

**STATE OF VERMONT
AGENCY OF NATURAL RESOURCES
1 NATIONAL LIFE DRIVE
MONTPELIER, VERMONT 05620-3521**

FACT SHEET

May, 2016

PERMIT NO.: ID-9-0074
PIN: NS95-0155

NAME AND ADDRESS OF APPLICANT: North Branch Fire District #1
78 Dorr Fitch Road
West Dover, Vermont 05356

NAME AND ADDRESS OF FACILITY:

North Branch Fire District #1 Wastewater Treatment Facility
West Dover, Vermont

RECEIVING WATER(S):

Indirect Discharge via North Branch Fire District #1 Sprayfield and Subsurface
Disposal System to the Deerfield River and Ellis Brook

I. Proposed Action, Type of Facility, and Discharge Location:

The above named applicant submitted an administratively complete application for renewal of ID-9-0074 on 3/25/16 to the Vermont Agency of Natural Resources. The permit authorizes the indirect discharge from the treatment and disposal facility which serves the residences and businesses in West Dover, Vermont. Upgrades to the wastewater treatment facility were constructed in 2012. The wastewater is now treated by passage through an anaerobic selector and continuous loop reactors followed by two secondary clarifiers. After passage through the clarifiers the effluent passes through an ultraviolet disinfection system for disinfection prior to discharge to the subsurface disposal fields. The capacity of the disposal fields is set at 136,172 gallons per day, maximum, at a rate of 12.5 gallons per square foot per day based on a January 26, 2015 approval letter from the Secretary. Alternatively, following the clarifiers the wastewater may still be chlorinated for disinfection prior to discharge to the polishing and effluent storage ponds. From the ponds the wastewater can be pumped to the existing spray disposal area. The treated wastewater is pumped to a spray disposal area with a wetted area of approximately 34 acres at a previously approved loading rate of 3.6" per week. .

The indirect discharge associated with the sprayfield can be located on the USGS Wilmington 15' quadrangle map at Latitude N 42° 55' 31" and Longitude W 72° 50' 22". The spray disposal laterals are located between elevations 1625' and 1720'. The subsurface disposal fields can be located on the USGS Wilmington 15' quadrangle map at Latitude N 42° 55' 19" and Longitude W 72° 50' 28".

II. Description of Discharges:

NORTH BRANCH FIRE DISTRICT SPRAY EFFLUENT CHEMISTRY BY SEASON (2011 - 2015) (AVERAGE CONCENTRATIONS (in mg/L))						
SEASON (MONTHS)	BOD ₅	TSS	TP	TDP	CL	(n)
SUMMER (June-Oct)	9.8	8.1	0.8	0.6	99	25
WINTER (Nov – Mar)	3.7	2.3	0.8	0.7	100	25
SPRING (Apr – May)	4.9	10.5	0.7	0.4	95	8
Based on a subset of all available BOD ₅ and TSS.						
NORTH BRANCH FIRE DISTRICT SPRAY EFFLUENT CHEMISTRY BY SEASON (2011 - 2015) (AVERAGE CONCENTRATIONS (in mg/L))						
SEASON (MONTHS)	NO ₂	NO ₃	NO _x	NH ₃	TKN	(n)
SUMMER (6-10)	0.2	2.1	2.2	0.6	2.4	25
WINTER (11-3)	0.3	4.5	4.7	6.6	7.6	25
SPRING (4-5)	0.2	3.3	3.4	2.3	3.6	8
NORTH BRANCH FIRE DISTRICT AVERAGE INFLUENT AND EFFLUENT CONCENTRATIONS AND REMOVAL PERCENTAGES (2011 - 2015)						
INFLUENT BOD ₅ (mg/L)	EFFLUENT BOD ₅ (mg/L)	AVERAGE REMOVAL PERCENTAGE *	INFLUENT TSS (mg/L)	EFFLUENT TSS (mg/L)	AVERAGE REMOVAL PERCENTAGE E*	
142	6.5	94.7	152	5.9	94.9	
Based on a subset of all available BOD ₅ and TSS data with n = 58						
*Based on a subset of 58 data pairs						

II. Description of Discharges (continued):

NORTH BRANCH FIRE DISTRICT #1 COMPARATIVE DATA 2011 - 2015 [AVERAGE CONCENTRATIONS (in mg/L)]						
SEASON (MONTHS)	TP	TDP	NO3	TN	CL	(n)
SPRAY EFFLUENT CHEMISTRY SUMMER (June-Oct)	0.8	0.6	2.1	5	99	25
SUBSURFACE EFFLUENT CHEMISTRY SUMMER (June-Oct)	0.5	0.3	2.8	4	114	8

III (A). Downgradient Groundwater Chemical Monitoring Data (Sprayfield):

NORTH BRANCH FIRE DISTRICT #1 - GROUNDWATER MONITORING WELLS FOR SPRAYFIELD DATA 2011 – 2015 [AVERAGE CONCENTRATIONS (in mg/L)]				
WELL#	NO₃	TDP	CL	(n)
1	4.4	0.199	48	21
2	3.9	0.184	75	59
3	1.6	0.05	66	58
16	1.8	0.184	28	25
17	5.0	0.031	74	59
19	3.7	0.039	67	59
20	2.3	0.059	37	46
21	0.7	0.025	68	60
Wells 1, 2 and 3 are downgradient in Deerfield River drainage.				
Wells 16, 17, 19, 20 and 21 are downgradient in Ellis Brook drainage.				

**III (B). Downgradient Groundwater Chemical Monitoring Data
 (Subsurface Disposal Fields):**

NORTH BRANCH FIRE DISTRICT #1 GROUNDWATER MONITORING WELLS FOR SUBSURFACE DISPOSAL FIELDS 2012-2015 [AVERAGE CONCENTRATIONS (in mg/L)]				
WELL #	NO₃	TDP	Cl-	(n)
A	1.0	0.088	35.7	44
B	0.9	0.040	33.0	44
C	3.1	0.054	37.5	30
D	1.5	0.035	45.6	29
E	2.3	0.077	53.5	12

IV (A). Receiving Stream Chemical Monitoring Data (Stations for Sprayfield Discharge)

NORTH BRANCH FIRE DISTRICT #1 RECEIVING STREAM MONITORING DATA 2011 - 2015 [AVERAGE CONCENTRATIONS (in mg/L)]					
LOCATION	NO₃	TP	TDP	CL	(n)
Ellis Brook WQ1 (Upstream)	0.15	0.009	0.008	8.8	60
Ellis Brook WQ2 (Downstream)	0.20	0.009	0.008	12.6	60
Deerfield R. WQ3 (Upstream)	0.15	0.009	0.007	29.3	60
Deerfield R. WQ4 (Downstream)	0.19	0.011	0.007	30.6	60

**IV (A). Receiving Stream Chemical Monitoring Data (Stations for Sprayfield Discharge)
 (continued)**

NORTH BRANCH FIRE DISTRICT #1 RECEIVING STREAM MONITORING DATA 2011 - 2015 MONTHS: JUNE - OCTOBER [AVERAGE CONCENTRATIONS (in mg/L)]					
LOCATION	NO₃	TP	TDP	CL	(n)
Ellis Brook WQ1 (Upstream)	0.13	0.008	0.009*	10.7	25
Ellis Brook WQ2 (Downstream)	0.12	0.011	0.009	16.3	25
Deerfield R. WQ3 (Upstream)	0.11	0.009	0.008	33.6	25
Deerfield R. WQ4 (Downstream)	0.13	0.011	0.008	35.0	25
<p>*This average includes an anomalously high value for a sample collected on 10/7/2015; if this value is removed from the dataset, the Ellis Brook upstream average TDP is 0.008 mg/L.</p>					

NORTH BRANCH FIRE DISTRICT #1 RECEIVING STREAM MONITORING DATA 2011 - 2015 MONTHS: NOVEMBER - MARCH [AVERAGE CONCENTRATIONS (in mg/L)]					
LOCATION	NO₃	TP	TDP	CL	(n)
Ellis Brook WQ1 (Upstream)	0.19	0.008	0.007	7.2	25
Ellis Brook WQ2 (Downstream)	0.28	0.007	0.007	9.3	25
Deerfield R. WQ3 (Upstream)	0.19	0.009	0.007	25.6	25
Deerfield R. WQ4 (Downstream)	0.25	0.010	0.007	26.6	25

IV (A). Receiving Stream Chemical Monitoring Data – Stations for Sprayfield Discharge (continued):

NORTH BRANCH FIRE DISTRICT #1 RECEIVING STREAM MONITORING DATA 2011 - 2015 MONTHS: APRIL - MAY [AVERAGE CONCENTRATIONS (in mg/L)]					
LOCATION	NO₃	TP	TDP	CL	(n)
Ellis Brook WQ1 (Upstream)	0.13	0.013*	0.007	8.2	10
Ellis Brook WQ2 (Downstream)	0.22	0.008	0.007	11	10
Deerfield R. WQ3 (Upstream)	0.15	0.010	0.006	27.6	10
Deerfield R. WQ4 (Downstream)	0.20	0.015	0.007	29.7	10

*This average includes an anomalously high value for a sample collected on 5/21/2013; if this value is removed from the dataset, the Ellis Brook upstream average TDP is 0.009 mg/L.

COMPLIANCE WITH VERMONT WATER QUALITY STANDARDS					
2011 – 2015 Results	Ellis Brook				
	Sample Results (n)	Upstream Mean (WQ1)	Downstream Mean (WQ2)	Next Downstream Mean (WQ5)	WQ Standard
Nitrate (mg/L) ¹	25	0.13	0.12	0.11	5.0
Total Phosphorus (mg/L) ¹	25	0.008	0.011	0.009	0.012 ²
Total Dissolved Phosphorus (mg/L) ¹	25	0.009	0.009	0.009	
Chloride (mg/L)	60	8.8	12.6	13.8	230
Turbidity (N.T.U.)	60	0.9 ⁴	1.0 ⁴	0.9	10 ³
pH (standard units)	60	6.3	6.2	6.7	6.5 – 8.5
E coli (colonies/100 ml)	60	4	5	5	126

¹Only results from June – October used for compliance
²Standard for small, high gradient stream
³Standard for cold water fish habitat
⁴Maxima : Upstream: 1.9 NTU Downstream: 3.4 NTU
 Note: Sample Size for WQ5 for June-October n = 19; For all months n = 43

**IV (A). Receiving Stream Chemical Monitoring Data – Stations for Sprayfield Discharge
 (continued):**

COMPLIANCE WITH VERMONT WATER QUALITY STANDARDS					
2011 – 2015 Results Parameter	Deerfield River				
	Sample Results (n)	Upstream Mean (WQ3)	Downstream Mean (WQ4)	Next Downstream Mean (WQ6)	WQ Standard
Nitrate (mg/L) ¹	25	0.11	0.13	0.12	5.0
Total Phosphorus (mg/L) ¹	25	0.009	0.011	0.010	0.012 ²
Total Dissolved Phosphorus (mg/L) ¹	25	0.008	0.008	0.009	
Chloride (mg/L)	60	29.3	30.6	34.0	230
Turbidity (N.T.U.)	60	1.8	1.8	1.6	10 ³
pH (standard units)	60	6.4	6.4	6.7	6.5 – 8.5
E coli (colonies/100 ml)	60	22	23	16	126
¹ Only results from June – October used for compliance ² Standard for small, high gradient stream ³ Standard for cold water fish habitat ⁴ Maxima : Upstream: 7.8 NTU Downstream: 8.3 NTU Note: Sample Size for WQ6 for June-October n = 19; For all months n = 43					

IV (A). Receiving Stream Chemical Monitoring Data – Stations for Sprayfield Discharge (continued):

For an average 223,250 gallon per day indirect discharge to the Deerfield River:

Parameter	Mean Discharge Concentration (mg/L)	Mean Upstream Concentration (mg/L)	Mean Downstream Concentration (mg/L)	Calculated Downstream Concentration (mg/L)	IDR Limit Concentration (mg/L) ¹
TDP	0.13	0.007	0.007	0.024	0.008
NO _x	3.0	0.15	0.19	0.5	2.0
Cl	67.1	29.3	33.6	34.4	—

For period: 2011 - 2015
 Discharge concentration data based on downgradient monitoring well data; n = 138 (n = number of samples analyzed) including wells 1, 2, and 3 (these are downgradient of the sprayfield in the Deerfield River drainage).
 Upstream and Downstream concentration data based on minimum n = 60
 Deerfield River - Low Median Monthly Flow = 1,441,000 gpd (est)
 and 7Q10 Flow = 199,198 gpd (est)

¹For comparative purposes only; this discharge is not required to meet Aquatic Permitting Criteria of Indirect Discharge Rules

For an average 251,750 gallon per day indirect discharge to Ellis Brook:

Parameter	Mean Discharge Concentration (mg/L)	Mean Upstream Concentration (mg/L)	Mean Downstream Concentration (mg/L)	Calculated Downstream Concentration (mg/L)	IDR Limit Concentration (mg/L) ¹
TDP	0.052	0.008	0.008	0.017	0.009
NO _x	2.8	0.15	0.20	0.69	2.0
Cl	71.5	8.8	12.6	21.6	N/A

For period: 2011 - 2015
 Discharge concentration data based on downgradient monitoring well data; n = 249 (n = number of samples analyzed) including wells 16, 17, 19, 20 and 21 (these are downgradient of the sprayfield in the Ellis Brook drainage).
 Upstream and downstream concentration data based on minimum n = 60
 Ellis Brook - Low Median Monthly Flow = 980,900 gpd (est)
 and 7Q10 Flow = 135,593 gpd (est)

¹For comparative purposes only; this discharge is not required to meet Aquatic Permitting Criteria of Indirect Discharge Rules

IV (B). Receiving Stream Chemical Monitoring Data – Stations for Subsurface Disposal Fields Discharge:

NORTH BRANCH FIRE DISTRICT #1 RECEIVING STREAM MONITORING DATA 2012 - 2015 [AVERAGE CONCENTRATIONS (in mg/L)]					
LOCATION	NO₃	TP	TDP	CL	(n)
Ellis Brook WQ2	0.20	0.009	0.008	12.6	60
Ellis Brook WQ5	0.33	0.009	0.008	13.8	43
Deerfield River WQ4	0.19	0.011	0.007	30.6	60
Deerfield River WQ6	0.17	0.010	0.008	34.0	42

These stations bracket the indirect discharge from the subsurface fields. The groundwater flow beneath the subsurface disposal fields is believed to flow primarily towards the Deerfield River.

For an average 136,172 gallon per day indirect discharge to the Deerfield River:

Parameter	Mean Discharge Concentration (mg/L)	Mean Upstream Concentration (mg/L)	Mean Downstream Concentration (mg/L)	Calculated Downstream Concentration (mg/L)	IDR Limit Concentration (mg/L)¹
TDP	0.035	0.007	0.008	0.009	0.007
NO _x	1.7	0.19	0.17	0.32	2.0
Cl	38.4	30.6	34.0	31.3	N/A

For period: 2011 - 2015
 Discharge concentration data based on downgradient monitoring well data; n = 159 (n = number of samples analyzed) including wells A,B,C,D and E(these are downgradient of the Subsurface disposal fields in the Deerfield River drainage).
 Upstream and Downstream concentration data based on minimum n = 60 and 42, respectively. Sampling of Station WQ6 began in 2012, accounting for the difference in sample data points.
 Deerfield River - Low Median Monthly Flow = 1,441,000 gpd (est)
 and 7Q10 Flow = 199,198 gpd (est)

V. Results of Biomonitoring During 2011 - 2015

LOCATION: Ellis Brook

Sampling Period	Results	Comments
8-20-14 to 9-25-01	SAAB	Significant Alteration of Aquatic Biota (SAAB) due to much higher relative abundance at the downstream station due to a highly significant increase in primary and secondary productivity. This is corroborated by the results of the periphytic chlorophyll sampling which indicated a statistically significant increase in algal growth at the downstream station when compared to the upstream station.

LOCATION: Deerfield River

Sampling Period	Results	Comments
8-13-15 to 9-20-15	NSAAB	No Significant Alteration of Aquatic Biota (NSAAB) was detected during the 2015 sampling which included Deerfield River Stations WQ3, WQ4 and WQ6. The results of the periphytic chlorophyll sampling indicated a statistically significant difference (increase) in algal growth when Station WQ4 was compared with WQ3 and also when WQ6 was compared to WQ3. No statistically significant difference was detected between Stations WQ4 and WQ6 during the same analysis (Kruskal-Wallis test).

VI. Discussion of Water Quality Monitoring Results

Chemical Monitoring

As was the case in previous analyses of chemical monitoring data (in 2011), the calculated downstream concentration for most parameters is higher than the mean (observed) downstream concentration. This may be due to several reasons including:

- (1) The average stream flow during sampling events is higher than either the Low Median Monthly stream flow, thus providing additional dilution. This would appear to be the case for nitrate and chloride.

VI. Discussion of Water Quality Monitoring Results (continued):

- (2) There can be a rapid uptake of limiting nutrients such as phosphorus by the periphytic stream community so as to mask the loading of the stream by the indirect discharge from the sprayfield or the subsurface disposal fields.
- (3) Nitrate undergoes additional conversion (denitrification) in soils downgradient of the sprayfield monitoring wells resulting in a loss of nitrogen to the atmosphere and a decreased discharge of nitrate to the receiving streams.
- (4) The calculated downstream concentration is based on the discharge at the permitted volume. However, sprayfield disposal systems typically discharge volumes less than the permitted amount, therefore the loading of contaminants to the groundwater and indirectly to the stream is lower.

Biological Monitoring Results:

Biological sampling of the Deerfield River (2015) and Ellis Brook (2014) has been conducted by the permittee.

A Significant Alteration of the Aquatic Biota (SAAB) was detected in Ellis Brook but not in the Deerfield River. For Ellis Brook the Significant Alteration was due to the increase in relative abundance of macroinvertebrates at the downstream station. For the Deerfield River, only a significant increase in periphytic chlorophyll was observed in the downstream Stations (WQ4 and WQ6) when compared to the upstream station (WQ3).

It is likely that the export of phosphorus from the sprayfield to both Ellis Brook and Deerfield River watersheds is the cause of the observed differences. While it may be too early to tell, the greater use of the subsurface disposal fields may decrease the overall loading of phosphorus to both streams. [See the spray effluent vs. subsurface effluent comparison table on bottom of page 3].

During the five-year life of the proposed renewed permit, the permittee will be required to conduct biomonitoring of Ellis Brook in 2019 and the Deerfield River in 2020. With an expiration date of June 30, 2021, the second round of biomonitoring results will need to be submitted by March 31, 2021, the date for applying for renewal of the permit.

VII. Proposed Changes to the Permit:

Condition A(3) - Expiration Date

This permit expires on June 30, 2021. The permittee should apply for renewal of the permit by March 31, 2021. However, for the purposes of Title 3 an application for renewal of the permit will be considered timely if received by the expiration date.

Condition A(4) - Effective Date

This condition now simply states that the permit becomes effective on July 1, 2016.

Condition A(13) – Uncommitted Reserve Connection Capacity

This permit condition has been updated because the document “Agency Policy on Connections to Wastewater Treatment Facilities”, effective July 24, 1989” is no longer in active use. The calculation of Uncommitted Reserve Connection Capacity shall occur annually. See the proposed permit condition for details.

Condition D(2) General Operating Requirements – Treatment and Subsurface Disposal:

This condition now contains the following language relative to discharges to the subsurface disposal fields:

The effluent shall be discharged to the subsurface disposal fields in discrete doses with no more than 34,043 gallons per dose. The time period between doses should initially be at least the same length of time as the dose itself.

Condition D(9) Update to Operations and Maintenance Manual:

The completion date for submitting the revisions to the O&M Manual has been extended:

By August 1, 2016 the permittee shall have a Vermont registered professional engineer submit a complete update to the Nbfd #1 O&M Manual to the Secretary for review and approval. The update shall address all new and upgraded components of the WWTF including the subsurface disposal option.

Condition E(3)(A) – Receiving Stream Monitoring – Chemical

The stream monitoring frequency for Ellis Brook (three stations) and the Deerfield River (three stations) has been reduced from monthly to only the months of February (for winter low flow conditions) and June – October (to be consistent with Water Quality Standards base flow requirements). A requirement for monitoring the dissolved oxygen at all stations has been added.

Condition E(3)(B) - Biological Monitoring

The permit now requires biological sampling in Ellis Brook in 2019 and the Deerfield River in 2020.

Condition E(4) - Summary Water Quality Evaluation

Annual water quality evaluations are required as per the previous permit but the submittal date is now March 31st. The evaluation due on March 31, 2021 should provide the data analyses required for renewal of this permit in accordance with the Indirect Discharge Rules in effect at that time.

END OF PROPOSED CHANGES

Tentative determinations regarding conditions to be included in the pending Vermont Indirect Discharge Permit have been made by the Vermont Agency of Natural Resources, Department of Environmental Conservation. The conditions imposed will assure that the Vermont Water Quality Standards and applicable provisions of 10 V.S.A. Chapter 47 will be met.