Lower Main St. Crossing of James Creek
Design Team

RockSol Consulting Group, Inc.

Project Principal - Miranda Lange, P.E.
Project Manager - Dan Tuttle, P.E.
Structural Engineer - Steven Lykens, P.E.
Geotechnical Engineer - Ryan Lepro, P.G.
Roadway Design - Dan Tuttle, P.E.

Lead Hydraulics - Anthony Alvarado, P.E.
Hydraulics Engineer - James Hitchman, P.E.

BCA Analysis - Steve Pardue
Project Background

After the 2013 floods, the Town applied for and received a FEMA Hazard Mitigation Program Grant (HMGP) to analyze the Lower Main St. crossing of James Creek.

After the proposal and interview process, our team was awarded this project in late May 2016.

The main objective of this project, is to: *Increase the capacity of the creek crossing to pass the 100-year storm event to reduce the risk of similar damage in a future flood.*

The major scope items that our team has been tasked with includes (but is not limited to):

- Topographic Survey
- Hydrology/hydraulic analysis for existing and proposed conditions
- Geotechnical investigations and reporting
- Develop alternatives for proposed improvements
- Benefit Cost Analysis (BCA)
- 60% design plans, specifications, and estimate
Progression of Project

2016

May
- Awarded Project
- Finalizing Contract & Subcontracts

June
- Data Collection (LOMR data, utilities, Hydrology & Hydraulic Analysis of Existing Conditions

July
- Hydraulic Analysis for existing conditions continued
- Field Survey Done & Received Topographic Survey

August
- Hydraulics for existing conditions complete; begin analyzing proposed conditions.
- Geotechnical Bores Done (Bedrock ~23’ Deep)
- Begin preliminary design for 3 alternatives

September
- Public Involvement & Town Board Presentation
- BCA Analysis

October
- Direction from Town Board for selected design alternative
- Begin 60% design upon receiving Town Board Approval
Project Information

Definition(s):

**Freeboard** - This is the distance between the water surface elevation and the bottom of the bridge. Freeboard is important because it correlates with the ability to pass floating debris. If we can pass floating debris, there is a high likelihood that the bridge does not get plugged and then flanked.

**Clear Flow** - This represents the flow of water that passes under the bridge with NO debris.

**Debris Flow** - This represents the flow of water that passes under the bridge with debris.

**Hydraulics & Hydrology:**

**Hydraulic Modeling** - It is difficult to model debris flow, but as a standard practice, 2 or more feet of freeboard is used as a target during design.
Initial Alternatives

- Option 1 - Remove and Replace Bridge
- Option 2 - Raise Existing Bridge Deck
- Option 3 - Additional Span

Discarded

- Remove and Relocate Bridge Downstream - VCUP issues at Elysian Park and private property impacts
- Fuse Plug - Difficult to design for the unknown & didn’t solve problem.
- Widen and Raise Existing Bridge - High cost and difficult to design with no as-built plans.

- Do nothing

Existing Bridge
Existing Bridge

PROS
- No construction needed.
- No construction impact to private property.

CONS
- Does not pass 100-year flow.
- Shallow spread footings that are vulnerable to failure during a 50 & 100-year storm.
- Old bridge built in 80s with approximately 20 years left on its lifespan (assuming properly maintained).

Estimated Cost:
Future maintenance costs needed includes: deck rehab, spalling, future storm damage, etc.

FREEBOARD DURING 100-YEAR EVENT

Approximate level of debris

WATER SURFACE ELEVATION

-23’ to bedrock

Freeboard Per Storm Event:
- 100-Year = 0 FT
- 50-Year = 0 FT
- 10-Year = 2.4’
Existing Conditions - 100 Year Event (Clear Flow - No Debris)

Breakout Flow (This is independent of bridge, and will happen in all scenarios)

Fire Station

Bridge Location

Breakout Flow (This is independent of bridge, and will happen in all scenarios)

Breakout flow down Lower Main (Approximately 200 cfs)

James Creek Flow (cfs)
500-year event = 4834
100-year event = 2777
50-year event = 2095
25-year event = 1502
10-year event = 912
Existing Conditions - 50 Year Event (Clear Flow - No Debris)

- Breakout Flow (This is independent of bridge, and will happen in all scenarios)
- Bridge Location
- Fire Station
- Breakout flow down Lower Main

James Creek Flow (cfs)
- 500-year event = 4834
- 100-year event = 2777
- 50-year event = 2095
- 25-year event = 1502
- 10-year event = 912
Existing Conditions - 10 Year Event (Clear Flow - No Debris)

- Breakout Flow (This is independent of bridge, and will happen in all scenarios)
- Fire Station
- Bridge Location
- Breakout flow down Lower Main

James Creek Flow (cfs)
- 500-year event = 4834
- 100-year event = 2777
- 50-year event = 2095
- 25-year event = 1502
- 10-year event = 912
Option 1 - New Bridge

**PROS**
- Passes 100-year, clear flow
- Passes 100-year, debris flow
- Design life of new bridge would be 75 years.
- Constructible under current grant, except for the demolition costs.

**CONS**
- Increases driveway slopes & requires moderate channel excavation.
- Requires a small amount of property acquisition or permanent easements.
- Highest construction cost, but still eligible under the current grant.

**Estimated Construction Cost:**
$1,033,443* (includes 30% Contingency)
*Cost does not include: Final design, Town administration costs, construction management costs, property or easement acquisition.

**FREEBOARD DURING 100-YEAR EVENT**

Approximate level of debris:

- 100-Year = 2.2 FT
- 50-Year = 2.9 FT
- 10-Year = 5.0’
Option 1 - New Bridge
Option 1 - 100 Year Event (Clear Flow - No Debris)

- Breakout Flow (This is independent of bridge, and will happen in all scenarios)
- Fire Station
- Bridge Location
- Breakout flow down Lower Main St. eliminated

James Creek Flow (cfs)
- 500-year event = 4834
- 100-year event = 2777
- 50-year event = 2095
- 25-year event = 1502
- 10-year event = 912
Option 1 - 50 Year Event (Clear Flow - No Debris)

- Breakout Flow (This is independent of bridge, and will happen in all scenarios)
- Fire Station
- Bridge Location
- Breakout Flow (This is independent of bridge, and will happen in all scenarios)
- Breakout flow down Lower Main St. eliminated

James Creek Flow (cfs)
- 500-year event = 4834
- 100-year event = 2777
- 50-year event = 2095
- 25-year event = 1502
- 10-year event = 912
Option 2 - Raise Existing Bridge Deck

**Pros**
- Passes 25 & 50-year, clear flow.
- Passes 25-year, debris flow.
- Minimal channel grading.

**Cons**
- Does not pass 100-year, clear flow.
- Does not pass 100-year, debris flow.
- Unlikely to pass 50-year debris flow.
- Requires retrofitting deep foundations.
- Increases driveway slopes.
- Requires a small amount of property acquisition or permanent easements.

**Estimated Construction Cost:**
$663,287* (includes 30% Contingency)

*Cost does not include: Final Design, Town administration costs, construction management costs.

**Freeboard Per Storm Event:**
- 100-Year = 0 FT
- 50-Year = 0.5 FT
- 10-Year = 3.6’
Option 2 - Raise Existing Bridge Deck
Option 2 - 100 Year Event (Clear Flow - No Debris)

- Breakout Flow (This is independent of bridge, and will happen in all scenarios)
- Fire Station
- Bridge Location
- Breakout flow down Lower Main

James Creek Flow (cfs)
- 500-year event = 4834
- 100-year event = 2777
- 50-year event = 2095
- 25-year event = 1502
- 10-year event = 912
Option 2 - 50 Year Event (Clear Flow - No Debris)

- Breakout Flow (This is independent of bridge, and will happen in all scenarios)

  - Fire Station
  - Bridge Location
  - Breakout flow down Lower Main

- James Creek Flow (cfs)
  500-year event = 4834
  100-year event = 2777
  50-year event = 2095
  25-year event = 1502
  10-year event = 912
Option 3 - Additional Span

**PROS**
- Passes 100-year, clear flow.
- Constructible under current grant.

**CONS**
- Does not pass 100 or 50-year flow, debris flow.
- Creates a center pier that may catch debris.
- Requires retrofitting deep foundations.
- Increases driveway slopes & requires significant channel excavation.
- Requires property acquisition or permanent easements.

**Estimated Construction Cost:**
$906,737* (w/30% Contingency)

*Cost does not include: Final Design, Town administration costs, construction management costs, property or easement acquisitions.

**Freeboard Per Storm Event:**
- 100-Year = 0.7 FT
- 50-Year = 1.5 FT
- 10-Year = 3.2’
Option 3 - Additional Span
Section 3 - 100 Year Event (Clear Flow - No Debris)

- Breakout Flow (This is independent of bridge, and will happen in all scenarios)
  - Fire Station
  - Bridge Location

- Breakout flow down Lower Main eliminated

- James Creek Flow (cfs)
  - 500-year event = 4834
  - 100-year event = 2777
  - 50-year event = 2095
  - 25-year event = 1502
  - 10-year event = 912
Section 3 - 50 Year Event (Clear Flow - No Debris)

- Breakout Flow (This is independent of bridge, and will happen in all scenarios)

- Fire Station

- Bridge Location

- Breakout Flow (This is independent of bridge, and will happen in all scenarios)

- Breakout flow down Lower Main eliminated

- James Creek Flow (cfs)
  - 500-year event = 4834
  - 100-year event = 2777
  - 50-year event = 2095
  - 25-year event = 1502
  - 10-year event = 912
Summary of Alternatives

DO NOTHING - EXISTING BRIDGE
- Does not help to address the problem (Existing Bridge does not pass the 100-year storm and has shallow foundations that are vulnerable to scour during a 50 or 100-year event.
- No upfront cost, but will require maintenance & inspection costs in the near future.

OPTION 1 - NEW BRIDGE
- Helps to address the problem (Passes 100-Year Flow & Provides Required Freeboard).
- Construction Cost = $1,033,442 (FEMA grant money does not cover $$ for demolition).

OPTION 2 - RAISE EXISTING BRIDGE
- Does not help to address the problem (Does not pass clear flow and does not provide enough freeboard to allow floating debris to pass).
- Construction Cost = $663,287 (Feasible to construct under FEMA grant program).

OPTION 3 - ADDITIONAL SPAN
- Does not help to address the problem (Does not provide enough freeboard to allow floating debris to pass and center pier creates catchment point for debris).
- Construction Cost = $906,737 (Feasible to construct under FEMA grant program).
Benefit Cost Analysis

In order to obtain FEMA Phase 2 funding for this project, we must justify our proposed alternative & cost through a Benefit Cost Analysis (BCA).

The following items are just a few of the costs evaluated in the BCA:

- Loss of life
- Injuries
- Property Damage
- Damage to public infrastructure
- Cost of future maintenance

Each of these items have an assigned dollar amount that is used to determine whether or not the benefits of the new improvements outweigh the cost of the bridge alternative.
Design Team Recommendation

After fully investigating and analyzing the existing conditions and potential alternatives, the RockSol team recommends that the Town pursue Option 1 - New Bridge.

While the other options do provide some benefits, only this option attempts to fully address the problem, which is to: *Increase the capacity of the creek crossing to pass the 100-year storm event to reduce the risk of similar damage in a future flood.*
Next Steps

- Town Board direction on preferred alternative - October 3, 2016
- Prepare 60% design plans, specification, and estimate - October - December 2016
- Finalize BCA analysis, Hydraulics & Geotechnical work - October - December 2016
- Submit final package to FEMA for approval and award of Phase 2 funding to proceed with final design and construction - December 23, 2016
Thank You!

QUESTIONS??