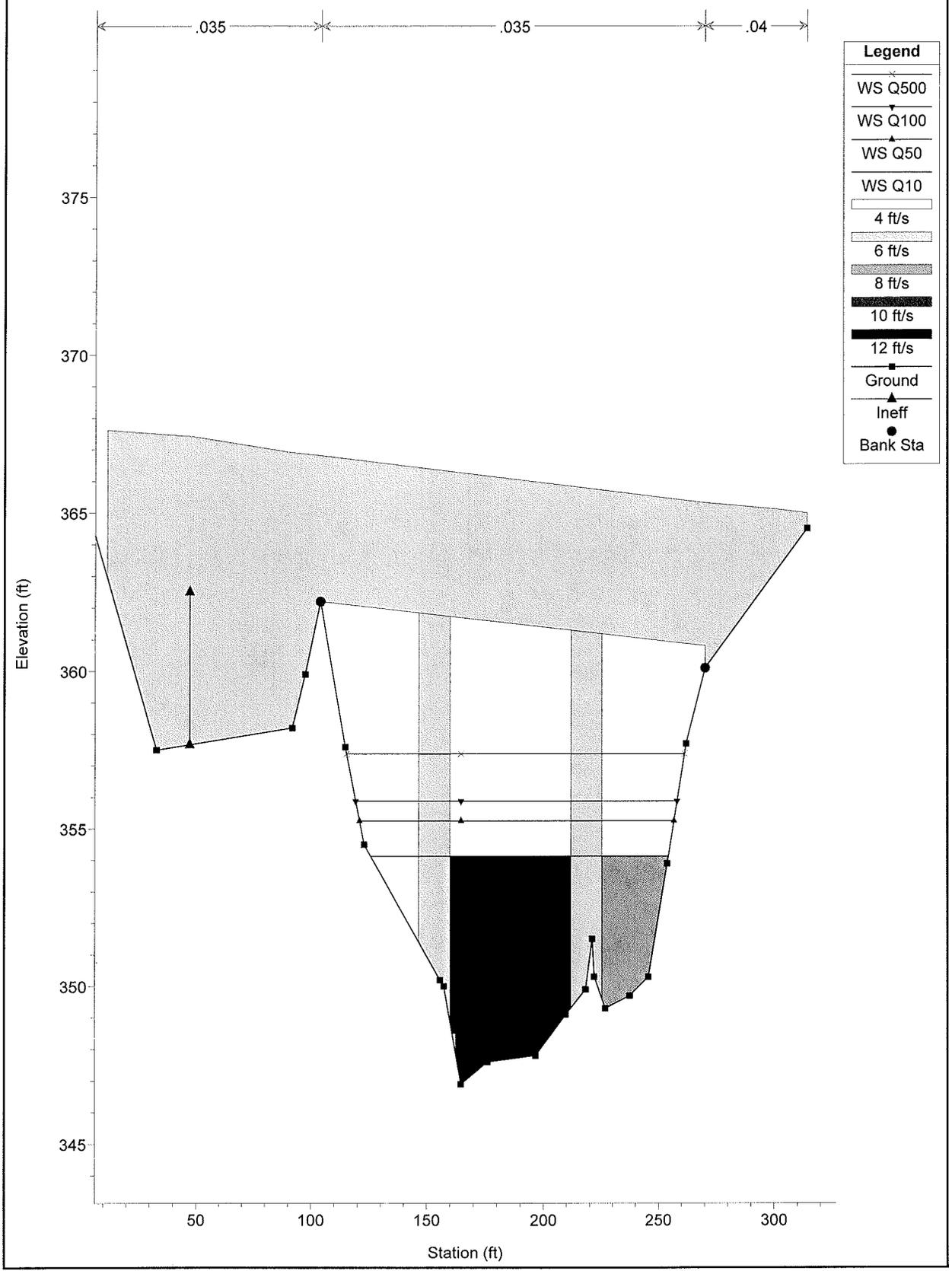
Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
Austin St	4082	Q10	368.02	367.45	0.57	8.56	0.09		4870.00		232.42
Austin St	4082	Q50	369.51	368.82	0.69	7.97	0.13		7569.00		253.36
Austin St	4082	Q100	370.13	369.40	0.73	7.72	0.14		8848.00		262.23
Austin St	4082	Q500	371.62	370.78	0.83	7.18	0.19		12204.44	17.56	305.06
Austin St	2373	Q10	359.38	357.92	1.45	2.56	0.26		4870.00		106.56
Austin St	2373	Q50	361.41	359.43	1.98	2.36	0.38		7569.00		115.03
Austin St	2373	Q100	362.26	360.08	2.18	2.30	0.42		8848.00		118.72
Austin St	2373	Q500	364.24	361.51	2.74	2.12	0.56		12200.20	21.80	134.23
Austin St	1693	Q10	356.55	355.97	0.58	0.22	0.01		4870.00		156.26
Austin St	1693	Q50	358.67	357.95	0.71	0.20	0.01		7569.00		167.33
Austin St	1693	Q100	359.54	358.77	0.77	0.19	0.01		8848.00		171.87
Austin St	1693	Q500	361.56	360.69	0.87	0.17	0.01	21.92	12050.05	150.03	382.06
Austin St	1600	Q10	356.33	355.70	0.63	0.34	0.11		4870.00		135.04
Austin St	1600	Q50	358.45	357.61	0.84	0.36	0.18	0.02	7568.98		154.31
Austin St	1600	Q100	359.33	358.42	0.92	0.35	0.20	44.66	8803.34		222.33
Austin St	1600	Q500	361.38	360.41	0.98	0.31	0.25	569.83	11644.75	7.42	276.93
Austin St	1523.5		Bridge								
Austin St	1383	Q10	354.34	353.48	0.85	0.58	0.06		4870.00		146.89
Austin St	1383	Q50	356.14	355.02	1.12	0.60	0.12		7569.00		154.69
Austin St	1383	Q100	356.90	355.65	1.24	0.59	0.13		8848.00		185.64
Austin St	1383	Q500	358.53	356.89	1.64	0.56	0.10		12220.23	1.77	345.95
Austin St	1287	Q10	353.69	352.20	1.50	5.22	0.33		4870.00		132.48
Austin St	1287	Q50	355.43	353.15	2.29	5.51	0.56		7569.00		136.73
Austin St	1287	Q100	356.18	353.64	2.54	5.48	0.63		8848.00		138.96
Austin St	1287	Q500	357.88	355.26	2.61	5.03	0.64		12057.99	164.01	333.36
Austin St	0	Q10	348.14	347.75	0.38			705.71	3963.31	200.98	688.39
Austin St	0	Q50	349.23	348.80	0.43			1248.04	5476.28	844.69	772.85
Austin St	0	Q100	349.66	349.21	0.45			1498.13	6140.32	1209.56	806.59
Austin St	0	Q500	350.66	350.17	0.49			2141.44	7800.55	2280.01	883.89

Section 4.1



Bingham #2027 Plan: Plan 01 6/15/2011
 Section 3.2





Plan: Plan 01 Austin St Austin St RS: 1693 Profile: Q10

E.G. Elev (ft)	356.55	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.58	Wt. n-Val.		0.035	
W.S. Elev (ft)	355.97	Reach Len. (ft)	97.00	93.00	86.00
Crit W.S. (ft)		Flow Area (sq ft)		797.20	
E.G. Slope (ft/ft)	0.002396	Area (sq ft)		797.20	
Q Total (cfs)	4870.00	Flow (cfs)		4870.00	
Top Width (ft)	156.26	Top Width (ft)		156.26	
Vel Total (ft/s)	6.11	Avg. Vel. (ft/s)		6.11	
Max Chl Dpth (ft)	6.77	Hydr. Depth (ft)		5.10	
Conv. Total (cfs)	99488.6	Conv. (cfs)		99488.6	
Length Wtd. (ft)	93.00	Wetted Per. (ft)		158.18	
Min Ch EI (ft)	349.20	Shear (lb/sq ft)		0.75	
Alpha	1.00	Stream Power (lb/ft s)		4.61	
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)	5.52	23.71	4.09
C & E Loss (ft)	0.01	Cum SA (acres)	2.21	5.55	5.51

Plan: Plan 01 Austin St Austin St RS: 1693 Profile: Q10

	Pos	Left Sta	Right Sta	Flow	Area	W.P.	Percent	Hydr	Velocity
		(ft)	(ft)	(cfs)	(sq ft)	(ft)	Conv	Depth(ft)	(ft/s)
1	Chan	81.00	141.00	927.50	181.88	46.48	19.05	3.96	5.10
2	Chan	141.00	201.00	2174.49	335.87	60.01	44.65	5.60	6.47
3	Chan	201.00	261.00	1768.01	279.45	51.69	36.30	5.55	6.33

Plan: Plan 01 Austin St Austin St RS: 1600 Profile: Q10

E.G. Elev (ft)	356.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.63	Wt. n-Val.		0.035	
W.S. Elev (ft)	355.70	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	353.31	Flow Area (sq ft)		762.63	
E.G. Slope (ft/ft)	0.002310	Area (sq ft)		762.63	
Q Total (cfs)	4870.00	Flow (cfs)		4870.00	
Top Width (ft)	135.04	Top Width (ft)		135.04	
Vel Total (ft/s)	6.39	Avg. Vel. (ft/s)		6.39	
Max Chl Dpth (ft)	6.70	Hydr. Depth (ft)		5.65	
Conv. Total (cfs)	101331.0	Conv. (cfs)		101331.0	
Length Wtd. (ft)	80.00	Wetted Per. (ft)		137.74	
Min Ch EI (ft)	349.00	Shear (lb/sq ft)		0.80	
Alpha	1.00	Stream Power (lb/ft s)		5.10	
Frctn Loss (ft)	0.34	Cum Volume (acre-ft)	5.52	22.04	4.09
C & E Loss (ft)	0.11	Cum SA (acres)	2.21	5.24	5.51

Plan: Plan 01 Austin St Austin St RS: 1600 Profile: Q10

	Pos	Left Sta	Right Sta	Flow	Area	W.P.	Percent	Hydr	Velocity
		(ft)	(ft)	(cfs)	(sq ft)	(ft)	Conv	Depth(ft)	(ft/s)
1	Chan	119.00	169.00	1450.75	234.03	43.89	29.79	5.53	6.20
2	Chan	169.00	219.00	2116.67	309.30	50.00	43.46	6.19	6.84
3	Chan	219.00	269.00	1302.58	219.31	43.85	26.75	5.14	5.94

Plan: Plan 01 Austin St Austin St RS: 1523.5 Profile: Q10

E.G. US. (ft)	356.33	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	355.70	E.G. Elev (ft)	355.88	355.25
Q Total (cfs)	4870.00	W.S. Elev (ft)	354.13	353.28
Q Bridge (cfs)	4870.00	Crit W.S. (ft)	353.69	353.22
Q Weir (cfs)		Max Chl Dpth (ft)	7.23	6.68
Weir Sta Lft (ft)		Vel Total (ft/s)	10.59	11.28
Weir Sta Rgt (ft)		Flow Area (sq ft)	459.67	431.62
Weir Submerg		Froude # Chl	0.88	0.98
Weir Max Depth (ft)		Specif Force (cu ft)	2873.92	2757.64
Min El Weir Flow (ft)	364.27	Hydr Depth (ft)	4.52	4.13
Min El Prs (ft)	362.20	W.P. Total (ft)	121.05	121.10
Delta EG (ft)	1.99	Conv. Total (cfs)	47499.2	42756.5
Delta WS (ft)	2.21	Top Width (ft)	101.65	104.48
BR Open Area (sq ft)	1354.26	Frctn Loss (ft)	0.61	0.58
BR Open Vel (ft/s)	11.28	C & E Loss (ft)	0.02	0.34
Coef of Q		Shear Total (lb/sq ft)	2.49	2.89
Br Sel Method	Energy only	Power Total (lb/ft s)	26.40	32.57

Plan: Plan 01 Austin St Austin St RS: 1523.5 BR U Profile: Q10

	Pos	Left Sta	Right Sta	Flow	Area	W.P.	Percent	Hydr	Velocity
		(ft)	(ft)	(cfs)	(sq ft)	(ft)	Conv	Depth(ft)	(ft/s)
1	Chan	104.03	159.46	125.86	28.20	23.63	2.58	1.36	4.46
2	Chan	159.46	214.89	3845.67	324.95	63.07	78.97	6.25	11.83
3	Chan	214.89	270.32	898.47	106.52	34.36	18.45	3.68	8.43

Bingham # 2027
10yr Event

Contraction Scour

	Left	Channel	Right
Input Data			
Average Depth (ft):		5.10	
Approach Velocity (ft/s):		6.11	
Br Average Depth (ft):		4.52	
BR Opening Flow (cfs):		4870.00	
BR Top WD (ft):		101.65	
Grain Size D50 (mm):		5.00	
Approach Flow (cfs):		4870.00	
Approach Top WD (ft):		156.26	
K1 Coefficient:		0.640	
Results			
Scour Depth Ys (ft):		2.20	
Critical Velocity (ft/s):		3.73	
Equation:		Live	

Pier Scour

	All piers have the same scour depth		
Input Data			
Pier Shape:	Sharp nose		
Pier Width (ft):	4.60		
Grain Size D50 (mm):	5.00000		
Depth Upstream (ft):	6.19		
Velocity Upstream (ft/s):	6.84		
K1 Nose Shape:	1.00		
Pier Angle:	10.00		
Pier Length (ft):	66.00		
K2 Angle Coef:	2.07		
K3 Bed Cond Coef:	1.10		
Grain Size D90 (mm):	40.00000		
K4 Armouring Coef:	0.40		
Set K1 value to 1.0 because angle > 5 degrees			
Results			
Scour Depth Ys (ft):	6.81		
Froude #:	0.48		
Equation:	CSU equation		

Abutment Scour

	Left	Right
Input Data		
Station at Toe (ft):	122.87	245.75
Toe Sta at appr (ft):	95.09	242.66
Abutment Length (ft):	0.00	8.69
Depth at Toe (ft):	0.00	3.83
K1 Shape Coef:	0.55 - Spill-through abutment	
Degree of Skew (degrees):	127.00	90.00
K2 Skew Coef:	1.05	1.00
Projected Length L' (ft):	0.00	8.69
Avg Depth Obstructed Ya (ft):	0.00	1.92
Flow Obstructed Qe (cfs):	0.00	130.00
Area Obstructed Ae (sq ft):	0.00	16.70
Results		
Scour Depth Ys (ft):		6.48

$Q_e/A_e = V_e$: 7.78
 Froude #: 0.99
 Equation: Default Froehlich

Combined Scour Depths

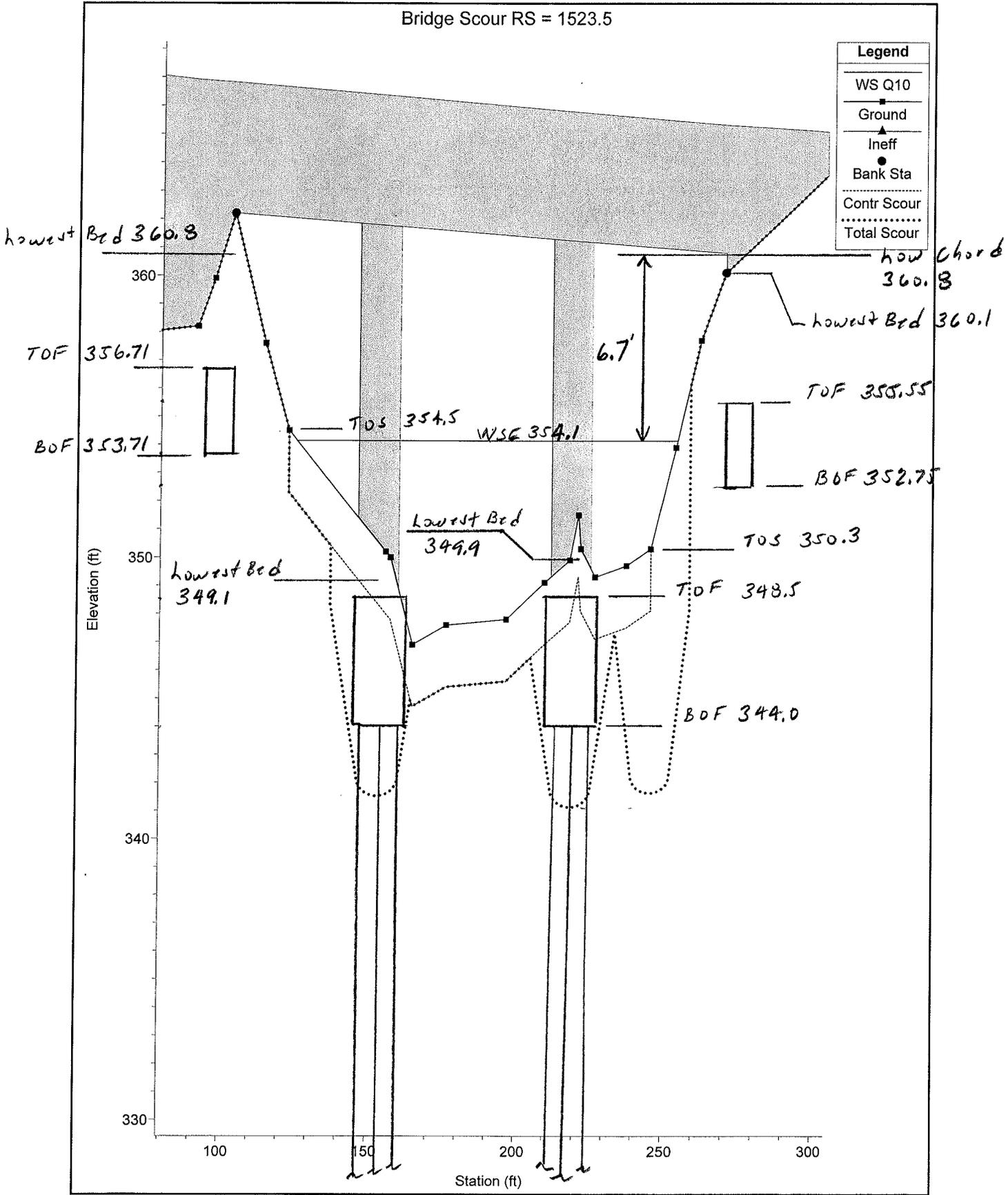
Pier Scour + Contraction Scour (ft):
 Channel: 9.00

Right abutment scour + contraction scour (ft): 8.68

	L. Abut.	Pier 1	Pier 2	R. Abut
lowest Bed	360.8	349.1	349.9	360.1
Scour Depth	<u>- 2.2</u>	<u>- 9.0</u>	<u>- 9.0</u>	<u>- 8.7</u>
Scour Elev.	358.6	340.1	340.9	351.4

Bingham# 2027
10-Yr Event

Bridge Scour RS = 1523.5



Legend	
WS Q10	—
Ground	—
Ineff	▲
Bank Sta	●
Contr Scour	⋯
Total Scour	⋯

Pile Tip EL 314 ±

Plan: Plan 01 Austin St Austin St RS: 1693 Profile: Q50

E.G. Elev (ft)	358.67	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.71	Wt. n-Val.		0.035	
W.S. Elev (ft)	357.95	Reach Len. (ft)	97.00	93.00	86.00
Crit W.S. (ft)		Flow Area (sq ft)		1117.58	
E.G. Slope (ft/ft)	0.002066	Area (sq ft)		1117.58	
Q Total (cfs)	7569.00	Flow (cfs)		7569.00	
Top Width (ft)	167.33	Top Width (ft)		167.33	
Vel Total (ft/s)	6.77	Avg. Vel. (ft/s)		6.77	
Max Chl Dpth (ft)	8.75	Hydr. Depth (ft)		6.68	
Conv. Total (cfs)	166512.2	Conv. (cfs)		166512.2	
Length Wtd. (ft)	93.00	Wetted Per. (ft)		169.99	
Min Ch EI (ft)	349.20	Shear (lb/sq ft)		0.85	
Alpha	1.00	Stream Power (lb/ft s)		5.74	
Frctn Loss (ft)	0.20	Cum Volume (acre-ft)	7.86	30.04	10.40
C & E Loss (ft)	0.01	Cum SA (acres)	2.29	5.80	6.58

Plan: Plan 01 Austin St Austin St RS: 1693 Profile: Q50

	Pos	Left Sta	Right Sta	Flow	Area	W.P.	Percent	Hydr	Velocity
		(ft)	(ft)	(cfs)	(sq ft)	(ft)	Conv	Depth(ft)	(ft/s)
1	Chan	81.00	141.00	1599.49	279.82	53.86	21.13	5.28	5.72
2	Chan	141.00	201.00	3342.49	454.68	60.01	44.16	7.58	7.35
3	Chan	201.00	261.00	2627.02	383.08	56.11	34.71	7.05	6.86

Plan: Plan 01 Austin St Austin St RS: 1600 Profile: Q50

E.G. Elev (ft)	358.45	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.84	Wt. n-Val.	0.035	0.035	
W.S. Elev (ft)	357.61	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	354.59	Flow Area (sq ft)	0.11	1028.25	
E.G. Slope (ft/ft)	0.002223	Area (sq ft)	0.69	1028.25	
Q Total (cfs)	7569.00	Flow (cfs)	0.02	7568.98	
Top Width (ft)	154.31	Top Width (ft)	12.19	142.12	
Vel Total (ft/s)	7.36	Avg. Vel. (ft/s)	0.16	7.36	
Max Chl Dpth (ft)	8.61	Hydr. Depth (ft)	0.02	7.24	
Conv. Total (cfs)	160547.8	Conv. (cfs)	0.4	160547.5	
Length Wtd. (ft)	80.00	Wetted Per. (ft)	4.65	145.79	
Min Ch El (ft)	349.00	Shear (lb/sq ft)	0.00	0.98	
Alpha	1.00	Stream Power (lb/ft s)	0.00	7.20	
Frctn Loss (ft)	0.36	Cum Volume (acre-ft)	7.86	27.74	10.40
C & E Loss (ft)	0.18	Cum SA (acres)	2.28	5.47	6.58

Plan: Plan 01 Austin St Austin St RS: 1600 Profile: Q50

	Pos	Left Sta	Right Sta	Flow	Area	W.P.	Percent	Hydr	Velocity
		(ft)	(ft)	(cfs)	(sq ft)	(ft)	Conv	Depth(ft)	(ft/s)
1	LOB	0.00	47.00	0.00	0.59	7.55	0.00	0.08	0.00
2	LOB	47.00	83.00	0.02	0.11	4.65	0.00	0.02	0.16
3	LOB	83.00	119.00						
4	Chan	119.00	169.00	2241.31	318.56	47.86	29.61	6.95	7.04
5	Chan	169.00	219.00	3249.81	405.13	50.00	42.94	8.10	8.02
6	Chan	219.00	269.00	2077.87	304.56	47.92	27.45	6.58	6.82

Plan: Plan 01 Austin St Austin St RS: 1523.5 Profile: Q50

E.G. US. (ft)	358.45	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	357.61	E.G. Elev (ft)	357.91	357.31
Q Total (cfs)	7569.00	W.S. Elev (ft)	355.25	354.58
Q Bridge (cfs)	7569.00	Crit W.S. (ft)	355.25	354.66
Q Weir (cfs)		Max Chl Dpth (ft)	8.35	7.98
Weir Sta Lft (ft)		Vel Total (ft/s)	13.09	13.26
Weir Sta Rgt (ft)		Flow Area (sq ft)	578.32	570.69
Weir Submerg		Froude # Chl	1.00	1.02
Weir Max Depth (ft)		Specif Force (cu ft)	4929.01	4819.55
Min El Weir Flow (ft)	364.27	Hydr Depth (ft)	5.31	5.21
Min El Prs (ft)	362.20	W.P. Total (ft)	133.15	131.94
Delta EG (ft)	2.31	Conv. Total (cfs)	65361.1	64320.2
Delta WS (ft)	2.59	Top Width (ft)	108.85	109.48
BR Open Area (sq ft)	1354.26	Frctn Loss (ft)		0.69
BR Open Vel (ft/s)	13.26	C & E Loss (ft)		0.01
Coef of Q		Shear Total (lb/sq ft)	3.64	3.74
Br Sel Method	Energy only	Power Total (lb/ft s)	47.59	49.60

Plan: Plan 01 Austin St Austin St RS: 1523.5 BR U Profile: Q50

	Pos	Left Sta	Right Sta	Flow	Area	W.P.	Percent	Hydr	Velocity
		(ft)	(ft)	(cfs)	(sq ft)	(ft)	Conv	Depth(ft)	(ft/s)
1	Chan	104.03	159.46	375.17	54.81	29.70	4.96	2.15	6.85
2	Chan	159.46	214.89	5672.35	383.20	65.31	74.94	7.37	14.80
3	Chan	214.89	270.32	1521.48	140.31	38.14	20.10	4.47	10.84

Bingham #2027
50-Yr Event

Contraction Scour

	Left	Channel	Right
Input Data			
Average Depth (ft):		6.68	
Approach Velocity (ft/s):		6.77	
Br Average Depth (ft):		5.31	
BR Opening Flow (cfs):		7569.00	
BR Top WD (ft):		108.85	
Grain Size D50 (mm):		5.00	
Approach Flow (cfs):		7569.00	
Approach Top WD (ft):		167.33	
K1 Coefficient:		0.590	
Results			
Scour Depth Ys (ft):		3.30	
Critical Velocity (ft/s):		3.90	
Equation:		Live	

Pier Scour

All piers have the same scour depth	
Input Data	
Pier Shape:	Sharp nose
Pier Width (ft):	4.60
Grain Size D50 (mm):	5.00000
Depth Upstream (ft):	8.10
Velocity Upstream (ft/s):	8.02
K1 Nose Shape:	1.00
Pier Angle:	10.00
Pier Length (ft):	66.00
K2 Angle Coef:	2.07
K3 Bed Cond Coef:	1.10
Grain Size D90 (mm):	40.00000
K4 Armouring Coef:	0.40
Set K1 value to 1.0 because angle > 5 degrees	
Results	
Scour Depth Ys (ft):	7.56
Froude #:	0.50
Equation:	CSU equation

Abutment Scour

	Left	Right
Input Data		
Station at Toe (ft):	122.87	245.75
Toe Sta at appr (ft):	89.97	244.20
Abutment Length (ft):	1.99	11.11
Depth at Toe (ft):	0.75	4.95
K1 Shape Coef:	0.55 - Spill-through abutment	
Degree of Skew (degrees):	127	90
K2 Skew Coef:	1.05	1.00
Projected Length L' (ft):	1.59	11.11
Avg Depth Obstructed Ya (ft):	4.66	6.38
Flow Obstructed Qe (cfs):	53.0	486
Area Obstructed Ae (sq ft):	9.3	70.9
Results		
Scour Depth Ys (ft):	7.07	12.83

Qe/Ae = Ve:	5.70	6.85
Froude #:	0.47	0.48
Equation:	Froehlich	Froehlich

Combined Scour Depths

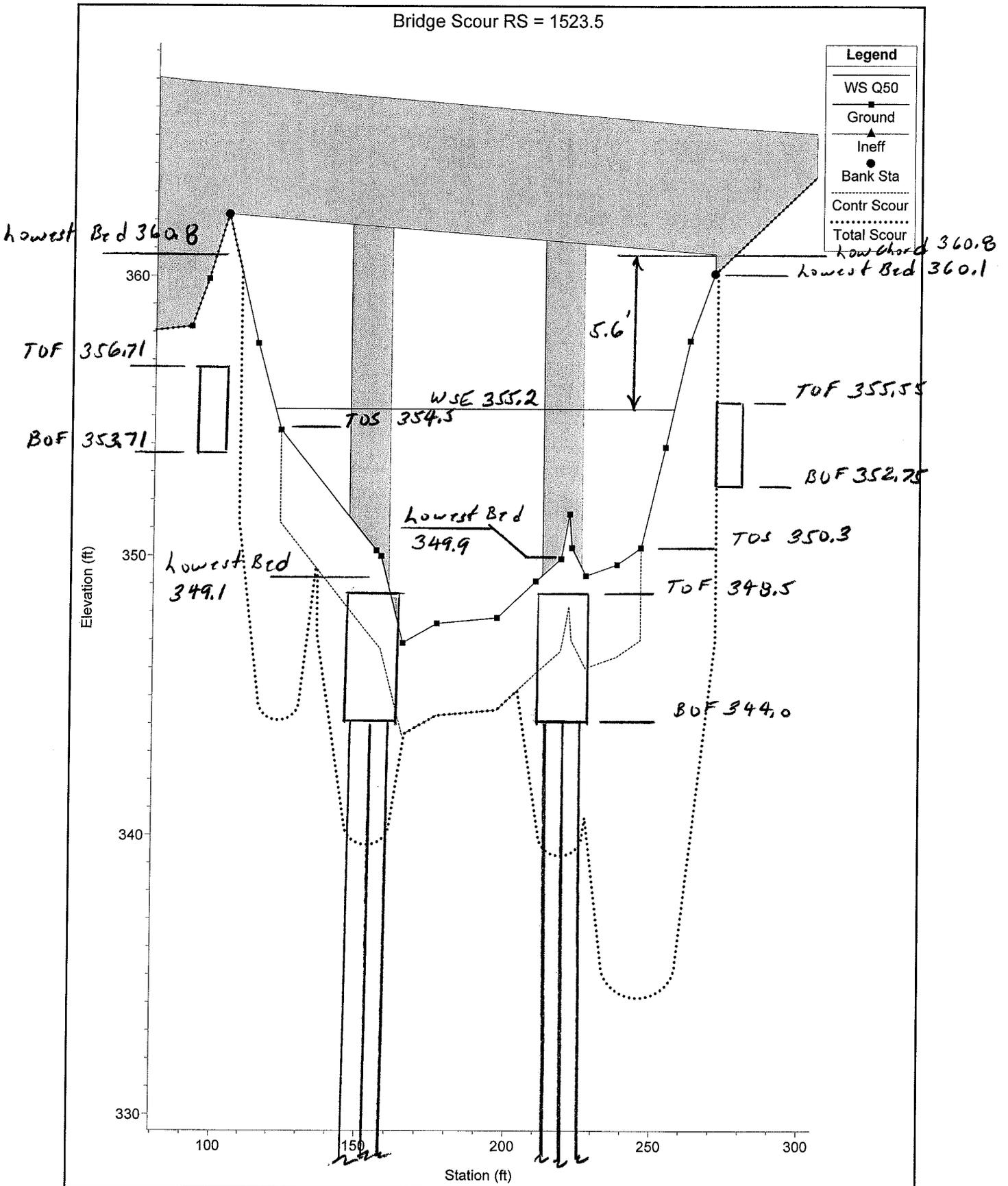
Pier Scour + Contraction Scour (ft):	Channel:	10.86
Left abutment scour + contraction scour (ft):		10.37
Right abutment scour + contraction scour (ft):		16.13

	L. Abut	Pier 1	Pier 2	R. Abut
lowest bed	360.8	349.1	349.9	360.1
Scour Depth	<u>10.4</u>	<u>10.9</u>	<u>10.9</u>	<u>16.1</u>
	350.4	338.2	339.0	344.0

Bingham #2027

50-Yr Event

Bridge Scour RS = 1523.5



Pile Tip EL 314±

Plan: Plan 01 Austin St Austin St RS: 1693 Profile: Q100

E.G. Elev (ft)	359.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.77	Wt. n-Val.		0.035	
W.S. Elev (ft)	358.77	Reach Len. (ft)	97.00	93.00	86.00
Crit W.S. (ft)		Flow Area (sq ft)		1255.53	
E.G. Slope (ft/ft)	0.001989	Area (sq ft)		1255.53	
Q Total (cfs)	8848.00	Flow (cfs)		8848.00	
Top Width (ft)	171.87	Top Width (ft)		171.87	
Vel Total (ft/s)	7.05	Avg. Vel. (ft/s)		7.05	
Max Chl Dpth (ft)	9.57	Hydr. Depth (ft)		7.30	
Conv. Total (cfs)	198403.2	Conv. (cfs)		198403.2	
Length Wtd. (ft)	93.01	Wetted Per. (ft)		174.84	
Min Ch EI (ft)	349.20	Shear (lb/sq ft)		0.89	
Alpha	1.00	Stream Power (lb/ft s)		6.28	
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	8.90	32.98	13.24
C & E Loss (ft)	0.01	Cum SA (acres)	2.45	5.91	7.06

Plan: Plan 01 Austin St Austin St RS: 1693 Profile: Q100

	Pos	Left Sta	Right Sta	Flow	Area	W.P.	Percent	Hydr	Velocity
		(ft)	(ft)	(cfs)	(sq ft)	(ft)	Conv	Depth(ft)	(ft/s)
1	Chan	81.00	141.00	1931.74	324.13	56.89	21.83	5.79	5.96
2	Chan	141.00	201.00	3884.05	503.48	60.01	43.90	8.39	7.71
3	Chan	201.00	261.00	3032.22	427.91	57.93	34.27	7.65	7.09

Plan: Plan 01 Austin St Austin St RS: 1600 Profile: Q100

E.G. Elev (ft)	359.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.92	Wt. n-Val.	0.035	0.035	
W.S. Elev (ft)	358.42	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	355.10	Flow Area (sq ft)	34.63	1143.43	
E.G. Slope (ft/ft)	0.002176	Area (sq ft)	42.80	1143.43	
Q Total (cfs)	8848.00	Flow (cfs)	44.66	8803.34	
Top Width (ft)	222.33	Top Width (ft)	77.25	145.08	
Vel Total (ft/s)	7.51	Avg. Vel. (ft/s)	1.29	7.70	
Max Chl Dpth (ft)	9.42	Hydr. Depth (ft)	0.53	7.88	
Conv. Total (cfs)	189686.0	Conv. (cfs)	957.4	188728.7	
Length Wtd. (ft)	80.00	Wetted Per. (ft)	65.92	149.16	
Min Ch El (ft)	349.00	Shear (lb/sq ft)	0.07	1.04	
Alpha	1.05	Stream Power (lb/ft s)	0.09	8.02	
Frctn Loss (ft)	0.35	Cum Volume (acre-ft)	8.85	30.42	13.24
C & E Loss (ft)	0.20	Cum SA (acres)	2.36	5.57	7.06

Plan: Plan 01 Austin St Austin St RS: 1600 Profile: Q100

	Pos	Left Sta	Right Sta	Flow	Area	W.P.	Percent	Hydr	Velocity
		(ft)	(ft)	(cfs)	(sq ft)	(ft)	Conv	Depth(ft)	(ft/s)
1	LOB	0.00	47.00	0.00	8.16	11.45	0.00	0.72	0.00
2	LOB	47.00	83.00	34.94	24.20	36.00	0.39	0.67	1.44
3	LOB	83.00	119.00	9.72	10.43	29.91	0.11	0.35	0.93
4	Chan	119.00	169.00	2605.38	355.91	49.53	29.45	7.52	7.32
5	Chan	169.00	219.00	3760.02	445.24	50.00	42.50	8.90	8.45
6	Chan	219.00	269.00	2437.94	342.28	49.63	27.55	7.16	7.12

Plan: Plan 01 Austin St Austin St RS: 1523.5 Profile: Q100

E.G. US. (ft)	359.33	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	358.42	E.G. Elev (ft)	358.78	358.17
Q Total (cfs)	8848.00	W.S. Elev (ft)	355.88	355.21
Q Bridge (cfs)	8848.00	Crit W.S. (ft)	355.88	355.29
Q Weir (cfs)		Max Chl Dpth (ft)	8.98	8.61
Weir Sta Lft (ft)		Vel Total (ft/s)	13.66	13.81
Weir Sta Rgt (ft)		Flow Area (sq ft)	647.65	640.66
Weir Submerg		Froude # Chl	1.00	1.02
Weir Max Depth (ft)		Specif Force (cu ft)	5991.52	5879.67
Min EI Weir Flow (ft)	364.27	Hydr Depth (ft)	5.79	5.72
Min EI Prs (ft)	362.20	W.P. Total (ft)	138.93	137.21
Delta EG (ft)	2.43	Conv. Total (cfs)	76729.2	75983.9
Delta WS (ft)	2.76	Top Width (ft)	111.87	111.91
BR Open Area (sq ft)	1354.26	Frctn Loss (ft)		0.68
BR Open Vel (ft/s)	13.81	C & E Loss (ft)		0.00
Coef of Q		Shear Total (lb/sq ft)	3.87	3.95
Br Sel Method	Energy only	Power Total (lb/ft s)	52.87	54.59

Plan: Plan 01 Austin St Austin St RS: 1523.5 BR U Profile: Q100

	Pos	Left Sta	Right Sta	Flow	Area	W.P.	Percent	Hydr	Velocity
		(ft)	(ft)	(cfs)	(sq ft)	(ft)	Conv	Depth(ft)	(ft/s)
1	Chan	104.03	159.46	555.61	71.36	32.10	6.28	2.63	7.79
2	Chan	159.46	214.89	6448.79	415.85	66.56	72.88	8.00	15.51
3	Chan	214.89	270.32	1843.59	160.44	40.26	20.84	4.90	11.49

Bingham #2027
100-yr Event

Contraction Scour

	Left	Channel	Right
Input Data			
Average Depth (ft):		7.30	
Approach Velocity (ft/s):		7.05	
Br Average Depth (ft):		5.79	
BR Opening Flow (cfs):		8848.00	
BR Top WD (ft):		111.87	
Grain Size D50 (mm):		5.00	
Approach Flow (cfs):		8848.00	
Approach Top WD (ft):		171.87	
K1 Coefficient:		0.590	
Results			
Scour Depth Ys (ft):		3.61	
Critical Velocity (ft/s):		3.96	
Equation:		Live	

Pier Scour

All piers have the same scour depth

Input Data

Pier Shape:	Sharp nose
Pier Width (ft):	4.60
Grain Size D50 (mm):	5.00000
Depth Upstream (ft):	8.90
Velocity Upstream (ft/s):	8.45
K1 Nose Shape:	1.00
Pier Angle:	10.00
Pier Length (ft):	66.00
K2 Angle Coef:	2.07
K3 Bed Cond Coef:	1.10
Grain Size D90 (mm):	40.00000
K4 Armouring Coef:	0.40

Set K1 value to 1.0 because angle > 5 degrees

Results

Scour Depth Ys (ft):	7.83
Froude #:	0.50
Equation:	CSU equation

Abutment Scour

	Left	Right
Input Data		
Station at Toe (ft):	122.87	245.75
Toe Sta at appr (ft):	84.65	248.54
Abutment Length (ft):	3.65	12.46
Depth at Toe (ft):	3.91	8.11
K1 Shape Coef:	0.55 - Spill-through abutment	
Degree of Skew (degrees):	127.00	90.00
K2 Skew Coef:	1.05	1.00
Projected Length L' (ft):	2.92	12.46
Avg Depth Obstructed Ya (ft):	5.40	7.13
Flow Obstructed Qe (cfs):	117.50	629.70
Area Obstructed Ae (sq ft):	19.70	88.90
Results		
Scour Depth Ys (ft):	8.75	14.25

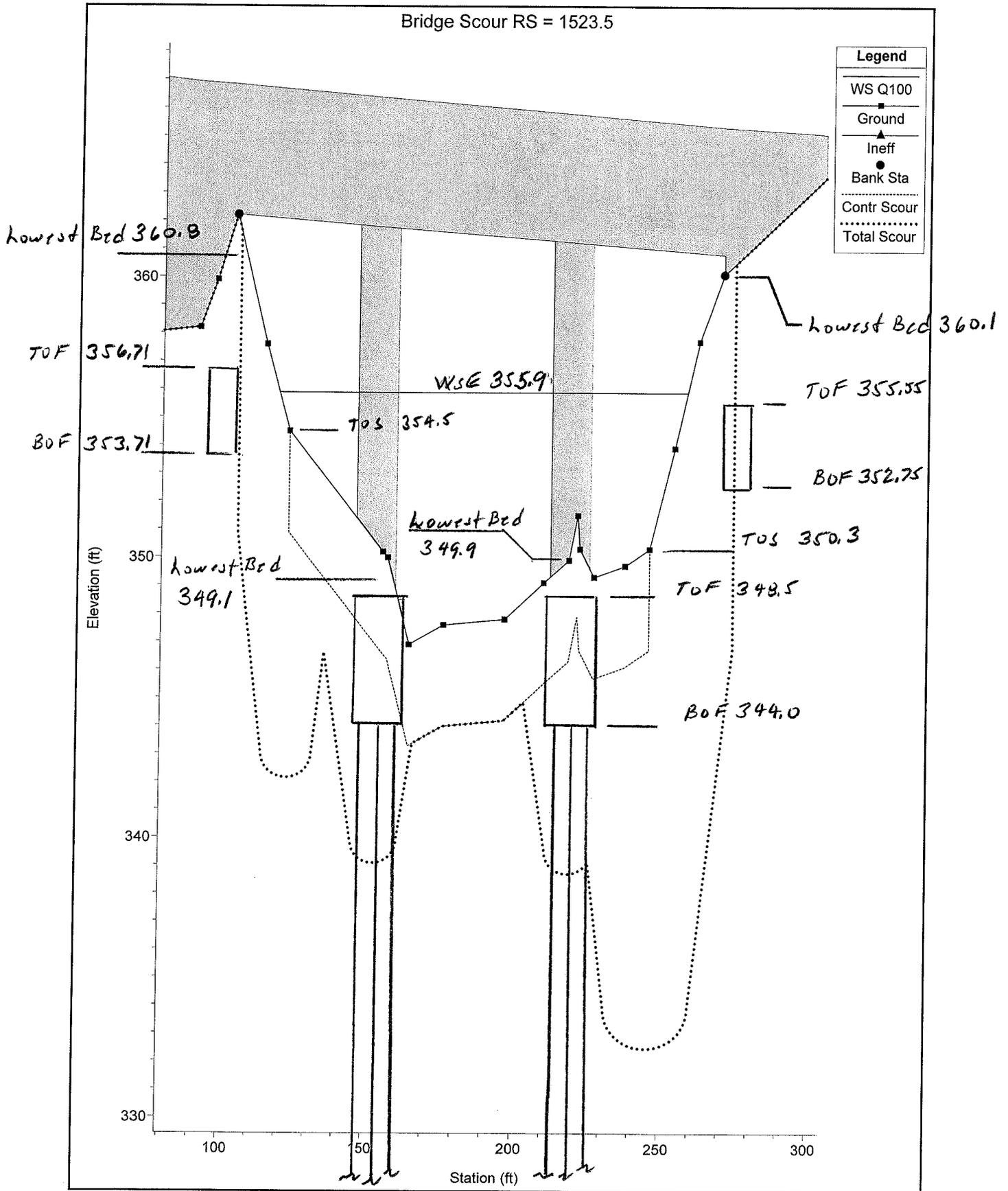
Qe/Ae = Ve:	5.96	7.08
Froude #:	0.45	0.47
Equation:	Froehlich	Froehlich

Combined Scour Depths

Pier Scour + Contraction Scour (ft):	Channel:	11.44
Left abutment scour + contraction scour (ft):	12.36	
Right abutment scour + contraction scour (ft):	17.86	

Bingham #2027
100-Yr Event

Bridge Scour RS = 1523.5



Pile Tip EL 314 ±

Plan: Plan 01 Austin St Austin St RS: 1693 Profile: Q500

E.G. Elev (ft)	361.56	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.87	Wt. n-Val.	0.035	0.035	0.040
W.S. Elev (ft)	360.69	Reach Len. (ft)	97.00	93.00	86.00
Crit W.S. (ft)		Flow Area (sq ft)	16.59	1594.90	122.40
E.G. Slope (ft/ft)	0.001770	Area (sq ft)	16.59	1594.90	122.40
Q Total (cfs)	12222.00	Flow (cfs)	21.92	12050.05	150.03
Top Width (ft)	382.06	Top Width (ft)	26.06	179.78	176.22
Vel Total (ft/s)	7.05	Avg. Vel. (ft/s)	1.32	7.56	1.23
Max Chl Dpth (ft)	11.49	Hydr. Depth (ft)	0.64	8.87	0.69
Conv. Total (cfs)	290480.7	Conv. (cfs)	521.1	286393.9	3565.7
Length Wtd. (ft)	93.05	Wetted Per. (ft)	26.09	183.35	176.24
Min Ch EI (ft)	349.20	Shear (lb/sq ft)	0.07	0.96	0.08
Alpha	1.13	Stream Power (lb/ft s)	0.09	7.26	0.09
Frctn Loss (ft)	0.17	Cum Volume (acre-ft)	11.47	41.03	22.61
C & E Loss (ft)	0.01	Cum SA (acres)	2.56	6.19	11.56

Plan: Plan 01 Austin St Austin St RS: 1693 Profile: Q500

	Pos	Left Sta	Right Sta	Flow	Area	W.P.	Percent	Hydr	Velocity
		(ft)	(ft)	(cfs)	(sq ft)	(ft)	Conv	Depth(ft)	(ft/s)
1	LOB	54.00	81.00	21.92	16.59	26.09	0.18	0.64	1.32
2	Chan	81.00	141.00	2863.78	437.10	61.11	23.43	7.28	6.55
3	Chan	141.00	201.00	5173.35	618.75	60.01	42.33	10.31	8.36
4	Chan	201.00	261.00	4012.93	539.06	62.23	32.83	9.02	7.44
5	ROB	261.00	375.67	124.89	93.11	109.14	1.02	0.85	1.34
6	ROB	375.67	490.33	25.13	29.29	67.10	0.21	0.44	0.86

Plan: Plan 01 Austin St Austin St RS: 1600 Profile: Q500

E.G. Elev (ft)	361.38	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.98	Wt. n-Val.	0.035	0.035	0.040
W.S. Elev (ft)	360.41	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	356.42	Flow Area (sq ft)	173.53	1438.93	10.30
E.G. Slope (ft/ft)	0.001858	Area (sq ft)	213.78	1438.93	10.30
Q Total (cfs)	12222.00	Flow (cfs)	569.83	11644.75	7.42
Top Width (ft)	276.93	Top Width (ft)	92.85	150.00	34.08
Vel Total (ft/s)	7.53	Avg. Vel. (ft/s)	3.28	8.09	0.72
Max Chl Dpth (ft)	11.41	Hydr. Depth (ft)	2.41	9.59	0.30
Conv. Total (cfs)	283512.0	Conv. (cfs)	13218.3	270121.6	172.1
Length Wtd. (ft)	80.00	Wetted Per. (ft)	72.21	154.76	34.13
Min Ch El (ft)	349.00	Shear (lb/sq ft)	0.28	1.08	0.04
Alpha	1.11	Stream Power (lb/ft s)	0.92	8.73	0.03
Frctn Loss (ft)	0.31	Cum Volume (acre-ft)	11.22	37.79	22.48
C & E Loss (ft)	0.25	Cum SA (acres)	2.42	5.83	11.35

Plan: Plan 01 Austin St Austin St RS: 1600 Profile: Q500

	Pos	Left Sta	Right Sta	Flow	Area	W.P.	Percent	Hydr	Velocity
		(ft)	(ft)	(cfs)	(sq ft)	(ft)	Conv	Depth(ft)	(ft/s)
1	LOB	0.00	47.00	0.00	40.24	21.15	0.00	1.93	0.00
2	LOB	47.00	83.00	335.22	95.92	36.00	2.74	2.66	3.49
3	LOB	83.00	119.00	234.62	77.61	36.20	1.92	2.16	3.02
4	Chan	119.00	169.00	3462.62	453.52	52.61	28.33	9.07	7.64
5	Chan	169.00	219.00	4863.10	544.85	50.00	39.79	10.90	8.93
6	Chan	219.00	269.00	3319.03	440.57	52.14	27.16	8.81	7.53
7	ROB	269.00	301.50	7.41	10.23	32.55	0.06	0.31	0.72
8	ROB	301.50	334.00	0.01	0.06	1.58	0.00	0.04	0.18

Plan: Plan 01 Austin St Austin St RS: 1523.5 Profile: Q500

E.G. US. (ft)	361.38	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	360.41	E.G. Elev (ft)	360.82	360.22
Q Total (cfs)	12222.00	W.S. Elev (ft)	357.38	356.67
Q Bridge (cfs)	12222.00	Crit W.S. (ft)	357.38	356.74
Q Weir (cfs)		Max Chl Dpth (ft)	10.48	10.07
Weir Sta Lft (ft)		Vel Total (ft/s)	14.89	15.12
Weir Sta Rgt (ft)		Flow Area (sq ft)	820.97	808.29
Weir Submerg		Froude # Chl	1.00	1.02
Weir Max Depth (ft)		Specif Force (cu ft)	8989.07	8881.71
Min EI Weir Flow (ft)	364.27	Hydr Depth (ft)	6.89	6.88
Min EI Prs (ft)	362.20	W.P. Total (ft)	152.74	149.39
Delta EG (ft)	2.85	Conv. Total (cfs)	106946.6	105761.7
Delta WS (ft)	3.52	Top Width (ft)	119.07	117.52
BR Open Area (sq ft)	1354.26	Frctn Loss (ft)		0.68
BR Open Vel (ft/s)	15.12	C & E Loss (ft)		0.00
Coef of Q		Shear Total (lb/sq ft)	4.38	4.51
Br Sel Method	Energy only	Power Total (lb/ft s)	65.24	68.21

Plan: Plan 01 Austin St Austin St RS: 1523.5 BR U Profile: Q500

	Pos	Left Sta	Right Sta	Flow	Area	W.P.	Percent	Hydr	Velocity
		(ft)	(ft)	(cfs)	(sq ft)	(ft)	Conv	Depth(ft)	(ft/s)
1	Chan	104.03	159.46	1111.18	115.13	37.85	9.09	3.70	9.65
2	Chan	159.46	214.89	8385.90	493.86	69.57	68.61	9.50	16.98
3	Chan	214.89	270.32	2724.92	211.98	45.33	22.30	5.90	12.85

Bingham #2027
500-Yr Event

Contraction Scour

	Left	Channel	Right
Input Data			
Average Depth (ft):	0.64	8.87	0.69
Approach Velocity (ft/s):	1.32	7.56	1.23
Br Average Depth (ft):		6.89	
BR Opening Flow (cfs):		12222.00	
BR Top WD (ft):		119.07	
Grain Size D50 (mm):		5.00	
Approach Flow (cfs):	21.92	12050.05	150.03
Approach Top WD (ft):	26.06	179.78	176.22
K1 Coefficient:	0.590	0.640	0.590
Results			
Scour Depth Ys (ft):		4.80	
Critical Velocity (ft/s):		4.09	
Equation:		Live	

Pier Scour

All piers have the same scour depth

Input Data

Pier Shape:	Sharp nose
Pier Width (ft):	4.60
Grain Size D50 (mm):	5.00000
Depth Upstream (ft):	10.90
Velocity Upstream (ft/s):	8.93
K1 Nose Shape:	1.00
Pier Angle:	10.00
Pier Length (ft):	66.00
K2 Angle Coef:	2.07
K3 Bed Cond Coef:	1.10
Grain Size D90 (mm):	40.00000
K4 Armouring Coef:	0.40

Set K1 value to 1.0 because angle > 5 degrees

Results

Scour Depth Ys (ft):	8.24
Froude #:	0.48
Equation:	CSU equation

Abutment Scour

	Left	Right
Input Data		
Station at Toe (ft):	122.87	245.75
Toe Sta at appr (ft):	87.62	245.08
Abutment Length (ft):	33.68	191.92
Depth at Toe (ft):	2.88	7.08
K1 Shape Coef:	0.55 - Spill-through abutment	
Degree of Skew (degrees):	127.00	90.00
K2 Skew Coef:	1.05	1.00
Projected Length L' (ft):	26.90	191.92
Avg Depth Obstructed Ya (ft):	1.92	1.38
Flow Obstructed Qe (cfs):	337.90	1214.80
Area Obstructed Ae (sq ft):	64.80	265.40
Results		
Scour Depth Ys (ft):	8.02	12.82

Qe/Ae = Ve:	5.21	4.58
Froude #:	0.66	0.69
Equation:	Froehlich	Froehlich

Combined Scour Depths

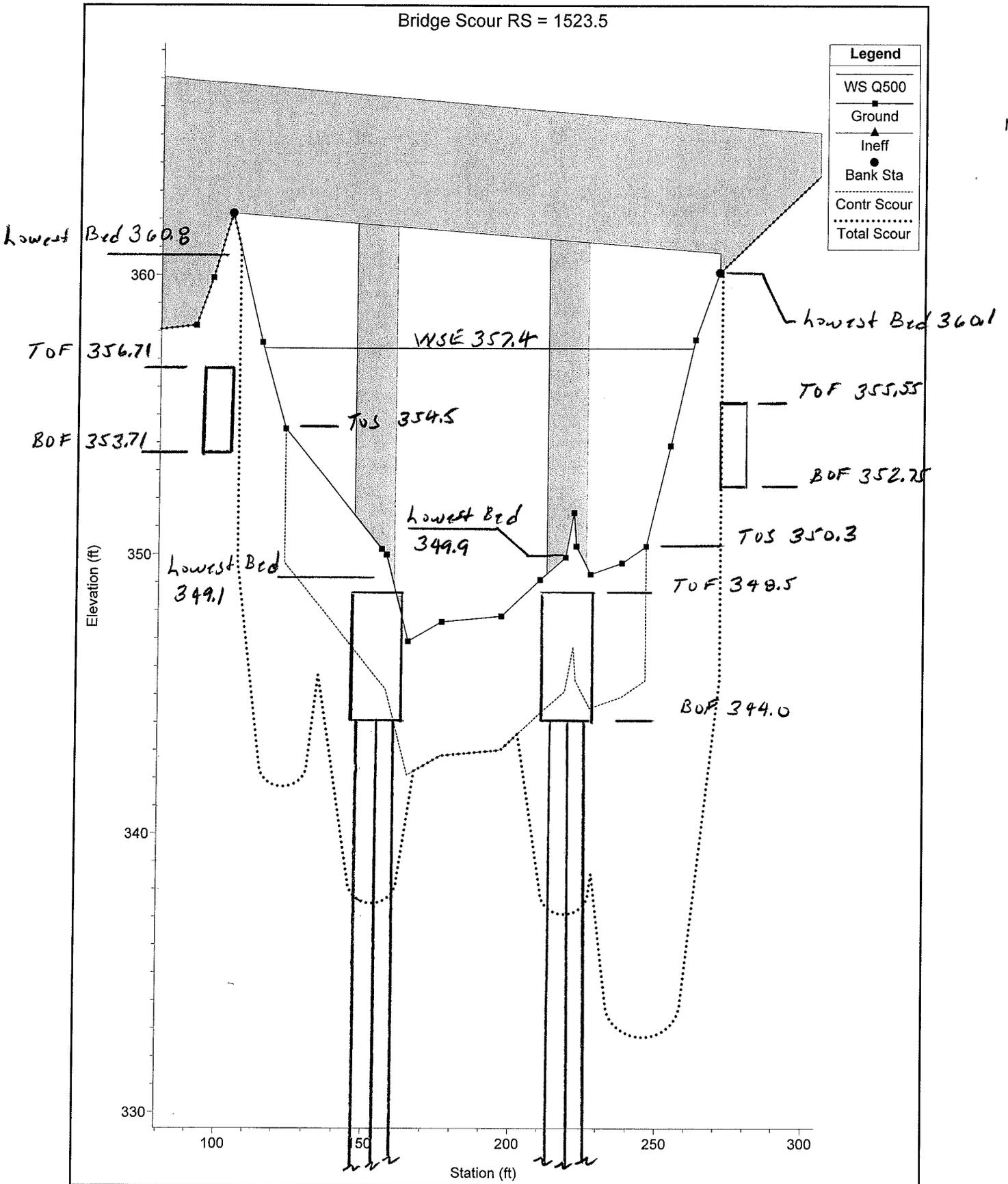
Pier Scour + Contraction Scour (ft):	Channel:	13.04
Left abutment scour + contraction scour (ft):	12.81	
Right abutment scour + contraction scour (ft):	17.61	

	L. Abut	Pier 1	Pier 2	R. Abut
lowest Bed	360.8	349.1	349.9	360.1
Scour Depth	<u>12.8</u>	<u>13.0</u>	<u>13.0</u>	<u>17.6</u>
	348.0	336.1	336.9	342.5

Bingham #2027

500-Yr Event

Bridge Scour RS = 1523.5



Pile Tip EL 314±