

Godfrey 7 Native Prairie Bank Prescribed Burn Escape Review

Review Team

Blair Olson, NW Regional Prescribed Burn Committee, ICT4, FIRB--DNR Forestry

Cindy Lueth, NW Regional Prescribed Burn Committee, RXB2, TFLD--DNR Parks and Trails

Doug Franke, MRXB2--DNR Section of Wildlife

Brad Bolduan, MRXB2--DNR Ecological and Water Resources

Travis Verdegan, LTAN(t), ICT4--MIFC

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Summary

An escaped prescribed burn resulted in the Godfrey Wildfire on May 17, 2021. The Godfrey 7 Native Prairie Bank Prescribed Burn (Godfrey 7 Rx Burn) was planned to benefit privately owned remnant prairie enrolled in a conservation easement with the State of Minnesota. The 67-acre planned burn included 25 acres of federal Glacial Ridge National Wildlife Refuge (NWR). MNDNR Divisions of Ecological and Water Resources and Section of Wildlife personnel conducted the prescribed burn.

Shortly after 1145 on May 17th, 5-7 spot fires ignited outside the east line 200-300 yards south of the point of ignition. Two spots were quickly extinguished but the remaining spots grew together and formed a head fire front moving northeast. Fire intensity prevented ground resources from catching the spot fire and a wildfire (Godfrey Wildfire) was declared at 1200. The head fire breached contingency lines and ran approximately 1.5 miles through mostly wet and dry prairie and 11 acres of aspen timber. In addition to the east line spot fires, at about 1400 a 6.5-acre escape occurred on the northwest corner of the prescribed burn unit and ignited a cattail swamp. The Godfrey Wildfire blackened 273 acres: 223 acres of private land (different owner than the prairie bank owner); 33 acres of state land; 17 acres of federal land. Twenty-three acres of the prescribed burn were accomplished.

Factors that contributed to the occurrence, size and/or spread of the spot fires included:

- *A large expanse of volatile continuous fuels lay adjacent to the prescribed burn unit*
- *Dry vertically arranged fuels influenced by drought readily ignited and burned with high intensity and impeded the ability of ground resources to control the fire*
- *Shifting and variable winds*
- *Burn crew did not recognize that humidity was dropping earlier than forecast that day*

Purpose

This review was conducted without intent to focus blame on any single person, action (or lack thereof), or policy. Rather the members of this review team sought to identify specific areas to enhance our ability as an agency and individuals to safely accomplish prescribed burning, a core management action.

It should be recognized that prescribed fire, like any management action including driving, carries with it a level of risk. By lessening the stigma of mishap reporting, we stand to gain a tremendous amount by providing readily available Lessons Learned that can be used to reduce our overall exposure to risk and provide a conduit for those lessons to feed policy, procedure, and guideline updates.

This review is limited to the prescribed fire and reasons for escape but excludes a thorough review of wildfire response. The prescribed burn community recognizes the need to enhance understanding and working relationships in an emergent wildfire that results from an escaped prescribed fire.

The Godfrey escape review team used fire environment information beyond that normally used by Minnesota prescribed burn practitioners. The review team had the skills to interpret fire environment data not normally expected of field practitioners.

Fire Environment

By May 2021, NW Minnesota saw intensifying levels of drought as depicted by the US Drought Monitor Classification (Figure 1). Drought Code, a long-term component of the Canadian Forest Fire Danger Rating System (CFFDRS) for weather stations in NW Minnesota showed values of 170 – 250, which are significant for late spring. A low snowpack quickly receded in March leading to abnormally high wildfire activity. Aggressive wildfires were common throughout the spring and generated a Fuels and Fire Behavior Advisory posted on the National Interagency Coordination Center (NICC) and Eastern Area Coordination Center (EACC) webpages. On March 29, the Oxcart Fire ignited and burned 12,500 acres 3.75 miles north of the Godfrey 7 Rx Burn.

The Godfrey 7 Rx Burn implementation planning began during the end of the week of May 9th, continued through the weekend, and the burn was conducted Monday, May 17th.

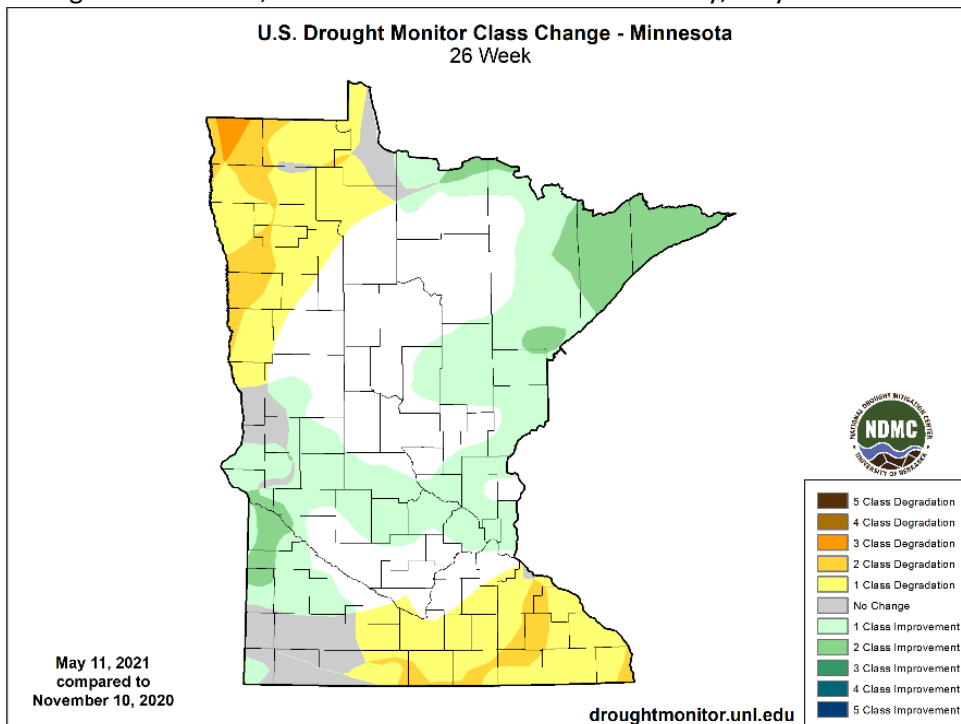


Figure 1. US Drought Monitor Class Change, Minnesota 26 Week

During this period, NW Minnesota had little to no precipitation and Fine Fuel Moisture Codes (FFMC), a short-term indicator of fire danger in CFFDRS, were showing *high* to *extreme* values leading up to the burn and were observed at *extreme* on the day of (Figure 2). Build Up Index (BUI) values, a CFFDRS indicator of difficulty to control, were also observed at *very high* to *extreme* leading up to and on the day of the burn.

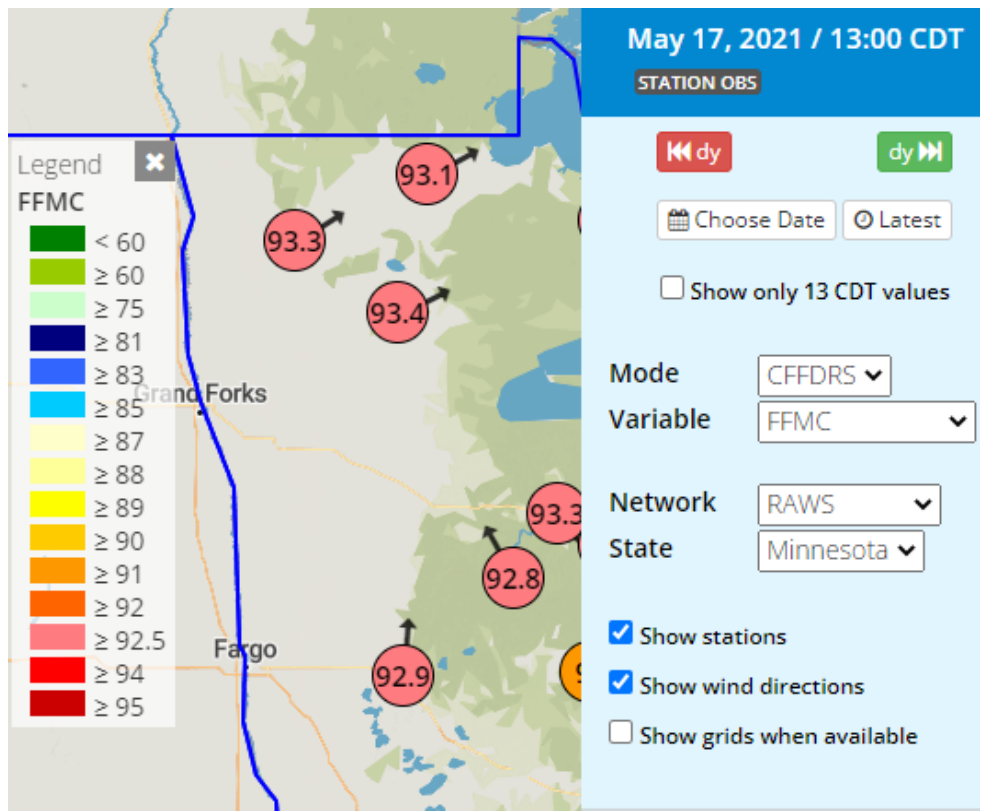


Figure 2. CFFDRS Fine Fuel Moisture Code values for NW Minnesota on May 17, 2021

A National Weather Service (NWS) Spot Weather Forecast obtained the morning of the burn showed temperatures peaking in the low to mid 80s, with winds in the low teens, and relative humidity in the mid-20s (Table 1).

Table 1. NWS Spot Weather Forecast Godfrey 7 Rx Burn. May 17, 2021

TIME (CDT)	8AM	9AM	10A	11A	12P	1PM	2PM	3PM	4PM	5PM	6PM
Sky (%)	11	7	3	3	3	3	4	5	6	5	3
Temp (°F)	60	64	68	72	77	80	81	83	83	83	82
RH (%)	64	58	52	46	39	31	28	25	24	24	24
20 FT wind (direction)	SW	SW	SW	SW	SW	S	S	S	S	S	S
20 FT wind (speed)	9	9	9	9	9	13	13	13	13	13	13
20 FT wind gust (speed)	14	14	14	14	14	21	21	21	21	21	21

Note: It is important to understand that while the actual observed weather indicated hotter and drier conditions than the forecast, the Spot Weather Forecast identified the acceptable prescription parameters between 8am and noon. At noon mitigations were required due to elevated FFM and Probability of Ignition (PIG).

The Godfrey 7 Rx Burn unit is in Section 7, Township 148N, Range 44W. The escape was primarily in Section 6, Township 146N, Range 44W and Section 33, Township 149N, Range 44W. The area fuels were wet seepage prairie, mesic prairie, planted upland CRP prairie and aspen stringers. The area is generally flat and interrupted by low-rising beach ridges. Due to gravel and sandy soils, fuels on beach ridges are prone to drying quickly and fires can readily ignite spread rapidly.

Chronology of Events

Long Term

Timeline	Event
Fall- 2019	State DNR staff request permission to include 25 acres of NWR lands in Native Prairie Bank easement burn (the Godfrey 7 Rx Burn) The Native Prairie Bank easement is on private land.
2020	Godfrey 7 Rx Burn plan written, reviewed. Covid restrictions prevent prescribed burning in 2020.

Building Situational Awareness

March-2021	3/29 Oxcart wildfire occurs three miles north of prescribed burn unit on NWR. Local conditions were red flag with prolonged moderate drought and fuels exhibiting abnormal readiness to burn. 12,507 acres burned and was managed by a MN Type 3 Incident Management Team.
Early April	MN DNR grants permission to resume limited prescribed burning under Covid restrictions. Rx burns require high level review and approval, and smoke management is more stringent than normal
22 days, pre-burn	Local NWR burn crew stop prescribed burning and switch to suppression due to dry fuels. Local fire organizations are informed.
21 days, pre-burn	MRXB2 site visit: ridges dry with standing water/wet seepages in low elevations.
10 days, pre-burn	NW Region moves to Planning Level 4. Since the area is already under seasonal fire restrictions, this triggers mandatory Fire Section Manager approval of all prescribed burn permit activations.
May 9	Permission to burn the Godfrey unit was initially requested on May 9 th with burn activities planned for May 10 th , but notification of approvals was received too late in the day to conduct the burn.
7 days pre-burn	MRXB2 revisits site to assess moisture and site conditions

Short Term

3 days, pre-burn	MRXB2 request burn permit activation from Fire Section Manager, Area Forestry for period of 5/17 – 5/19; activation approval granted. Region Division manager approval for the Godfrey 7 RX Burn requested.
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1 day, pre-burn	Godfrey 7 Rx Burn area fire danger rating is Very High which triggers mandatory regional Division approval to commence burning, which is received.
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Burn Day

Day of burn	DNR Predictive Service Fire Behavior Forecast 0830: "...Probability of ignition is elevated over a wider area today and all fuel types will be highly receptive." Grass Flame Length-14-15'; ROS 90-95 ch/hr; 60 min spread-155 acres.
0555	NWS Grand Forks Red Flag Warning issued for Eastern ND from 1400 to 2000 (no MN counties listed).
Early am	Interdivisional burn crew leadership agree to burn Godfrey 7 Rx Burn due to small size and ability to finish early enough to allow a second Rx burn that day.
0740	MRXB2 requests NOAA spot weather; Spot forecast for 1000: T-68; RH-52%; Wind-SW, 9-14mph. Spot forecast for 1100: T-72; RH46%; Wind-SW 9-14mph.
0754	Godfrey 7 Rx Burn permit is activated.
1015	On-site briefing; ICT4 designated as command in event of escape; Observed weather: T-68; RH-45%; Wind-S, 3-5mph, gusts to 8mph.
1045	Test Fire, NE corner; Observed weather: T-79; RH-36%; Wind-S, 3-5mph. "No concerning fire behavior."
1115-1130	North control line installed; 20-30 yards of black and "no concerning fire behavior".
1130	Ignition proceeds south along east and west lines with down-wind (east) line slightly ahead of west line. 1-2 foot backing flames.
1145	East line spot fires called over radio estimated to be 300-350 yards south of Point of Ignition (NE corner). Spots are outside of burn unit and about 20-30 yards away from flames on interior of burn unit. Ignition halts and UTV1 and UTV2 extinguish 2 spots.
1148	ICT4 at NE corner observes more spots outside of burn unit. Flames in one spot are too big for UTVs so tractor and all-track attempt suppression. Spot fires merge together and equipment is unable to extinguish.
1200	Wildfire declared due to inability of resources to extinguish fire; USFWS suppression resources requested.
1215	Bemidji Dispatch office receives report of wildfire from FIRB. Fire is running N/NE, estimated size at 80 acres, and their report indicates that structures threatened. Engines, air, and tracked units are dispatched over the next half hour.
1220	ICT4 notes neighbor with tractor and pickup truck downwind of wildfire attempting to put in fire line.
1243	Air Attack 5 overhead and establishes communication with ICT4.

1246	USFWS taskforce arrives and takes command of east line. TFLD observations: "fire was intense, fuels driven. It was slowed by the aspen stringer and LAT drop." Cattail flames were observed at 20'. Flames in grass too big to go direct.
1311-1604	Various ground and air resources arrive.
1400	Heat in the duff on the NW corner creeps out and ignites cattails outside of the Rx burn unit. Ground resources at the site call air to extinguish the escape and holds the area at 6.5 acres
1545	Air Attack 5 released; 9BH (helicopter) continues assisting mop-up. Air Attack observations: fire behavior was too big for direct attack; some green-up was visible from the air but appeared minimal in the escape area; flame lengths estimated at 25-30 feet when the south wind pushed; backing flames estimated at 7'.

Lessons Learned

Lessons by those Involved (views expressed by those involved in the incident related to what they learned and what they believe the organization should learn from their experience ("What would I do differently next time, knowing what I know now?").

Human factors

- "High workload, low staffing leads to burning on marginal days"
Agency Covid policies did not allow prescribed burning during 2020. The 2021 prescribed burn season was delayed and burning was only allowed after meeting county Covid case-load restrictions. Agency policy in 2021 allowing burning during Covid also required elevated smoke management precautions. The Covid issues contributed to a sense of urgency to accomplish the priority burns and may have favored a bias for action. The question arises whether the organization has sufficient fire resources to accomplish critical prescribed fire projects.

Burn planning

- "If I were to burn this unit again...I would consider strengthening ...contingency line(s)..."
The contingency line challenged by the escape was ineffective in providing ample opportunity for the contingency resources to halt the escape. Improving contingency lines through fuels manipulation would have increased the probability that the fire could have been contained within the intended contingency line.
- "New policy requiring regional manager approval was surprising, not much prep time was given. Clear roles and responsibilities ahead of time would have been helpful"
The Fire Danger Rating on May 17, 2021 was *Very High* and the statewide Planning Level was 4. The combination of Fire Danger Rating and Planning Level required the regional manager to review all Godfrey 7 Rx Burn documents and make the final decision to commence burning. This procedural change, effective in 2020, caught the regional manager by surprise and, as a non-fire trained manager, he felt un-prepared.
- "A call from the burn boss [to local area forestry] is a nice courtesy. In this case, the burn window was several days so a courtesy call would've been nice and perhaps a different Go/No Go decision would've been reached"

The DNR's Burning Permit Activation System runs on the timeline of 0800-0759. For example, a permit activated between 0001 - 0759 will show up as activated for the previous day. The local Area Forestry Office responsible for wildfire suppression was unaware of the Godfrey 7 Rx Burn implementation until the wildfire was called in to Forestry as an escaped prescribed fire.

Review Team Analysis

Prescribed Burn Unit Plan (Plan)

Underlying the burn plan was an expectation of normal hydrologic site conditions for the area. The Plan was adequate for "normal" site conditions, but conditions (Fire Environment) at the time of the burn were not normal.

The review team noted the following notable items during the review:

- **Burn Unit Description**

Description of adjacent fuels indicates continuous grass for one half miles to the north. It may be more accurate to say that there is near continuous fuel for approximately three miles north until it is interrupted by a road.

- **Burn Prescription Window**

The Spot Weather and observed readings were within acceptable Plan prescription parameters the morning of the prescribed burn.

The Plan recognizes two triggers requiring mitigation, but the Plan does not go into detail as to what measures are required.

4% FFM requires mitigation. The spot weather for the day indicates likelihood of 4% FFM during the burning period.

The Plan also calls for re-evaluating the burn if PIG approaches 65%. Calculated PIG using the Spot Weather Forecast shows PIG hitting 65% by 1200.

It is unclear that the 4% FFM or increasing PIG were used as a decision point to evaluate the decision to burn this unit under these conditions.

- **Personnel Needs**

Burning in the high end of the prescription required greater resources than the minimal list in the burn plan. The burn crew recognized this and increased personnel and water equipment above the minimum listed in the plan.

- **Contingency Plans**

There is no requirement in the plan that resources be able to contain an escape using the haul chart. However, the fire intensity combined with the haul chart and PIG during the first hour of the escape show ground resources will likely not be able to catch an escape. This reinforces observations by both the Incident Commander and incoming Task Force Leader that ground resources using water and hoses were inadequate to suppress due to extreme heat coming from the escaped fire.

Experience and Training Levels of Personnel

Key personnel were appropriately qualified for their roles on this burn and had considerable experience burning in these fuel types. All burn crewmembers were qualified as firefighter type II, at a minimum.

Review Team Recommendations for Consideration by the Statewide Prescribed Committee and Prescribed Burn Handbook

Underlying the burn planning and implementation was an expectation of normal hydrologic site conditions for the area. While planning was adequate for “normal” site conditions, the Fire Environment at the time of the burn was not normal. The recommendations below all encourage prescribed fire practitioners to recognize the value of using Fire Environment data at various decision points when planning and implementing prescribed burns.

1. Incorporate fire danger indices along with NWS Fire Weather into burn planning to better recognize a changing fire environment.
2. Expand Fire Environment training opportunities for prescribed fire practitioners.
3. Plans should be written with identified thresholds to better mitigate risk when burning under the high end of prescriptions.
4. Burn prescriptions written with mitigations should detail the mitigations.
5. Clearly identify mitigation measures that speak to the expected worst-case conditions in adjacent fuels when a threshold is met.
6. Investigate alternatives to the current system of writing prescriptions, such as allowing the use of Canadian Forest Fire Danger Rating System indices.
7. Train prescribed burners in methods of real time forecast verification and the effects of Anchoring Bias as it relates to the initial framing of a fire day based on the forecast.
8. Seek solutions to timing issues surrounding burn permit activation and Forestry knowledge of these activations.
9. Expand the understandings between suppression and prescribed fire practitioners faced with cooperatively managing wildfire caused by an escaped prescribed fire.
10. Clarify the role of non-forestry incident command qualified prescribed burners during suppression activity resulting from prescribed burn activity once a wildfire is declared.
11. After Action Reviews that include all relevant parties are recommended for prescribed burns and should be mandatory for escapes or significant incidents.
12. Create a Lessons Learned virtual space to disseminate escaped fire reviews.
13. Ensure Burn Bosses and involved DNR staff review the Prescribed Burn Handbook annually and after updated handbook editions.

Supporting Documentation

MN DNR Prescribed Burn Unit Plan												NA-01990-04
Burn Unit Name and ID:		Godfrey 7 NPB – Polk County										
Wind Direction		Spread Rate		Flame Length		Wind Speed		Temp.	Relative Humidity	1 Hr Fuel Moisture	1000 Hr Fuel Moisture or Drought Code	
		Head	Backing	Head	Backing	20'	Mid flame					
Any (N or S Preferred)	Maximum Prescription	200 ch/hr	5.7 ch/hr	14.6 ft	2.9 ft	Max	Max	Max	Min	5%, 4% w/ mitigation	NA	
	Minimum Prescription	19.6 ch/hr	3.4 ch/hr	6.0 ft	2.1 ft	Min	Min	Min	Max	9%	NA	
Burns shall not be conducted when all Guidance Prescription Parameters are at maximums.												
Consideration						Additional Considerations						
Max. Probability of Ignition:						Burn will be reevaluated if Prob. Ign. Approaches 65%						
Cultural site(s): none known						No digging into the ground						
Natural Heritage Elements: yes						Prairie habitat for obligate insects, plants and animals has been divided into units to avoid burning all breeding and foraging habitat at one time.						
Adjacent Land Concerns: yes						All low maintenance gravel roads are lightly used. Prescription keeps smoke from directly impacting residences. Notify residents' prior to burn.						
Peat Soils or Wet Soils: no						Avoid rutting wet soils. Rehab any damage done to soils.						
Other:						Neighbor contacts completed before ignition						

Figure 3. Excerpt from Godfrey 7 Rx Burn plan highlighting mitigation needed for PIG approaching 65%

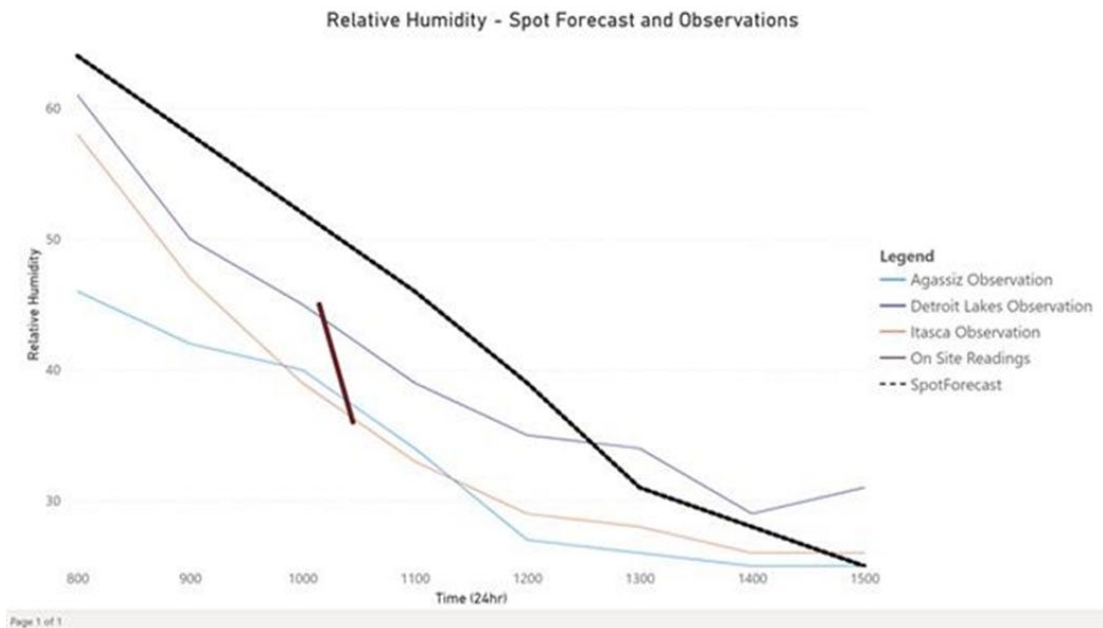


Figure 4. Relative Humidity trends as shown on the NWS Spot Weather Forecast, the onsite readings, and observation from selected remoted automated weather stations. The decision to burn was based on the NWS Spot Weather Forecast. The onsite readings – were questioned for accuracy. The RAWS observations were used only for after the fact analysis.

Table 2. Progression of fine dead fuel moisture and **Probability of Ignition** using weather inputs from 1100 – 1500 obtained from spot weather forecast used for Godfrey 7 Rx Burn prescription.

	Temp oF	72	77	80	81	83
	RH %	46	39	31	28	25
1-h Fuel	4				76	76
Moisture	5		65	66		
%	8	42				
	Time	11	12	13	14	15

Table 3. Progression of fine dead fuel moisture and **Rates of Spread** from burn plan Behave table with 30% live fuel moisture using weather inputs from 1100 – 1500 obtained from spot weather forecast used for Godfrey 7 Rx Burn prescription.

	20' Wind	9	9	13	13	13
	Mid Flame .4 WAF	4	4	5	5	5
1-h Fuel	4				100.8	100.8
Moisture	5		68.2	82.3		
%	8	57.8				
	Time	11	12	13	14	15

Table 4. Progression of fine dead fuel moisture and **Flame Lengths** from burn plan Behave table with 30% live fuel moisture using weather inputs from 1100 – 1500 obtained from spot weather forecast used for Godfrey 7 Rx Burn prescription.

	20' Wind	9	9	13	13	13
	Mid Flame .4 WAF	4	4	5	5	5
1-h Fuel	4				10.8	10.8
Moisture	5		8.7	10.1		
%	8	7.8				
	Time	11	12	13	14	15

Onsite Observations

Table 5. Progression of fine dead fuel moisture and **Probability of Ignition** using weather inputs from 1015 – 1045 obtained from onsite observations.

	Temp oF	68	79
	RH %	45	36
1-h Fuel			
Moisture	6		57
%	8	41	
	Time	1015	1045

Table 6. Progression of fine dead fuel moisture and **Rates of Spread** from burn plan Behave table with 30% live fuel moisture using weather inputs from 1015 – 1045 obtained from onsite observations.

	20' Wind	9	9
	Mid Flame .4 WAF	4	4
1-h Fuel			
Moisture	6		63.8
%	8	57.8	
	Time	1015	1045

Table 7. Progression of fine dead fuel moisture and **Flame Lengths** from burn plan Behave table with 30% live fuel moisture using weather inputs from 1015 – 1045 obtained from onsite observations.

	20' Wind	9	9
	Mid Flame .4 WAF	4	4
1-h Fuel			
Moisture	6		8.3
%	8	7.8	
	Time	1015	1045

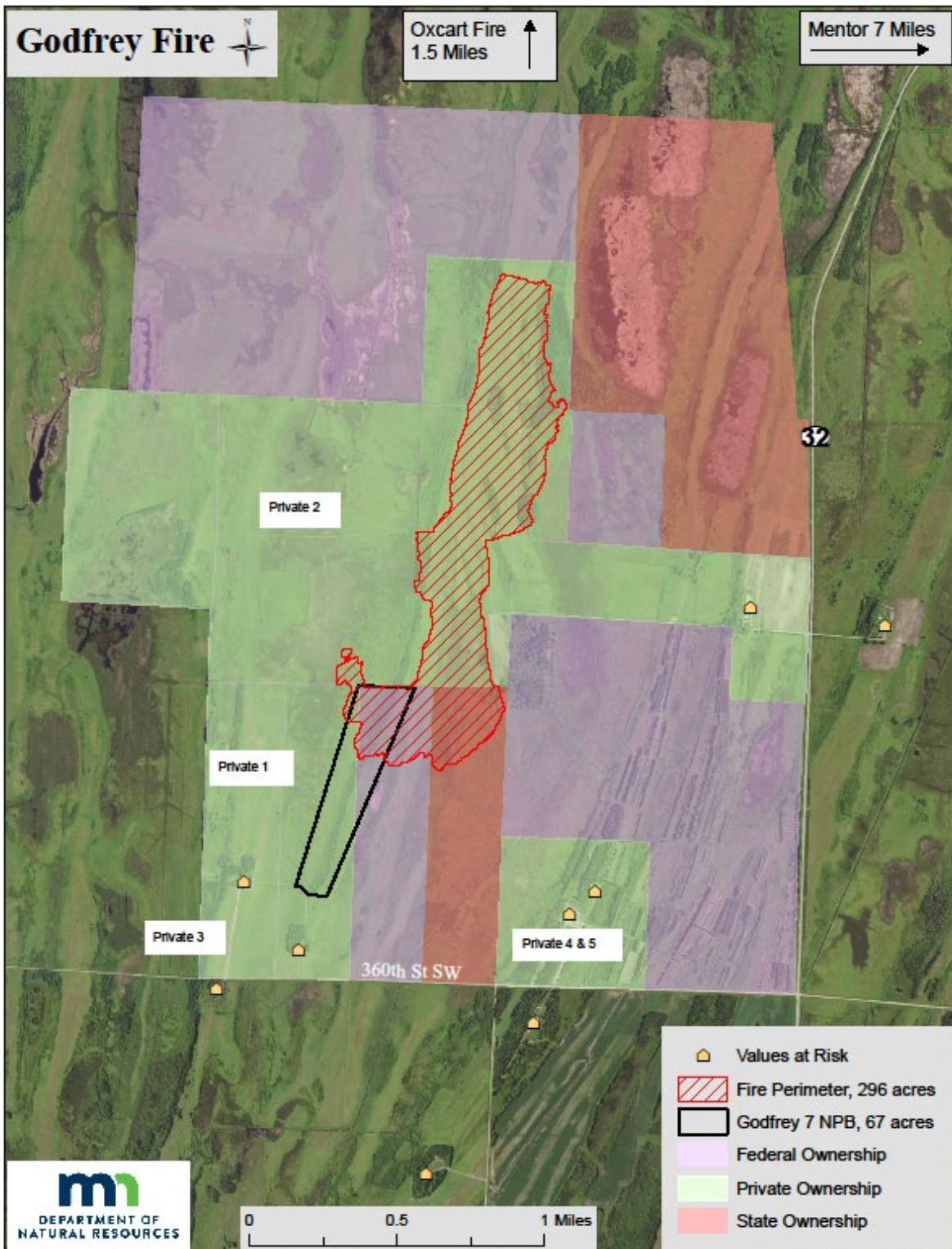


Figure 5. Godfrey 7 Rx Burn and escaped fire perimeters and ownership map.