Prepared For:

## **TOWN OF BRATTLEBORO, VERMONT**



# BLACK MOUNTAIN FEASIBILITY STUDY FINAL REPORT

## **FEBRUARY 2013**

Prepared By:



125 College Street, 4<sup>th</sup> Floor Burlington, Vermont

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#### **Black Mountain Feasibility Study Final Report**

From:Hoyle, Tanner & AssociatesDate:February 22, 2013Subject:Town of Brattleboro, VTBlack Mountain Sewer Alternatives Assessment

#### Introduction

The Black Mountain Pump Station, located on Black Mountain Road, was constructed in 1976. It accepts flow from a residential area, which includes a university and a mobile home park located adjacent to the station. The station has an exterior manhole that receives flow from an eight (8) inch vitrified clay pipe (VCP) pipe, a six (6) inch pipe from the mobile home park and a floor drain from the Pump Station. The station discharges through a six (6) inch cast iron pipe (CIP) force main, over Interstate 91 (I-91) and to a gravity sewer that flows south along Route 5 to the Spring Tree Pump Station. There are two compressors and two 150 gallon per minute (gpm) receiver tanks in the existing station. Due to the age of the equipment, problems with maintenance, a lack of adequate ventilation, over heating of the station and access concerns, a comprehensive upgrade of the Black Mountain Pump Station has been designed in conjunction with the Brattleboro Wastewater Treatment Facility (WWTF) Upgrade design project.

The concept of eliminating the Black Mountain Pump Station and conveying flow by gravity under I-91 has been identified. At the direction of the Town of Brattleboro, Hoyle, Tanner & Associates, Inc. (Hoyle, Tanner) was contracted to evaluate the feasibility of this concept and better understand what would be involved with the removal of the Black Mountain Pump Station and installation of sewage conveyance under the highway.

#### Alternatives Identification

#### Alternative 1: Upgrade Existing Pump Station with a New Pump Station

Due to the problems identified above, a comprehensive upgrade of the Black Mountain Pump Station has been designed. For the purposes of this assessment, Alternative 1 is based on this design. This upgrade would include new submersible pumps designed to meet the flow requirements of 560 gpm and 60 feet of TDH, construction of a new wet well and related site work, replacement of the existing generator, and electrical, heating, ventilation and plumbing improvements. This upgrade would utilize the existing collection system and Pump Station discharge.

#### Alternative 2: Replace Existing Pump Station with a Gravity Sewer

Under this alternative, the existing pump station would be abandoned and a gravity sewer would be installed that connects the sewer manhole upstream of the existing pump station to an existing manhole in the collection system on the east side of I-91. This gravity sewer pipe would be installed using a combination of trenchless technology and open cut installation. An entrance and receiving pit, or staging area as needed, would be excavated on either side of I-91 to install the pipe and sleeve. After this work is completed, the existing pump station would be demolished. The following discussion assesses the feasibility of installing this sewer line to flow by gravity into the collection system.

#### Analysis of Existing Information

Hoyle, Tanner has reviewed existing information provided by the Town of Brattleboro, including

as-built drawings and utility and maintenance bills. Using this information, Hoyle, Tanner confirmed that there is an adequate grade change between invert elevations in a manhole adjacent to the existing pump station and a receiving manhole on the east side of I-91. Hoyle, Tanner then coordinated with DiBernardo Associates to perform a topographical survey of the area to define site grading, locate existing infrastructure, and to assess potential sewer pipe locations (see Appendix A for the survey). Hoyle, Tanner visited the site and, with the survey information, determined that a potential sewer pipe would be best located to the north of the Black Mountain Road bridge due to grading on the west side of I-91 and existing utilities on the east side of I-91 south of Black Mountain Road.

As described in the Hoyle, Tanner Black Mountain Sewer Alternatives Assessment Design Memo, dated 11/8/11, the original concept for Alternative 2 included performing directional drill/auger only through the I-91 right-of-way (ROW) to minimize anticipated construction costs. When comparing the proposed sewer pipe grade to the survey data, however, it became clear that open cut pipe installation on the east side of I-91 just outside of the ROW would result in a relatively deep excavation in proximity to the Locust Ridge Cemetery. Due to anticipated high costs for the excavation, potential concerns digging in proximity to the cemetery, and traffic control considerations, alternatives for terminating the directional drill/auger portion of the sewer pipe on the east side of I-91 were considered.

Hoyle, Tanner met on-site with Engineers Construction, Inc. (ECI) of Williston, VT, as they specialize in trenchless technologies. At this site visit, it was determined to locate the trenchless pipe installation termination in a flat area to facilitate access during construction. The VFW parking lot was identified on the east side of I-91 and an area adjacent to the Tri-Park playground was identified on the west side of I-91 as meeting this criteria. These locations appear to be adequate for transitioning from trenchless technology to open cut pipe installation. This would result in a longer trenchless pipe laying length but is the recommended alternative for the reasons stated above. The proposed alignment, including sections of open cut pipe installation for improved constructability, is included in Appendix B. Note that final alignment of the proposed sewer pipe will be confirmed with Vermont Agency of Transportation (VTRANS) during final design.

With the proposed alignment of the sewer pipe, Hoyle, Tanner reviewed the survey for potential conflicts. Hoyle, Tanner identified that the pipe in this alignment would cross the culvert under I-91 that carries Sargent Brook. The brook crosses in a 11.5' x 7.4' corrugated metal culvert. It was determined that the proposed sewer pipe could not go over the top of the culvert and maintain the VTRANS minimum depth requirements (5' minimum from finish grade to top of sleeve), so the proposed pipe will have to be installed below the culvert. Hoyle, Tanner also confirmed that the proposed alignment would not conflict with the Black Mountain Road bridge abutments. It should be noted that a portion of the proposed sewer alignment is outside the limits of the survey area. No potential conflicts were observed during the on-site review.

Plans for the construction of I-91 were obtained from VTRANS, however, existing information regarding the soils at the Black Mountain road location was limited. Therefore, Hoyle, Tanner coordinated with TransTech Drilling Services to conduct five (5) borings to gain more information on the soils in the area. These soil borings were offset from the proposed pipe route so as not to interfere with potential trenchless pipe installation (see Appendix B for soil boring locations). The soil borings revealed fine sands and silt at the elevation of the proposed sewer pipe at each boring location (see Appendix C for soil boring logs).

Based on analysis of existing information, including the survey and soil data, and discussions with ECI and VTRANS representatives, bypassing the Black Mountain Pump Station with a gravity sewer as described above under Alternative 2 appears to be technically feasible.

#### Feasibility Analysis

#### Present Worth Analysis

Hoyle, Tanner then conducted a present worth analysis, using the survey and soil data collected, to assess the economic feasibility of constructing the gravity sewer compared to constructing the Pump Station Upgrade. The present worth analysis identifies the capital costs as well as the operation and maintenance costs of the two alternatives. The operation and maintenance costs have been projected over a 20 year time frame for this analysis, at the current discount rate used by the Environmental Protection Agency, 4.125% (FY 2013), to assess the value of the project in today's dollars. Permitting and additional non-monetary considerations are also discussed herein.

For Alternative 1, the capital costs are based on the Engineer's opinion of probable cost for the construction project that has been designed. The project cost for the Pump Station Upgrade, including Contractor's overhead and profit, construction phase engineering services. contingency and escalation, assuming the project is constructed in 2013, is \$911,000 (see below for present worth analysis summary - see Appendix D for detailed analysis). Annual operating and maintenance costs, identified through analysis of utility and maintenance bills and discussions with Wastewater Treatment Facility and Department of Public Works Staff, are estimated as \$15,000. Over the 20-year period assumed for this analysis, the present worth of the Black Mountain Pump Station Upgrade is approximately \$1,113,000. Note that current operating costs are high due to the age and maintenance needs of the existing equipment. Analysis of this alternative assumes that equipment will be upgraded thereby lowering future maintenance requirements.

To develop the cost estimate for the trenchless technology portion of Alternative 2, Hoyle, Tanner worked with ECI and used the soil boring data. The cost estimate also includes additional subsurface exploration, new sewer manholes, excavation for entrance and retrieving pits for the directional drill/auger, connecting to the existing manholes, traffic control, demolition of the existing pump station, site preparation and restoration, and Contractor's mobilization and demobilization. Total project cost estimate for the gravity sewer alternative, which includes final design and construction engineering fees, Contractor's overhead and profit, contingency and escalation, assuming the project is constructed in 2013, is \$977,000 (see below for present worth analysis summary - see Appendix D for detailed analysis). Annual operating costs for the gravity sewer alternative are thought to be minor - a small place holder is included for miscellaneous tasks such as manhole clean-out, line flushing, etc. - resulting in a present worth (20-year period) of the gravity sewer alternative of approximately \$984,000.

Description of Item	Total Project Cost	Present Worth Cost
Pump Station Upgrade	\$911,000	\$1,113,000
Gravity Sewer - remove PS	\$977,000	\$984,000
	Description of Item Pump Station Upgrade Gravity Sewer - remove PS	Description of ItemTotal Project CostPump Station Upgrade\$911,000Gravity Sewer - remove PS\$977,000

Table 1: Summary of Costs for Alternatives 1 and 2

As the existing Pump Station is approximately 30 years old, Hoyle, Tanner also performed the present worth analysis over a 30-year period. The present worth of Alternative 1 and Alternative 2 then become \$1,166,000 and \$986,000, respectively. This reveals that as the annual operation and maintenance costs of Alternative 1 are higher, a longer period of use will make

Alternative 2 more attractive. Note that this longer time horizon estimate does not factor in higher costs for maintaining aging equipment, which will increase the costs of Alternative 1 even more. Furthermore, Alternative 1 would likely require significant capital investment at the end of 20-30 years.

#### Permitting

Hoyle, Tanner contacted the Agency of Natural Resources (ANR) to request that an ANR Project Review Sheet be completed for Alternative 2 (see Appendix E for ANR Project Review Sheet). The ANR Project Review Sheet identified the following permits as potentially applying to this project: stream alteration under the Water Quality Division; State-funded sewer extensions under the Facilities Engineering Division; construction within State highway ROW under VTRANS; and, Federal Permits under the U.S. Army Corps of Engineers (USACE). Hoyle, Tanner followed up with the ANR permit specialist who completed this review. ANR confirmed that Act 250 would not be applicable to this project as the total project area is less than ten acres. ANR also confirmed that as the project is not in a flood plain, wetlands, crossing the Connecticut River or having fill from the project deposited in a wetland or navigable water, the Federal USACE permit is also not applicable. ANR did identify that a construction stormwater permit would likely be required for this project.

ANR has also indicated that an amendment to the National Environmental Policy Act (NEPA) will likely be needed if Alternative 2 is selected as this represents a change from the pump station upgrade project originally proposed. After discussions with ANR, there do not appear to be any significant permitting issues with the proposed Alternative 2.

Additional Town permits may be required. Based on the survey information, easements will be needed with Tri-Park Cooperative Housing, Locust Ridge Cemetery Association, and the VFW.

#### Non-monetary considerations

The Town of Brattleboro is committed to environmental protection and minimizing its resource footprint. For this reason, the removal and replacement of the Black Mountain Pump Station with a gravity sewer that does not require ongoing pumping is attractive. The sustainability factor is an important one to consider in weighing these alternatives. Furthermore, based on preliminary discussions with Efficiency Vermont project representatives, it appears that there could be incentives available which would benefit Alternative 2. This analysis does not include these potential incentives.

Selection of Alternative 2, which includes the demolition of the existing Pump Station building, would mean that trips to the facility would no longer be necessary for daily checks and equipment maintenance. Furthermore, maintenance of the site, including lawn care and snow removal, would also no longer be required. In addition to the financial impacts of this Plant Staff will also have more time available for other important tasks.

#### **Recommendations and Conclusions**

Evaluated over a 20-year period, Alternative 2 has a lower present value than Alternative 1. It is important to note that evaluated over a 30-year period, the difference in the present value of the two alternatives grows larger. Furthermore, Alternative 1 would likely require significant capital investment at the end of 20 - 30 years.

It is estimated that Alternative 2 has a higher upfront project cost by approximately \$66,000. It is our understanding that the Town of Brattleboro has confirmed that the gravity sewer project

does not warrant a bond authority re-vote. It is anticipated that the project cost of Alternative 2, if selected, could be covered under the existing bond authorization.

There are no significant issues anticipated with the required permitting for the gravity sewer project. Furthermore, all non-monetary considerations are in favor of the gravity sewer alternative.

Based on the analysis and findings described herein, Hoyle, Tanner recommends proceeding with final design of Alternative 2. Hoyle, Tanner proposes to begin final design collecting additional subsurface information to aid Contractor's in the bidding and construction phases of the project. Hoyle, Tanner will apply for the required permits and coordinate with ANR throughout the process. Hoyle, Tanner proposes to then proceed with development of Construction Bid Documents, including Contract Drawings and Specifications for this project.

Appendix A – Topographical Survey



### SEWER STRUCTURES

1	INLET	INLET	INLET	INLET	OUTLET	OUTLET	OUTLET
5'	8" V.T.P. NORTH 304.54'	SOUTH 310.02'			 304.50'		
'8'	6" WEST 300.23'	6" V.T.P. SOUTH 300.23'	6" V.T.P. NORTH EAST 301.98'	8" NORTH 304.13'	6" SOUTHEAST 300.10'	4" EAST 309.08'	6" NORTHEAST 300.08'
20'	321.24'				321.04'		
18'	 315.93'				 314.57 <b>'</b>		
51'	283.29'				283.26'		
IESES	REFERS TO MAN	NHOLE NUMBER	ON REFERENCE	PLAN H. MANHO	LE MH#23D WAS	NOT FOUND.	

FOUND CONCRETE BOUND

4X4 0.4' HIGH VTHD

### DRAINAGE STRUCTURES

STRUCTURE NO.	RIM	INLET	OUTLET	SUMP
1	294.23	18" CMP 289.23'	18" CMP 289.09'	288.82'
2	293.05'	18" CMP 288.93'	12" CMP 288.76'	288.65 <b>'</b>
3	291.49'	FILLED WITH WATE OR OUTLET O	R. NO INLET BSERVED	284.59
4	294.23			

					BOOK 207 FAGE 299 ON MAT 10, 2001	
4/3 ELEV. = 301.22'					6. DEED FROM EMERSON A. THOMAS AND ALICIA B. T THOMAS, RECORDED IN BOOK 281 PAGE 230 ON J	HOMAS TO ARTHUR N. THOMAS AND EMILIE A. ULY 14, 2000
CK BIRCH TREE		CONT	IROL		7. DEED FROM TOWN OF BRATTLEBORO TO V.F.W. CAR BOOK 271 PAGE 271 ON DECEMBER 9, 1998	L M. DESSAINT POST 1034, INC., RECORDED IN
	POINT NO.	NORTHING	EASTING	ELEVATION	8. DEED FROM EAGLE STREET REALTY TRUST TO BRA BOOK 250 PAGE 128 ON SEPTEMBER 5, 1995	TLEBORO PUBLISHING COMPANY, RECORDED IN
11.5'X7.4' CMP —INVT = 295.50'±	3	139694.3167	1623450.8391	313.29'	9. DEED FROM VICTOR J. JOHNSON TO SANDRA K. HA MAY 20, 1992	RRIS, RECORDED IN BOOK 227 PAGE 803 ON
COVERED WITH SEDIMENT	30	139490.7006	1623513.2647	321.44'	10. DEED FROM MOUNTAIN HOME, INC., TO TOWN OF E ON NOVEMBER 15, 1984	RATTLEBORO, RECORDED IN BOOK 181 PAGE 14
- 605+00	32	139242.2797	1623879.9751	327.21'	11. DEED FROM MOUNTAIN HOME, INC., TO TOWN OF E ON JUNE 21, 1971	RATTLEBORO, RECORDED IN BOOK 129 PAGE 28
Athon and a second s	33	139097.0411	1624137.9368	309.57'	~ NOTES~	
s. /	L	L	L		1. METHOD OF SURVEY: LEICA TCR 805A TOTAL STA	TION & LEICA 1200 GPS.
1.5MO					2. BEARINGS ARE REFERENCED TO VERMONT STATE F ELEVATIONS ARE TIED TO THE NORTH AMERICAN	VERTICAL DATUM OF 1988 (NAVD88).
OR THEO					3. DIBERNARDO ASSOCIATES IS NOT RESPONSIBLE FO PERSONS FOR CONVEYANCE OF THE PROPERTY S	R PROPERTY DESCRIPTIONS PREPARED BY OTHE HOWN HEREON.
604+00 <b>9</b>					<ol> <li>THIS PLAN WAS PREPARED FOR THE SOLE USE OF TANNER &amp; ASSOCIATES, INC. AND IS NOT INTEND OR BUSINESS WITHOUT THE CONSENT OF TOWN O ASSOCIATES, INC. AND DIBERNARDO ASSOCIATES,</li> </ol>	F TOWN OF BRATTLEBORO & HOYLE ED TO BE USED BY ANY OTHER INDIVIDUAL F BRATTLEBORO & HOYLE TANNER & LLC.
JR (TYP)					5. BOUNDARY LINES SHOWN HEREON ARE BASED ON EVIDENCE FOUND IN THE FIELD AND ARE SHOWN	REFERENCE PLANS AND DEEDS AND PHYSICAL AS APPROXIMATE.
11.5'X7.4' CMP INVT = 294.21'		í				
	CMP = 299.24'					
	NT BROC					
		_			E&C PROPERT	IES LLC
	507 50		LOCUST RIDGE CEN 75 BLACK M	METERY ASSOCIATION	824 BUTTERNUT	HILL ROAD
		310	BRATTLEBOR TAX MAP 7 BL	RO, VT 05301 LOCK 05 LOT 22	BOOK 396 PA	GE 616
THE STATE OF ET FORCE MAIN		3	BOOK E	PAGE 90	/	
	314-	315	A BE			
		11		NO OUTLET F	FOUND	
			GATE APPRO	OX. LOCATION OF E MAIN 8" V.T.P.		/
	325 32 42		FOU	ND STONE BOUND	ONE HUNDRED ELEVEN REAL P.O. BOX 622 CAPE FUZABETH ME	TY ASSOCIATION CHESHIRE OIL COMPANY INC. P.O. BOX 586 04107 KEENE NH 03431
	STATISTICS STATISTICS	322		314-	TAX MAP 7 BLOCK 05 BOOK 287 PAGE	LOT 20 /TAX MAP 7 BLOCK 05 LOT 18– 299 BOOK 349 PAGE 854
TELEPHONE CABINET			Kirk		3	/
PARKING LOT THE				1/5A (=		TBM#4 ELEV. = 297.86' SPIKE IN UTILITY POLE X/3
-UTILITY CABINET	DRIVEWAY		19 518 IS	S to the state of		
<i>i</i>						-296
	5/8"Ø 0.2' DOWN	315	43/5/6			3 295///
BRATTLEBORO REAL ESTATE INVESTMENTS P.O. BOX 357		FOUND IR 5/8 <b>*</b> ø 0.	2' DOWN			PHD -294-3, H
TAX MAP 7 BLOCK 05 LOT 23 BOOK 353 PAGE 36			٦Ŀ	E S	300	
	BRATTLE	BORO PUBLISHING CO	FOUND IR MPANY 1.25"ø 0.	2' DOWN	TELEPHONE CABINET	TO ROUTE 5
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/	E	BOOK 250 PAGE 128		/	PARKING LOT 295	
/				/	VFW CARL M DESSAINT POST 1034 INC.	E 1_293
				1	P.O. BOX 8233 SANDRA HA BRATTLEBORO, VT 05304 972 PUTNEY RE TAX MAP 7 BLOCK 05 LOT 251 DEATH FROM	RRIS UNIT#3
/				/	BOOK 271 PAGE 271 TAX MAP 7 BLOCK BOOK 227 PAGE 271 TAX MAP 7 BLOCK BOOK 227 PAGE 271	05 LOT 25.2 / GE 803 C COPYRIGHT 2012

- DEPARTMENT OF RIGHT OF WAY.
- IN SLIDE A10.4
- BRATTLEBORO LAND RECORDS IN SLIDE A3.3
- OF BRATTLEBORO LAND RECORDS IN SLIDE A14.3
- DATED JULY 1965 SHEET 6 OF 15
- RECORDED AT THE TOWN OF BRATTLEBORO LAND RECORDS AUGUST 22, 2011

- BOOK 295 PAGE 513 ON MARCH 4, 2002

~ REFERENCE PLANS~ A. PLAN ENTITLED "BRATTLEBORO PROJ. 1 NO. 91-1(2) SHEET 77 OF 496" ON FILE WITH THE STATE OF VERMONT DEPARTMENT OF RIGHT OF WAY.

B. PLAN ENTITLED "STATE OF VERMONT AGENCY OF TRANSPORTATION TOWN OF BRATTLEBORO PROJECT: 191-1(2)" ON FILE WITH THE STATE OF VERMONT

C. PLAN ENTITLED "PLAN SHOWING THE 1983 LAYOUT OF A SECTION OF BLACK MOUNTAIN ROAD (TOWN HIGHWAY NO36) BRATTLEBORO, VERMONT" SURVEYED FOR THE TOWN OF BRATTLEBORO, BRATTLEBORO VERMONT ON NOVEMBER 11, 1982 BY W.E. SHUMWAY. ON FILE WITH THE TOWN OF BRATTLEBORO DEPARTMENT OF PUBLIC WORKS.

D. PLAN ENTITLED "A SUBDIVISION OF THE LAND BELONGING TO EMERSON A. & ALICIA B. THOMAS BRATTLEBORO ~ VERMONT" PREPARED BY JAMES C. FERGUSON ON JUNE 6, 1995. RECORDED IN THE TOWN OF BRATTLEBORO LAND RECORDS

E. PLAN ENTITLED "SUBDIVISION PREPARED FOR EAGLE STREET REALTY TRUST BLACK MOUNTAIN ROAD TOWN OF BRATTLEBORO, WINDHAM CO., VERMONT" PREPARED BY SOUTHERN VERMONT ENGINEERING ON MARCH 9, 1995. RECORDED IN THE TOWN OF

F. PLAN ENTITLED" SUBDIVISION PLAN LAND OF ALFRED CHICKERING BRATTLEBORO VERMONT" PREPARED BY SOUTHERN VERMONT ENGINEERING ON MARCH 28, 1984. RECORDED IN THE TOWN OF BRATTLEBORO LAND RECORDS IN SLIDE A204.2

G. PLAN ENTITLED "SUBDIVISION PLAT BLACK MOUNTAIN VISTAS BRATTLEBORO, VERMONT" PREPARED BY CARON ENGINEERING ON FEBRUARY 19, 1996. RECORDED IN THE TOWN

H. PLAN ENTITLED "TOWN OF BRATTLEBORO WINDHAM COUNTY, VERMONT U.S. PUBLIC HEALTH SERVICE PROJECT WRC VT 38 VT DEPARTMENT OF WATER RESOURCES PROJECT VT 14 CONTRACT NO. 1 PUTNEY ROAD INTERCEPTOR BRUDIES RD., OPTICAL RD & BLACK MOUNTAIN RD" PREPARED BY JOSEPH A. KESTNER JR.

~ REFERENCE DEEDS~

1. DEED FROM ELIZABETH J. HARRIS TO E&C PROPERTIES, LLC, RECORDED IN BOOK 396 PAGE 616 ON

2. DEED FROM LARRY L. COOKE FAMILY LIMITED PARTNERSHIP TO BRATTLEBORO REAL ESTATE INVESTMENTS I, LP, RECORDED IN BOOK 353 PAGE 36 ON SEPTEMBER 6, 2006

3. DEED FROM DORRIE L. O'MEARA TO CHESHIRE OIL COMPANY, INC, RECORDED IN BOOK 349 PAGE 854 ON MAY 25, 2006

4. DEED FROM BLACK MOUNTAIN VISTAS, LLC TO WORLD LEARNING INC., RECORDED IN

5. DEED FROM EVELYN B. COBB TO ONE HUNDRED ELEEN REALTY ASSOCIATES, RECORDED IN BOOK 287 PAGE 299 ON MAY 18, 2001





### ~ L E G E N D ~

	APPROXIMATE PROPERTY LINE
	MINOR CONTOUR
	MAJOR CONTOUR
S S	- SEWER LINE
SD SD	STORM SEWER LINE
വ	UTILITY POLE
ОНО ОНО	OVERHEAD WIRE
S	SEWER MANHOLE
	FIRE HYDRANT
X	WATER VALVE
\$	LIGHT POST
<del> </del>	GUARD RAIL
$\triangle$	TRAVERSE POINT
<b>9</b>	GUY WIRE
	FENCE
	CATCH BASIN
•	BOLLARD
0	FOUND STONE BOUND
O	FOUND CONCRETE BOUND
0	FOUND IRON PIN
+ 601+00	I-91 CENTER LINE STATIONING

GRAPHIC SCALE ( IN FEET ) 1 inch = 40 ft. PLAN SHOWING TOPOGRAPHIC SURVEY OF A PORTION OF **BRATTLEBORO SEWERAGE SYSTEM BLACK MOUNTAIN ROAD EJECTOR STATION** PREPARED FOR **TOWN OF BRATTLEBORO** 230 MAIN STREET BRATTLEBORO, VT 05301

BLACK MOUNTAIN ROAD ~ WINDHAM COUNTY ~ BRATTLEBORO, VERMONT

DIBERNARDO ASSOCIATES, LLC VT LICENSED LAND SURVEYORS 02-463-3031 440 ROCKINGHAM ROAD 603-358-550 P.O. BOX 52 BELLOWS FALLS, VT 05101 DATE JAN. 11, 2012 | SCALE 1" = 40' DRAWN BY JW CK'D BY JAD

TAX MAP 7 BLOCK 05 LOT 25.2 BOOK 227 PAGE 803 COPYRIGHT 2012 DIBERNARDO ASSOCIATES, LLC.

TAX MAP 7 BLOCK 05 LOT 18-19

SURVEYED BY JW, TM DWG.NO. 2812-2

**Appendix B – Proposed Sewer Alignment and Boring Locations** 





**Appendix C – Soil Boring Logs** 

DA ST/ FIN SHE	TE ART ISH ET	T: <u>11/15/2012</u> t: <u>11/15/2012</u> Trans DRILLI SUBSURFA							Trans Tech DRILLING SERVICES	BORING NO.         B-1           PROJ. NO.         D12-3363           SURF. ELEV.         G. S.           G.W. DEPTH         See Notes
PRO	JJF	CI:	Black I Hoyle,	<u>Mounta</u> Tannei	in Grav r & Ass	ociates	er		LOCATION: Brattleboro, VI	
DEDTH	ES	BLOWS ON SAMPLER				MPLER		REC		
(ft.)	SAMPL	SAMP NO	0/6	6/12	12/18	18/24	N	(ft.)	CLASSIFICATION	NOTES
			29 29 11 8 8 8 7	9 13 10 6 9	6 7 10 6 14	5 5 8 11 7 6 12	15 20 20 12 12 23	0.8 1.3 1.5 0.4 1.4 1.0	Brown, Firm, Fine SAND, and Silt, Wet Grades to "Grey"	Free standing water was not encountered upon completion of drilling and sampling.
30 		7	12	11	19	14	30	1.4	Boring terminated at a depth of 32.0 feet.	
N = I DRIL MET										

DA <sup>-</sup> ST/ FIN SHE	DATE       START:       11/15/2012       II/15/2012       BORING NO.       B-2         FINISH:       11/15/2012       DRILLING       SERVICES       BURSURFACE EXPLORATION LOG         SHEET       1       OF       1       G.W. DEPTH       7.2'         PROJECT:       Black Mountain Gravity Sewer       LOCATION: Brattleboro, VT       BORING NO.       BORING NO.											
			Hoyle,	Tanne	r & Ass	ociates						
DEPTH	LES	PLE O.		BLOWS	S ON SA	MPLER		REC.	SOIL OR ROCK	NOTES		
(ft.)	SAMF	SAM	0/6	6/12	12/18	18/24	N	(ft.)	CLASSIFICATION	NOTES		
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	/	1	16	18	20	7	38	0.7	Grey Compact Fine SAND AND SILT, Some Gravel, Wet	Free standing water was		
_	7	2	3	4	5	5	9	1.0	Grades to "Loose", "No" Gravel	with augers at a depth of		
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_	/	3	5	5	4	4	9	1.3		_		
	7	4	3	3	3	3	6	1.1		_		
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40-	40-40-											
N = 1	NO.	BLOW	S TO DF	RIVE 2-IN	ICH SPL	IT SPOC	DN 12-IN	ICHES	WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW	CLASSIFICATION: Visual by		
DRIL	DRILLER: M. Blakely DRILL RIG TYPE : CME 45 Geotechnical Specialist											
MET	HOL		IVESTIC	BATION:		ASIM	1586	0.0510	U 3.20 I.D. HULLUW STEM AUGEKS			

DATE START: <u>11/15/2012</u> FINISH: <u>11/15/2012</u> SHEET <u>1</u> OF <u>1</u>									Trans <i>DRILLING</i> SUBSURFACE EXPLORATION LOG	BORING NO.         B-3           PROJ. NO.         D12-3363           SURF. ELEV.         G. S.           G.W. DEPTH         8.4'
PRO	JJE	CT:	Black I Hoyle,	Mounta Tannei	<u>in Grav</u> r & Ass	<u>rity Sew</u> ociates	er		LOCATION: Brattleboro, VT	
DEDTU	ES	Щ.		BLOWS	S ON SA	MPLER		PEC		
(ft.)	SAMPL	SAMP	0/6	6/12	12/18	18/24	N	(ft.)	CLASSIFICATION	NOTES
_										
										_
_										
_ 5 _										_
_	-									
-										Free standing water was
10	./	1	14	16	21	13	37	0.6	Brown Compact Medium SAND AND GRAVEL, Wet	measured at a depth of 8.4'
-	/	2	7	5	5	5	10	0.5	Grades to "Loose"	25.0'.
_	Υ,						-	1.0		
	$\mathbf{V}$	3	3	4	3	4	7	1.3	Grades to "Fine" SAND, "AND SILT", "No" Gravel	_
- 15-	/	4	4	3	4	5	7	1.8		_
		5	7	9	9	10	18	0.7	Grades to "Firm"	_
_	$\backslash$									
20										_
-										_
25										
-									Boring terminated at a depth of 25.0 feet	-
_	1									
-										
30	1									
-										_
_	1		-							
35										
_	1		-							
-										_
40-										
N = 1										
DRIL	DRILLER: M. Blakely DRILL RIG TYPE : CME 45 Geotechnical Specialist									
MET	HOE	D OF IN	IVESTIG	BATION:		ASTM	D1586	USIN	G 3.25" I.D. HOLLOW STEM AUGERS	

PROJECT:         Black Mountain Gravity Sever Holps, Tanner & Associates         LOCATION: Brattleboro, VT           remn         1         1         1218         1224         N         REC. (LASSINGATION         SOIL OR ROCK CLASSINGATION         NOTES           -         -         -         -         -         -         -         -         NOTES           -         -         -         -         -         -         -         NOTES           -         -         -         -         -         -         -         NOTES           -         -         -         -         -         -         -         -         NOTES           - <th>DAT STA FIN SHE</th> <th colspan="7">DATE START: <u>11/16/2012</u> FINISH: <u>11/16/2012</u> SHEET <u>1</u> OF <u>2</u></th> <th></th> <th>Trans Tech DRILLING SERVICES</th> <th>BORING NO.         B-4           PROJ. NO.         D12-3363           SURF. ELEV.         G. S.           G.W. DEPTH         See Notes</th>	DAT STA FIN SHE	DATE START: <u>11/16/2012</u> FINISH: <u>11/16/2012</u> SHEET <u>1</u> OF <u>2</u>								Trans Tech DRILLING SERVICES	BORING NO.         B-4           PROJ. NO.         D12-3363           SURF. ELEV.         G. S.           G.W. DEPTH         See Notes
Hoyle, Tanner & Associates           Provide Tanner & Associates           Soli, DR ROCK CLASSIFICATION         NOTES           NOTES         Soli, DR ROCK CLASSIFICATION         NOTES           NOTES         Soli, DR ROCK CLASSIFICATION         NOTES           Soli, DR ROCK CLASSIFICATION         NOTES           Soli, DR ROCK CLASSIFICATION         NOTES           Soli, DR ROCK CLASSIFICATION         NOTES           Soli, DR ROCK CLASSIFICATION         NOTES           Soli, DR ROCK CLASSIFICATION         NOTES           Soli, DR ROCK         CLASSIFICATION         NOTES           Soli, DR ROCK         CLASSIFICATION         NOTES           Image: Classification         CLASSIFICATION         NOTES           Image: Classification         Free standing water was not encountered upon completion of drilling and sampling.           Image: Classification         Free standing water was not encountered upon completion of drilling and sampling.           Image: Classification         Classification         Classif	PRC	JJE	CT:	Black I							
note         no         no         no         no <td></td> <td></td> <td></td> <td>Hoyle,</td> <td>Tannei</td> <td>r &amp; Ass</td> <td>ociates</td> <td></td> <td></td> <td></td> <td></td>				Hoyle,	Tannei	r & Ass	ociates				
1       1       12       12/15       16/24       N       10	DEPTH (ft.)	NPLES	MPLE NO.		BLOWS	S ON SA	MPLER	1	REC.	SOIL OR ROCK CLASSIFICATION	NOTES
- 5       -		SAI	/S	0/6	6/12	12/18	18/24	N	(,		
-       -											-
5       -	-	-									-
-10       -	5										
-10       -10       -10       -10       -10       -10       -10       -10       -10       -10       -10       -11       -	_										-
-10       -10       -10       -10       -10       -10       -10       -10       -10       -10       -10       -10       -10       -10       -11       -											-
Image:	-									-	-
encountered upon completion of drilling and sampling.	— 10—										Free standing water was not
15       1	-	-									encountered upon completion
15       1       1       1       1       1       1       1       1         20       1       12       19       23       31       0.9       Brown Compact Medium SAND, Little Gravel, Moist         25       1       12       19       23       31       0.9       Brown Compact Medium SAND, Little Gravel, Moist         25       1       12       11       10       23       0.9       Grades to "Firm"         25       2       11       12       11       10       23       0.9         4       10       9       7       15       16       0.8         5       12       15       16       21       31       1.4         35       6       18       15       15       30       0.9											
-20       -	<b>—</b> 15 <b>—</b>										-
20       1       12       12       19       23       31       0.9         21       1       12       12       19       23       31       0.9         25       1       12       11       10       23       0.9         25       1       12       11       10       23       0.9         25       1       12       11       10       23       0.9         25       1       12       11       10       23       0.9         3       9       9       9       10       18       1.1         30       4       10       9       7       15       16       0.8         5       12       15       16       21       31       1.4       4         35       6       18       15       15       30       0.9         4       10       9       7       15       16       0.8         35       6       18       15       15       30       0.9											-
20       1       12       12       19       23       31       0.9         1       12       12       19       23       31       0.9         25       2       1       12       11       10       23       0.9         25       2       1       12       11       10       23       0.9         25       2       1       12       11       10       23       0.9         3       9       9       9       10       18       1.1         30       4       10       9       7       15       16       0.8         5       12       15       16       21       31       1.4         33       9       9       7       15       16       0.8         30       4       10       9       7       15       16       0.8         31       1.4       5       15       15       30       0.9       9         4       10       9       7       15       16       0.8       7         35       12       15       15       30       0.9       9       9       10<											-
1       12       12       19       23       31       0.9       Brown Compact Medium SAND, Little Gravel, Moist         25       1       1       1       1       1       1       1         25       1       12       11       10       23       0.9       Grades to "Firm"         25       1       12       11       10       23       0.9       Grades to "Firm"         30       1       12       11       10       23       0.9       Grades to "Firm"         30       4       10       9       7       15       16       0.8         5       12       15       16       21       31       1.4         35       6       18       15       15       30       0.9											-
25       2       11       12       11       10       23       0.9         30       2       11       12       11       10       23       0.9         30       4       10       9       7       15       16       0.8         -30       -4       10       9       7       15       16       0.8         -31       -4       10       9       7       15       16       0.8         -33       -4       10       9       7       15       16       0.8         -33       -4       10       15       15       15       0.9         -35       -6       18       15       15       15       30       0.9		/	1	12	12	19	23	31	0.9	Brown Compact Medium SAND, Little Gravel, Moist	-
25     2     11     12     11     10     23     0.9       3     9     9     9     10     18     1.1       30     4     10     9     7     15     16     0.8       4     10     9     7     15     16     0.8       5     12     15     16     21     31     1.4       35     6     18     15     15     30     0.9	-	/									-
25       2       11       12       11       10       23       0.9         30       2       11       12       11       10       23       0.9         30       3       9       9       9       10       18       1.1         30       4       10       9       7       15       16       0.8         5       12       15       16       21       31       1.4         31       -       -       -       -       -         4       10       9       7       15       16       0.8         -       -       -       -       -       -       -         -       -       -       -       -       -       -         -       -       -       -       -       -       -         -       -       -       -       -       -       -         -       -       -       -       -       -       -         -       -       -       -       -       -       -         -       -       -       -       -       -       -											-
2       11       12       11       10       23       0.9         3       9       9       9       10       18       1.1         30       4       10       9       7       15       16       0.8         4       10       9       7       15       16       0.8         5       12       15       16       21       31       1.4         31       -       -       -       -       -         4       10       9       7       15       16       0.8         -       -       -       -       -       -       -         6       18       15       15       30       0.9       -         -       -       -       -       -       -       -         -       -       -       -       -       -       -         -       -       -       -       -       -       -         -       -       -       -       -       -       -         -       -       -       -       -       -       -         -       -       -	25										-
3     9     9     9     10     18     1.1       30     4     10     9     7     15     16     0.8       4     10     9     7     15     16     0.8       5     12     15     16     21     31     1.4       6     18     15     15     30     0.9		/	2	11	12	11	10	23	0.9	Grades to "Firm"	
30     4     10     9     7     15     16     0.8       5     12     15     16     21     31     1.4       35     6     18     15     15     30     0.9	-	/	2	۵	۵	۵	10	18	11		-
4     10     9     7     15     16     0.8       5     12     15     16     21     31     1.4       35     6     18     15     15     30     0.9		$\backslash$		3	3	3	10	10	1.1		-
5     12     15     16     21     31     1.4       35     6     18     15     15     30     0.9		/	4	10	9	7	15	16	0.8		-
		/	5	12	15	16	21	31	1.4	Grades to "Compact", "No" Gravel	-
	_	Ľ	6	10	15	15	15	20	0.0		-
	35	Z	0	10	15	15	10	30	0.9		-
	_										-
	-	1									-
	40	]									
N = NO. BLOWS TO DRIVE 2-INCH SPLIT SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFICATION: Visual by	N = 1										
DRILLER: M. Blakely DRILL RIG TYPE : CME 45 Geotechnical Specialist	DRIL										
METHOD OF INVESTIGATION: ASTM D1586 USING 3.25" I.D. HOLLOW STEM AUGERS	MET	HOI	d of II	IVESTIG	BATION:		ASTM	D1586	S USIN	IG 3.25" I.D. HOLLOW STEM AUGERS	

DA <sup>-</sup> ST/ FIN SHE PRO	TE ART ISH ET	-: 1: 2 CT:	OF Black I	11/16 11/16 2 Mounta	5/2012 5/2012 - in Grav	ity Sew	rer		Trans Tech DRILLING SERVICES SUBSURFACE EXPLORATION LOG LOCATION: Brattleboro, VT	BORING NO.         B-4           PROJ. NO.         D12-3363           SURF. ELEV.         G. S.           G.W. DEPTH         See Notes
DEPTH	PLES	IPLE 0.	Hoyle,	Tanner BLOWS	r & Ass s on sa	ociates		REC.	SOIL OR ROCK	NOTES
(ft.)		ves 7	<b>0/6</b> 17	6/12 14	<b>12/18</b> 14	<b>18/24</b> 16	<b>N</b> 28	(ft.) 0.8	CLASSIFICATION Brown Firm Fine SAND, Some Silt, Moist	
	4									_
_									Boring terminated at a depth of 42.0 feet.	_
<b>—</b> 45 <b>—</b>										-
_										-
_										-
-50-										-
										_
- 55										_
										_
-60-										_
-										-
_										_
-65-										
										_
										-
- 70										_
										_
-75-										
-										
_	1									
N = I DRIL MET	NO. .LER HOE	BLOW R: D OF IN	S TO DF	RIVE 2-IN N ATION:	NCH SPL M. Blake	IT SPOC ely ASTM	DN 12-IN		WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW ( DRILL RIG TYPE : <u>CME 45</u> IG 3.25" I.D. HOLLOW STEM AUGERS	LASSIFICATION: Visual by Geotechnical Specialist

DATE START: <u>11/16/2012</u> FINISH: <u>11/16/2012</u> SHEET <u>1</u> OF <u>1</u>					5/2012				Trans Tech DRILLING SERVICES SUBSURFACE EXPLORATION LOG	BORING NO.         B-5           PROJ. NO.         D12-3363           SURF. ELEV.         G. S.           G.W. DEPTH         See Notes
PROJECT:       Black Mountain Gravity Sewer       LOCATION: Brattleboro, VT         Hoyle, Tanner & Associates       LOCATION: Matter Sewer										
DEPTH	LES	ЪГЕ		BLOWS	S ON SA	MPLER		REC.	SOIL OR ROCK	NOTES
(ft.)	SAMP	SAM NC	0/6	6/12	12/18	18/24	N	(ft.)	CLASSIFICATION	NOTES
_										_
_		4	0		7	7	40	4.0		_
5		1	3	6	1	1	13	1.3	Brown Firm Fine SAND, Dry	_
		2	7	9	11	12	20	1.3	Grades to "Little Gravel", "Moist"	_
	17	3	7	8	7	6	15	0.7		
	7	4	3	5	8	9	13	1.1		Free standing water was not
	7	5	11	11	10	11	21	1.5		encountered upon completion
		5		11	10	11	21	1.5		
										_
15										_
-	-									_
_										_
20										_
-									Boring terminated at a depth of 22.0 feet	
_										
25										-
_										_
-										
										-
_										
_										
										–
_	1									_
-										–
40	]								]	
N = DRII	N = NO. BLOWS TO DRIVE 2-INCH SPLIT SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFICATION: Visual by DRILLER: M. Blakely DRILL RIG TYPE : CME 45 Geotechnical Specialist									
MET	HO	o of In	IVESTIG	ATION:		ASTM	D1586	USIN	IG 3.25" I.D. HOLLOW STEM AUGERS	

#### EXAMPLE KEY TO SUBSURFACE EXPLORATION LOGS

DATE	Π		ſ		
START: <u>XX/XX/XX</u>	Trang	- <b>₹</b> _'l'eel	h		
FINISH: <u>XX/XX/XX</u>			SURF. ELEV. XXX.X'		
SHEET <u>X</u> OF <u>X</u>	DRILLI	ING AN SERVICES		G.W. DEPTH <u>X.X'</u>	
PROJECT: PROJECT NAME		LOCATION:	PROJECT LOCATIO	N	
				N	
BLOWS ON SAMPLES SAMPLER N SAMPLER N SAMPLE SAMPLE SAMPLE SAMPLE SAMPLE SAMPLE SAMPLE SAMPLE SAMPLE SAMPLE SAMPLES SAM	SOIL CLASS	SOIL OR ROCK CLASSIFICATION			
	3" TOPSOIL Brown SILT, some : (Moist-Loose)	Sand, trace cl	lay, ML	Groundwater at 10' _ upon completion, and 5' 24 hrs. after	
2 50/.5 50/.5 NR	Gray SHALE, medium	m hard, weathe	ered,	completion	
	thin bedded, some 6 7 (numb	Run#1, 3.5'-6.0'         95% Recovery         50% RQD			
TABLE I TABL	E II	ied on reverse)	TABLE III		
Split Spoon Sample Identifie of parti	cation of soil type is made on basi cle sizes, and in the case of fine g is of plasticity.	s of an estimate rained soils also	The following terms are used in classifying soils consisting of mixtures of two or more soil types. The estimate is based on weight of total sample.		
Shelby Tube	ype Soil Particle Size		Term	Percent of Total Sample	
Sample Boulde	r >12"				
Geoprobe Cobble	3" - 12" Coarso 3" - 3/4"	Coarso Grainod	"some"	35 - 50 20 - 35	
Macro-Core	- Coarse 3 - 3/4 - Fine 3/4" - #4	(Granular)	"little"	10 - 20	
Auger or Test Sand	- Coarse #4 - #10		"trace"	less than 10	
Pit Sample	- Medium #10 - #40		(M/bon sampling	a aravelly soils with a standard solit	
	- Fine #40 - #200		spoon, the true percentage of gravel is often not		
Rock Core Silt - N Clay - I	on Plastic (Granular)      <#200 Plastic (Cohesive)	Fine Grained	recovered due to diameter.)	e relatively small sampler	
TABLE IV			TABLE V		
The relative compactness or consis following terms:	tency is described in accordance	with the	Varved Hor soil	rizontal uniform layers or seams of l(s).	
Term Blows per Foo	ot. N Term Blows	s per Foot. N	Laver Soi	I deposit more than 6" thick	
Verv Loose 0 - 4	Very Soft	0-2			
Loose 4-10	Soft	2 - 4	Seam Soi	I deposit less than 6" thick.	
Firm 10 - 30	Stiff	4 - 8 8 - 15			
Compact 30 - 50	Very Stiff 1	Very Stiff 15 - 30		I deposit less than 1/8" thick.	
Very Compact >50	Hard	>30			
(Large particles in the soils will ofter recorded during the penetration test	n significantly influence the blows t)	per foot	Laminated Irre	gular, horizontal and angled seams d partings of soil(s).	
TABLE VI					
Rock Classification Term	Meaning	Rock Cl	assification Term	Meaning	
Hardness - Soft	Scratched by fingernail	Bedding	- Laminated	(<1")	
- Medium Hard	Scratched easily by penknife		- Thin Bedded	(1" - 4")	
- Hard	Scratched with difficulty by penkr	nife	- Bedded	(4" - 12") Natural breaks	
- Very Hard	Cannot be scratched by penknife		- Thick Bedded	(12" - 36") (12"-36")	
Weathering - Very Weathered - Weathered	Judged from the relative amounts disintegration, iron staining, core	s of (Fracturin	- massive (>36") (Fracturing refers to natural breaks in the rock oriented at son angle to the rock layers)		

### **GENERAL INFORMATION & KEY TO SUBSURFACE LOGS**

The Subsurface Logs attached to this report present the general observations and mechanical data collected by the driller at the site, supplemented by classificiation of the material removed from the borings as determined through visual identification by technicians in the laboratory. It is cautioned that the materials removed from the borings represent only a small fraction of the soils at the site and may not be representative of subusurface conditions between and/or away from the boring locations or betweeen the sampled intervals. The data presented on the Subsurface Logs along with the recovered samples provide a basis for estimating the engineering characteristics of the soils at the site. The evaluation must consider all the recorded details and their relative significance to the project. It is common that evaluation of standard subsurface data indicates the need for additional testing and/or sampling to more accurately evaluate the subsurface conditions. Any evaluation of the data presented on the Subsurface Logs to describe the conditions encountered. The paragraph numbers below correspond to the numbered features identified on the opposite page.

- 1. The figures in the Depth column define the scale of the Subsurface Log.
- 2. The Samples column shows a graphical representation of the depth and type of sampling performed. See Table I for descriptions of the symbols used to represent the various types of samples.
- 3. The Sample No. is used for identification on sample containers and laboratory test reports.
- 4. Blows on Sampler shows the results of the "Standard Penetration Test" (SPT), recording the number of blows required to drive a split spoon sampler into the soil. The number of blows required to drive the sampler for each six inch increment is recorded. The first six inches of penetration is considered a seating drive. The sum of the number of blows required for the second and third six inch increments is termed the penetration resistance, N. The outside diameter of the sampler, hammer weight and length of drop are noted at the bottom of the Subsurface Log.
- 5. Recovery Shows the length of the recovered sample.
- 6. All recovered soil samples are reviewed in the laboratory by an engineering technician or geotechnical engineer, unless noted otherwise. Visual descriptions are made on the basis of a combination of the driller's field descriptions and noted observations together with the sample as received in the laboratory. The method of visual classification is based primarily on the Unified Soil Classification System (ASTM D 2487) with regard to the particle size and plasticity (See Table No. II), and the Unified Soil Classification group symbols for the soil types are sometimes included with the soil classification. Additionally, the relative portion, by weight, of two or more granular soil types is described in accordance with "Suggested Methods of Test for Identification of Soils" by D.M. Burmister, ASTM Special Technical Publication 479, June 1970, (See Table No. III). Description of the relative soil density or consistency is based upon the penetration records as defined in Table No. IV. The description of the soil moisture is based upon the relative wetness of the soil as recovered and is decribed as dry, moist, wet or saturated. Water introduced into the boring either naturally or during drilling may have affected the moisture condition of the recovered samples. Special terms are used as required to describe soil deposition in greater detail; several such terms are listed in Table V. When sampling gravelly soils with a standard two inch diameter split spoon sampler, the true percentage of gravel is often not recovered due to the relatively small samper diameter. The presence of boulders and large gravel is sometimes, but not necessarily, detected by an evaluation of the sampler blows or through the action of the drill rig as reported by the driller.
- 7. Rock descriptions are based on review of the recovered rock core samples and the driller's notes. Typical rock classification terms are included in Table VI.
- 8. The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Solid stratification lines delineate apparent changes in soil type, based upon review of recovered soil samples and the driller's notes. Dashed lines indicate a lesser degree of certainty with respect to either a change in soil type or where such a change may occur.
- 9. Miscellaneous observations and procedures noted by the driller are shown in this column, including water level observations. It is important to understand that the reliability of the water observations depends upon the soil type (water level does not readily stabilize in a bore hole through fine grained soils), and that any drill water used to advance the boring may have influenced the observations. Typically, the ground water level will fluctuate with seasonal changes in precipitation patterns. One or more perched or trapped water levels may exist in the ground seasonally. Generally, it is prudent to install a groundwater observation well to better define water levels.
- 10. The length of core run is defined as the length of penetration of the core barrel. Core recovery is the length of core recovered divided by the core run length. The Rock Quality Designation (RQD) is the total length of pieces of recovered core exceeding 4 inches divided by the core run length. The size of the core barrel used is also noted.

**Appendix D – Detailed Present Worth Analysis** 

HOYLE, T	ANNER &	ASSOCIAT	TES	Project No.:	122004.21
125 Colleg	e St., 4th F	loor	Town of Brattleboro, VT	By:	DBM
Burlington	, VT 05401		Black Mountain PS Feasbility Study	CK By:	MVS
(802) 860-	1331		Alternative 1: Pump Station Upgrade		
			Opinon of Probable cost		
ITEM	APPROX	•		UNIT COST	AMOUNT
NO.	QUANT.	UNIT	DESCRIPTION OF ITEMS	DOLLAR	DOLLAR
	Pump Sta	tion Upgra	de		
	1	LS	Pump Station Upgrade	\$593,000	\$593,000
			Contractor's Overhead & Profit	15%	\$89,000
			Contingency	10%	\$60,000
			Construction Cost Index	8%	\$46,000
			Escalation	3%	\$18,000
			Construction Phase Engineering Services	13%	\$105,000
			Black Mountain Pump Station Capital Cost Total		\$911,000
	Annual C	perating C	osts		
	365 Per Day		Daily Operator Check, 45 minutes per day	\$35	\$9,600
	25 Per Year		Site Maintenance, lawn care and snow removal, 1 hr per trip	\$35	\$875
	1 LS		Vehicle and Maintenance Equipment Costs	\$250	\$250
	12 Per Month		Average Monthly Electric Usage, 8/2010 - 8/2011	\$270	\$3,240
	1 Per Year		Annual Propane Usage	\$200	\$200
	1 Per Year		Annual Generator Check-up Service	\$600	\$600
	1 LS		Pumping Equipment / Generator Replacement Parts	\$500	\$500
			Annual Operating Costs Total		\$15,000
	<u> </u>				
Present W	orth Cost				
	20 years		Period, <i>n</i>		
	4.125%		Annual interest rate cost of money, <i>i</i>		
			Present worth of annual operating costs		\$202,000
			Alternative 1 Capital Cost		\$911,000
		Present V	Vorth of Black Mountain Pump Station Upgrade		\$1,113,000
		Notes	Electricity inflation rate has not been calculated separately from inflation		

HOYLE, T	ANNER &	ASSOCIA	TES	Project No.:	122004.21
125 Colleg	e St., 4th Fl	oor	Town of Brattleboro, VT	By:	DBM
Burlington	, VT 05401		Black Mountain PS Feasbility Study	CK By:	MVS
(802) 860-	1331		Alternative 2: Replace PS with Gravity Sewer		
			Opinon of Probable cost		
ITEM	APPROX.			UNIT COST	AMOUNT
NO.	QUANT.	UNIT	DESCRIPTION OF ITEMS	DOLLAR	DOLLAR
	Existing P	ump Stati	on Bypass and Gravity Sewer		
	1	LS	Additional Subsurface Exploration	\$10,000	\$10,000
	1	LS	Pre-excavation for trenchless technologies	\$4,000	\$4,000
	1	LS	Traffic Control	\$2,000	\$2,000
			Directional Drill under I-91 Right-of-Way <sup>1</sup>		
	550	LF	Directional Drill, including 20" sleeve	\$800	\$440,000
	550	LF	8" Ductile Iron Pipe, including spacers	\$50	\$27,500
			Open Cut Pipe Run Outside of Right-of-Way		
	850	LF	8" Ductile Iron Pipe, installed	\$65	\$55,300
	2	EA	New Sewer Manholes	\$2,000	\$4,000
	1	LS	Connect to Existing, core and plug existing manholes	\$3,000	\$3,000
	1	LS	Black Mountain PS Demolition	\$10,000	\$10,000
			Sub-total		\$555,800
			Mobilization/Demobilization	5%	\$28,000
			Site Preparation & Restoration	5%	\$28,000
			Sub-total		\$611,800
			Final Design Phase Engineering Services	7%	\$57,000
			Construction Phase Engineering Services	13%	\$106,000
			Contractor's Overhead & Profit	15%	\$92,000
			Contingency	15%	\$92,000
			Escalation	3%	\$18,000
			Black Mountain Gravity Sewer Capital Cost Total		\$977,000
Annual Or	perating Co	osts			
	1	LS	Annual Labor and Materials Costs	\$500	\$500
			Annual Operating Costs Total		\$500
					<i>\$</i> 200
Present W	orth Cost				
	20	vears	Period. <i>n</i>		
	4.125%	J	Annual interest rate cost of money, <i>i</i>		
			Present worth of annual operating costs		\$7,000
			Alternative 2 Capital Cost		\$977,000
		Pro	esent Worth of Black Mountain Gravity Sewer		\$984.000
Notes					<i></i> ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
inotes				·	
1	Directional	Drill is the 1	more expensive, but more accurate, installation method. Unit Price	ce is per ECI reco	ommendation

An engineering estimate is an opinion of probable construction cost made by an engineer and not by a professional construction cost estimator or construction contractor. The accuracy of the engineering estimate cannot be guaranteed.

**Appendix E – Agency of Natural Resources Project Review Sheet** 

#### AGENCY OF NATURAL RESOURCES (ANR) AND NATURAL RESOURCES BOARD

http://www.anr.state.vt.us/dec/eao/pa/index.htm / http://www.nrb.state..vt.us/

### PROJECT REVIEW SHEET ONLY

THIS IS NOT A PERMIT

TOTAL # OF DEC PERMITS: **RESPONSE DATE:** DISTRICT: 2

PRE-APPLICATION REVIEW: **PENDING APPLICATION #:** PIN#:

Town: Brattleboro

OWNER OF PROJECT SITE:	APPLICANT OR REPRESENTATIVE:				
Town of Brattleboro	Hoyle Tanner & Associates				
Steve Barrett, Director of Public Works	Dan Marks, Project Engineer				
211 Fairground Road	125 College Street, 4 <sup>th</sup> Floor				
Brattleboro, VT	Burlington, VT 05401				
802-254-4255	802-860-1331 (O)/802-338-0347 (C)				
Project Name: Black Mountain Ejector Station					

Based on an oral or written request or information provided by Hoyle & Tanner Associates received on 10/11/11 a project was reviewed on a tract/tracts of land of acres, located on Black Mountain Road. Project is generally described as: The Black Mountain Ejector Station was constructed in 1976. It accepts sewage flow from a residential area with a school and from the mobile home park located directly behind the station. Due to the following identified problems; equipment age, maintenance problems, lack of adequate ventilation, over heating of station and access concerns, the Town is considering either upgrading the Black Mountain Ejector Station (a project which has already been designed in conjunction with the Brattleboro WWTF Upgrade) or eliminating the Black Mountain Ejector Station and conveying flow by gravity under I-91. The Town is currently evaluating the feasibility of the gravity sewer concept and would like to better understand what would be involved with the removal of the Black Mountain Ejector Station and installation of sewage conveyance under the highway.

Prior permits from this office:

#### PERMITS NEEDED FROM THE DISTRICT ENVIRONMENTAL OFFICE PRIOR TO COMMENCEMENT OF CONSTRUCTION

X I hereby request a jurisdictional opinion from the District Coordinator or Assistant District Coordinator regarding the jurisdiction of 10 V.S.A. Chapter 151 (Act 250) over the project described above.

Landowner/Agent X Permit Specialist Jacqueline Carr Other Person

ACT 250: THIS IS A JURISDICTIONAL OPINION BASED UPON AVAILABLE INFORMATION, AND A WRITTEN REQUEST FROM THE ANR PERMIT SPECIALIST, THE LANDOWNER/AGENT, OR OTHER PERSON. ANY NOTIFIED PERSON OR ENTITY WILL BE BOUND BY THIS OPINION UNLESS THAT PERSON OR ENTITY FILES A REQUEST FOR RECONSIDERATION WITH THE DISTRICT COORDINATOR (10 V.S.A. § 6007 (c) AND ACT 250 RULE 3 (b) OR AN APPEAL WITH THE ENVIRONMENTAL COURT WITHIN 30 DAYS OF THE ISSUANCE OF THIS OPINION (10 V.S.A. Chapter 220). (#47)

Project:	_ Commercial	Residential		_ Municipal		
Has the	landowner subdi	vided before?	Yes	No	When/where:	# of lots:
AN ACT	250 PERMIT IS	REQUIRED:	Yes	No	Copies sent to Owner	; Applicant or Representative;
S <sup>.</sup>	tatutory Parties	Other: (Attach	certific	ate of service i	f necessary.)	

BASIS FOR DECISION:

Act 250 jurisdiction would be based on specific project information, and this project may trigger jurisdiction. Please contact me to discuss further. If a municipal project involves more than 10 acres, an Act 250 permit will be required, but exceptions to upgrades in treatment facilities may apply.

SIGNATURE:

Assistant and/or District Coordinator

DATE: 11/30/11

Telephone: 802-885-8842 ADDRESS: District # Environmental Commission, 100 Mineral Street, Suite 305, Springfield, VT 05156-3168

WASTEWATER MANAGEMENT DIVISION REGIONAL OFFICE: PERMIT/APPROVAL REQUIRED? 1 X Yes No \_X\_\_Wastewater System Potable Water Supply Permit (#1 & 32) \_\_Notice of Permit Requirements (#2) (deferral language) \_ Floor drains (#1.2) \_\_\_\_ Campgrounds (#3) \_X \_Extension of sewer lines #5

BAS rev	BIS FOR DECISION: A Wastewater System Potable Water Supply Permit is needed unless the sewer line is being iewed and approved by the Facilities Engineering Division.
RE	GIONAL ENGINEER ASSIGNED: Dan Wilcox Daniel Wilcox 10/18/11
	Wastewater Management Division, Telephone: 802-885-8847 Dept. of Environmental Conservation, 100 Mineral Street, Suite 303, Springfield, VT 05156-3168
**No http	ote: Numbers in Parentheses () refer to Permit Information Sheets in the Vermont Permit Handbook p://www.anr.state.vt.us/dec/permit hb/index.htm
Tŀ	IIS IS A PRELIMINARY, NON-BINDING DETERMINATION REGARDING THE FOLLOWING PERMITS WHICH YOU MAY NEED PRIOR TO COMMENCEMENT OF CONSTRUCTION. PLEASE CONTACT THE DEPARTMENTS INDICATED BELOW.
2.	WASTEWATER MANAGEMENT DIVISION, ANR (802-241-3822)       Contact:          Discharge Permit; pretreatment permits; industrial, municipal (#7.1, 7.2 & 8)       Indirect Discharge Permits (#9 & 9.1)
3. 	AIR POLLUTION CONTROL DIVISION, ANR (888-520-4879)       Contact:         Construction/modification of source (#14)       Open Burning (#18)       Wood Chip Burners (>90 HP) (#14)         Furnace Boiler Conversion/Installation (#14)       Industrial Process Air Emissions (#14)       Diesel Engines (>450 bHP) (#14)
4. 	WATER SUPPLY DIVISION, ANR 800-823-8500 (in VT) 802-241-3400 New Hydrants(#22) >500' waterline construction (#22) Community Water System (CWS) Bottled Water (#20) _ Operating permit (#21) _ Transient Non-Community water system (TNC) (#21) Capacity Review for Non-transient non-community water systems (NTNC) (#21)
5.	WATER QUALITY DIVISION, ANR       STORMWATER PERMITS 802-241-4581 or 802-241-1511         _ River Management (241-3770) (Ponds) (#32,1)       Construction General Permits >1AC of disturbance (#6.1)         _ Shoreland Encroachment (241-3777) (#28)       Stormwater from new development or redevelopment sites (#6.2 & 6.3)         _ Wetlands 802-885-8851 (#29)       Multi-Sector General Permit (MSGP) industrial activities with exposure (#6.4)         > Stream Alteration / Section 401 Water Quality Certificate / Stream Crossing Structures 802-786-5921 (#27 & 32)         _ Floodplains Management 802-241-4597
6.	WASTE MANAGEMENT DIVISION, ANR       Contact:         _ Notification of Regulated Waste Activity (241-3888) (#36)      Underground Storage Tanks (241-3888) (33)         _ Lined landfills; transfer stations, recycling facilities drop off (241-3444) (#37, 39, 40)      Underground Storage Tanks (241-3444)        Disposal of inert waste, untreated wood & stumps (241-3444) (#41 & 44)      Composting Facilities (241-3444) (#43)        Uste oil burning (241-3888)      Waste transporter permit (#35)      Used septic system components/stone (#41)
7.	FACILITIES ENGINEERING DIVISION, ANR       Contact:         _ Dam operations (greater than 500,000 cu. ft.) (241-3451) (#45)
8.	POLLUTION PREVENTION & MERCURY DISPOSAL HOTLINE (1-800-974-9559) SMALL BUSINESS & MUNICIPAL COMPLIANCE ASSISTANCE (800-974-9559) Contact: Judy Mirro or John Daly RECYCLING HOTLINE (1-800-932-7100)
9.	FISH & WILDLIFE DEPARTMENT (802-241-3700)      Stream Obstruction Approval (#47.5)        Stream Obstruction Approval (#47.5)      Stream Obstruction Approval (#47.5)
10.	DEPARTMENT OF PUBLIC SAFETY         District Office Contact:         Bruce Martin 802-885-8883 or LD Sutherland 802-786-0073           Construction Permit fire prevention, electrical, plumbing, accessibility (#49, 50, 50.1, 50.2) (Americans with Disabilities Act)
11. <sup> </sup> <sup> </sup>	BEPARTMENT OF HEALTH         802-296-5562         802-447-6412         802-786-5853            Food, lodging, bakeries, food processors (#51, 5.1, 52, 53, 53,1)         802-296-5562         802-447-6412         802-786-5853            Program for asbestos control & lead certification (#54, 55, 55.1)         800-439-8550(in VT) or 802-863-7220
12.	AGENCY OF HUMAN SERVICES         Contact:           _ Child care facilities (1-800-649-2642 or 802-241-2159) (#57)
13.	AGENCY OF TRANSPORTATIONContact:_ Access to state highways (residential, commercial (828-2653) (#66)
	Construction within state highway right-of-way (Utilities, Grading, etc.) (828-2653) (#66) Motor vehicle dealer license (828-2067) (#68)
14. 	DEPARIMENT OF AGRICULTURE (800-675-9873 or 802-828-3429)         Contact:           _ Use/sale of Pesticides (828-3429) (#72, 73, 74, 75, 76, 77, 78)          Slaughter houses, poultry processing (828-3429) (#81)           _ Milk Processing Facilities (828-3429) (#83, 83.1, 85, 87)          Slaughter houses, poultry processing (828-3429) (#81)           _ Golf Courses (828-2431) (#71)          Weights and measures. Gas Pumps. Scales (828-2436) (#88)

Green Houses/Nurseries (828-2431) (#79) \_\_\_\_\_ Retail Sales/Milk/Meat/Poultry/Frozen Dessert/Class "C" Pesticides (828-3429) (#79.1, 80)

Medium and Large Farm Operations (828-2431)

- 15. PUBLIC SERVICE DEPARTMENT Energy Efficiency Div. (888-373-2255) \_\_ VT Building Energy Standards(#47.2)
- 16. DIVISION FOR HISTORIC PRESERVATION (802-828-3213) Historic Buildings (#47.1 & 101) Archeological Sites (47.1 & 101)

 
 (339) \_\_\_\_\_ Liquor Licenses (#90) \_\_\_\_ General Info (1-800-642-3134)

 Business Registration (#90.1) \_\_\_\_ Professional Boards (1-800-439-8683) (#90.2)
 17. DEPARTMENT OF LIQUOR CONTROL (1-800-832-2339) \_\_\_\_

- 18. SECRETARY OF STATE (1-802-828-2386) 19. DEPARTMENT OF TAXES (802-828-2551 & 828-5787)\_ Business Taxes (sales & rooms, amusement machines) (#91.92, 93, 94, 95, 96)
- 20. DEPARTMENT OF MOTOR VEHICLES (802-828-2070) Fuel Taxes; Commercial Vehicle (#69-70)
- 21. LOCAL PERMITS (SEE YOUR TOWN CLERK, ZONING ADMINISTRATOR, PLANNING COMMISSION, OR PUBLIC WORKS)
- 22. FEDERAL PERMITS U.S. ARMY CORPS OF ENG, 8 Carmichael St., Ste. 205, Essex Jct., VT 05452 (802) 872-2893 (#97, 98,99)
- 23. OTHER:

Jacquelue Can

Sections #3-#24 above have been completed by Permit Specialist Jacqueline Carr Rev. 1/2010 I may be reached at 802-885-8850



AVIATION HIGHWAY/STRUCTURES ENVIRONMENTAL SITE/CIVIL