Bruce Johnson

From: Doug Newton <newtontechnicalservices@charter.net>
Sent: Tuesday, March 17, 2015 1:01 PM
To: Bruce Johnson
Subject: Fw: Estimates and Scopes of Work for E. Montpelier, TH 47 Murray Road

Hi Bruce,
One thing I failed to mention in the previous email is the fact that even if the town decides to go with the plate pipe arch, (the cheaper of the 2 options), it too would have a "natural bottom" similar to the single radius arch.

Not only would the invert be buried, but working in conjunction with each other, ANR and AOT have developed a "spec" for what type of Streambed Stone Fill material would be used when burying the invert.

They developed 4 types, Type 1, 2, 3, & 4, with each type increasing in size of material. Even though the new structure is sized based on a Q25 flow, the type that you use is dictated by what you would have for outlet velocities based on a Q50 discharge.

So in the end, it is a "natural bottom" with the material sized properly for those specific conditions.

Just so you know.

Doug

----- Original Message -----
From: Doug Newton
To: Bruce Johnson
Sent: Monday, March 16, 2015 5:25 PM
Subject: Estimates and Scopes of Work for E. Montpelier, TH 47 Murray Road

Hi Bruce,
I've been to the site and looked things over a bit; naturally there's a lot of snow but I was able to get a few measurements and estimated a few others to try and put some numbers together.

I talked with Justin Hadley who put the hydraulics report together; the report mentions both 40 sf and 43 sf of waterway area so I just wanted to make sure we were all on the same page. He told me that he was looking for 40 sf in the end and that the 43 sf was a typo on his part.

Before I ventured too far down the road of putting an estimate together, I also talked with River Mgmt. Engineer Jaron Borg about how much he felt the invert had to be buried. The hydraulics report mentioned 24" but Jaron uses 30% of the height of the structure and won't issue a permit unless that criteria is met.

The estimates are based on VAOT's 2011 Specifications as well as their most recent (January 2010 - December 2014) 5-year average of the bid prices for the items involved.

I dug out an area where I could measure from face of guard rail to face of guard rail; that measurement was nearly 21' so my estimates are based on a rail to rail width of 22' with 3' of material behind each face of rail before the slope starts down.

Option 1: Use an aluminum pipe arch and bury the invert to meet ANR requirements:

Using the 24" embedment, I had originally looked at using an aluminum plate pipe arch with a span of 11'-1" and a rise of 7'-0"; it has an original area of 61.4 sf and when buried 24" it still has 43.15 sf so it would work.

Using Jaron's factor of 30%, the invert would be buried 25.2" (30% of 84", i.e. 7'). I ran the program using an embedment of 26", and the remaining area is 41.61 sf so it's still good. In addition, it meets the criteria of having a minimum clear span of 10' which is called for in the hydraulics report.

Jaron is not requiring baffles in this new structure; being buried over 2' should be sufficient to retain most of the streambed material during a large event.

I've talked with Steve Wolf at CONTECH and told him what we would need for a length of that sized structure and he has provided a price for that new structure.

The unit price shown for assembly was furnished by CONTECH and is what they would charge if they hired one of their subcontractors to come and do the assembly work.

These structures are made from structural aluminum plate and come as a series of 54" wide individual plates that are bolted together in the field. We've done three in Calais over the last few years and have done one in Cabot as well.

Calais did their first 2 structures like this by hiring CONTECH to do it. Since then they have assembled and set another similar type structure on their own. The one we used in Cabot was assembled by the contractor; they had not done any of that type of work before but found it to be fairly easy to do.

They're structurally sound yet relatively lightweight so they can be set with an excavator rather than needing a crane to do it.

The headwalls and wingwalls are also made from the same material; they're bolted together and are then bolted to the pipe arch itself. Both the headwalls and wingwalls have anchor rods; the ones that stabilize the headwall run back and connect to reinforcing ribs on the top of the pipe; the ones that are connected to the wingwalls attach to the back side of a wale beam that runs horizontally across the front of the wingwall, and the other end connects to an anchor plate buried in the slope.

I've attached a couple of pictures from the project we did in 2013 on Mack Mountain Road in Cabot job to give you an idea of the process. A couple of the pictures show the roof panels left off; that's done so that once it's set in place, the streambed stone fill material can be added. Once that work is done, the roof panels are installed and the backfilling and compaction is finished up

As you know, Jeff Cueto has asked that we also investigate an open bottom structure as part of this process. I looked into using a single radius arch to comply with his request.

Option 2: Use an open bottom aluminum single radius arch:

A single radius arch is an open bottom type of structure; the one selected to use at this site has a span of 10'-0", a rise of 5'-3", provides 41 sf of waterway area, and would need to be 42' long.

This structure also comes as a series of plates and, although not as many plates as the pipe arch (because it is open bottom), still needs to be assembled on site. The plates are bolted together with hardware supplied by CONTECH.

Because it is an open bottom structure, it needs to be supported on a pair of reinforced concrete walls; those walls are supported by reinforced concrete footings, the bottom of which are 6' below streambed grade.

The headwalls and wingwalls are also constructed using reinforced concrete and all exposed concrete is treated with silane, a water repellent used to seal new concrete.

When you look at both estimates, this option is somewhat more expensive; the cost of the single radius arch arch and the assembly is less, and there is less excavation and backfill material needed than the plate pipe arch, **BUT** it's the concrete, rebar, formwork, etc. that drives the cost up.

As you will see, the majority of the items involved are common to both options.

I developed a Scope of Work for both options and those are attached as well.

This email didn't start out to be this long but I hope it explains the 2 options clearly; if not, please let me know and I will try and answer any questions you may have.

Thanks,
Doug

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Town of East Montpelier, TH No. 47, Murray Road over Brook

Proposed Scope of Work re: Aluminum Plate Pipe Arch

1. Dig-Safe Project Area including where Detour Signs will be Installed
2. Erect Detour Signs, Notify Appropriate Entities including City of Montpelier and Close Road to Thru Traffic
3. Mobilize and Erect Construction Signs/Barricades in Area of Project
4. Remove Existing Steel Beam Guard Rail
5. Implement Erosion Prevention and Sediment Control Measures
6. Excavate, Install Temporary Stream Diversion and Remove Existing 48" RCP
7. Assemble New 11'-1" x 7'-0" x 45' Aluminum Plate Pipe Arch, Headwalls and Wingwalls (Leaving 2-3 Roof Panels out of Pipe Arch)
8. Excavate for New Aluminum Plate Pipe Arch, Headwalls and Wingwalls
9. Install New Pipe Arch in Place
10. Place Streambed Stone Fill, Type E2 in Invert and Install Remaining Roof Panels
11. Install Headwall and Wingwall Panels
12. Backfill and Compact Area Around Pipe Arch, Headwalls and Wingwalls; Install Anchors for Headwalls and Wingwalls as Backfill Operations Progress
13. Place Geotextile under Stone Fill; Place Stone Fill, Type II around and in front of New Headwalls and Wingwalls and on Slope to 1' above Top of Pipe
14. Remove Temporary Stream Diversion, Turn Water Back Into Original Channel and thru New Structure
15. Backfill and Compact Excavated Portion of Murray Road up to Subgrade
16. Place, Grade and Compact Subbase of Gravel and Aggregate Surface Course
17. Install Steel Beam Guard Rail and Anchors for Steel Beam Guard Rail
18. Grade Thru Construction Area and Begin Cleanup Operations
19. Remove Detour Signs and Open Road to Traffic

Town of East Montpelier, TH No. 47, Murray Road over Brook

Proposed Scope of Work re: Aluminum Plate Pipe Arch (cont'd.)

20. Provide Turf Establishment on all Affected Areas

21. Remove Construction Signs and Demobilize

East Montpelier, TH 47 (Murray Road) over Brook					
	Remove 48"RCP and Install New 11'-1" x 7'-0" x 40'-6"' Plate Pipe Arch				
Item No.	**Item Name**	**Quantity**	**Unit**	**Unit Price**	**Total**
203.15	Common Excavation	65	CY	$ 8.44	$ 548.60
204.25	Structure Excavation	350	CY	$ 21.21	$ 7,423.50
204.30	Granular Backfill for Structures	250	CY	$ 35.75	$ 8,937.50
301.15	Subbase of Gravel	60	CY	$ 27.55	$ 1,653.00
401.10	Aggregate Surface Course	30	CY	$ 37.21	$ 1,116.30
529.15	Removal of Structure	1	EACH	$ 500.00	$ 500.00
613.11	Stone Fill, Type II	40	CY	$ 36.25	$ 1,450.00
621.20	Steel Beam Guard Rail, Galvanized	150	LF	$ 15.58	$ 2,337.00
621.60	Anchor for Steel Beam Guard Rail	4	EACH	$ 678.18	$ 2,712.72
621.80	Removal and Disposal of Guard Rail	150	LF	$ 1.36	$ 204.00
635.11	Mobilization/Demobilization (7%)	1	LUMP SUM	$ 5,547.98	$ 5,547.98
641.10	Traffic Control	1	LUMP SUM	$ 3,000.00	$ 3,000.00
649.31	Geotextile Under Stone Fill	75	SY	$ 2.19	$ 164.25
	New 11'-1" x 7'-0" x 40'-6" Aluminum Plate Pipe Arch	1	LUMP SUM	$ 30,150.00	$ 30,150.00
	Assembly of New Plate Pipe Arch	1	LUMP SUM	$ 10,000.00	$ 10,000.00
	Streambed Stone Fill, Type E2	33	CY	$ 70.00	$ 2,310.00
	Temporary Diversion of Stream	1	LUMP SUM	$ 3,500.00	$ 3,500.00
	Erosion Prevention & Sediment Control	1	LUMP SUM	$ 2,000.00	$ 2,000.00
	Turf Establishment	1	LUMP SUM	$ 1,250.00	$ 1,250.00
				Total	**$ 84,804.85**

Town of East Montpelier, TH No. 47, Murray Road over Brook

Proposed Scope of Work re: Single Radius Arch

1. Dig-Safe Project Area including where Detour Signs will be Installed
2. Erect Detour Signs, Notify Appropriate Entities including City of Montpelier and Close Road to Thru Traffic
3. Mobilize and Erect Construction Signs/Barricades in Area of Project
4. Remove Existing Steel Beam Guard Rail
5. Implement Erosion Prevention and Sediment Control Measures
6. Excavate, Install Temporary Stream Diversion and Remove Existing 48" RCP
7. Excavate for New Single Radius Arch and Concrete Footings
8. Set Formwork, Place & Tie Reinforcing Steel and Pour Concrete Footings
9. Set Formwork, Place & Tie Reinforcing Steel and Pour Concrete Stem Walls
10. Provide Curing for all Concrete Work
11. Strip Formwork, Backfill and Compact Around Footings and Stem Walls
12. Assemble Single Radius Arch and Set in Place on top of Stem Wall
13. Backfill and Compact Area Around Arch
14. Excavate, Set Formwork, Place & Tie Reinforcing Steel and Pour Concrete Headwalls and Wingwalls
15. Provide Curing for all Concrete Work
16. Strip Formwork, Backfill and Compact Around Headwalls and Wingwalls
17. Place Geotextile under Stone Fill; Place Stone Fill, Type II around and in front of New Headwalls and Wingwalls and on Slope to 1' above Top of Arch
18. Remove Temporary Stream Diversion, Turn Water Back Into Original Channel and thru New Structure
19. Backfill and Compact Excavated Portion of Murray Road up to Subgrade
20. Place, Grade and Compact Subbase of Gravel and Aggregate Surface Course

Town of East Montpelier, TH No. 47, Murray Road over Brook

Proposed Scope of Work re: Single Radius Arch (cont'd.)

21. Install Steel Beam Guard Rail and Anchors for Steel Beam Guard Rail

22. Grade Thru Construction Area and Begin Cleanup Operations

23. Remove Detour Signs and Open Road to Traffic

24. Provide Turf Establishment on all Affected Areas

25. Remove Construction Signs and Demobilize

East Montpelier, TH 47 (Murray Road) over Brook					
	Remove 48"RCP and Install New 10'-0" x 5'-3" x 42' Single Radius Arch				
Item No.	**Item Name**	**Quantity**	**Unit**	**Unit Price**	**Total**
203.15	Common Excavation	65	CY	$ 8.44	$ 548.60
204.25	Structure Excavation	310	CY	$ 21.21	$ 6,575.10
204.30	Granular Backfill for Structures	175	CY	$ 35.75	$ 6,256.25
301.15	Subbase of Gravel	60	CY	$ 27.55	$ 1,653.00
401.10	Aggregate Surface Course	30	CY	$ 37.21	$ 1,116.30
501.34	Concrete, High Performance Class B	120	CY	$ 532.16	$ 63,859.20
507.15	Reinforcing Steel	14,500	LBS	$ 1.08	$ 15,660.00
514.10	Water Repellent, Silane	10	GAL	$ 73.78	$ 737.80
529.15	Removal of Structure	1	EACH	$ 500.00	$ 500.00
613.11	Stone Fill, Type II	40	CY	$ 36.25	$ 1,450.00
621.20	Steel Beam Guard Rail, Galvanized	150	LF	$ 15.58	$ 2,337.00
621.60	Anchor for Steel Beam Guard Rail	4	EACH	$ 678.18	$ 2,712.72
621.80	Removal and Disposal of Guard Rail	150	LF	$ 1.36	$ 204.00
635.11	Mobilization/Demobilization (7%)	1	LUMP SUM	$ 8,728.60	$ 8,728.60
641.10	Traffic Control	1	LUMP SUM	$ 3,000.00	$ 3,000.00
649.31	Geotextile Under Stone Fill	75	SY	$ 2.19	$ 164.25
	New 10'-0" x 5'-3" x 42'-0" Aluminum Single Radius Arch	1	LUMP SUM	$ 8,670.00	$ 8,670.00
	Assembly of New Single Radius Arch	1	LUMP SUM	$ 2,500.00	$ 2,500.00
	Temporary Diversion of Stream	1	LUMP SUM	$ 3,500.00	$ 3,500.00
	Erosion Prevention & Sediment Control	1	LUMP SUM	$ 2,000.00	$ 2,000.00
	Turf Establishment	1	LUMP SUM	$ 1,250.00	$ 1,250.00
				Total	**$ 133,422.82**