



NOTICE IS HEREBY GIVEN that a Regular meeting of the Board of Directors and the Water/Sewer Enterprise Fund of the **FOREST HILLS METROPOLITAN DISTRICT**, Jefferson County, Colorado has been scheduled for Wednesday, May 19, 2021 beginning at the hour of 5:30 PM via ZOOM video conference for the purpose of addressing those matters in the Agenda set forth below and conducting such other business as may properly come before the Board.

<u>Board of Directors:</u>	<u>Office</u>	<u>Term/Expiration</u>
Gary Carson	Director	May 2023
Julie Noonan	Director	May 2022
Michael Oakley	Director	May 2022
Mike Swartzlander	Treasurer/Asst Secretary	May 2022
Craig Weinberg	Chairperson	May 2022
Ronda Zivalich	District Manager/Secretary	(Staff)

CONSENT AGENDA

1. CALL TO ORDER
2. ADMINISTRATIVE MATTERS
 - a. May 19, 2021 Regular Board Meeting Agenda
 - b. Minutes for April 21, 2021 Regular Board Meeting
3. REPORTS
 - a. Operator's Report
 - b. Engineer's Report
 - c. Manager's Report
 - i. Capital Improvements and Repairs List (W/S)
 - d. Master Planning Committee Report/Minutes
4. FINANCIAL MATTERS
 - a. Payment of claims for the period ending April 30, 2021
 - b. Unaudited financial statements and cash positions for the period ending April 30, 2021
5. APPROVE CONSENT AGENDA

REGULAR AGENDA

6. PUBLIC COMMENT ON NON-AGENDA ITEMS (3 minutes per person; 60 minutes maximum)
7. OLD BUSINESS
 - a. Resolution Approving a Loan from the CWRPDA
 - b. Stormwater Drainage Recommendations (EE)
 - c. PFA Test Results on Wells 6 and 9
 - d. Outdoor Design Group Plan
 - e. Gate Installation/Replacement Project
 - f. MPC 10-Year Budget Review and Discussion
 - g. Emergency Evacuation/Traffic Control Plan
 - h. Homeowner Communication/Gate House Use/Joint Meeting/Website
 - i. Status of Transfer from the General Fund to the Water & Sewer Fund
8. NEW BUSINESS
 - a. Eastwood Back Gate Illegal Entries/Boulders
 - b. Stock Fishing Pond
 - c. In-Person Board Meetings
9. ADJOURNMENT

THE NEXT REGULARLY SCHEDULED MEETING: June 16, 2021 at 5:30 P.M. via ZOOM



RECORD OF PROCEEDINGS

MINUTES OF THE BOARD OF DIRECTORS OF THE FOREST HILLS METROPOLITAN DISTRICT

April 21, 2021, 5:30 p.m.

Held via conference/Zoom call.

ATTENDEES Directors present: Gary Carson, Michael Oakley, Mike Swartzlander, Julie Noonan, and Craig Weinberg.
Others present Ronda Zivalich (MAPs, Inc.), Jordan Herzing (ORC Water Professionals) and Nickie Holder (NMHolder Financial, Inc.).
Residents present: Erich Kirsch, Mike Zinniker, Stephen Iskalis, Brenda Shuler, Steve Burden and David Moser
Guests: Matt Corrion (Outdoor Design Group)

QUORUM The meeting was called to order by Chairperson Weinberg at 5:33 p.m. and a quorum was noted.

CHANGE IN ATTENDANCE

Jordan Herzing left at 7:15 p.m. Matt Corrion left at 7:29 p.m. Steve Burden left at 7:30. David Moser left at 7:54 p.m.

CONSENT AGENDA ITEMS

1. ADMINISTRATIVE MATTERS

- A. Agenda: Director Noonan inquired about item 9c – MPC 10-Year Budget Review and Discussion – under new business on the agenda, she had not received any information prior to the meeting. Director Oakley stated that the agenda item is just a place holder for the time being and that he would give an update on the Master Plan under the consent agenda.
- B. Minutes: No changes necessary.

2. REPORTS

- A. Operator's Report: The Operator's Report was submitted in the Board packet for review. In addition, Mr. Herzing noted the following: At the wastewater treatment plant, the clogged siphon break caused the system to equalize SAM & SBR tank levels preventing normal cycle times and adequate treatment. The siphon break has been repaired, and the system is back to normal operating conditions. Chairperson Weinberg inquired about the process for testing the well depth levels. Mr. Herzing explained the process taken by ORC to the Board. Director Swartzlander inquired about the pond by the front gate, as to when it would be filled/ Manager Zivalich noted that the Manager's Report addresses this under the heading "Ponds".

- B. Engineer's Report (Element Engineering {EE}): The Engineer's Report was submitted in the BOD packet for review. No further questions or discussion.
- C. Manager's Report: The Manager's Report was submitted in the BOD packet for review. Ms. Zivalich informed the Board that a subcommittee of the Colorado Water Resources & Power Development Authority (CWRPDA) reviewed the District's credit report and loan application and have recommended that the FHMD loan application be placed on the CWRPDA's consent agenda for their board meeting on April 23, 2021. Ms. Zivalich anticipates being notified by April 26, 2021.

The contract with RN Civil for the booster pump station is ready to be signed by Chairperson Weinberg; and Ms. Zivalich will coordinate with him to obtain signatures.

Ms. Zivalich noted that she has learned the HOA has planned a community BBQ on May 15, 2021 at the park. It is noted that Hill and Dale will be closed to through-traffic, because of The Pines roofing project. Ms. Zivalich will send an email to the community about the closure.

- D. Master Planning Committee Report/Minutes: No documents were provided in the Board packet, prior to the meeting. Director Oakley provided the following comments: As mentioned at the March 2021 Board meeting, the Master Planning Committee (MPC) continues to search for a seventh homeowner member. Outdoor Design Group provided the MPC a conceptual landscaping plan for the District for review; and the Board would review this report under Old Business. The MPC continues to prepare the 10-year Master Plan and will update with Outdoor Design Group's proposed budgets for future project. The MPC will have a draft ready for discussion at the May 2021 meeting.

3. FINANCIAL MATTERS

- A. Claims: Through March 2021. Submitted in the BOD Packet for review. No discussion.
- B. Financial Statements: Through March 2021. Submitted in the BOD packet for review. No discussion.
- C. Uncollected Fees: Manager Zivalich noted that there are a few delinquent accounts that she recommends pursuing via collections. After discussion, the Board directed that the following process be followed for collections: ORC shall find the curb stop of the property; a letter will be drafted and sent via certified mail; if there is no response, water will be shut off.

Upon **motion** by Director Oakley, duly seconded by Director Noonan, and upon vote, unanimously carried, the Board approved the Consent Agenda items.

REGULAR AGENDA ITEMS

4. PUBLIC HEARING ON WATER AND SEWER RATES INCREASE

Chairperson Weinberg called to order a public hearing on the water and sewer rates increase. Chairperson Weinberg asked if there were any comments from the public. Ms. Shuler suggested that the Board provide a statement to the residents as to why a rate increase is necessary. Mr. Kirsch agreed, stating that it would be better for the Board to be proactive instead of reactive. Mr. Iskalis noted that he had read prior Board meeting minutes, where it was stated that there would be no rate increase in 2021, and he was concerned that the Board is now increasing rates. There being no additional comments, the public hearing was closed.

After discussion and upon **motion** by Chairperson Weinberg, duly seconded by Director Carson, and upon vote, carried 4 to 1, the Board approved the \$4 base water and \$4 sewer rate increase.

Chairperson Weinberg will draft a cover letter regarding the rate increase to include with the May billing.

5. PUBLIC COMMENT (if any)

Mr. Kirsch expressed his concern regarding the Audit Committee stating that he did not feel that the District Manager should be part of the committee as she is part of the daily operations. It was explained that the Audit Committee is made up of two Board members who review the draft financial statement audit report, as prepared by the outside CPA firm. The Audit Committee members are ????

Mr. Iskalis noted that his last bill was for 39 days and not the usual 30 or 31 days and was concerned that some residents may be pushed into a higher tier for water usage, as a result of the longer billing period. Manager Zivalich stated that the water reads were delayed last month, and she will discuss this with the billing company. In addition, Mr. Iskalis stated he could not sign into his account and review prior bills as he had before. Manager Zivalich will check with the billing company regarding the sign-in issues.

6. OLD BUSINESS

A. PFA Test Results on Wells 6 and 9: The District received results of the PFA tests; and the Board agreed that additional research should be done by a committee to determine options available to the District and their associated costs. Chairperson Weinberg, along with Director Carson, will research these options and report back to the Board. No further action needs to be taken by ORC at this time.

B. Outdoor Design Group Plan: Matt Corrien (Outdoor Design Group) presented an overview of his plan to the Board. He introduced an initial

concept along with the four goals the plan is to achieve. Certain areas of the neighborhood will have a higher priority than others. The Master Planning Committee will discuss ODG's proposed plan, in conjunction with development of the 10-year Master Plan, prior to its being presented to the FHMD Board at its May meeting.

- C. Gate Installation/Replacement: Director Carson provided the Board with a project update. Further investigation needs to be done, regarding cabling through existing conduit, so final budget costs can be determined. After discussion and upon **motion** by Director Carson, duly seconded by Director Oakley, and upon vote, unanimously carried, the Board approved up to \$6,000 to investigate the condition of existing cabling and conduits and to identify high risk areas.
- D. Homeowner Communication/Website: Director Carson informed the Board that the new website is up and running. The new website does not have a pdf searchable feature, but he can use the Tech-Bear resource, who implemented the gazebo reservation feature, if a need arises in the future. Director Carson asked if the placing of the sandwich boards, used to inform residents of Board meetings, can be stopped; and the Board agreed. Manager Zivalich and Ms. Holder will schedule time for training on maintenance of the website.
- E. Status of Transfer from the General Fund to the Water & Sewer Fund: No update/placeholder.
- F. The Pines at Riva Chase Meter Access: No update/placeholder.
- G. HOA Communications/Gate House Use/Joint Meeting: No update/placeholder.

7. NEW BUSINESS

- A. Eastwood Gate Damage: A resident's vehicle caused damage to the Eastwood gate , and they have accepted responsibility for the cost of repairs. Ms. Zivalich has been in touch with both the owner and their insurance carrier and will provide a bid to repair the gate and photos of the damage. Ms. Holder provided the initial date and cost of the gate per the District's accounting records. Ms. Zivalich will provide the Board additional information at the May Board meeting.
- B. 22525 Tree Top – Snowplow Damage: Homeowner is requesting that the District pay for the repair of their rock wall damaged by the snowplow vendor. Before the Board agrees to payment of the damages, measurements need to be taken of the District easement in this location. Ms. Zivalich and Director Noonan will take the measurements of the easements and report to the Board at the May meeting and advise the homeowner of their findings.
- C. MPC 10-year Master Plan Review and Discussion: As discussed above in item 2D, this plan will be discussed at the May 2021 Board meeting.

D. Emergency Evacuation Plan/Traffic Control Plan: The Board discussed the need for an emergency evacuation plan for the District. The Foothills Fire Protection District has an emergency plan for the area; and Director Noonan will follow up and note where it can be located on their website. It was discussed that Board members might be assigned responsibility for opening gates in an emergency. This was tabled until May.

8. ADJOURNMENT

Upon **motion** by Director Swartzlander, duly seconded by Director Carson, and upon vote, unanimously carried, the Board approved adjournment of the meeting. There being no further business to come before the Board at this time, the meeting was adjourned at 8:15 p.m. The next regular meeting is scheduled for May 19, 2021, via conference call beginning at 5:30 p.m.

THESE MINUTES APPROVED AS THE OFFICIAL APRIL 21, 2021 MINUTES OF THE FOREST HILLS METROPOLITAN DISTRICT AND ITS WATER ACTIVITY ENTERPRISE BY THE RESPONSIBLE PARTIES SIGNING BELOW:

ATTEST:

Recording Secretary

APPROVED:

Chairperson

Forest Hills Metropolitan District

Operations Report

April 2021

Prepared by Jordan Herzing, ORC Water Professionals

Water Treatment Facility

- The storage tank has remained within comfortable limits.
- Tank levels are checked on a routine basis multiple times per week.
- Chlorine residual analysis was performed, and the analysis was acceptable.
- Routine Bacteriological sampling was performed from a rotating address listing and the results were absent for total coliform bacteria.
- See the total gallons produced through the WTP versus the total metered usage to arrive at the discrepancy between water produced and sold. Part of the 18.49% discrepancy is due to 6 residential registers that stopped sending data to Waterscope.

Distribution System

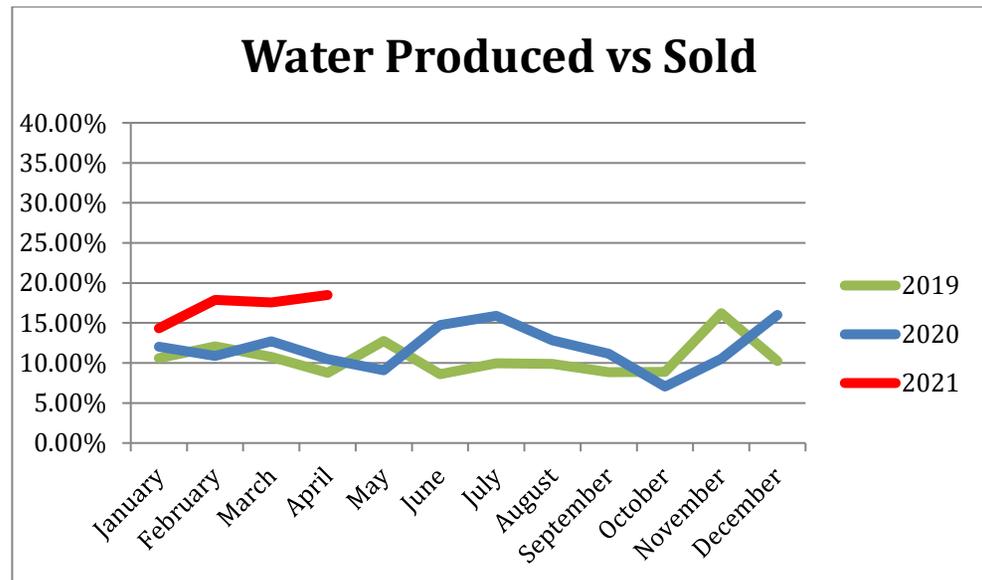
- The top of the valve casing on the isolation valve for Hydrant 14 was found to be damaged most likely from being hit by snowplow or another vehicle. ORC will be coordinating with CBS Excavation to get the valve casing repaired. The valve casing is scheduled to be repaired on the 17th of May.
- Valve exercising on all valves in the distribution system will begin in mid-May. After all valves have been exercised ORC will perform a uni-directional hydrant flush of the distribution system. Residents will be given advance notice of the hydrant flushing.

Collections System

- Triple S Sanitary Sewer Services will be onsite May 17th through May 19th to perform the slip-line repair on the collections system between MH Y-3 and MHCO Y3.2 on Willobe Way.



2021	Plant Production	Metered Usage	Discrepancy
January	679,000	581,700	14.33%
February	671,000	551,000	17.88%
March	851,000	701,600	17.56%
April	515,000	419,800	18.49%
May			
June			
July			
August			
September			
October			
November			
December			
TOTAL	2,716,000	2,254,100	17.01%



Wastewater Treatment Facility

- Monthly influent and effluent samples were taken, and the results were well within the regulatory limits. A copy of the Discharge Monitoring Report DMR is attached to this submittal. DMRs are submitted to the State and EPA on a monthly and quarterly basis on or before the 28th day of the following month per the Colorado Discharge Permit System.

Recirculation Ponds

- The recirculation ponds will be filled beginning May 15th. Once the ponds are filled the aerators for Pond 4 and Pond 5 will be installed.
- Monthly readings take place to evaluate storage. This documentation is provided to RESPEC monthly.
- The inlet pond has been examined. It was determined that sediment removal will not be necessary for operation of recirculation pumps this season.
- The air compressor for Pond 6 has been operating normally. The compressor has been adjusted to run during the night to avoid overheating in the warmer days to come.

DMR Copy of Record

Permit
 Permit #: **CO0037044** | Permittee: Forest Hills Metro District | Facility: FOREST HILLS METROPOLITAN DIST
 Major: No | Permittee Address: 14405 W Colfax Ave Ste 165 Lakewood, CO 80401 | Facility Location: 22933 FOREST HILLS DR GOLDEN, CO 80401
 Permitted Feature: 300 Influent Structure | Discharge: **300-I** Influent Measurements

Report Dates & Status
 Monitoring Period: **From 03/01/21 to 03/31/21** | DMR Due Date: **04/28/21** | Status: **NetDMR Validated**

Considerations for Form Completion
 Influent samples must be collected, analyzed and reported monthly regardless of whether an effluent discharge occurred. Plant capacity - report hydraulic @ MLOC=P; organic @ MLOC=Q. Hydraulic capacity = 0.05 MGD; organic capacity = 96 lbs BOD-5/Day.

Principal Executive Officer
 First Name: | Title: | Telephone:
 Last Name:

No Data Indicator (NODI)
 Form NODI: --

Code	Parameter Name	Monitoring Location	Season #	Param. NODI	Quantity or Loading					Quality or Concentration					# of Ex.	Frequency of Analysis	Sample Type					
					Qualifier 1	Value 1	Qualifier 2	Value 2	Units	Qualifier 1	Value 1	Qualifier 2	Value 2	Qualifier 3				Value 3	Units			
00180	Plant capacity fact. percent of capacity	P - See Comments	0	--	Sample																	
					Permit Req.																	
					Value NODI																	
00180	Plant capacity fact. percent of capacity	Q - See Comments	0	--	Sample																	
					Permit Req.																	
					Value NODI																	
00530	Solids, total suspended	G - Raw Sewage Influent	0	--	Sample																	
					Permit Req.																	
					Value NODI																	
50050	Flow, in conduit or thru treatment plant	G - Raw Sewage Influent	0	--	Sample		0.033287		0.043176	03 - MGD												
					Permit Req.		Req Mon 30DA AVG		Req Mon DAILY MX 03 - MGD													
					Value NODI																	

Submission Note
 If a parameter row does not contain any values for the Sample nor Effluent Trading, then none of the following fields will be submitted for that row: Units, Number of Excursions, Frequency of Analysis, and Sample Type.

[Edit Check Errors](#)
 No errors.

DMR Copy of Record

Permit
 Permit #: **CO0037044** | Permittee: Forest Hills Metro District | Facility: FOREST HILLS METROPOLITAN DIST
 Major: No | Permittee Address: 14405 W Colfax Ave Ste 165 Lakewood, CO 80401 | Facility Location: 22933 FOREST HILLS DR GOLDEN, CO 80401
 Permitted Feature: 300 Influent Structure | Discharge: **300-Q** Quarterly Influent Measurements

Report Dates & Status
 Monitoring Period: **From 01/01/21 to 03/31/21** | DMR Due Date: **04/28/21** | Status: **NetDMR Validated**

Considerations for Form Completion
 Quarterly discharge - see I.C.20, pg 12.

Principal Executive Officer
 First Name: | Title: | Telephone:
 Last Name:

No Data Indicator (NODI)
 Form NODI: --

Code	Parameter Name	Monitoring Location	Season #	Param. NODI	Quantity or Loading					Quality or Concentration					# of Ex.	Frequency of Analysis	Sample Type				
					Qualifier 1	Value 1	Qualifier 2	Value 2	Units	Qualifier 1	Value 1	Qualifier 2	Value 2	Qualifier 3				Value 3	Units		
00310	BOD, 5-day, 20 deg. C	G - Raw Sewage Influent	0	--	Sample		63.4		63.4	26 - l/ld											
					Permit Req.		Req Mon 30DA AVG		Req Mon MX 7D AV 26 - l/ld												
					Value NODI																

Submission Note
 If a parameter row does not contain any values for the Sample nor Effluent Trading, then none of the following fields will be submitted for that row: Units, Number of Excursions, Frequency of Analysis, and Sample Type.

[Edit Check Errors](#)
 No errors.

DMR Copy of Record

Permit	Permit #: CO0037044	Permittee: Forest Hills Metro District	Facility: FOREST HILLS METROPOLITAN DIST
Major: No	Permittee Address: 14405 W Colfax Ave Ste 165 Lakewood, CO 80401	Facility Location: 22933 FOREST HILLS DR GOLDEN, CO 80401	
Permitted Feature: 001 External Outfall	Discharge: 001-A Discharge to Mount Vernon Creek		
Report Dates & Status	Monitoring Period: From 03/01/21 to 03/31/21	DMR Due Date: 04/28/21	Status: NetDMR Validated
Considerations for Form Completion			
Oil and grease - see I.A.2, pg 3. If no chlorine was used, report "NCT" (no chlorine treatment). Report influent samples on DMR marked 300I/300Q.			
Principal Executive Officer			
First Name:	Title:	Telephone:	
Last Name:			
No Data Indicator (NODI)			
Form NODI:			

Code	Parameter Name	Monitoring Location	Season #	Param. MOD	Quantity or Loading				Quality or Concentration				Units	# of Ex.	Frequency of Analysis	Sample Type
					Qualifier 1	Value 1	Qualifier 2	Value 2	Qualifier 1	Value 1	Qualifier 2	Value 2				
00400	pH	1 - Effluent Gross	0	--	Sample Permit Rec. Value NODI					= 6.92			= 7.45	12 - SU	01/07 - Weekly	GR - GRAB
					Permit Rec. Value NODI					>= 6.5 MINIMUM			<= 9.0 MAXIMUM	12 - SU	01/07 - Weekly	GR - GRAB
00530	Solids, total suspended	1 - Effluent Gross	0	--	Sample Permit Rec. Value NODI					= 12.0		= 12.0	19 - mg/L	01/30 - Monthly	CP - COMPOS	
					Permit Rec. Value NODI					<= 33.0 30DA AVG		<= 45.0 MX 7D AV	19 - mg/L	01/30 - Monthly	CP - COMPOS	
00610	Nitrogen, ammonia total [as N]	1 - Effluent Gross	3	--	Sample Permit Rec. Value NODI					= 0.054		= 0.054	19 - mg/L	01/30 - Monthly	CP - COMPOS	
					Permit Rec. Value NODI					<= 5.4 30DA AVG		<= 32.0 DAILY MX	19 - mg/L	01/30 - Monthly	CP - COMPOS	
00640	Nitrogen, inorganic total	1 - Effluent Gross	0	--	Sample Permit Rec. Value NODI							= 10.741	19 - mg/L	01/30 - Monthly	CP - COMPOS	
					Permit Rec. Value NODI							Req Mon DAILY MX	19 - mg/L	01/30 - Monthly	CP - COMPOS	
00665	Phosphorus, total [as P]	1 - Effluent Gross	0	--	Sample Permit Rec. Value NODI	= 2.715	= 2.715	76 - lbmo		= 0.553		= 0.553	19 - mg/L	01/30 - Monthly	CP - COMPOS	
					Permit Rec. Value NODI	Req Mon 30DA AVG	Req Mon DAILY MX	76 - lbmo		<= 1.0 30DA AVG		Req Mon DAILY MX	19 - mg/L	01/30 - Monthly	CP - COMPOS	
00665	Phosphorus, total [as P]	P - See Comments	0	--	Sample Permit Rec. Value NODI	= 8.593	= 3.576	50 - lbyr						01/30 - Monthly	CA - CALCTD	
					Permit Rec. Value NODI	80.0 ANNL AVG	Req Mon DAILY MX	50 - lbyr						01/30 - Monthly	CA - CALCTD	
03582	Oil and grease	P - See Comments	0	--	Sample Permit Rec. Value NODI							<= 10.0 INST MAX	19 - mg/L	7/7/7 - Contingent	GR - GRAB	
					Permit Rec. Value NODI							9 - Conditional Monitoring - Not Required This Period				
50050	Flow, in conduit or thru treatment plant	1 - Effluent Gross	0	--	Sample Permit Rec. Value NODI	= 0.019674	= 0.027225	03 - MGD						01/01 - Daily	RC - Recorder (auto)	
					Permit Rec. Value NODI	<= 0.05 30DA AVG	Req Mon DAILY MX	03 - MGD						01/01 - Daily	RC - Recorder (auto)	
51040	E. coli	1 - Effluent Gross	0	--	Sample Permit Rec. Value NODI					< 1.0	< 1.0	13 - #/100mL	01/30 - Monthly	GR - GRAB		
					Permit Rec. Value NODI					<= 126.0 30DA GM	<= 252.0 MX 7D GM	13 - #/100mL	01/30 - Monthly	GR - GRAB		
81011	Solids, suspended percent removal	K - Percent Removal	0	--	Sample Permit Rec. Value NODI					= 89.83		= 89.83	23 - %	01/30 - Monthly	CA - CALCTD	
					Permit Rec. Value NODI					>= 85.0 MQ AV MN			23 - %	01/30 - Monthly	CA - CALCTD	

84066	Oil and grease visual	1 - Effluent Gross	0	--	Sample Permit Rec. Value NODI		= 0.0	AB - abst=0 prst=1						01/07 - Weekly	VI - VISUAL
					Permit Rec. Value NODI		Req Mon INST MAX	AB - abst=0 prst=1						01/07 - Weekly	VI - VISUAL

DMR Copy of Record

Permit																	
Permit #:	CO0037044	Permittee:	Forest Hills Metro District	Facility:	FOREST HILLS METROPOLITAN DIST												
Major:	No	Permittee Address:	14405 W Cofax Ave Ste 165 Lakewood, CO 80401	Facility Location:	22933 FOREST HILLS DR GOLDEN, CO 80401												
Permitted Feature:	001 External Outfall	Discharge:	001-Q Quarterly Monitoring for 001A														
Report Dates & Status																	
Monitoring Period:	From 01/01/21 to 03/31/21	DMR Due Date:	04/28/21	Status:	NetDMR Validated												
Considerations for Form Completion																	
Quarterly discharge - see I.C.20, pg 12.																	
Principal Executive Officer																	
First Name:		Title:		Telephone:													
Last Name:																	
No Data Indicator (NODI)																	
Form NODI:	--																
Code	Parameter Name	Monitoring Location	Season #	Param. NODI	Quantity or Loading			Quality or Concentration			Units	# of Ex.	Frequency of Analysis	Sample Type			
					Qualifier 1	Value 1	Qualifier 2	Value 2	Qualifier 3	Value 3							
00310	BOD, 5-day, 20 deg. C	1 - Effluent Gross	0	--	Sample												
					Permit Req.												
					Value NODI												
50600	Chlorine, total residual	1 - Effluent Gross	0	--	Sample												
					Permit Req.												
					Value NODI												
81010	BOD, 5-day, percent removal	K - Percent Removal	0	--	Sample												
					Permit Req.												
					Value NODI												

Submission Note
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Edit Check Errors
No errors.

ENGINEER'S PROGRESS REPORT

TO: Forest Hills Metropolitan District
FROM: Element Engineering, LLC
DATE: May 19, 2021
SUBJECT: Progress Report on Current Projects – **New Items Bold**

GENERAL ENGINEERING

The Forest Hills Metropolitan District WWTP discharge permit was recently issued by CDPHE. This discharge permit includes more stringent ammonia and E. coli limits and new limits for Total Inorganic Nitrogen (TIN). These limits become effective September 31, 2023, August 31, 2020, and August 31, 2023 respectfully.

The discharge permit also includes a compliance schedule with deadlines to meet the new TIN, Ammonia, and E. Coli limits. In order to meet these compliance schedules Element has met with district staff (management and operators) to determine possible operational and physical changes/updates to the WWTP with the overall goal being to meet limits with minimal capital improvements to the plant. Discussions are ongoing, and Element has drafted a list of potential modifications/improvements for district staff consideration.

The new TIN limit becomes effective August 31st, 2023. Therefore, all improvements to the facility must be completed before that. However, we recommend a period of time for the operator to tweak changes and show compliance prior to the actual CDPHE deadline. Therefore, we recommend the following schedule:

- Design of Upgrades (Working with Fluidyne, and ORC): July 2021
- Finalize Design of Upgrades, Bid Improvements, and Begin Construction Work: March 2022
- Finalize Construction Work: July 2022
- Operational Proving Period: July 2022 – July 2023

There are three reporting deadlines associated with the project as required in the permit, these are: August 31, 2021, August 31, 2022, and February 29, 2023. CDPHE has set these dates envisioning that a full design submittal must be completed and approved through the engineering section. However, modifications required are minor enough that Element does not believe CDPHE approval is necessary.

WATER BOOSTER PUMP STATION REPLACEMENT PROJECT

The booster pump station PNA has been approved by CDPHE. Element Engineering is now working on the design of the booster pump station. Element staff met with ORC and surveying staff onsite prior to the start of the survey. The survey also includes point locations of all the district's valves, hydrants, PRV vaults,



and the interconnect. We have completed the survey of all district owned valves, hydrants, vaults, and the project (storage tank area). A water model of the district's entire system was developed. A public meeting was held during the April meeting for this project. Due to comments received during the public meeting CDPHE has asked the district to address additional environmental comments. The loan application for the project has been submitted to CDPHE. The loan application and loan documents will not be completed by CDPHE until the additional environmental work is complete.

We have received all necessary drawings from the pump manufacturer including the vault and pump skid. Element staff met onsite with our electrical engineer to finalize electrical plans. The full design will be complete by the end of October including electrical design.

Element completed a fire flow analysis of the existing system (pumps, pump bypass line). The results of this fire flow analysis show that the existing system cannot, under any circumstance, provide 1,500 gpm fire flow to the district, even using the pump bypass line.

An onsite meeting was held with Respec Engineering on December 9th.

This project has been approved to move forward. Final drawings have been sent to district staff (operations and management) and district board for review. Final drawings will be sent to the district board. The project will be sent to CDPHE for review upon receiving and completing comments from all parties. CDPHE review may take approximately a month with bidding in June or July.

The district's attorney has reviewed the contract documents and has provided comments. All comments have been incorporated into the bidding documents.

The project has been advertised with the following bid schedule:

Project Advertisement: Week of Dec. 14th, 2020

Plans and Specifications Available: Dec. 16th, 2020

Mandatory Pre-Bid Meeting: Jan. 12th, 2021 10:00 a.m. (Forest Hills is a gated community, therefore the pre-bid meeting will be the only time for contactors to visit the site)

Last day for Questions: Jan. 28th, 2021 by 4:00 p.m.

Last day for issuance of Addenda: Feb. 2nd, 2021

Public Bid Opening: Feb. 9th, 2021, 10:00 a.m. at the office of Element Engineering, 12687 W. Cedar Drive, Suite 300 Lakewood CO 80228.

NOA Issued (Approximate): Feb. 18th, 2021

Pre-Con/Notice to Proceed: (Approximate): March. 2nd, 2021

Start Construction (Approximate): March 2nd, 2021



Project Completion Date: July 29th, 2021

(150 Calendar Days, allows for 100-day equipment order and delivery) Changed to 225 calendar days by addendum due to expected COVID related delays in equipment procurement.

The pre-bid meeting was held with six (6) contractors attending and one (1) supplier attending. The pre-bid meeting was mandatory so only these contractors will be allowed to bid the project.

A public bid opening was held on February 9th at 10:00 AM at the offices of Element Engineering. We received four (4) bids ranging from a low of \$551,500 (RN Civil) to a high of \$785,450 (Stanek). A certified bid tabulation is included with this board report.

According to Element records the total SRF loan amount for construction of the project is \$490,148. The district may choose to fund the discrepancy out of fund balance or apply for additional funds from CDPHE.

It is recommended that Element and the district discuss the level of construction management and onsite inspection that is desired. Construction management includes submittal review, Davis Bacon compliance assistance, American Iron and Steel compliance assistance, pay application review, RFI and change order review, etc. Onsite observation provides assurance and documentation that the contractor is installing material and equipment per the plans and specifications.

Element has assisted the district management staff with applying for and coordinating on the supplemental loan for the project.

We have received the performance and payment bonds and a signed contract for the contractor. The next steps are for the district to sign the contract and issue the notice to proceed as well as hold a pre-construction meeting. We are waiting to sign the final documents until the additional loan is executed.

All contract documents have been signed and the notice proceed has been issued. A preconstruction meeting has been scheduled for the 21st.

DRAINAGE STUDY

Element has worked with board member Mike Oakley to develop a proposal for an initial evaluation of the district's drainage infrastructure. It was determined that the following scope of services:

1. One (1) full day visual survey along with board member representative – This survey will allow Element to document known trouble areas and visually survey culverts and other drainage infrastructure.
2. Complete office work to document data from visual survey and create exhibit for coordination with survey crew. Brief onsite meeting with survey crew.
3. Field survey (2-man crew) two (2) ten-hour days of field work along with survey base file generation – This work is intended to allow a survey crew time to perform a basic topographical survey of the known trouble spots so that the issue in those areas can be properly analyzed.



4. Memo and Map – Generate a memorandum and map summarizing findings from the visual survey and topographical survey. Summarize trouble areas and reasons why drainage issues are occurring. Generate basic cost estimates for future budgeting purposes.

The not to exceed fee for this work, including two (2) days of survey field work is \$10,400. Additional survey work can be completed at a daily rate of \$1,500 per day. A detailed summary of assumed hours was previously sent to the board.

A breakdown of phased services was previously sent to the management company.

A meeting to tour the district was held on February 11, 2020. Element was approved to move forward with Phase I of the drainage study which includes this tour.

Exhibits showing the location of the drainage areas of concern were submitted to the district and a proposal to complete the next phase of the work was provided.

The district voted to move forward with Phase II of the project which includes survey and design. Our surveyor should be onsite after the snow melts from the recent project.

A topographical survey has been completed and we are working on exhibits for improvements.

UTILITY LOCATES

A utility locate log is attached to this report.

General

Agreements

The following contracts and/or PO were created in April 2021:

- Millennium Electrical Systems, Inc. – Electrical Services Related to Gate Project

Invoices/ACH/Autopay Payments

Invoices were reviewed and approved on May 10, 2021. Contacted RN Civil for ACH information for booster pump station payments.

Billing

Billings were reviewed and approved on 5/3/2021. A letter was drafted along with an updated water rate sheet and mailed with the bills regarding the new rate increase. RKZ is working with Director Noonan on the draft "collection" letter to the Willobe and Sleepy Hollow owners who are delinquent.

Snowplow Damage

A homeowner on Tree Top Lane was notified of the Board's decision and assessment that the stone wall is constructed within the easement and therefore, is not responsible for repairs.

Repairs & Capital Improvements List

Minor updates were made to the list to include completion dates for some projects.

Website

RKZ and NH had a training session with Director Carson for maintenance of the website.

Bear Creek Watershed Association

Participated in the monthly meeting. It was noted by Denver Water and the City of Lakewood that the local reservoirs have been nearly filled with recent rains/snow and runoff easing the drought concerns.

Master Planning Committee

Participated in the April MPC meeting. Please see the MPC minutes for more details.

HOA Matters

The Pines at Riva Chase

RKZ is drafting a letter to the homeowners to advise them they would be responsible for moving meters to a vault for easier access. This letter is on hold due to their roof project. Director Noonan will review it.

Water

Booster Pump Station

CDPHE and the power authority approved the District's supplemental loan. The loan documents have been drafted and reviewed and approved by both CCC and bond counsel. RKZ and NMH have also reviewed the document. Chair Weinberg is reviewing the final draft before the Board meeting and the Board will consider the Resolution for the loan during the meeting. Signature pages will be signed by Chair Weinberg after the Board meeting. The tentative closing date is May 27, 2021.

The contracts for RN Civil were executed and delivered and notice to proceed was given. A pre-construction meeting is scheduled for May 20, 2021.

Hydrant Flush

The hydrant flush will occur once ORC exercises the valves, sometime in mid-June. Notices will be sent to owners once we have the date scheduled.

Wells

As a reminder, ORC quoted \$3,000 to install static level monitoring equipment and noted that the receiving panel at the WTP would potentially need additional equipment installed. ORC can perform instantaneous well depth levels and drawdown measurements periodically through the year which would require 2.5 hours per well and be an additional cost.

Collection System

Triple S has been delayed in repairing the slip line for the collection system due to cold weather. A blockage has been discovered in the line which needs to be cleared before they can repair the line. Anticipated date to clear the blockage is 5/17/2021 and repairs to the slip line are scheduled, weather pending, for May 17 and 18, and potentially May 19, 2021 if needed.

Distribution System

Second half videoing of piping is scheduled for the Summer of 2022. DRC has been notified of the change to 2022. The broken valve casing at hydrant 14 will be repaired on May 17, 2021.

Ponds

ORC has inspected the inlet pond and determined that sediment removal will not be necessary this year. Filling of the ponds will begin on May 15 and aerators for Ponds 4 and 5 will be installed once they are full. The air compressor for Pond 6 has been operating normally and has been adjusted to run at night to avoid overheating.

Smart Meters

There were no new meters installed or registers replaced in April. An error regarding addresses and usage was noted in WaterScope and the program updated with correct information from the District's spreadsheet.

Stormwater Drainage Study

Surveying was completed and data reported to Element Engineers. EE is now reviewing the information and is putting together their recommendations for areas to focus on for repairs. They will submit a Phase III bid for design of those areas. EE anticipates having an update with a rough estimate for design during the meeting. EE recommends that the WesTest bid documents include cleaning of District culverts as many of them are full and cannot drain properly (i.e., Nakota and Forest Hills Drive).

Water Rights

No updates.

Wastewater Treatment Facility

Bear Creek Watershed Association

Monthly samples were taken, and results are well within regulatory limits. Sample results were submitted to BWCA for Regulation 85 and the discharge monitoring report was submitted to the State and the EPA.

Road/Hill to WWTP

Noble's recommendation that the sewer road be rebased and addition of a few culverts, shall remain on this report as a reminder of the approximate costs. The Board should discuss this further in a meeting in the Spring. Approximate costs to rebase and add two culverts would be about \$10K (rebase) and \$2,400 (culverts).

Roads

Road Repair, Design & Construction

Director Oakley and RKZ participated in a meeting with WesTest to discuss options, based on our budget, for crack sealing and overlay repairs, and a schedule for putting out bid documents. The location of cross walks was discussed and will be included in the bid document. There will be no additional speed control included. Striping of roadways was discussed and determined that it a reflective white paint would be required on Eastwood, Forest Hills and Willobe. The bid document will also include EE's stormwater drainage recommendations/design. A draft copy of the District's contract was provided to WesTest for inclusion. It is anticipated that the bid could be advertised by mid-June.

EE has reached out to Elite Surface Infrastructure to discuss the cracking occurring on Forest Hills Drive as this work would be under warranty. ESI was onsite the week of 5/3/2021 to inspect the area and we are awaiting their determination.

Street Sweeping

Pending weather, street sweeping was scheduled for 5/14 and 5/15/2021.

Emergency Evacuation/Traffic Control Plan

Several homeowners have communicated that they are concerned with the District's current emergency evacuation/traffic control plan and asked that the Board review them. This was briefly discussed at the April Board meeting, but ultimately tabled until May. The Riva Chase Community Wildland Fire Mitigation Plan was included in the Board packet for review and discussion during the meeting.

Facilities

Landscaping Assessment

The Master Planning Committee discussed ODG's options and agreed to provide a recommendation to the Board during the May meeting for Phase I of the landscaping plan for their consideration.

Eastwood Gate

Rocky Mountain Access Controls has provided a bid to repair the Eastwood gate only at this time. An evote was sought and ultimately approved by the Board to proceed with the removal and replacement of the gate. A contract will be sent the week of May 17, 2021 to RMAC and a PO cut for the Eastwood portion of the gate work. We were informed by RMAC that manufacturing of the gates could take up to eight weeks. The old gate will be removed as soon as the contract and PO are executed.

RKZ worked with Progressive Insurance to provide photos and a bid for replacement of the Eastwood gate. The claims adjuster is reviewing the file and will make a determination for a settlement to FHMD.

Gate Project

A Zoom meeting was held with Directors Carson and Oakley, Mike Zinniker and Dave Clappisi to discuss getting power to the Summerwood and gates and potential new landscaping at the Forest Hills median. A second onsite meeting was held with RMAC on 4/13/2021 to discuss all gate work. A contract was issued for Mike Zinniker (MES) to provide electrical services, generally, and a PO cut for him to provide power from the guard house to the Summerwood gate, extend a new circuit under Summerwood for the gate, and extend control conduit for future landscaping at Forest Hills median. This work was by the Board at the April meeting. Jim Noble will be involved in the overall project once the gates are ready to be installed.

Eastwood Back Gate

This was tabled at the December 2020 meeting until Spring of 2021. As a reminder, Noble estimates the cost of purchasing two boulders, trucking onsite and placement would cost approximately \$2,500. RKZ would like the Board to consider installing a split rail fence like that at the Forest Hills back gate.

Description	Cost Estimate	Budgeted?	Date Scheduled	Date Completed	Notes
Water					
Booster pump station design	\$ 52,210	Yes (2019)	completed	11/1/2020	completed, project awarded, contracts to be signed
Replace booster pump station	\$ 500,000	Yes (2019)	12.24.2021		NTP issued
Pond 6 aeration improvements	\$ 15,000	Yes (2019)	31-Dec-2019		Low priority
Pond 6 and Pond 4 Dam Safety Items	\$ 10,000	No	31-Dec-2019		Partially completed
New ARV and vault at Eastwood Drive gate	\$ 15,000	No			On hold
Install extension and raise valve box for FH near Lift Station #1	\$ 2,500	No			Low priority...FH is still operational
Install extension for FH at Forest Hills Drive and Anasazi Way	\$ 3,500	No			Low priority...FH is still operational
Conditionally decreed reservoirs - next diligence compliance date		No	19-Dec-2024		Annual efforts should be made towards pursuing implementation
7.5 HP Pump and Hydro Pro Tank - 4/30/16				30-Apr-2016	
Gate Valve Replacement				6/31/2019	
Telemetry System					Future additions of telemetry on the wells to automate on/off - currently have some wells on telemetry and others are not.
Recirculation Pump replacement					
Well Replacement (every two years)	\$5,000				estimated budget every other year
PRV maintenance	\$1,000				estimated budget every year
Wastewater					
WWTP TIN Permit Limit		No	31-Aug-2023		Deadline for construction completion
WWTP E. coli Permit Limit		No	31-Aug-2020		Deadline for study results; Update submitted on 17 Mar 2020
Repair WWTP building roof	\$ 20,000	No			On hold
Upgrade effluent pump controls		No			On hold
Install pump, controls, piping for EQ/overflow tank automatic pump back	\$ 10,000	No			
Consider UV disinfection	\$ 85,000	No			Run ROI versus chemicals (Cost includes design/permitting, and equipment)
Influent Flume Improvements	\$ 25,000	No			Innacurate readings based on location - New influent structure/manhole with flume and equipment
Repairs to Collection System	?				
Consider aerobic digester	?	No			Run ROI versus sludge hauling
Augmentation Pond					??
Wastewater plant - CIP					??
Roads					
Forest Hills Drive and Panorama Point	\$ 95,000	Yes (2020)		2020	Initiate design and bidding documents production
Speed Bumps	\$ 20,000	No			Unable to do speedbumps
Bollards (Forest Hills Drive & Red Hawk Lane; Sleepy Hollow & Springflower)	\$ 5,000	No		2020	Plus bollards damaged by resident
Review storm drains and clean		No			Part of 2021 Roadway project
Address erosion on Summerwood		No			Low priority
Level bollards		No			Need to inventory
Facilities					
Playground Improvements	\$ 60,000	Yes (2020)		2020	
Rules signs at Pond 6	\$ 500	No			Draft signs in development
Install lights at big sign		No			On hold
Fire mitigation along Forest Hill Drive and on District-owned property	\$ 15,000	Yes (2020)		2020	
Painting entrance signs		No			On hold
Bunker Signs		No	Apr-21		Old lighting replaced w/new LED fixtures at no charge by homeowner (MES)

FHMD Master-planning Committee Meeting Minutes

Meeting date: 4 May 2021 (Held via Zoom)

Members present: Steve Burden (SJB) sjburden@hotmail.com (New HOA Rep???)
Gary Carson (GAC) - garyacarson@comcast.net
Stephen Iskalis (SCI) - siskalis@yahoo.com
Erich Kirsch (EWK) - erichkirsch@gmail.com
Michael Oakley (MPO) - director2@fhmd.net (Chair & FHMD Rep)
Brenda Shuler (BAS) - brendashuler@yahoo.com

Guests present: Gary Carson – Director1@fhmd.net

Members absent: David Moser (DM) - david.moser@comcast.net
Ronda Zivalich (RKZ) - management@fhmd.net (District Mgr.)

1. Discussion on the next steps for the Outdoor Master Plan (OMP)

- After airing their concerns about not being sufficiently involved in the OMP development up to this point, Committee Members agreed to focus on and participate in the next steps, which are to:
 - Present a recommendation to the Board that the District proceed with Phase I of the landscaping plan which is already funded in the 2021 Budget
 - Request the Board approve a sum not to exceed \$6,000 to engage in a negotiated design contract for a 2021 scope of landscaping/irrigation work that would not exceed \$34,500
 - If design funds are approved, some Committee Members would form a project working group to assist Director Carson with scope development
 - Allocate the remaining high-priority phases of the OMP to follow-on years of the draft Master Plan that the Committee will present to the Board at its May meeting
- The Committee will also provide to the Board the recommended priority list all anticipated phases of the landscaping and irrigation improvement initiative

2. Status of ongoing 2021 projects

- Committee Members received status updates on the following projects
 - Gate replacement/addition – Gary Carson
 - Gatehouse interior/exterior structural repairs – MPO, in lieu of RKZ
 - Gatehouse interior/exterior electrical repairs – SCI and MPO, in lieu of RKZ
 - Pavement and stormwater drainage repairs – MPO

3. MPC space on FHMD SharePoint Drive

- RKZ had advised Members that the MPC space was available for use.

- MPO advised the Members that he had populated the space with all the documents the Committee created since its inception, and the space was available for additional postings

4. Candidates for the open Committee position

- Efforts to recruit a new volunteer had not yet borne fruit

5. Review of the new draft Master Plan document

- EWK and MPO had updated the Master Plan spreadsheet to incorporate the FHMD Revised 2021 Budget and include a summary format that should be easier to understand
- Further refinement is needed to eliminate or hide work actions that may already be part of other proposed projects
- Members agreed that a certain amount of the available future budget funds should be set aside each year and transferred into the Capital Projects Fund to create a reserve for the next major road project(s). They set that initial annual amount at \$100,000, which is subject to review, based on other project funding needs
- EWK will populate the traffic and road sign section, and MPO/BAS will provide numbers for outyear road repair/maintenance projects

6. Select date, time and location for the next meeting

- Wednesday, 26 May 2021 at 6:30 PM, via Zoom

Forest Hills Metro District
Balance Sheet
As of April 30, 2021

	{12} General Fund	{15} Debt Service	{14} Capital Projects	{16} Water & Sewer	Total
ASSETS					
Current Assets					
Checking/Savings					
12-1000 · First Bank - Checking (GF)	\$ 5,497.16	\$ -	\$ -	\$ -	\$ 5,497.16
16-1000 · First Bank - Checking (WS)				77,530.41	77,530.41
12-1150 · Colotrust	132,837.83				132,837.83
12-1160 · Colotrust - CTF	11,095.22				11,095.22
14-1160 · Colotrust			743,909.66		743,909.66
15-1150 · Colotrust (DS)	-	64,761.85			64,761.85
Total Checking/Savings	<u>149,430.21</u>	<u>64,761.85</u>	<u>743,909.66</u>	<u>77,530.41</u>	<u>1,035,632.13</u>
Accounts Receivable					
16-1300 · A/R - Customers	-			5,134.81	5,134.81
16-1305 Allowance for doubtful accounts				-	-
Total Accounts Receivable	<u>-</u>	<u>-</u>	<u>-</u>	<u>5,134.81</u>	<u>5,134.81</u>
Other Current Assets					
Cash with County Treasurer					
12-1200 - Cash with County Treasurer	-				-
12-1310 Property taxes receivable	316,933.00				316,933.00
15-1310 Property taxes receivable		150,522.00			150,522.00
12-1400 - Prepaid Expenses	3,918.34				3,918.34
16-1400 - Prepaid Expenses				3,981.61	3,981.61
Total Cash with County Treasurer	<u>320,851.34</u>	<u>150,522.00</u>	<u>-</u>	<u>3,981.61</u>	<u>475,354.95</u>
Intercompany Transactions					
12-1450 · Due from Other Funds	86,247.61				86,247.61
14-1450 · Due to/from other Funds			-		-
15-1450 · Due from other Funds (DS)		-			-
16-1450 · Due from other Funds (WS)				(86,247.61)	(86,247.61)
17-1450 · Due from other Funds (CTF)				-	-
Total Intercompany Transactions	<u>86,247.61</u>	<u>-</u>	<u>-</u>	<u>(86,247.61)</u>	<u>-</u>
Total Other Current Assets	<u>86,247.61</u>	<u>-</u>	<u>-</u>	<u>(86,247.61)</u>	<u>-</u>
Total Current Assets	<u>556,529.16</u>	<u>215,283.85</u>	<u>743,909.66</u>	<u>399.22</u>	<u>1,516,121.89</u>
Fixed Assets					
12-1500 - Security Gates	-				-
14-1710 · Streets			1,794,920.34		1,794,920.34
14-1720 · Erosion System			61,089.00		61,089.00
14-1730 · Landscaping			152,954.00		152,954.00
14-1740 · Recreation			237,152.75		237,152.75
14-1750 · Accumulated Depreciation			(1,870,050.75)		(1,870,050.75)
16-1700 - Construction in Progress				51,030.50	51,030.50
16-1750 · Accumulated Depreciation (WS)				(2,686,077.76)	(2,686,077.76)
16-1760 · Water System				2,572,900.55	2,572,900.55
16-1770 · Sewer System				2,677,695.94	2,677,695.94
Total Fixed Assets	<u>-</u>	<u>-</u>	<u>376,065.34</u>	<u>2,615,549.23</u>	<u>2,991,614.57</u>
Other Assets					
15-1510 · Original Issue Discount		-			-
15-1900 - Amount provided for Debt		1,828,000.00			1,828,000.00
Total Other Assets	<u>-</u>	<u>1,828,000.00</u>	<u>-</u>	<u>-</u>	<u>1,828,000.00</u>
TOTAL ASSETS	<u>\$ 556,529.16</u>	<u>\$ 2,043,283.85</u>	<u>\$ 1,119,975.00</u>	<u>\$ 2,615,948.45</u>	<u>\$ 6,335,736.46</u>

Forest Hills Metro District
Balance Sheet
As of April 30, 2021

	{12} General Fund	{15} Debt Service	{14} Capital Projects	{16} Water & Sewer	Total
LIABILITIES & EQUITY					
Liabilities					
Current Liabilities					
Accounts Payable					
12-2000 · Accounts Payable	\$ 13,184.70				\$ 13,184.70
14-2000 · Accounts Payable (CP)	-		\$ 14,988.60		14,988.60
12-2005 · Credit Card Payable	240.50			\$ -	240.50
14-2005 · Retainage Payable (CP)			-		-
15-2000 · Accounts Payable (DS)		-			-
16-2000 · Accounts Payable (WS)				13,231.46	13,231.46
Total Accounts Payable	<u>13,425.20</u>	<u>-</u>	<u>14,988.60</u>	<u>13,231.46</u>	<u>41,645.26</u>
Other Current Liabilities					
12-2010 · Deposit in Lieu of Surety Bond	1,000.00				1,000.00
15-2016 · Bonds payable - short term		104,000.00			104,000.00
12-2020 Property taxes deferred	316,933.00				316,933.00
15-2020 Property taxes deferred		150,522.00			150,522.00
15-2025 · Accrued Interest		3,539.21			3,539.21
15-2050 · Construction deposit				-	-
Total Other Current Liabilities	<u>317,933.00</u>	<u>258,061.21</u>	<u>-</u>	<u>-</u>	<u>575,994.21</u>
Total Current Liabilities	331,358.20	258,061.21	14,988.60	13,231.46	617,639.47
Long Term Liabilities					
15-2015 · Bonds Payable - Long Term		1,724,000.00			1,724,000.00
15-2040 · Investment in Fixed Assets			376,065.34		376,065.34
Total Long Term Liabilities	<u>-</u>	<u>1,724,000.00</u>	<u>376,065.34</u>	<u>-</u>	<u>2,100,065.34</u>
Total Liabilities	<u>331,358.20</u>	<u>1,982,061.21</u>	<u>391,053.94</u>	<u>13,231.46</u>	<u>2,717,704.81</u>
Equity					
12-3080 · Retained Earnings	166,933.08				166,933.08
14-3060 · Net Investment in Capital Assets (CP)					-
14-3080 · Retained Earnings (CP)			750,052.89		750,052.89
15-3060 · Net Investment in Capital Assets (DS)					-
15-3080 · Retained Earnings (DS)		(1,257.48)			(1,257.48)
16-3060 · Net Assets - Invstd Captl Asset				2,615,549.23	2,615,549.23
16-3080 · Retained Earnings (WS)				(16,454.70)	(16,454.70)
Net Income	58,237.88	62,480.12	(21,131.83)	3,622.46	103,208.63
Total Equity	<u>225,170.96</u>	<u>61,222.64</u>	<u>728,921.06</u>	<u>2,602,716.99</u>	<u>3,618,031.65</u>
TOTAL LIABILITIES & EQUITY	<u>\$ 556,529.16</u>	<u>\$ 2,043,283.85</u>	<u>\$ 1,119,975.00</u>	<u>\$ 2,615,948.45</u>	<u>\$ 6,335,736.46</u>

FOREST HILLS METROPOLITAN DISTRICT
2019 Actual, 2020 Actual, 2021 YTD and Budget
As of April 30, 2021, Preliminary

	2019		2020		2021	
	Actual	Original Budget	Actual	Original Budget	Actual	Amended Budget
General Fund:						
Total Revenue	266,228	250,610	264,644	258,246	143,039	350,097
Total Expenditures	(166,422)	(182,790)	(393,809)	(352,466)	(84,801)	(315,269)
Net Revenue (Expenditures)	99,806	67,820	(129,165)	(94,220)	58,239	34,828
Interfund Transfers	-	-	-	-	-	-
Water & Sewer Fund:						
Total Revenue	295,821	792,280	309,497	798,940	98,646	823,704
Total Expenditures	(308,247)	(797,963)	(323,068)	(801,930)	(95,000)	(803,657)
Net Revenue (Expenditures)	(12,426)	(5,683)	(13,571)	(2,990)	3,646	20,047
Interfund Transfers	-	-	-	-	-	-
Capital Fund:						
Total Revenue	-	-	785,165	-	116	-
Total Expenditures	-	-	(35,165)	-	(6,337)	(500,000)
Net Revenue (Expenditures)	-	-	750,000	-	(6,221)	(500,000)
Interfund Transfers	-	-	-	-	-	-
Debt Fund:						
Total Revenue	322,405	322,013	332,786	303,967	63,430	151,482
Total Expenditures	(322,015)	(322,369)	(390,621)	(316,320)	(952)	(149,978)
Net Revenue (Expenditures)	390	(356)	(57,835)	(12,353)	62,478	1,504
Combined Funds:						
Total Revenue	884,454	1,364,903	1,692,092	1,361,153	305,231	1,325,283
Total Expenditures	(796,684)	(1,303,122)	(1,142,663)	(1,470,716)	(187,090)	(1,768,904)
Net Revenue (Expenditures)	87,770	61,781	549,429	(109,563)	118,142	(443,621)
Fund Balance End of Year:						
General	273,693	227,166	134,185	186,180	92,213	315,228
Capital	-	-	-	-	250,053	250,053
Water & Sewer	64,268	54,132	(4,884)	89,378	42,887	112,415
Total	337,961	281,298	129,301	275,558	385,153	677,696
Debt Fund Balance	51,425	59,675	51,425	3,397	51,425	-
Assessed Value		8,963,176		9,276,027		9,291,512
Mill Levies:						
General		24.285		24.285		34.110
Debt		32.000		32.000		16.200
Total		56.285		56.285		50.310
Minimum Emergency Reserves		\$ 39,094		\$ 44,121		\$ 53,067

FOREST HILLS METROPOLITAN DISTRICT
2020 Actual and 2021 YTD and Budget
GENERAL FUND
As of April 30, 2021, Preliminary

	2020		2021					Actual to Budget Percentage	Amended Budget	Projected Variance Favorable / (Unfavorable)
	April	Jan-Dec	April Actual	Actual Jan-Apr	Estimate May- Dec	Estimate Projection				
Revenue:										
Property Taxes	17,305	225,222	73,660	133,525	183,408	316,933	42%	316,933	-	
Conservation Trust Fund	-	2,044		554	1,386	1,940	29%	1,940	-	
Specific Ownership Taxes	2,402	35,551	3,195	8,909	21,091	30,000	30%	30,000	-	
Interest, Grants, Other	260	1,827	33	51	1,173	1,224	4%	1,224	-	
Total Revenue	19,967	264,644	76,888	143,039	207,058	350,097	41%	350,097	-	
Expenditures:										
Administration	6,028	46,670	4,198	12,266	22,298	34,564	35%	34,564	-	
Contractors	3,973	54,125	3,143	13,285	(1,285)	12,000	111%	12,000	-	
Other Expenses	349	5,975	1,229	5,331	27,250	32,581	18%	30,365	-	
Maintenance Expense	15,071	89,734	8,554	35,735	53,034	88,769	40%	88,340	-	
Repairs and Improvements	-	197,305	5,807	18,184	131,816	150,000	12%	150,000	-	
Total Expenditures	25,421	393,809	22,931	84,801	233,113	317,914	27%	315,269	-	
Revenue in Excess of Expenditures Before Transfers	(5,454)	(129,165)	53,957	58,239	(26,055)	32,184		34,828	-	
Transfer (to) from W&S Fund	-	-	-	-	-	-		-	-	
Transfer to Capital Projects Fund	-	-	-	-	-	-		-	-	
Revenue in Excess of Expenditures After Transfers	(5,454)	(129,165)	53,957	58,239	(26,055)	32,184		34,828		
Fund Balance Beginning of Year	60,029	189,194	64,311	60,029	60,029	60,029		280,400		
Fund Balance End of Year	54,575	60,029	118,268	118,268	33,974	92,213		315,228		
* See Detail on page 2										
	2014	2015	2016		2017	2018	2019	2020	2021	
ASSESSED VALUATION	8,706,180	8,658,652	8,746,265		8,747,778	8,958,166	8,963,176	9,276,027	9,291,512	
MILLS	24.285	24.285	24.285		24.285	24.285	24.285	24.285	34.110	
REVENUE	211,430	210,275	212,403		212,440	217,549	217,671	225,268	316,933	

FOREST HILLS METROPOLITAN DISTRICT
2020 Actual and 2021 YTD and Budget
GENERAL FUND DETAIL
As of April 30, 2021, Preliminary

	2021								
	2020		April	Actual	Estimate	Actual to Budget		Amended	Projected Variance
	April	Jan-Dec	Actual	Jan-Apr	May-Dec	Projection	Percentage	Budget	Favorable / (Unfavorable)
Administration Detail:									
District Manager	2,040	24,910	750	3,900	7,500	11,400	100%	11,400	-
Administrative Assistant	550	6,694	550	2,200	4,400	6,600	100%	6,600	-
Accountant	350	4,200	350	1,400	2,800	4,200	100%	4,200	-
County Treasurer Fees	260	3,380	1,105	2,003	2,751	4,754	100%	4,754	-
Insurance and Bonds	378	4,536	843	2,163	2,397	4,560	100%	4,560	-
Audit	2,450	2,950	600	600	2,450	3,050	100%	3,050	-
Total Administration	6,028	46,670	4,198	12,266	22,298	34,564	35%	34,564	-
Contractors Detail:									
Legal	1,257	32,880	2,073	11,490	(5,490)	6,000	100%	6,000	-
Legal - Election expense	2,716	18,685	-	-	-	-	#DIV/0!	-	-
Engineering	-	2,560	1,070	1,795	4,205	6,000	100%	6,000	-
Total Contractors	3,973	54,125	3,143	13,285	(1,285)	12,000	111%	12,000	-
Other Expenses Detail:									
Telephone	49	1,327	283	482	862	1,344	100%	1,344	-
Mailbox	-	288	-	-	288	288	0%	288	-
Membership Dues									
SDA	-	621	128	280	345	625	45%	625	-
Website	234	1,936	-	3,156	-	3,156	336%	940	(2,216)
Office Supplies	8	421	749	1,043	(475)	568	184%	568	-
Bank Fees	10	402	20	90	30	120	75%	120	-
Meetings	-	120	-	-	480	480	0%	480	-
Utilities	48	860	49	280	720	1,000	28%	1,000	-
Grant Expense - Water/Sewer Fund	-	-	-	-	25,000	25,000	0%	25,000	-
Total Other Expenses	349	5,975	1,229	5,331	27,250	32,581	18%	30,365	(2,216)
Maintenance Detail:									
General Maintenance	154	5,459	429	1,556	10,444	12,000	13%	12,000	-
Landscape Maintenance	1,491	16,639	1,365	5,550	10,830	16,380	34%	16,380	-
Community Clean Up	-	-	-	-	1,000	1,000	0%	1,000	-
Restroom Cleaning	-	-	260	260	960	1,220	27%	960	(260)
Snow Removal	6,500	45,500	6,500	26,600	13,400	40,000	67%	40,000	-
Sand/Salt	-	4,800	-	1,600	10,400	12,000	13%	12,000	-
Street Sweeping	-	2,450	-	-	3,000	3,000	0%	3,000	-
Security Gates	6,926	14,886	169	3,000	3,000	3,169	6%	3,000	(169)
Total Maintenance	15,071	89,734	8,554	35,735	53,034	88,769	40%	88,340	(429)
Repairs and Improvements Detail:									
Gates - Repair, replace, install	-	42,940	-	-	65,000	65,000	0%	65,000	-
Gatehouse - Exterior, painting, interior/exterior	-	154,365	-	-	20,000	20,000	0%	20,000	-
Outdoor Master Plan	-	-	-	-	14,500	14,500	0%	14,500	-
Phase 1 Landscaping and irrigation	-	-	5,027	14,934	25,566	40,500	37%	40,500	-
Stormwater Drainage Study	-	-	-	2,470	50	2,520	98%	2,520	-
Stormwater Drainage Survey	-	-	780	780	6,700	7,480	10%	7,480	-
Total Repairs and Improvements	-	197,305	5,807	18,184	131,816	150,000	12%	150,000	-

FOREST HILLS METROPOLITAN DISTRICT
2020 Actual and 2021 YTD and Budget
WATER AND SEWER FUND
As of April 30, 2021, Preliminary

	2020		2021					Actual to Budget Percentage	Amended Budget	Projected Variance Favorable / (Unfavorable)
	April	Jan-Dec	April Actual	Actual Jan-Apr	Estimate May - Dec	Projection				
Revenue:										
Water Use Fees	1,190	37,242	1,731	5,326	17,762	23,088	23%	23,088	-	
Water Service Fees	9,768	112,388	9,794	39,093	78,123	117,216	33%	117,216	-	
Sewer Service Fees	13,098	156,667	13,133	52,422	104,754	157,176	33%	157,176	-	
Availability of Service	240	960	240	480	240	720	67%	720	-	
SRF Loan					500,000	500,000	0%	500,000	-	
Grant Income - General Fund					25,000	25,000	0%	25,000	-	
Interest & Other	80	2,240	300	1,325	(821)	504	263%	504	-	
Total Revenue	24,376	309,497	25,198	98,646	725,058	823,704	12%	823,704	-	
Expenditures:										
Administration	6,387	52,464	3,272	11,307	25,792	37,099	30%	37,099	-	
Contractors	8,450	105,247	8,116	32,439	67,131	99,570	33%	99,570	-	
Water System R&M	2,770	67,252	5,442	24,615	51,923	76,538	32%	76,538	-	
Sewer System R&M	5,889	72,917	13,169	17,306	73,144	90,450	19%	90,450	-	
Repairs and Improvements	-	25,188	1,440	9,333	490,667	500,000	2%	500,000	-	
Total Expenditures	23,496	323,068	31,439	95,000	708,657	803,657	12%	803,657	-	
* See Detail on page 2										
Revenue in Excess of Expenditures Before Transfers	880	(13,571)	(6,241)	3,646	16,401	20,047		20,047	-	
Transfer from GF	-	-	-	-	-	-		-		
Transfer (to) CPF	-	-	-	-	-	-		-		
Revenue in Excess of Expenditures After Transfers	880	(13,571)	(6,241)	3,646	16,401	20,047		20,047		
Depreciation Expense		-								
Fund Balance Beginning of Year	36,411	36,411	32,727	22,840	22,840	22,840		92,368		
Fund Balance End of Year	\$ 37,291	\$ 22,840	\$ 26,486	\$ 26,486	\$ 39,241	\$ 42,887		\$ 112,415	\$ -	

FOREST HILLS METROPOLITAN DISTRICT
2020 Actual and 2021 YTD and Budget
WATER AND SEWER FUND DETAIL
As of April 30, 2021, Preliminary

	2021								
	2020		April	Actual	Estimate	Actual to Budget		Amended	Projected
	April	Jan-Dec	Actual	Jan-Apr	May - Dec	Projection	Percentage	Budget	Variance Favorable / (Unfavorable)
Administration:									
District Manager	2,040	24,437	750	3,000	6,000	9,000	33%	9,000	-
Administrative Assistant	550	6,628	550	2,200	4,400	6,600	33%	6,600	-
Accountant	350	4,200	350	1,400	2,800	4,200	33%	4,200	-
Billing	559	6,949	559	2,280	4,620	6,900	33%	6,900	-
Insurance and Bonds	378	4,536	403	1,587	2,973	4,560	35%	4,560	-
Permits	-	1,949	-	-	1,949	1,949	0%	1,949	-
Dues & Subscription	60	720	60	240	480	720	33%	720	-
UNCC	-	-	-	-	120	120	0%	120	-
Audit	2,450	2,950	600	600	2,450	3,050	20%	3,050	-
Office Supplies	-	95	-	-	-	-	#DIV/0!	-	-
Total Administration	6,387	52,464	3,272	11,307	25,792	37,099	30%	37,099	-
Contractors:									
Legal and Water Rights									
Attorney	414	9,359	263	2,614	(1,414)	1,200	218%	1,200	-
Engineer	690	13,400	765	3,355	5,645	9,000	37%	9,000	-
Engineering	700	3,490	-	55	11,945	12,000	0%	12,000	-
Utility Locates	298	2,582	740	1,023	177	1,200	85%	1,200	-
Operator	6,348	76,416	6,348	25,392	50,778	76,170	33%	76,170	-
Total Contractors	8,450	105,247	8,116	32,439	67,131	99,570	33%	99,570	-
Water System R&M:									
Water Rights Memberships									
BCWA	-	4,390	-	4,415	85	4,500	98%	4,500	-
Utilities	2,133	27,496	2,341	9,165	18,435	27,600	33%	27,600	-
Testing	88	1,668	44	997	2,963	3,960	25%	3,960	-
Maintenance	549	32,707	372	7,122	12,678	19,800	36%	19,800	-
Monitoring/alarms	-	-	-	-	1,200	1,200	0%	1,200	-
Meter Reading	-	991	77	308	686	994	31%	994	-
Chemicals	-	-	-	-	2,580	2,580	0%	2,580	-
SRF Loan Payment	-	-	2,608	2,608	13,296	15,904	16%	15,904	-
Total Water System R&M	2,770	67,252	5,442	24,615	51,923	76,538	32%	76,538	-
Sewer System R&M:									
Maintenance	-	4,187	-	-	12,200	12,200	0%	12,200	-
Clean and Video	-	11,788	-	-	-	-	#DIV/0!	-	-
WWTP Upgrade	-	-	-	-	25,000	25,000	0%	25,000	-
Sludge Hauling	-	37,840	6,805	9,705	30,345	40,050	24%	40,050	-
Testing	-	4,041	374	1,436	1,564	3,000	48%	3,000	-
Chemicals	5,889	15,061	5,990	6,165	4,035	10,200	60%	10,200	-
Total Sewer System R&M	5,889	72,917	13,169	17,306	73,144	90,450	19%	90,450	-
Repairs and Improvements Detail:									
Booster Pump Station	-	25,188	1,440	9,333	490,667	500,000	2%	500,000	-
Total Repairs and Improvements	-	25,188	1,440	9,333	490,667	500,000	2%	500,000	-

FOREST HILLS METROPOLITAN DISTRICT
2020 Actual and 2021 YTD and Budget
CAPITAL PROJECTS FUND
As of April 30, 2021, Preliminary

	2020		2021				Actual to Budget Amended Budget	Projected Variance Favorable / (Unfavorable)	
	Apr	Jan - Dec	April Actual	Jan - Apr Actual	Estimate May - Dec	Projection			
						Percentage			
Revenue:									
Interest on Investments		-	35	192		-			
Loan Proceeds	-	785,165				-		-	
Total Revenue	-	785,165	35	192	-	-	-	-	
Expenditures:									
General Fund Projects									
Road Project			5,111	21,325	478,675	500,000	1%	500,000	-
Closing Costs on Loan	-	35,165							-
Gate Operators/Gatehouse									-
Crack Sealing/Patching				-					-
Fire Mitigation				-					-
Roof Replacement									-
Total General Fund Improvements:	-	35,165	5,111	21,325	478,675	500,000		500,000	-
Revenue in Excess of Expenditures Before Transfers	-	750,000	(5,076)	(21,133)	(478,675)	(500,000)		(500,000)	-
Transfer from Debt Service Fund		-	-	-	-			-	
Transfer from W&S Fund									
Revenues in Excess of Expenditures After Transfers	-	750,000	(5,076)	(21,133)	(478,675)	(500,000)		(500,000)	
Reserve Funds Beginning of Year	-	-	750,053	750,053		750,053		750,053	
Reserve Funds End of Year	-	750,000	744,977	728,920		250,053		250,053	-

FOREST HILLS METROPOLITAN DISTRICT
2020 Actual and 2021 YTD and Budget
DEBT SERVICE FUND
As of April 30, 2021, Preliminary

	2020		2021					<i>Projected Variance Favorable / (Unfavorable)</i>
	April	Jan-Dec	April	Estimate	Projection	Actual to Budget	Amended	
			Actual	Apr - Dec		Percentage	Budget	
Revenue:								
Property Taxes	22,802	296,773	34,984	87,107	150,522	42%	150,522	-
Interest on Investments	101	858	14	945	960	2%	960	-
Transfer In		35,155		-	-	0%	-	-
Total Revenue	22,903	332,786	34,998	88,052	151,482	42%	151,482	-
Expenditures:								
Principal Payments	-	250,000		104,000	104,000	0%	104,000	-
Interest Payments	30,734	61,468		43,720	43,720	0%	43,720	-
Paying Agent Fees	200	400		-	-	0%	-	-
Bond Closing Costs		74,300			-	0%	-	-
County Treasurer Fees	342	4,453	525	1,306	2,258	42%	2,258	-
Total Expenditures	31,276	390,621	525	149,026	149,978	1%	149,978	-
Revenue in Excess of Expenditures	(8,373)	(57,835)	34,473	(60,974)	1,504	0	1,504	-
Reserve Funds Beginning of Year	59,728	59,728	29,898	1,893	1,893	-	1,893	-
Reserve Funds End of Year	51,355	1,893	64,371	(59,081)	3,397	0	3,397	-
	2014	2015	2016	2017	2018	2019	2020	2021
ASSESSED VALUATION	8,706,180	8,658,652	8,747,778	8,746,265	8,958,166	8,963,176	9,276,027	9,291,512
MILLS	31.500	33.500	33.500	36.500	36.500	35.500	32.000	16.200
REVENUE	274,245	290,065	293,051	319,239	326,973	318,193	296,833	150,522

Forst Hills Metropolitan District
 Estimated Cash Flow
 May 31, 2021

	4/30/2021 Balance	Interfund Transfers	Add: Deposits	Less: Board Checks	Monthly EFTs	Total Cash Available
General Fund						
1st Bank Checking	\$ 10,958.60					\$ 10,958.60
Less: April o/s checks	(5,460.91)					(5,460.91)
Colostrust (General and CTF)	143,933.05		-			143,933.05
February tax deposit (5/10/21)			91,710.63			91,710.63
Transfers out - May 2021		(28,610.35)	-			(28,610.35)
April 2021 Checks (A/P as of 4/30/21)				(13,184.70)	-	(13,184.70)
May 2021 EFT payments - utilities					(469.05)	(469.05)
Estimated 5/31/21 available cash in General Fund	149,430.74	(28,610.35)	91,710.63	(13,184.70)	(469.05)	198,877.27

Water/Sewer Fund						
1st Bank Checking	97,296.74					97,296.74
Less: April o/s checks	(19,766.33)					(19,766.33)
Transfers out - May 2021		-				-
April 2021 Checks (A/P as of 4/30/21)				(13,231.46)		(13,231.46)
May 2021 EFT payments - utilities					(2,212.74)	(2,212.74)
May 2021 customer deposits made as of 5/31/2021 (ESTIMATE)			24,000.00			24,000.00
Estimated 5/31/21 available cash in Water/Sewer Fund	77,530.41	-	24,000.00	(13,231.46)	(2,212.74)	86,086.21

Estimated 5/31/21 available cash in Combined Funds \$ 226,961.15 \$ (28,610.35) \$ 115,710.63 \$ (26,416.16) \$ (2,681.79) **\$ 284,963.48**

Estimated 5/31/21 available cash in Capital Projects Fund \$ 743,909.66 \$ - \$ 40.00 \$ (14,988.60) **\$ 728,961.06**

Estimated 5/31/21 available cash in Debt Service \$ 64,761.85 \$ 28,610.35 \$ 30.00 \$ - **\$ 93,402.20**

April 2021 Outsanding Checks:

				Cleared Bank
Tara Prosser	4013	380.00		Paid in May 2021
Collins Cockrel and Cole	4050	3,600.41		5/10/2021
Professional Business Services	4052	1,311.50		5/4/2021
Doors West	4051	169.00		5/3/2021
General Fund Checking		\$ 5,460.91		
McDonald Farms	11020	9,705.00		
Univar USA Inc.	11021	5,989.51		
Insturment & Supply	11019	3,516.82		
American Conservation Billing	11018	555.00		
Water/Sewer Fund Checking		\$ 19,766.33		

EFT's During May 2021:

Republic Services - trash	5/15/2021	\$ 429.38	
Vonage	5/12/2021	39.67	
1st Bank CC	5/2/2021	-	
		\$ 469.05	General Fund
Xcel Energy	5/21/2021	\$ 2,212.74	
		\$ 2,212.74	Water/Sewer Fund

ESTIMATED CASH FLOWS THROUGH 5/31/21:	
Estimated General Fund Bank Balance at 5/31/21	\$ 198,877.27
Total 2021 GF Revenues not received	143,957.00
Total 2021 GF Expenses not paid	(233,113.00)
Estimated General Fund Bank Balance at 12/31/21	<u>\$ 109,721.27</u>
Estimated Water/Sewer Fund Bank Balance at 5/31/21	\$ 86,086.21
Total 2021 Water/sewer Fund Revenues not received	725,058.00
Total 2021 W/S Fund Expenses not paid	(708,657.00)
Estimated W/S Fund Bank Balance at 12/31/21	<u>\$ 102,487.21</u>
Estimated Capital Projects Fund Bank Balance at 5/31/21	\$ 728,961.06
Total 2021 CPF Revenues not received	-
Total 2021 CPF Expenses not paid	(478,675.00)
Estimated Capital Projects Fund Bank Balance at 12/31/21	<u>\$ 250,286.06</u>
Estimated Debt Service Fund Bank Balance at 5/31/21	\$ 93,402.20
Total 2021 DSF Revenues not received	122,872.00
Total 2021 DSF Expenses not paid	(149,978.00)
Estimated Debt Service Fund Bank Balance at 12/31/21	<u>\$ 66,296.20</u>

Forest Hills Metropolitan District
Expense Detail
As of April 30, 2021

April 2021							
Paid at May 2021 Board Meeting	Bank Debits	Credit Card Exp.	Treasurer Fees	Amortized Prepaid Exp	Bank Srvc Chrg	TOTAL EXPENSES	
Accounts Payable as of 4/30/21 - to be paid at May 2021 Board mtg - via ACH/check							
American Conservation & Billing Solutions	\$ 558.75					\$	558.75
CenturyLink	81.10						81.10
Collins Cockrel & Cole	2,072.80						2,072.80
Colorado Greenscapes	1,365.00						1,365.00
Element Engineering LLC	4,030.00						4,030.00
Hamre, Rodriguez, Ostrander & Dingess, PC	262.56						262.56
Haynie & Company	1,200.00						1,200.00
Jim Noble, Inc.	6,500.00						6,500.00
MAPS, Inc.	1,500.00						1,500.00
NMHolder Financial, Inc.	1,800.00						1,800.00
ORC Water Professionals, Inc.	7,195.35						7,195.35
Professional Business Services, LLC	125.00						125.00
RESPEC	765.00						765.00
Tara Prosser	260.00						260.00
UNCC	19.80						19.80
WesTest	14,988.60						14,988.60
Total Other Expenses paid during April 2021							
Vonage - 4/12/21		39.67					39.67
Republic Services - 4/15/21		429.38					429.38
Xcel Energy - 3/24/21		2,389.64					2,389.64
CenturyLink		162.50					162.50
Treasurer fees - paid to Jeffco - general fund			1,105.30				1,105.30
Treasurer fees - paid to Jeffco - debt service fund			524.95				524.95
Dues Expense (SDA) - paid at beginning of year - General Fund				128.53			128.53
Insurance Expense - paid at beginning of year - General Fund				843.48			843.48
Insurance Expense - paid at beginning of year - Water/Sewer Fund				403.20			403.20
Antx 3 year subscription - paid in full				60.00			60.00
1st Bank Service Charge		-			20.00		20.00
Credit Card Charges			-				-
CWR&PDA Loan Payment - 5/1/21	2,607.70						2,607.70
Westest - April 201 expense - paid in May 2021	(9,877.20)						(9,877.20)
Univar USA Inc. - April 8, 2021 (invoice date)	5,989.51						5,989.51
McDonald Farms - April 1, 2021 invoice (service date)	6,805.00						6,805.00
Professional Business Services, LLC - April 9, 2021 (invoice date)	624.00						624.00
Outdoor Design Group - April 13,2021 (service/invoice date)	5,027.05						5,027.05
Total Expenses per April 2021 Accounts Payable and Bank Statement	\$ 53,900.02	\$ 3,021.19	\$ -	\$ 1,630.25	\$ 1,435.21	\$ 20.00	\$ 60,006.67
Expenses per April 2021 Unaudited Financial Statements:							
General Fund							\$ 22,932.49
Capital Projects Fund							5,111.40
Water/Sewer Fund							31,437.83
Debt Service Fund							524.95
Total Expenses per Unaudited Financial Statements							\$ 60,006.67



FOREST HLLS MTRO DST
Account Number: XXXX XXXX XXXX 1845

Billing Questions:

303-237-5000
1-800-964-3444

Website:

efirstbank.com

Send Billing Inquiries To:

FirstBank, P.O. Box 150427, Lakewood, CO 80215

FIRSTBANK CREDIT CARD CENTER Credit Card Account Statement
Activity Through April 6, 2021

SUMMARY OF ACCOUNT ACTIVITY

Previous Balance	\$391.05
- Payments	\$391.05
- Other Credits	\$0.00
+ Purchases	\$0.00
+ Cash Advances	\$0.00
+ Fees Charged	\$0.00
+ Interest Charged	\$0.00
= New Balance	\$0.00

PAYMENT INFORMATION

New Balance:	\$0.00
Minimum Payment Due:	\$0.00
Payment Due Date:	May 1, 2021

Account Number	XXXX XXXX XXXX 1845
Credit Limit	\$3,000.00
Available Credit	\$1,922.00
Statement Closing Date	April 6, 2021
Days in Billing Cycle	30

TRANSACTIONS

An amount followed by a minus sign (-) is a credit unless otherwise indicated.

Tran Date	Post Date	Reference Number	Transaction Description	Amount
04/01	04/01	F3390002V00CHGDDA	AUTOMATIC PAYMENT - THANK YOU	\$391.05-
			TOTAL XXXXXXXXXXXXXXX1845	\$391.05-

NOTICE: SEE REVERSE SIDE OF PAGE 1 FOR IMPORTANT ACCOUNT AND ANNUAL FEE INFORMATION

5547 0001 BHH 001 7 3 210406 0 PAGE 1 of 2 15 3390 2000 VBUS 01AD5547 6275

FIRSTBANK CREDIT CARD CENTER
PO BOX 150427
LAKEWOOD CO 80215-0427



Account Number: XXXX XXXX XXXX 1845
New Balance: \$0.00
Minimum Payment Due: \$0.00
Payment Due Date: May 1, 2021

Please use enclosed envelope to remit payment.

Amount Enclosed: \$

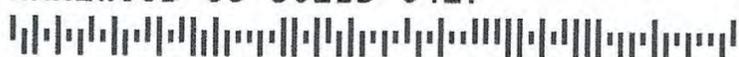
Indicate name or address change on reverse side and check here.

Please return this portion of the statement with payment.

Make Check Payable to:

FIRSTBANK
PO BOX 150427
LAKEWOOD CO 80215-0427

FOREST HLLS MTRO DST 6275
14405 W COLFAX #165
GOLDEN CO 80401



⑆03390 2000⑆ ⑆8000 2 1845⑆



FOREST HLLS MTRO DST
 Account Number: XXXX XXXX XXXX 1845

REWARDS SUMMARY

PREVIOUS FIRSTCASH BALANCE	=	\$6.12
DOLLARS EARNED THIS STATEMENT	+	\$0.00
DOLLARS ISSUED THIS STATEMENT	-	\$0.00
DOLLARS FORFEITED THIS STATEMENT	-	\$0.00
ENDING FIRSTCASH BALANCE	=	\$6.12

INTEREST CHARGE CALCULATION

Your Annual Percentage Rate (APR) is the annual interest rate on your account

Type of Balance	Annual Percentage Rate (APR)	Balance Subject to Interest Rate	Days in Billing Cycle	Interest Charge
Purchases	15.15% (v)	\$0.00	30	\$0.00
Cash Advances	18.15% (v)	\$0.00	30	\$0.00

(v) - variable

Interest Charge adjustments are not in this amount, but will appear in the body of the statement

NOTICE: SEE REVERSE SIDE OF PAGE 1 FOR IMPORTANT ACCOUNT AND ANNUAL FEE INFORMATION

1-2

BHH



**American Conservation
& Billing Solutions**

PO Box 51356
 Colo Spgs, CO 80949

877-410-0167 x 1985
 719-599-4057

Invoice Number: 12500
 Invoice Date: Apr 20, 2021

Sold To: ~~FAKE~~

Ship To:

Forest Hills Metropol District
 14405 W Colfax Ave #165
 Lakewood, CO 80401

Customer ID	Purchase Order	Payment Terms	Sales Rep	Page
FOREHI		Net 30 Days		1

Quantity	Item	Description	Unit Price	Extension
149.00		Billing - Metered 2/29 - 3/28/ 2021 Inserts Titles	3.75	558.75

Check No:

Sales Tax	
Total Invoice Amount	\$558.75
Amount Received With Invoice	0.00
Total	\$558.75



FOREST HILLS METRO DIS
14405 WEST COLFAX AVE
Bill Date: Apr 7, 2021
Account No: 303-526-0769 466B

Visit centurylink.com

Balance Forward	New Charges	Total Amount Due	Due Date for New Charges
\$162.50	\$81.10	\$243.60	Apr 28, 2021

Account Summary

Previous Balance

Charges 162.50
Balance Forward \$162.50

New Charges

For questions, call:

Page

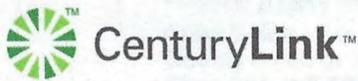
CenturyLink	1 800 777-9594	3	74.84
Long Distance Service	1 800 603-6000	5	6.26
Total New Charges			\$81.10

TOTAL AMOUNT DUE \$243.60

A late payment charge of 5.0% or \$13.00, whichever is greater, may apply on any amount left unpaid 30 days after bill date. Separate late payment charges apply to Internet services.

CenturyLink, P O Box 91155, Seattle, WA 98111-9255

Please fold, tear here and return this portion with your payment.



62202520 C3 RP 05 20210405 NNNNNNNY 0001145 0004



FOREST HILLS METRO DIS
14405 W COLFAX AVE
165
LAKEWOOD CO 80401-3247

Bill Date: Apr 7, 2021
Account No: 303-526-0769 466B
Bill Due Date: Apr 28, 2021
Balance Forward: \$162.50
New Charges: \$81.10
TOTAL AMOUNT DUE: \$243.60

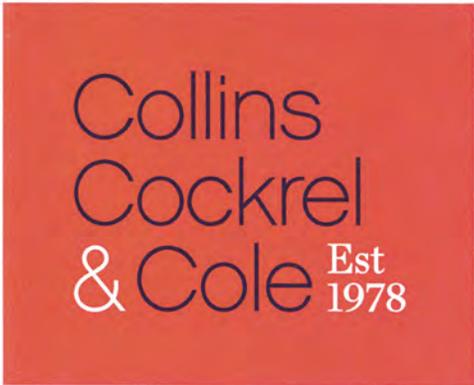
Amount Enclosed \$ _____

CENTURYLINK
P O BOX 91155
SEATTLE, WA 98111-9255



41 02303526076904667 1221040721 000001625003 000002436004

continued on back



SHAREHOLDERS
 Paul R. Cockrel
 Robert G. Cole
 Timothy J. Flynn
 Evan D. Ela
 Linda M. Glesne
 David A. Greher
 Kathryn G. Winn
 Allison C. Ulmer
 Matthew P. Ruhland

OF COUNSEL
 James P. Collins

ASSOCIATES
 Joseph W. Norris
 Bart W. Miller
 Ayshan E. Ibrahim

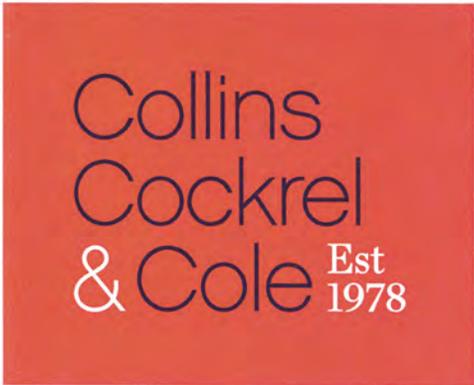
cccfirm@cccfirm.com

BILLING ENTRIES ARE ATTY-CLIENT PRIVILEGED COMMUNICATIONS

FOREST HILLS METROPOLITAN DISTRICT
 14405 W. COLFAX AVENUE
 SUITE 165
 LAKEWOOD CO 80401
 VIA EMAIL

Page: 1
 April 30, 2021
 ACCOUNT NO. 10011M

PREVIOUS BALANCE	APR. FEES	APR. EXP.	ADVANCES	PAYMENTS	BALANCE DUE
GENERAL 3,600.41	2,064.00	8.80	0.00	-3,600.41	<u>\$2,072.80</u>



SHAREHOLDERS
 Paul R. Cockrel
 Robert G. Cole
 Timothy J. Flynn
 Evan D. Ela
 Linda M. Glesne
 David A. Greher
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cccfirm@cccfirm.com

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FOREST HILLS METROPOLITAN DISTRICT
 14405 W. COLFAX AVENUE
 SUITE 165
 LAKEWOOD CO 80401
 VIA EMAIL

Page: 1
 April 30, 2021
 ACCOUNT NO. 10011-001M

GENERAL

PROFESSIONAL SERVICES RENDERED

		Hours
04/19/2021		
ACU	Emails with R. Zivalich regarding supplemental loan application.	0.30
04/20/2021		
CS	Telephone call with ACU; work on draft of rate increase resolution; emails to and from ACU regarding the same.	0.60
ACU	Review and revise resolution authorizing water and wastewater rate increase; conference with CS regarding same; emails with R. Zivalich regarding same. Telephone call and emails with R. Zivalich and K. Crawford regarding CWRPDA loan resolution.	2.60
04/22/2021		
ACU	Emails with R. Zivalich, K. Crawford and CS regarding executed rate increase resolution. Emails with N. Holder regarding 2020 loan closing documents.	0.30
CS	Follow up on any addition requirements for imposing increased rate; email to ACU regarding the same.	0.20
04/26/2021		
ACU	Emails with R. Zivalich, K. Crawford, and CWRPDA regarding supplemental loan approval.	0.20
04/30/2021		
ACU	Review CWRPDA supplemental loan documents.	<u>1.60</u>

FOREST HILLS METROPOLITAN DISTRICT

Page: 2
April 30, 2021
ACCOUNT NO. 10011-001M

GENERAL

	Hours	
FOR CURRENT SERVICES RENDERED	5.80	2,064.00

SUMMARY OF HOURS

<u>Timekeeper</u>	<u>Hours</u>
Crystal Schott	0.80
Allison C. Ulmer	5.00

EXPENSES

03/17/2021	Miscellaneous - Conference Call; paid to AMEX.	2.58
03/31/2021	Miscellaneous - Conference Call; paid to AMEX.	<u>6.22</u>
	TOTAL EXPENSES FOR MONTH	8.80

TOTAL SERVICES FOR MONTH 2,072.80

PREVIOUS BALANCE \$3,600.41

PAYMENT(S)

05/05/2021 PAYMENT ON ACCOUNT -3,600.41

BALANCE DUE \$2,072.80

COLORADO GREENSCAPES

INVOICE 05-21
05/2021

11768 W Marlowe Ave

Morrison Co 80465

(720)470-5761

BILL TO

Forest Hills Metropolitan District
14405 W Colfax Ave #165
Lakewood Co. 80401
303.495.2330

DESCRIPTION	AMOUNT
General Weekly/Monthly Responsibilities for month of May 2021	\$1365.00
<i>Thank you for your business!</i>	TOTAL \$1365.00

If you have any questions about this invoice please contact
Mike or Angela gingerhead1221@gmail.com (720)470-5761



Element Engineering, LLC
 12687 W Cedar Drive, Suite 300
 Lakewood, CO 80228
 (303) 378-2969

INVOICE

Invoice Date: 05/03/21
 Due Date: 06/02/21
 Total Amount: \$740.00
 Number: 03
 Invoice Period: 04/01/21 - 04/30/21
 Job: 0004A - 2021 Locate

0025 - Forest Hills Metropolitan District
 Ronda Zivalich
 14405 West Colfax Avenue #165
 Lakewood, CO 80401

INVOICE DETAILS

Description	Prior Billing (\$)	This Invoice (\$)
Utility Locate Services	\$282.50	\$740.00
BUDGET TOTALS	\$282.50	\$740.00

Source	Date	Description	Hrs / Qnt	Rate	Amount
Professional Fees					
Matt Hess	04/08/21	Locate Areas Marked x7 Tickets - 2021 Roadway Improvements	6.00	\$95.00	\$570.00
Matt Hess	04/29/21	Emergency Locate Cleared 22897 Solitude Lane	1.00	\$95.00	\$95.00
Matt Hess	04/15/21	Locate Cleared - 820 Genesee Ridge Road	1.00	\$30.00	\$30.00
Matt Hess	04/20/21	Locate Cleared 21921 Anasazi Way	1.00	\$15.00	\$15.00
Matt Hess	04/21/21	Locates Cleared (x2) - 829 Eastwood Drive	1.00	\$15.00	\$15.00
Matt Hess	04/23/21	Locate Cleared 22303 Anasazi Way	1.00	\$15.00	\$15.00
Professional Fees			11.00		\$740.00
AMOUNT DUE (THIS INVOICE)			11.00		\$740.00
TOTAL AMOUNT DUE					\$740.00



Element Engineering, LLC
 12687 W Cedar Drive, Suite 300
 Lakewood, CO 80228
 (303) 378-2969

INVOICE

Invoice Date: 05/04/21
 Due Date: 06/03/21
 Total Amount: \$1,070.00
 Number: 04
 Invoice Period: 04/01/21 - 04/30/21
 Job: 0001A - 2021 On-Call Engineering Services

0025 - Forest Hills Metropolitan District
 Ronda Zivalich
 14405 West Colfax Avenue #165
 Lakewood, CO 80401

INVOICE DETAILS

Description	Prior Billing (\$)	This Invoice (\$)
Engineering Services	\$3,667.50	\$1,070.00
BUDGET TOTALS	\$3,667.50	\$1,070.00

Source	Date	Description	Hrs / Qnt	Rate	Amount
Professional Fees					
Nicholaus Marcotte	04/02/21	Loan Application Assistance	2.00	\$140.00	\$280.00
Nicholaus Marcotte	04/23/21	Useful Life Calculation for CDPHE	2.50	\$140.00	\$350.00
Matt Hess	04/07/21	2021 Roadway Improvements - Map Research, Call 811 for Utility Locates x7 Tickets, Log Locate Tickets	3.00	\$110.00	\$330.00
Matt Hess	04/12/21	Organize 811 Locate Responses and Maps	1.00	\$110.00	\$110.00
		Professional Fees	8.50		\$1,070.00
		AMOUNT DUE (THIS INVOICE)	8.50		\$1,070.00
TOTAL AMOUNT DUE					\$1,070.00



Element Engineering, LLC
 12687 W Cedar Drive, Suite 300
 Lakewood, CO 80228

INVOICE

0025 - Forest Hills Metropolitan District
 Ronda Zivalich
 14405 West Colfax Avenue #165
 Lakewood, CO 80401

Invoice Date: 05/03/21
 Due Date: 06/02/21
 Total Amount: \$1,440.00
 Number: 01
 Invoice Period: 04/01/21 - 04/30/21
 Job: 0003C - BPS Construction Management

INVOICE SUMMARY

Description	Total Budget	Remaining Budget (\$)	Prior Billing (\$)	This Invoice (\$)
Engineering Services	\$39,500.00	\$38,060.00	--	\$1,440.00
BUDGET TOTALS	\$39,500.00	\$38,060.00	--	\$1,440.00

Source	Date	Description	Hrs/ Qnt	Rate	Amount
Professional Fees					
Patrick Roberts	04/28/21	Pre-Construction Meeting Agenda	3.00	\$130.00	\$390.00
Rachel Lee	04/11/21	Contract Docs	7.00	\$105.00	\$735.00
Rachel Lee	04/19/21	Contract Docs	3.00	\$105.00	\$315.00
			Professional Fees	13.00	\$1,440.00
			AMOUNT DUE (THIS INVOICE)	13.00	\$1,440.00
TOTAL AMOUNT DUE					\$1,440.00



Element Engineering, LLC
 12687 W Cedar Drive, Suite 300
 Lakewood, CO 80228

INVOICE

0025 - Forest Hills Metropolitan District
 Ronda Zivalich
 14405 West Colfax Avenue #165
 Lakewood, CO 80401

Invoice Date: 05/04/21
 Due Date: 06/03/21
 Total Amount: \$780.00
 Number: 01
 Invoice Period: 04/01/21 - 04/30/21
 Job: 0006A - Drainage Evaluation Phase 2

INVOICE SUMMARY

Description	Total Budget	Remaining Budget (\$)	Prior Billing (\$)	This Invoice (\$)
Engineering Services	\$8,720.00	\$7,940.00	--	\$780.00
BUDGET TOTALS	\$8,720.00	\$7,940.00	--	\$780.00

Source	Date	Description	Hrs/ Qnt	Rate	Amount
Professional Fees					
Mike Hager	04/07/21	Exhibits and Locate Coordination	2.00	\$130.00	\$260.00
Mike Hager	04/09/21	Coordination with Surveyors	1.00	\$130.00	\$130.00
Mike Hager	04/13/21	Survey Coordination	1.00	\$130.00	\$130.00
Mike Hager	04/22/21	Survey Coordination	1.00	\$130.00	\$130.00
Mike Hager	04/30/21	Survey Coordination	1.00	\$130.00	\$130.00
			Professional Fees	6.00	\$780.00
			AMOUNT DUE (THIS INVOICE)	6.00	\$780.00

TOTAL AMOUNT DUE \$780.00



1221 W. Mineral Ave, Suite 202
 Littleton, CO 80120-4544
 (303) 734-4800

FOREST HILLS METROPOLITAN DISTRICT
 C/O WILLIAM RAATZ
 14405 W COLFAX AVENUE #165
 LAKEWOOD, CO 80401

Date: 3/31/2021
 Invoice Number: D57965
 Client: D04960.000

Please return a copy of this invoice with your remittance.

Progress billing for work performed on the audit of your December 31, 2020 financial statements \$1,200.00

Total Amount Due: \$1,200.00

Current	31-60	61-90	91-120	Over 120	Total Due
\$1,200.00	\$0.00	\$0.00	\$0.00	\$0.00	\$1,200.00

Payment is due upon receipt of this invoice. A finance charge of 1.5% per month will accrue on balances over 30 days. There will be a \$25 fee for all returned checks. For your convenience, you can pay online at hayniecpas.com. If you have any questions regarding payment please email AccountsReceivable@HaynieCPAs.com.



HAMRE, RODRIGUEZ,
OSTRANDER & DINGESS, P.C.

Attorneys and Counselors at Law

3600 S. Yosemite Street, Suite 500
Denver, Colorado 80237-1829
Telephone: (303) 779-0200
Telefax: (303) 779-3662
mail@hrodlaw.com
www.hrodlaw.com

Forest Hills Metropolitan District
14405 W. Colfax Avenue #165
Lakewood, CO 80401

May 4, 2021
Invoice # 8577

Re: FHMD

Professional Services

<u>Date</u>	<u>Staff</u>	<u>Description</u>	<u>Hours</u>	<u>Amount</u>
John M. Dingess				
04/15/21	JMD	D-1, 19CW3103, Upper Bear Creek - Draft comment letter to Applicant	0.40	80.00
04/30/21	JMD	D-1 19CW3103, Upper Bear Creek - JTSC; file memo	0.50	100.00
SpecialCounsel-Petitt LLC				
04/19/21	TLP	D-, 19CW3103, Upper Bear Creek - Review Applicant's Rule 26(a)(1) disclosure	0.20	36.00
04/30/21	TLP	D-1, 20CW3107, Medved - Update Referee Deadlines	0.20	36.00
Total Professional Services			1.30	\$ 252.00

Costs and Disbursements

<u>Date</u>	<u>Description</u>	<u>Amount</u>
04/30/21	Conference Calls during March	10.56
Total Costs and Disbursements		\$ 10.56

Total Current Charges **\$ 262.56**

Previous Balance **\$ 1,111.30**

Payments and Credits

04/22/21 Payment - thank you 1,111.30

Total Payments and Credits **\$ 1,111.30**

Summary of Account

Balance Forward	\$ 1,111.30
Total Current Charges	262.56
Less Payments and Credits	<u>1,111.30</u>

Balance Due **\$ 262.56**



JIM NOBLE, INC

3741 SAGE CIRCLE

EVERGREEN, COLORADO 80439

303-674-3234



FHMD APRIL 2021 SNOW SERVICES INVOICE

6,500.00

MAPS, Inc.

2241 S DEFRAME CT
LAKEWOOD, CO 80228

Invoice

Date	Invoice #
5/1/2021	500

Bill To
Forest Hills Metro District 14405 W. Colfax Avenue, #165 Lakewood, CO 80401

P.O. No.	Terms	Project
	Net 15	

Quantity	Description	Rate	Amount
25	District Manager - Monthly Contract (25 - 30 hrs) - April 2021 (total hours 44.25) 30 hours: calls w/Admin Asst, review and approve invoices, board meeting prep, calls w/ various board members, calls w/EE, Noble and ORC, manager report, review board meeting reports and approve, attend board meetings, correspondence, attend Bear Creek Watershed Meeting, homeowner communications, maintain capital improvements list, review and update board meeting minutes, work w/AMCOBI re: billing and realtor questions, new owner communications, work w/admin re: payables and ACH payments, communications with RESPEC and John Dingess re: filings, tracked smart meter installations, worked w/bond and legal counsel re: supplemental loan, several conf calls w/EE and admin re: loan app information, calls/emails/meetings re: gate update project, participated in MPC meeting, review HROD summaries and filing information, review and provided comments on ODG submittals, worked w/owner re: easement issues, website inquiries and issues, worked w/vendor for credit app for services, Eastwood gate damage, worked with owners insurance, draft several email updates to community, CCR compliance, rate increase letter/billing, roadway project, stormwater drainage study, waterscope issues, contract/PO for MES	60.00	1,500.00

Thank you for your business.	Total	\$1,500.00
------------------------------	--------------	------------

--

NMHolder Financial, Inc.
9694 Chesapeake Street
Highlands Ranch, CO 80126
US
720-496-9343
nmholderbiz@gmail.com



BILL TO

Forest Hills Metropolitan District
14405 West Colfax Avenue, #165
Lakewood, CO 80401

INVOICE 2021-047

DATE 04/30/2021 **TERMS** Net 20

DUE DATE 05/20/2021

DATE	ACTIVITY	QTY	RATE	AMOUNT
12/31/2020	FHMD-Bookkeeping April 2021 accounting and financial report preparation	1	700.00	700.00

TOTAL DUE

\$700.00

NMHolder Financial, Inc.
9694 Chesapeake Street
Highlands Ranch, CO 80126
US
720-496-9343
nmholderbiz@gmail.com



BILL TO

Forest Hills Metropolitan District
14405 West Colfax Avenue, #165
Lakewood, CO 80401

INVOICE 2021-046

DATE 04/30/2021 **TERMS** Net 20

DUE DATE 05/20/2021

DATE	ACTIVITY	QTY	RATE	AMOUNT
12/31/2020	Administrative Assistant April 2021 Administrative services (per contract 12.50hrs per week)	1	1,100.00	1,100.00

TOTAL DUE

\$1,100.00



11919 I-70 Frontage Rd.
Suite 116A
Wheat Ridge, CO. 80033

Tel.: (720) 287-0605

Water Professionals

Invoice

Forest Hills Metropolitan District
14405 W Colfax Ave #165
Lakewood, CO 80401

Date:	4/30/2021
Number:	253658

Date	Description	Qty	Rate	Amount
04/30/2021	Contract O&M Forest Hills Metro District		6,347.50	6,347.50
03/31/2021	Meter Readings	14.0	5.53	77.42
04/08/2021	BOD-5, TSS	1.0	91.00	91.00
04/09/2021	Coliform	1.0	44.00	44.00
04/12/2021	1" x 8" Parts	1.0	16.13	16.13
04/12/2021	Work on clogged line: MC	3.0	80.00	240.00
04/13/2021	RB Quick Check Basket Filter 200 Mesh	1.0	81.00	81.00
04/14/2021	Ammonia, BOD-5, E-Coli, Nitrate, Nitrite, Phosphorus, TSS	1.0	283.00	283.00
04/21/2021	Rubber Gasket for Meter Couplings	1.0	15.30	15.30
Subtotal				\$7,195.35
Sales Tax (0.0%)				\$0.00
Total				\$7,195.35
Payments/Credits				\$0.00
Balance Due				\$7,195.35

Thank you for your business!



10969 West 30th Avenue; Lakewood, CO 80215

Phone: (303)232-5135
Fax: (303)237-2541
e-mail: Accounting@pbsllc.net

INVOICE

Date	Invoice No.
4/20/2021	20792

Bill To:	Ship To:
FHMD Suite 165 14405 W. Colfax Avenue Lakewood, CO 80401	

P.O. No.	Terms
	Due on receipt

Item	Description	Qty	Rate	Amount
Network Rem...	4/9/2021 Add GoDaddy hosting to SPF record to pass junk filters.	1	125.00	125.00

Thank you for your business. Please call for all your technology needs. PBS now accepts credit cards.	Subtotal	\$125.00
	Sales Tax (0.0%)	\$0.00
	Payments/Credits	\$0.00
	Balance Due	\$125.00

New Invoice from Republic Services

noreply@republicservices.com <noreply@republicservices.com>

Tue 4/27/2021 7:15 PM

To: Admin FHMD <admin@fhmd.net>

04/27/2021

Dear Ronda Zivalich,

Your current invoice is now available to view in your [Online Bill Pay account](#) 305350040977. Your payment of \$429.38 is due on 05/15/2021.

If you have any questions please [contact Customer Service](#) online at RepublicServices.com.

Thank you for being a valued customer and using Republic Services' Online Bill Pay.

Sincerely,
Republic Services Customer Resource Center

Please do not reply to this message, it was system generated and the mailbox is not monitored.

Disclaimer: This message has been sent under the Republic Services [Terms and Conditions](#) and in accordance with our [Privacy Policy](#).



Bill To:

Forest Hills Metropolitan District
Attn: Ronda Zivalich
14405 W. Colfax Ave, #165
Lakewood, CO 80401

Remit Payment To:

RESPEC
Attn: Accounts Receivable
P.O. Box 725
Rapid City, SD 57709-0725
(605) 394-6400, (605) 394-6514 (FAX)

RESPEC Project Number : 02201
Client Contract No. 1312
Client Purchase Order
Invoice Period : 03/01/2021 - 03/31/2021
Project Description :

Invoice No : INV-0321-638
Invoice Date : 03/31/21
Payments Terms : NET 30

Forest Hills Metropolitan District

Cost Category	Current Dollars	Dollars Billed to Date
Aug. Plan Water Acct	\$130.00	\$32,890.00
Labor	\$635.00	\$50,004.75
Equipment		\$1,149.14
Materials		\$235.33
Travel		\$75.39
Total Costs	\$765.00	\$84,354.61
Total Amount Due in US Dollars	\$765.00	\$84,354.61



Invoice Supporting Information

Cost Category	PLC Desc	RESPEC Project No.	Name	Week Ending Date	Hours	Billing Rate	Amount To Bill	Reference #	Description
Aug. Plan Water Acct		02201.0001					\$130.00		Augmentation Plan Water Acct.
							\$130.00		
Aug. Plan Water Acct							\$130.00		
Labor	Water Rights Engineer	02201.0002.002	Kennedy, Thomas J	03/20/21	1.00	\$145.00	\$145.00		Labor Hours
	Water Rights Engineer	02201.0002.002		03/27/21	1.00	\$145.00	\$145.00		Labor Hours
	Water Rights Engineer	02201.0002.002		03/31/21	1.00	\$145.00	\$145.00		Labor Hours
					3.00		\$435.00		
	Project / Program Manager	02201.0002.003	Leak, Alan J	03/27/21	1.00	\$200.00	\$200.00		Labor Hours
				1.00		\$200.00			
Labor					4.00		\$635.00		
Total					4.00		\$765.00		



Task Summary

Project ID	Description	Current Hours	Current Dollars	Hours Billed to Date	Dollars Billed to Date
02201.0001	FHMD - Augmentation Plan Water Accounting		\$130.00		\$32,890.00
02201.0002.001	Coordination with Water Commissioner/River Call Monitoring/Storage & Release Requirements			10.50	\$1,434.00
02201.0002.002	Work on Water Court Cases	3.00	\$435.00	206.25	\$27,454.00
02201.0002.003	Other Engineering Tasks	1.00	\$200.00	69.75	\$9,687.71
02201.0003	FHMD - Booster Pump Station Evaluation			78.00	\$12,888.90
Summary		4.00	\$765.00	364.50	\$84,354.61



Labor Hours Summary and Description

Project No.	Description	Name	Date	Hours	Comments
02201.0002.002	FHMD - Work on Water Court Cases	Kennedy, Thomas J	Mar 16, 2021	1.00	Review of UPBC Case (19CW3103) Material
	FHMD - Work on Water Court Cases	Kennedy, Thomas J	Mar 22, 2021	1.00	Review of Case No. 2021CW3012
	FHMD - Work on Water Court Cases	Kennedy, Thomas J	Mar 29, 2021	1.00	Court Case No. 21CW3012 - Medved material
02201.0002.002				3.00	
02201.0002.003	FHMD - Other Engineering Tasks	Leak, Alan J	Mar 24, 2021	1.00	Review well locations /depths/permits
02201.0002.003				1.00	
Total				4.00	

Statement

DATE Nov. 30, 2020 TERMS

TO Forest Hills Metropolitan District
 14405 W. Wolfway Ave #165
 Lakewood, CO. 80401

IN ACCOUNT WITH Tara Prosser
 4601 S. Balsam way #1324
 Littleton, CO. 80123

	Outstanding Bills			\$ 380	-
	Bathrooms Cleaning	July	7/23	20	-
			7/30	20	-
		Aug.	8/13	20	-
			8/27	20	-
		Sept.	9/10	20	-
			9/24	20	-
		Oct.	10/1	20	-
			10/8	20	-
			10/29	20	-
			TOTAL	180	-

CURRENT	OVER 30 DAYS	OVER 60 DAYS	TOTAL AMOUNT	560	-
---------	--------------	--------------	--------------	-----	---

UNCC

UTILITY NOTIFICATION
CENTER OF COLORADO

P.O. Box 208903, Dallas, TX 75320-8903
OFC (303) 232-1991 FAX (303) 234-1712

invoice

"IT'S THE LAW, CALL BEFORE YOU DIG"

To:

FOREST HILLS METRO DISTRICT
ATTN: RONDA ZIVALICH
14405 W COLFAX AVE, #165
LAKEWOOD, CO 80401

Invoice #: 221040584
Invoice Date: 04/30/21
Invoice for April 2021
P.O.#
Due Date: Upon Receipt
Member ID: 29530

Qty	Item	ID/Description	Price	Extension
14	1	RTL Transmissions FRHL01	1.32	18.48
1	2	Positive Response Re-Notifications FRHL01	1.32	1.32
1	3	Cancelled RTL Transmissions FRHL01	0.00	0.00

Amount Due 19.80

PLEASE INCLUDE MEMBER ID NUMBER AND INVOICE NUMBER ON CHECK.
PLEASE MAKE CHECKS PAYABLE TO UTILITY NOTIFICATION CENTER OF COLORADO OR UNCC.
PLEASE NOTE OUR NEW ACCOUNTS PAYABLE ADDRESS IS:
Utility Notification Center of Colorado P.O. Box 208903, Dallas, TX 75320-8903

Fw: Vonage Monthly Account Notice

Management FHMD <management@fhmd.net>

Mon 4/12/2021 10:23 AM

To: Admin FHMD <admin@fhmd.net>

From: Vonage Customer Care <donotreply@vonage.com>

Sent: Sunday, April 11, 2021 12:29 AM

To: Management FHMD <management@fhmd.net>

Subject: Vonage Monthly Account Notice

Para español, lea abajo



account
UPDATE.

SIGN IN

Account Number: 1012586779
Date Processed 04/11/2021
Amount: \$39.67

Dear Board of Directors Forest Hills Metropolitan District,

Thank you for your payment. We have submitted your electronic check payment to your bank for your monthly charges for your Vonage account in the amount listed above.

Please be aware that it may take up to eight business days for your bank to process this transaction. Should payment not clear through your bank for any reason, a return check fee of up to \$25 will be charged. [Click here](#) to learn more about our Return Check Policy.

Sign in to your [Online Account](#) at any time or [click here](#) to view or print your detailed billing statement or to update your payment method information.

Download the Vonage Extensions App now!

Link up to two mobile numbers and use the VONAGE Extensions App to make and receive calls on the go. **PLUS** use the App to block or unblock up to 25 callers from ringing your Vonage home phone and any smartphone linked by the app. For all the facts, see [Extensions® App for iPhone® or Android™](#).

Download App Now!



Invoice

WesTest
627 Sheridan Boulevard
Lakewood, CO 80214

INVOICE DATE	INVOICE No.
4/30/2021	13110

Forest Hills Metropolitan District
Mr. Michael P. Oakley
14405 W. Colfax Ave., #165
Golden, CO 80401

P.O. NUMBER	CDOT PROJECT NO.	DUE DATE	TERMS	PROJECT NAME
2021.02.01 A		5/30/2021	Net 30	Forest Hills, Jefferson County, CO

ITEM	DESCRIPTION	QTY	RATE	SERVICED	AMOUNT
Principal Engineer	Core Thickness Review	0.5	250.00	4/13/2021	125.00
Staff Engineer		5	125.00	4/13/2021	625.00
Coring		2	95.00	4/13/2021	190.00
Principal Engineer	Core Thickness Review	1	250.00	4/15/2021	250.00
Principal Engineer	Core Thickness Review	2	250.00	4/16/2021	500.00
Staff Engineer		2	125.00	4/19/2021	250.00
Staff Engineer		2	125.00	4/20/2021	250.00
Senior Project Manager		3.5	140.00	4/20/2021	490.00
Staff Engineer		1	125.00	4/21/2021	125.00
Senior Project Manager		1.5	140.00	4/21/2021	210.00
Staff Engineer		2.5	125.00	4/22/2021	312.50
Staff Engineer		3	125.00	4/22/2021	375.00
Staff Engineer		6.5	125.00	4/23/2021	812.50
Staff Engineer		3.5	125.00	4/23/2021	437.50
Staff Engineer		1	125.00	4/26/2021	125.00
Mileage		27	0.70	4/16/2021	18.90
Cores		3	5.00	4/16/2021	15.00
			Total		\$5,111.40

Telephone Number
303.975.9959
Fed. I.D. # 84-1459790



MAILING ADDRESS	ACCOUNT NUMBER	DUE DATE
FOREST HILLS METRO DISTRICT 14405 W COLFAX AVE # 165 LAKEWOOD CO 80401-3247	53-2543913-6	05/21/2021
	STATEMENT NUMBER	STATEMENT DATE
	730257431	05/03/2021
		AMOUNT DUE
		\$2,212.74

QUESTIONS ABOUT YOUR BILL?

See our website: xcelenergy.com/HomeSmart
 Email us: Info@HomeSmartColorado.com
 Or Call: 1-866-837-9762

ACCOUNT BALANCE *(Balance de su cuenta)*

Previous Balance	As of 03/29	\$2,389.64
Payment Received	Auto Pay 04/22	-\$2,389.64 CR
Balance Forward		\$0.00
Current Charges		\$2,212.74
Amount Due <i>(Cantidad a pagar)</i>		\$2,212.74

PREMISES SUMMARY

PREMISES NUMBER	PREMISES IDENTIFIER	PREMISES DESCRIPTOR	CURRENT BILL
300694302	HILL & DALE RD WELL #2 _		\$36.95
300802554	22205 FOREST HILLS DR UNIT WELL-3		\$43.01
300996243	EASTWOOD DR W ENTRANCE GATE _		\$11.97
301104477	22933 FOREST HILLS DR BLDG SEWA		\$1,241.18
301112319	1048 EASTWOOD UNIT 9-WELL		\$93.24
301255445	23199 SHINGLE CREEK RD BLDG CHLO		\$315.04
301257430	22004 ANASAZI WAY BLDG A		\$14.54
301260646	860 HILL AND DALE RD UNIT PUMP		\$130.82
301297992	FOREST HILLS DR WELL #5 _		\$38.77
301297999	GRAPEVINE RD TRACT C SEWAGE LI _		\$66.77
301557604	22864 FOREST HILLS DR BLDG GUAR		\$57.89
301565481	1008 EASTWOOD UNIT 8-WELL		\$10.70
301600124	FOREST HILLS DR WELL #4 _		\$90.78
301901666	ANASAZI WAY TRACT H RECIRCULAT _		\$50.38
301901714	FOREST HILLS DR TRACT N WATER _		\$10.70
Total			\$2,212.74

000031 2/11



INFORMATION ABOUT YOUR BILL

Thank you for your payment.

RETURN BOTTOM PORTION WITH YOUR PAYMENT • PLEASE DO NOT USE STAPLES, TAPE OR PAPER CLIPS



Please help our neighbors in need by donating to Energy Outreach Colorado. Please mark your donation amount on the back of this payment stub and CHECK THE RED BOX under your address below.

ACCOUNT NUMBER	DUE DATE	AMOUNT DUE	AMOUNT ENCLOSED
53-2543913-6	05/21/2021	\$2,212.74	Automated Bank Payment

Your bill is paid through an automated bank payment plan.

MAY						
S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

FOREST HILLS METRO DISTRICT
 14405 W COLFAX AVE # 165
 LAKEWOOD CO 80401-3247



XCEL ENERGY
 P.O. BOX 9477
 MPLS MN 55484-9477

31 53052121 25439136 0000022127400000221274

RIVA CHASE COMMUNITY WILDLAND FIRE MITIGATION PLAN



PREPARED FOR:

RIVA CHASE COMMUNITY JEFFERSON COUNTY, COLORADO

PREPARED BY:

**DAHL ENVIRONMENTAL SERVICES & ASSOCIATES, LLC
23890 GENESEE VILLAGE ROAD
GOLDEN, CO 80401**

Draft May 7, 2013



DAHL ENVIRONMENTAL SERVICES, LLC

Bjorn Dahl

Certified Forester, ACF

Natural Resource Consultant

Lyle Laverty

Certified Forester, ACF

Natural Resource Consultant

Christopher Licata, Ph. D.

Biologist/Accredited Forester/Soil Scientist

Natural Resource Consultant



Cover photo from a Riva Chase Ponderosa Pine Stand in a Shaded Fuel Break Thinning

23890 Genesee Village Road • Golden, Colorado 80401

Office: 303-526-2822 • Fax: 303-526-5197

Email: bdahl@dahlservices.com • Website: www.dahlservices.com

WILDLAND FIRE MITIGATION PLAN

MAY 6, 2013

THE RIVE CHASE COMMUNITY

**FOOTHILLS METROPOLITAN DISTRICT
C/O: MULHERN, MRE, INC**

**2 IVERNESS DRIVE EAST, SUITE 200
ENGLEWOOD, CO 80112**

LEGAL DESCRIPTION

**WEST ½ OF SECTION 17 AND THE EAST ½
OF THE SOUTHEAST ¼ OF SECTION 18
TOWNSHIP 4 SOUTH, RANGE 70 WEST
JEFFERSON COUNTY, COLORADO**

**33 TOTAL OPEN SPACE ACRES
223 TOTAL ACRES**

I have reviewed this plan, which has been prepared at my request to guide my stewardship management for wildfire mitigation activities, and I will voluntarily apply them on my property. I believe the management recommendations in this plan are appropriate to meet my goals and objectives, and will benefit the natural resources on my property. I intend to apply the recommended practices, thus helping me to be a good steward of the forest and associated resources entrusted to me on my property. I agree to follow this plan to ensure the sustainability of my management.

Date: _____ Signed by landowner: _____

Date: _____ Signed by CSFS District Forester: _____

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1.0 INTRODUCTION

The Strategic (Coarse Scale) Fire Mitigation Assessment (FMA) has been prepared by professional foresters at the request of the landowners for implementing forest stewardship activities on this property. The Forest Hills Metropolitan District has requested Dahl Environmental Services, LLC to prepare a FMA and develop wildfire mitigation treatment priorities. The FMA discusses the current and desired future condition of forest resources on this property. The plan also outlines the goals of the landowners and recommends management activities that integrate these goals with the requirements of the FMA. The FMA is intended to be a working document that leads to a long term plan which can and should be modified to accommodate unforeseen events that may alter the property's landscape. Events such as wildfires would undoubtedly affect the management of this property and subsequently change the scope of this plan.

This plan represents a ten-year land management strategy that includes completing specific activities on an annual basis. An annual work plan is provided to assist the landowners in planning and documenting all forest management activities. The plan covers only the Open Space acres owned by The Riva Chase Community and does not extend to the individual private home lots. A professionally-prepared FMA is often a requirement for grant applications offered at the federal or state level. The Riva Chase Community has had Forest Health/Fire Risk Assessment Report in the past prepared by The Golden District of the Colorado State Forest Service (Will 2008). Although several years have passed, this document is tiered as the management objectives have remained largely consistent.

The Riva Chase subdivision is located within the boundaries of the Genesee Fire Protection District (GFPD) which has an existing Community Wildfire Protection Plan (CWPP). A CWPP is a document prepared based on established federal guidelines that addresses wildfire protection by providing specific analysis of current conditions of both the landscape and community resources. The document provides guidance and recommendations to reduce wildfire risk using a combination of forestry-based solutions driven by fuels reduction and infrastructure-based needs through installation and maintenance of firefighting equipment and water storage. Federal grants (www.grants.gov) and Colorado state-level grants have both identified an approved CWPP, along with landowner objectives that are linked to the CWPP, as key components of a successful grant application. The presence of an FMA tiered to the GFPD CWPP forms the foundation of a successful strategy for applying and obtaining available competitive funds through grants or other programs that provide financial offsets. The Riva Chase Community has Fire Hazard Rating of 72 defined as a High Fire Hazard Rating in the GFPD CWPP (Greenwood 2008). The entire document is available for download at: csfs.colostate.edu/pages/documents/geneseefpd_cwpp_rprrt.pdf.

2.0 GOALS AND OBJECTIVES

The landowner's goals for this property are to:

- Decrease the risk of wildfire,
- Promote healthy forest conditions,
- Maintain and enhance the natural beauty and aesthetics of the property.

Forest management objectives represent activities that a landowner needs to implement in order to achieve the stated goals. They are concise statements of measurable and planned results that correspond to pre-established forest management goals. The landowner's objectives for this property are:

- Conduct active forest management in critical locations to reduce wildfires,
- Thin stands to reduce densities and the threat of Mountain Pine Beetle (*Dendroctonus ponderosae*) and Ips beetle (*Ips pini*) infestation,
- Remove dead and dying insect and disease affected trees from operable terrain except those specifically reserved for wildlife habitat,
- Encourage stand regeneration by creating openings in the forest canopy,
- Follow Colorado Best Management Practices in all management activities to protect soil and water quality.

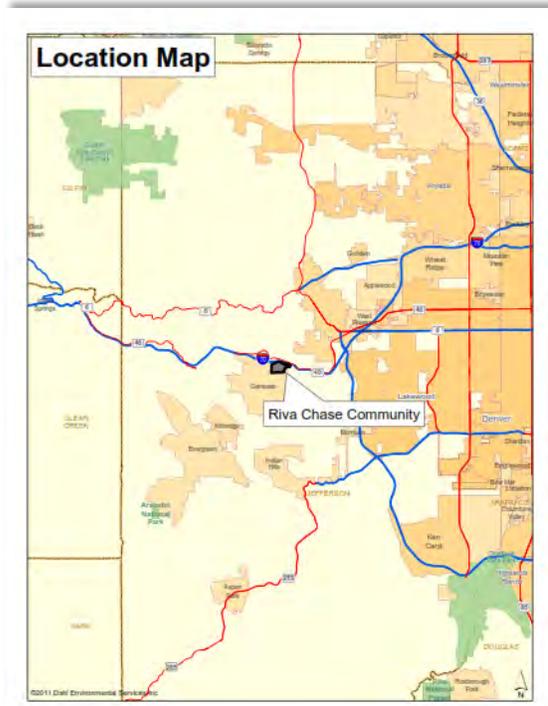
3.0 GENERAL DESCRIPTION/DISCUSSION

3.1 LOCATION

The Forest Hills Metropolitan District is located to the east of the Genesee Community in Golden, Colorado right off of I-70. To access the property, take I-70 west to exit 256. Go south and cross over I-70 for 0.10 mile and turn right onto Genesee Ridge Road. Follow Genesee Ridge Road for approximately 0.25 mile and turn left onto Forest Hills Drive. The gate to Riva Chase/Forest Hills Metropolitan District is 0.10 of a mile from the intersection (Will 2008).

The general topography is gentle terrain with 10 to 30% slopes with some steep slopes up to 50% trending from the north to northwest and to the southeast. Elevations range from 7,000 to 7,400 feet. The subdivision is in the Mount Vernon and Bear Creek watersheds and is bounded on the north by Interstate 70. The area is mostly forested by ponderosa pine (*Pinus ponderosa* var. *scopulorum*) and Rocky Mountain Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco var. *glauca*) with scattered Rocky Mountain juniper (*Juniperus scopulorum*) and quaking aspen (*Populus tremuloides*) tree species present. Grassy meadows are located throughout the property.

Historically, these forest types are prone to wildland fire that occur with high frequency (i.e. fire return interval between 35-50 years) but as low severity surface fires. Some of the north-facing stands with a thicker tree canopy and cooler weather have longer fire return intervals (i.e. 100 years) which results in a mixed severity fire regime with both surface fires and crown fires that can move from tree to tree creating very dangerous conditions. However, a decades-old fire suppression policy has caused many lower-elevation forests to deviate from their historic conditions leading to overly dense stands that burn outside their range of normal variation leading to potentially catastrophic fire events. It is these conditions that the Riva Chase Community seeks to reduce through an active fire mitigation program that uses a combination of hand and mechanical timber harvest methods leading to more open and fire-safe conditions.



Location Map

3.2 CURRENT AND HISTORICAL LAND USE

The Mount Vernon Canyon area was originally settled in the late 19th century and has a history of mining and logging. Large fires in during this era reduced most of the original forest cover leading to the establishment of many of the stands encountered today. Today, Riva Chase is considered part of the Wildland-Urban Interface (WUI) where homes are built in the forest leading to concerns about large wildfires affecting human safety and causing property damage.

The Forest Hill Metro District/Riva Chase Forest Health/Fire Risk Assessment Report (Will 2008) has guided land management activities for most of the past 4 years. According to Edward Laves, Director and Board President Forest Hills Metropolitan District, there was some timber harvest in the late 2011 and early 2012 guided by the Fire Risk Assessment Report. In recent years, volunteer residents within The Riva Chase Community have conducted thinning's and have consistently removed trees for wildfire mitigation.

3.3 CLIMATE

No specific weather data is available for the property; however, meteorological data is available for the Evergreen, CO station located to the southwest of the subdivision at an approximate elevation (7,000 feet). It is assumed that the meteorological data for this property is similar:

- Average Annual Maximum Temperature (°F): 60.7
- Average Annual Minimum Temperature (°F): 27.2
- Average Annual Precipitation (in.): 18.7
- Average Total Snowfall (in.): 84.8

(Source: Western Regional Climate Center 2013)

3.4 IMPACTS ON NEIGHBORS

Management of the Open Space acres and landowners property under a Fire Mitigation Assessment (FMA) should not adversely affect any neighbors. In fact, management of this property will benefit the surrounding homes and properties by implementing wildfire prescriptions and mitigate insect and disease outbreaks will reduce the threat of wildfire.

3.5 SOCIAL, ECONOMIC AND MARKET CONDITIONS

By implementing this assessment the community will be promoting healthy forest stewardship. This will enable the land to be passed onto future generations in a healthy condition. This FMA will serve as an example to other landowners of how land can be conserved and be economically viable at the same time.

Currently, the market for both small-diameter and larger timber is limited along the Colorado Front Range. An excess of supply and decreasing demand due to reduced milling capacity has driven prices down. Air quality restrictions on wood burning have affected the market for firewood in the Denver metropolitan area, though more rural areas of Jefferson, Park and Gilpin counties still utilize a large amount of firewood. The Colorado State University Wood Center in Fort Collins is currently working on developing new wood utilization and processing technologies to create new markets for small-diameter timber. Emerging programs at the state and federal levels encourage additional utilization of woody biomass. It is very probable that new markets and technology will be created for small-diameter timber on the Front Range over the coming decade.

There is some sawtimber-sized material suitable for harvest on the property in sufficient quantities that commercial timber sales may be possible in future years. We encourage the landowners to develop a business plan to remove commercial forest products once the timber market improves. Additionally, there is a possible small market for Christmas trees and ponderosa pine transplants.

3.6 RIPARIAN FEATURES

Mount Vernon Creek flows along the northern boundary of the subdivision. The Shingle Creek drainage is located on the northern boundary of the Riva Chase Community. There are no additional major water features on the property except for ephemeral streams and some ponds on the property. There are some wet meadows along the base of slopes.

3.7 WILDLIFE

There is very little development in the Open Space acres and this combined with several large contiguous blocks of nearby forested and non-forested areas result in potential quality wildlife habitat. According to the Golden Area Soil Survey, these areas are ranked fair for woodland and fair to good for openland habitat. It is assumed that implementing forest management activities described in this plan would further increase habitat quality as the stands would begin to reflect historic conditions. There may be short-term impacts during actual harvest activities but over time natural conditions would return.



Mountain lion, Curtsey of USDA

Evidence of mountain lions (*Puma concolor*), Mule deer (*Odocoileus hemionus*), pine squirrel (*Tamiasciurus hudsonicus*), Colorado chipmunk, (*Tamias quadrivittatus*) and common raven (*Corvus corax*) were seen during field surveys. Other species that may occur on the property

include but are not limited to black bear (*Ursus americanus*), coyote (*Canis latrans*), elk (*Cereus elaphus*), porcupine (*Erithizon dorsatum*), deer mouse (*Peromyscus maniculatus*), mountain chickadee (*Parus gambeli*), brown creeper (*Certhia americana*), Cassin's finch (*Carpodacus cassinii*), gray jay (*Perisoreous canadensis*), pygmy nuthatch (*Sitta pygmaea*), Williamson's sapsucker (*Sphyrapicus thyroideus*), dark-eyed junco (*Junco hyemalis*), downy woodpecker (*Picoides pubescens*), sharp-shinned hawk (*Accipiter striatus*) and great horned owl (*Bubo virginianus*).

3.8 THREATENED & ENDANGERED SPECIES

No threatened and endangered species are known to utilize this property. However, intensive species surveys have not been conducted. The Colorado Natural Heritage Program (CNHP) was consulted to assess the potential occurrence of any threatened, endangered and sensitive species (TES) in the area (Colorado Natural Heritage Program 2013). CNHP data consists of geographic information systems (GIS) maps of wildlife habitat and natural communities occurring in Colorado. According to the CNHP data no TES occur on this property.

3.9 UNIQUE RECREATIONAL QUALITIES

The Open Space acres provide picnicking, hiking and wildlife watching opportunities for the residents within the subdivision.

3.10 CULTURAL RESOURCES

There are no known archeological or cultural sites on the Open Space acres.

3.11 INSECTS AND DISEASES

Bark beetles affecting most every conifer species present on the property are active across Colorado at the present time and would be expected to attack trees if the stands are not managed to reduce susceptibility. The main bark beetle of concern is the mountain pine beetle (MPB). No MPB infested or killed trees were noted in our field survey, and the property is at low to moderate risk of MPB infestation. MPB activity is increasing in western portions of Clear Creek and Gilpin Counties and it is likely only a matter of time before activity increases in the vicinity of this property. Reducing stand densities to approximately 80-100 square feet of basal area per acre has been shown to substantially reduce mortality (McCambridge and Stevens 1982). Individual tree treatments such as cutting or spraying the logs with carbaryl can delay the spread of MPB into the stands. However, changing stand structure is the most effective long-term treatment.

Another bark beetle of concern is *Ips* (*Ips pini*). *Ips*-infested trees typically have dead tops and live foliage in the lower part of the crowns but can kill whole trees in a single year. *Ips* beetles are usually indicators of other stressors like drought or root disease but local population build-ups can cause them to be primary pests. Maintaining stands in a healthy condition through density control and prompt removal of wind and snow-breakage and thinning slash can nearly eliminate losses to *Ips* (Cranshaw and Leatherman 2002). Due to the high level of *Ips* activity throughout the region, it is important to monitor for them annually.



MPB galleries (not from property)



MPB pitch tubes and boring dust (from bugwood.org, not from property)



Ips pini egg galleries (from bugwood.org, (not from property)

Dwarf mistletoes (*Arceuthobium spp.*) are also a common problem in Colorado forests. They are small, leafless, parasitic flowering plants that grow into the phloem of trees that kill by slowly robbing the tree of food and water. Diseased trees decline and die from the top down as lower infected branches take more food and water. Death occurs slowly in most cases and depends on the severity of infection and on the vigor and size of the tree (Jacobi and Swift 2002). Dwarf Mistletoe was not observed during our field survey in the open ponderosa pine stands in both young and old trees. Treatment would involve pruning and disposing of the infected branches or complete removal of heavily infected trees.



*Dwarf mistletoe on young ponderosa pine tree
(not from property)*

Community volunteers living in the subdivision have been conducting annual field surveys for several years and have identified several bark beetle-infested trees which were subsequently removed. This practice should continue over the span of the management plan period. Information regarding the identification, treatment, and prevention of the pathogens discussed in this section is located in **Appendix 8.2**. No other significant insect or disease problems were observed.

3.12 FUEL MODELS

The fuel models representing these stands were determined using the USDA Forest Service General Technical Report INT-GTR-122 *Aids to Determining Fuel Models for Estimating Fire Behavior* (Anderson 1982). Wildfire hazard is currently low in the open stands and moderate in the more dense stands, but mortality from bark beetles like Ips or MPB and subsequent deadfall could increase hazard to high in the absence of fuels reduction treatments.

Fuel Model 2 describes the fuel conditions in open shrub lands and also open conifer stands. Such areas may include clumps of fuel that generate higher intensities that may produce fire-brands. In this fuel model, fire spread is primarily along the surface moving through the fine herbaceous fuels, either cured or dead. In addition to litter, dead and down stemwood from the open shrub or timber overstory contributes to fire intensity. Dead fuel loads in this Fuel Model range from 0.5 to 2.0 tons per acre with an average fuel bed depth of 1 foot or less (Anderson 1982).

Fuel Model 8-9 is present in most of the conifer stands and describes the fuel conditions in closed canopy stands of short-needle conifers that support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present in the stand. In this Fuel Model, slow-burning ground fires with low flame lengths generally occur, although the fire may encounter an occasional “jackpot” or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidity, and high winds do the fuels pose fire hazards. Dead fuel loads in this fuel model range from 1.0 to 2.0 tons per acre with an average fuel bed depth of 0.2 feet or less. (Anderson 1982).



Fuel Model 2 in Stand 1



Fuel Model 8 in Stand 1



Fuel Model 9 in Stand 2

Fuel Model 10 describes fuel conditions in any forest type that has heavy downed material. Fires in this type burn in the surface and ground fuels with greater fire intensity than the other timber models. Fuel Model 10 is found in limited areas mainly on slopes with north aspects. Dead-down fuels include greater quantities of 3-inch or larger coarse woody debris resulting from over-maturity or natural events that create a large load of dead material on the forest floor. Crowning out, spotting and torching of individual trees is more frequent in this fuel situation, leading to potential fire control difficulties (Anderson 1982).



Fuel Model 10 in Stand 1



*Fire Scar on Douglas-fir
Tree*



*Old Ponderosa Pine
Stump with Fire Scars*

3.13 WILDFIRE HAZARD

Transportation Road Right-of-Ways:

Roads in the Riva Chase community serve several purposes during an interface fire. Roads are access routes for emergency vehicles and serve as escape routes for residents during a fire. These important network or roadways need to provide safe simultaneous access for emergency vehicles and public evacuation. Vegetation management strategies for access routes Access routes in the Riva Chase community can serve as effective fuel breaks to provide fire protection assist in fire suppression efforts and improve effective evacuation. Most of the Right-of-Ways in the subdivision need active intervention – removal, reduction, or conversion of on-site fuels. This image near the south gate characterizes the very dense pockets of regeneration trees.



Roadside

Most of the Right-of-Ways in the subdivision also need management. These areas contain very dense pockets of regeneration trees.

Individual private home sites:

The goal of vegetation management is to create a fuel modified area in which flammable vegetation surrounding buildings and residences is eliminated creating an environment that will not support high-intensity crown fires. The main objective of fuel management in this site is to create conditions that will only support surface fires of lower intensity and lower rates of spread. The Forest Health/Fire Risk Assessment Report (Will 2008) contains wildfire hazard ratings for most of the home sites. These data has been reproduced as a map to aid in identifying landscape-level trends and prioritizing treatments (**Appendix 8.1**).



Home site

Community Water Resources:

Wildfire suppression requires substantial quantities of water from a dependable source. The capability of responding fire agencies is often limited by the adequacy of the water supply. Reducing wildfire risk and protecting the Riva Chase community water infrastructure is a priority.

Ponds and water source:

Ponds and water bodies are valuable water resources during interface suppression situations. Many incidences resulting tragic and costly losses are often the result of inadequate water supply. Water supply for suppression in many communities is often limited to the amount carried on responding emergency vehicles.



Pond

Evacuation routes:

Pre-designated principal evacuation routes should be well marked with easily identifiable signs. Secondary evacuation routes are also important to the safety of Riva Chase residents. They may be the only routes to safety in the event the principal evacuation route is blocked by fire, vehicle accidents, or by emergency vehicles. The secondary evacuation route should be marked, known and accessible to all Riva Chase residents.



Evacuation Route

Fire hydrant:

Hydrants provide fire service agencies additional wildfire suppression resources. Hydrants should be well marked and maintained annually. Vegetation management should reduce fuel loading to protect hydrant infrastructure and provide safe access to these important suppression resources.



Hydrant

Emergency exit gates:

Gate systems should be designed for easy opening should electrical or solar powered systems become inoperable. Fire service personnel must have access to any locking mechanism on any gate restricting access to the Riva Chase community.

The wildfire mitigation committee must involve interested community members, private landowners, stakeholders, and interest groups in the implementation process. The community base map illustrates important features such as landownership, structures, roads, surface water, fire districts, or major utility corridors. The map's importance is that it illustrates community values from which recommendations concerning wildfire planning can occur.



Exit Gate

3.14 COMMUNITY WILDFIRE RISK ASSESSMENT

The Colorado State Forest Service recently released the Colorado Wildfire Risk Assessment Portal. The Assessment Portal provides a spectrum of information, reports and analyses supporting mitigation, education and wildfire prevention initiatives for the Riva Chase community. The information generated several indicators of the risk elements. The Wildland Urban Interface Risk index rates the potential impact of a wildfire on people and their homes. The index combines housing density and flame lengths to determine where the greatest potential impact to homes and people is likely to occur. Approximately 78 percent of the Riva Chase community is classified with the most negative impact.

Two fire behavior characteristics of importance to the Riva Chase community are rate of spread and flame length. Rate of spread, the speed with which fire move across the landscape, is influenced by fuels, weather and topography. Nearly 90 percent of the Riva Chase community is located in areas defined as a high rate of spread, 44-88 feet per minute.

Flame length is an indicator of fire intensity and is often used to indicate how much heat is being generated by the fire. Approximately two thirds of the Riva Chase community is represented in the high to very high classification, with flame lengths projected to range from 8 to 25 feet in length. Additional indicators are available in the Riva Chase Colorado Wildfire Risk Assessment Portal reports (**Appendix 8.3**). The entire Riva Chase report is available at:

http://www.coloradowildfirerisk.com/docs/reports/RiskSummaryReport_20130507_125346.dox

The risk assessment provides critical information to make informed decisions. Community members should be actively involved in this step. Items that may be addressed include such things as risk of wildfire occurrence, structure hazard and risk, economic and ecological values at risk, local fire authority, preparedness and capability, and hazardous fuels.

3.14.1 DEFENSIBLE SPACE

Defensible space is the natural landscaped area around a home or other structure that has been modified to reduce fire hazard (**Appendix 8.4**). Defensible space gives homes a fighting chance to resist the impact of wildfire. Creating defensible space also reduces the chance of a structure fire spreading to the surrounding forest or other homes.

- **Zone 1 (0 to 15 feet from structure):** Within 3 to 5 feet of the structure, decorative rock or mowed, irrigated grass is recommended (Figure 10). Well-spaced and pruned, low-flammability plants (**Appendix 8.4**) are acceptable if the structure has noncombustible siding. In the remainder of Zone 1, trees' lower branches should be pruned 5 to 10 feet above the ground (not to exceed one-third of the tree height). Dead wood, tall grass, and ladder fuels (low limbs, small trees, and shrubs that may carry fire into tree crowns) should be removed from this area. Leaves and overhanging branches should be removed from the roof and gutters. The 15-foot area should be irrigated as appropriate. Woodpiles should be removed and stored in Zone 2, preferably upslope from structures.
- **Zone 2 (typically from 15 feet out to 60-210 feet from Zone 1):** The size of this zone is dependent upon slope. Treatment of ground fuels and ladder fuels is generally the same as for Zone 1. Trees (or small groups of trees) and shrubs should be thinned to provide 10 feet of clearance among crowns. Grasses should be mowed because they dry in late summer.
- **Zone 3 (beyond Zone 2 to property line):** This area outside of Zone 2 should be managed for the appropriate land use objectives, such as forest health, aesthetics, recreation, and wildlife habitat.

4.0 INVENTORY

4.1 FOREST RESOURCES

The property was delineated into two forested and one non-forested stands (**Appendix 8.1**). Forested stands were inventoried using a variable plot sample. Non-forested stands were not inventoried but were traversed to identify any noxious weeds. A total of 6 sample points were established throughout the two stands. A basal area factor (BAF) of 20 was used for Stand 1. At each sample point, every “in” tree that was 4.0 inches diameter and larger was recorded as a tally tree. BIOCRUZ, a timber cruising software program available from the USDA Forest Service (USFS) Rocky Mountain Research Station, was used to process the data from the timber inventory. The timber inventory stand table is located in the **Appendix 8.5**.

4.1.1 STAND 1 – MIXED CONIFER

Stand 1 is 17.3 acres and is co-dominated by Rocky Mountain Douglas-fir and ponderosa pine with Quaking aspen and Rocky Mountain juniper present. There are large clumps of pole-sized (2-4” diameter) ponderosa pine in certain areas of the Open Space acres. Slopes vary between 20 and 50% with mostly northern aspects. Forest condition is fair to good with rocky terrain and low soil moisture having reduced stand productivity. There is an average of 265 trees per acre with a total basal area of 144 square feet per acre. The stand averages approximately 8,939 board feet per acre (Scribner) and 2,804 cubic feet per acre. Quadratic mean diameter for the stand is 10 inches with 41 feet average height. Trees in this stand average 125 years with one individual being 185 years old.



Stand 1

The understory vegetation is limited but includes the shrub species common juniper (*Juniperus communis ssp. alpina*) and mountain mahogany (*Cercocarpus montanus*) along with elk sedge (*Carex geyerii*), western yarrow (*Achillea millefolium*), creeping Oregon grape (*Mahonia repens*), and bunchgrasses (*Festuca spp.*). The ground cover is generally needle litter with scattered shrubs in the denser areas and more grasses in open areas. Surface fuels are low to moderate with isolated pockets of downed logs. Regeneration is limited to conifer seedlings and saplings present throughout the stand.

Accessibility and operability are good with an access road along the north side of the property to the sewer pump station. There are also old road beds that could be improved allowing equipment into this stand. Old and new stumps were observed indicating both past and recent harvest.

4.1.2 STAND 2 – PARTIAL-FORESTED

Partial-forested areas comprise 21.2 acres of the Open Space areas. Most of these acres are located at the base of slopes. The vegetation is mostly bunchgrasses and mountain shrubs such as mountain mahogany with ponderosa pine and Rocky Mountain juniper trees in clumps or as isolated individuals.

Stand 2 was not inventoried but a broad traverse was conducted to identify noxious weeds and classify Fuel Models. Accessibility is good for most of this stand type. There are existing dirt roads and gentle terrain if vehicles or heavy equipment was used during harvest operations.



Stand 2

5.0 PRESCRIPTION AND IMPLEMENTATION SCHEDULE

The Open Space acres and subdivision roads were delineated into three Management Units (MU). A map is located in **Appendix 8.1**. Included in this section is an implementation schedule and record for the MUs. This schedule is intended to be reviewed every few years and can be amended to accommodate any changes in management priorities. Ideally, the landowners should target several acres of operable terrain per year for the next 10 years for treatment. It is recommended that a professional forester be consulted for all markings and layout of prescriptions. Slopes over 40% are classified as inoperable for wheeled equipment. However, steeper slopes could be accessed with tracked equipment and by hand crews depending on access and safety.

Harvest can take place gradually over the plan period or done in a single entry. An advantage of a single entry is that the amount of volume removed may make a commercial operation possible, providing additional income and offsetting costs of the silvicultural treatments on the property. Another advantage is that the positive biological or wildlife mitigation effects of the treatment would take place over an entire MU sooner.

In general, harvested trees should be skidded with tops attached to reduce fuel accumulation within the stands. Slash disposal could be done through pile and burn methods in the winter (check with local officials before conducting any burn) when large, localized accumulations of slash can be piled for burning when snow is 3 or more inches deep. Piles should be located at least 20 feet from any trees. Onsite chipping is also an option with the chips blown back into the forest if there is proper access for equipment. Lop and scatter techniques may be used to provide for ground protection if it is not causing fuel accumulation. Complete removal as chips or intact slash via trucks is the most expensive treatment option.

Products generated from these harvest prescriptions include firewood, post and poles, and possibly chips or saw-timber if purchased locally. Currently, stumpage for firewood is running between \$10-20 per cord. Using a conversion factor of 90 cubic feet per cord, an acre will produce about 5.5 cords per acre for MU1. Therefore the revenue per acre from firewood can be expected to be from \$55 to \$110 per acre. Post and poles can yield an estimated \$140 per 100 cubic feet. Overall expected revenue could range from \$55-550 per acre.

Harvest costs vary according to prescription and increase when slopes become steeper, access is limited, the timber is less valuable and fewer markets are available for harvested trees. In the Colorado Front Range, estimated per acre costs range from \$1,000-\$5,000. Additional cost is tied to timber sale layout including marking the timber and delineating the sale boundary. Other costs to consider include producing a sale prospectus and advertising.

5.1 MANAGEMENT UNIT 1

Management Unit (MU) 1 consists of Stand 1 (14.3 acres) and is dominated by an overstory of Rocky Mountain Douglas-fir and ponderosa pine. The objective in this MU is reducing wildfire risk and improving forest health. This can be accomplished by implementing a thin from below strategy to a target density of approximately 100 square feet basal area per acre. Reducing stand density and opening up the canopy through a thinning harvest strategy where trees are removed across most of the diameter distribution will improve forest vigor, lower risk of insect infestation and aid in establishment of a new age class. Harvesting 30% of the 6 through 18 inch diameter classes yields a residual stand density of 102 square feet per acre. Treat 1-2 acres annually.

Priority areas for treatment should be along dirt roads and in gentle terrain. Harvesting along existing dirt or paved roads will create shaded fuel breaks improving firefighter access as well as reducing fuels. Consult (Dennis 2005) for further guidance on creating shaded fuel breaks in subdivisions (**Appendix 8.6**). Most of this MU is on soil types where equipment limitation is slight for less steep slopes and severe for steeper slopes. A slight classification indicates no significant problems associated with the use of mechanized logging equipment. Using this prescription, post-treatment MU density and volumes would be:

	Trees per acre	Volume per acre		Basal Area (sq ft)
		Cubic Feet	Board Feet	
Removal	79	793	2,448	42
Residual	186	2011	6,491	102

5.2 MANAGEMENT UNIT 2

Management Unit 2 consists of Stand 2 (13.5 acres) which has limited forest cover. The objective in this MU is reducing potential spread of wildfire through the open areas and improving the health of individual trees. Forested areas should be thinned annually to encourage the development of dominant and co-dominant trees. Clumps of trees should be thinned and/or pruned by hand to reduce ladder fuels. Pruning height should be between 3-6 feet depending on tree size and location.

5.3 MANAGEMENT UNIT 3

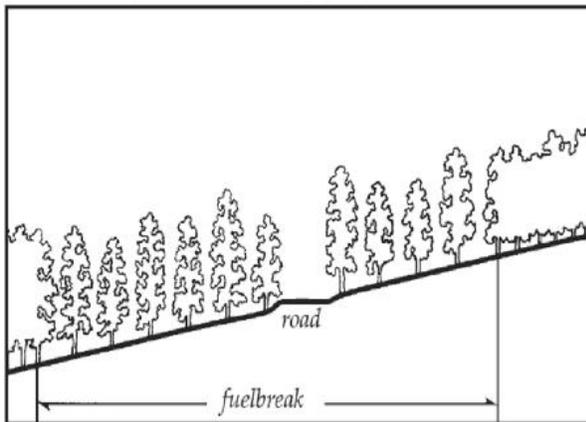
Management Unit 3 (101.1 acres) is the forested roadside right-of-way (ROW). The thinning silvicultural prescriptions were developed to implement the Shaded Fuel Break design prescribed in the Fuelbreak Guidelines for Forested Subdivisions (Dennis 2005). The treatment zone along ROW's is approximately 75 to 120 feet depending on slope from the edge of the road. The Riva Chase Transportation System is detailed on the Management Unit Map (**Appendix 8.1**).

Future treatments may be coordinated with property owners along adjoining private land and along public or community right-of-ways. Conifer regeneration and reproduction in previously mitigated areas should be addressed through annual thinning and maintenance. It is recommended that any mitigation always treat and remove woody slash and debris from the properties leaving little or no accumulated hazardous fuels.

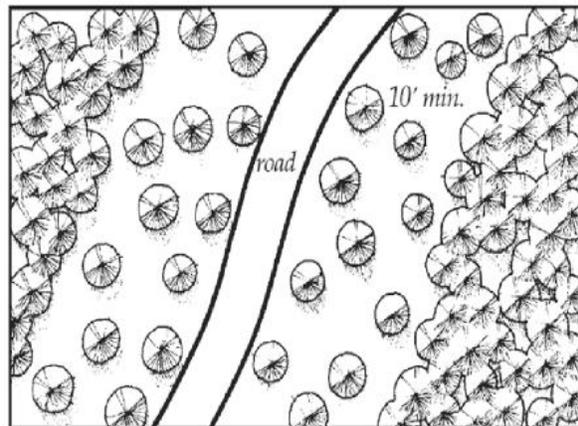
5.3.1 SHADED FUELBREAKS

All forested access roads should be maintained as shaded fuelbreak zones, where possible. Reducing the forest canopy along access roads enhances the effectiveness of the physical forest canopy break the road provides, as well as critical safety factors along likely evacuation and incident access routes. This creates a safer emergency ingress/egress scenario while greatly aiding potential tactical suppression efforts. Fuels treatment along roadways reduces removal costs of by-product as well as project complexity. The following passage is excerpted from the Genesee Fire Protection District (GFPD) CWPP in regards to specific recommendations for Riva Chase:

“All access roads within the GFPD with vegetation or timber encroachment should be considered for shaded fuelbreak treatment and/or seasonal mowing. Project priority should be given to the forested road margins of the primary evacuation routes along Forest Hills Drive where traffic flow for central and southern residents is restricted. Shaded fuelbreak treatment units have been identified in the 2002 Wildfire Hazard Analysis performed by the Anchor Point group and thinning projects have been undertaken in the area.”



Cross-section of a typical fuelbreak built in conjunction with a road.



Plan view of fuelbreak showing minimum distance between tree crowns.

Diagrams depicting cross-section and aerial views of a shaded fuelbreak (Reproduced from Dennis 2005)

5.4 RECOMMENDATIONS

The following recommendations should be considered to ensure adequate forest management, wildfire mitigation and to increase the forest health of the property:

- Selectively thin MU 1-3 to create a healthy forest with a fire-resistant stand structure,
- Remove all portions of trees, including the bole (wood) and slash (limbs) from the project area,
- Cut stumps as close to the ground as possible with no more than 4 inches on the uphill side,
- Annually survey for insects and diseases between October and June,
- Locate a temporary deck, landing or chip site in a grassy area and rehabilitate site when all work has been completed,
- Locate a fire access road along the un-roaded northern boundary of the subdivision,
- Seek a highly qualified logging contractor to cut and remove all marked trees, associated logging slash, specific downed woody material and limb to standards,
- Develop an Annual Operation Plan with the contractor to control work,
- Encourage homeowner's in the area to initiate an emergency response pre-attack plan and become a Colorado Fire Wise Community (www.firewise.org),
- Adhere to Colorado's Best Management Practices (**Appendix 8.7**),
- Work in cooperation with the neighboring residents where feasible in implementing this plan, if similar management measures can be implemented on adjacent lands in conjunction with this property then it will strengthen the forest management for the entire area,
- Seek grants and grant application assistance by accessing the Rocky Mountain Wildland Fire Information Grant Database: <http://www.rockymountainwildlandfire.info/grants.html>,
- Use the Grant Writing Handbook: <http://www.theideabank.com/freeguide.html>.

5.5 MITIGATION PRIORTIES

According to the GFPD CWPP, Riva Chase has a high wildfire hazard rating. The main recommendations contained in the report include improving defensible space around homes, limiting the number of homes with wood shingle roofs, reducing fuels and creating shaded fuel breaks along primary and secondary roads. Shaded fuel breaks are discussed in the Management Unit prescriptions and the CWPP is available online.

Mitigation priorities are developed by Management Units:

- Priority 1. Management Unit 3. Management Unit 3 is the roadside vegetation prescription. This management unit priority is designed to facilitate safe ingress and egress in the event of a wild fire in the Riva Chase community.
- Priority 2. Management Unit 2. Management Unit 2 includes the community water infrastructure. Reducing the fuel loading and stand structure to minimize fire impacts to the water storage facility.
- Priority 3. Management Unit 1. Management Unit 1, mitigation efforts focus on protecting residences on the northern face of the Riva Chase community.

Mitigation projects are identified and designed to reduce the risk of wildfire loss to the community and other values. Mitigation projects are prioritized and may include such things as hazardous fuels management, improving the wildfire suppression capability of the local fire authority, developing a permanent water supply, reducing structure flammability, improving emergency procedures and increasing public education.

This enclosed implementation plan identifies who will do what and when, see **Section 5.6 Implementation Schedule**. Identify areas of concern and integrate common values. Community funds for hazard reduction projects through grants need to be obtained. Also, the assessment strategy needs to be in place to ensure that the funding and commitments remains current and relevant for future years. Riva Chase needs to make sure that the recommended actions are implemented in a timely manner. In addition, the CWPP was approved by Jefferson County and the Colorado State Forest Service.

5.6 IMPLEMENTATION SCHEDULE

The implementation schedule for the coming decade is displayed for the MU's in the following spreadsheets.

10-Year Treatment Prescription, Implementation Schedule and Cost Analysis.

Management Unit 1

Period	Treatment	Year/Season	Cost	Income	Accomplishment
2013-14	Survey and treat annually for noxious weeds, insects and disease	2013-14 Spring			
	Harvest 30% of the 6" through 18" DBH classes across 1-2 acres. Remove all slash or pile tops and limbs for later burning.	1/1/13-9/30/14			
		Year Total			
2015-16	Survey and treat annually for noxious weeds, insects and disease	2015-16 Spring			
	Harvest 30% of the 6" through 18" DBH classes across 1-2 acres. Remove all slash or pile tops and limbs for later burning.	1/1/15-9/30/16			
		Year Total			
2017-18	Survey and treat annually for noxious weeds, insects and disease	2017-18 Spring			
	Harvest 30% of the 6" through 18" DBH classes across 1-2 acres. Remove all slash or pile tops and limbs for later burning.	1/1/17-9/30/18			
		Year Total			
2019-20	Survey and treat annually for noxious weeds, insects and disease	2019-20 Spring			
	Harvest 30% of the 6" through 18" DBH classes across 1-2 acres. Remove all slash or pile tops and limbs for later burning.	1/1/19-9/30/20			
		Year Total			
2021-22	Survey and treat annually for noxious weeds, insects and disease	2021-22 Spring			
	Harvest 30% of the 6" through 18" DBH classes across 1-2 acres. Remove all slash or pile tops and limbs for later burning.	1/1/21-9/30/22			
	Complete Forest Stewardship Plan Revision and submit by 10/1/22	Summer 2022			
		Year Total			

Comments:

**10-Year Treatment Prescription, Implementation Schedule and Cost Analysis.
Management Unit 2**

Period	Treatment	Year/Season	Cost	Income	Accomplishment
2013-14	Survey and treat annually for noxious weeds, insects and disease	2013-14 Spring			
	Lightly thin in clumps of conifer trees. Remove all slash or pile tops and limbs for later burning.	1/1/13-9/30/14			
	Year Total				
2015-16	Survey and treat annually for noxious weeds, insects and disease	2015-16 Spring			
	Lightly thin in clumps of conifer trees. Remove all slash or pile tops and limbs for later burning.	1/1/15-9/30/16			
	Year Total				
2017-18	Survey and treat annually for noxious weeds, insects and disease	2017-18 Spring			
	Lightly thin in clumps of conifer trees. Remove all slash or pile tops and limbs for later burning.	1/1/17-9/30/18			
	Year Total				
2019-20	Survey and treat annually for noxious weeds, insects and disease	2019-20 Spring			
	Lightly thin in clumps of conifer trees. Remove all slash or pile tops and limbs for later burning.	1/1/19-9/30/20			
	Year Total				
2021-22	Survey and treat annually for noxious weeds, insects and disease	2021-22 Spring			
	Lightly thin in clumps of conifer trees. Remove all slash or pile tops and limbs for later burning.	1/1/21-9/30/22			
	Complete Forest Stewardship Plan Revision and submit by 10/1/22	Summer 2022			
	Year Total				

Comments:

**10-Year Treatment Prescription, Implementation Schedule and Cost Analysis.
Management Unit 3**

Period	Treatment	Year/Season	Cost	Income	Accomplishment
2013-14	Survey and treat annually for noxious weeds, insects and disease	2013-14 Spring			
	Thin along forested access roads throughout the subdivision. Create a 75-120' buffer depending on slope and access. Remove all slash or pile tops and limbs for later burning.	1/1/13-9/30/14			
	Year Total				
2015-16	Survey and treat annually for noxious weeds, insects and disease	2015-16 Spring			
	Thin along forested access roads throughout the subdivision. Create a 75-120' buffer depending on slope and access. Remove all slash or pile tops and limbs for later burning.	1/1/15-9/30/16			
	Year Total				
2017-18	Survey and treat annually for noxious weeds, insects and disease	2017-18 Spring			
	Thin along forested access roads throughout the subdivision. Create a 75-120' buffer depending on slope and access. Remove all slash or pile tops and limbs for later burning.	1/1/17-9/30/18			
	Year Total				
2019-20	Survey and treat annually for noxious weeds, insects and disease	2019-20 Spring			
	Thin along forested access roads throughout the subdivision. Create a 75-120' buffer depending on slope and access. Remove all slash or pile tops and limbs for later burning.	1/1/19-9/30/20			
	Year Total				
2021-22	Survey and treat annually for noxious weeds, insects and disease	2021-22 Spring			
	Thin along forested access roads throughout the subdivision. Create a 75-120' buffer depending on slope and access. Remove all slash or pile tops and limbs for later burning.	1/1/21-9/30/22			
	Complete Forest Stewardship Plan Revision and submit by 10/1/22	Summer 2022			
	Year Total				

Comments:

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7.0 GLOSSARY

basal area: the cross-sectional area of a single stem, including the bark, measured at breast height (4.5 feet)

blowdown: trees or trees felled or broken off by wind

coppice: the production of new stems from the stump or roots; to cut the main stem at the base or to injure the roots to simulate the production of new shoots for regeneration

defensible space: an area around a structure where fuels and vegetation are treated, cleared or reduced to slow the spread of wildfire towards the structure

density-dependent mortality: trees which die as a result of other (usually larger) trees being able to out-compete them for light, water, and nutrients

diameter at breast height (dbh): the diameter of a stem of a tree at 4 ½ feet above the ground

even-aged stand: a stand of trees composed of a single age class

fuel loading: the oven-dry weight of fuel per unit area

improvement cutting: the removal of less desirable trees of any species in a stand of poles or larger trees, primarily to improve composition and quality

ladder fuels: vegetative materials with vertical continuity that allows fire to burn from the ground level up to the branches and crowns of trees (Dennis 1999)

litter: the surface layer of a forest floor that is not in an advanced stage of decomposition, usually consisting of freshly fallen leaves, needles, twigs, stems, bark, and fruits

noxious weed: a plant specified by law as being especially undesirable, troublesome, and difficult to control

quadratic mean diameter: the diameter corresponding to a stand's mean basal area per acre divided by the mean number of trees per acre

patch: a small part of a stand or forest

pure stand: a stand composed principally of one species, conventionally at least 80 percent based on numbers, basal areas, or volumes

riparian area: related to, living, or located in conjunction with a wetland, on the bank of a river or stream but also at the edge of a lake or tidewater

serotinous: pertaining to fruit or cones that remain on a tree without opening for one or more years

skid road: a road on which logs are hauled

snag: a standing, generally unmerchantable dead tree from which the leaves and most of the branches have fallen

stand: a contiguous group of trees sufficiently uniform in age-class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit

thinning: a cultural treatment made to reduce stand density of trees primarily to improve growth, enhance forest health, or recover potential mortality

uneven-aged stand: a stand with trees in three or more distinct age classes, either intimately mixed or in small groups

windbreak: a strip of trees or shrubs maintained mainly to alter windflow and microclimates in the sheltered zone, usually farm buildings

windfirm: trees able to withstand strong winds and resist windthrow

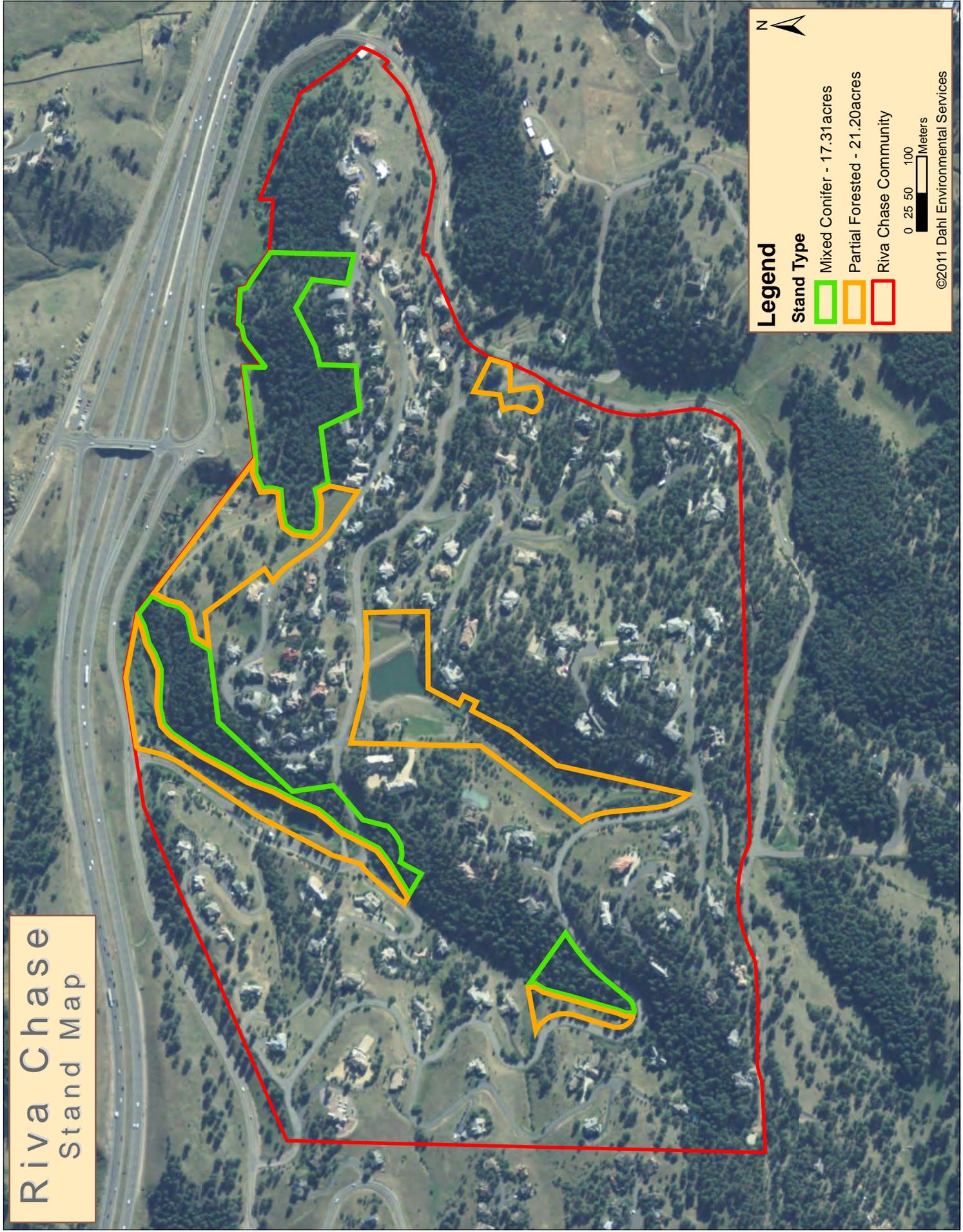
(Source: Helms, J. A., 1998)

8.0 APPENDICES

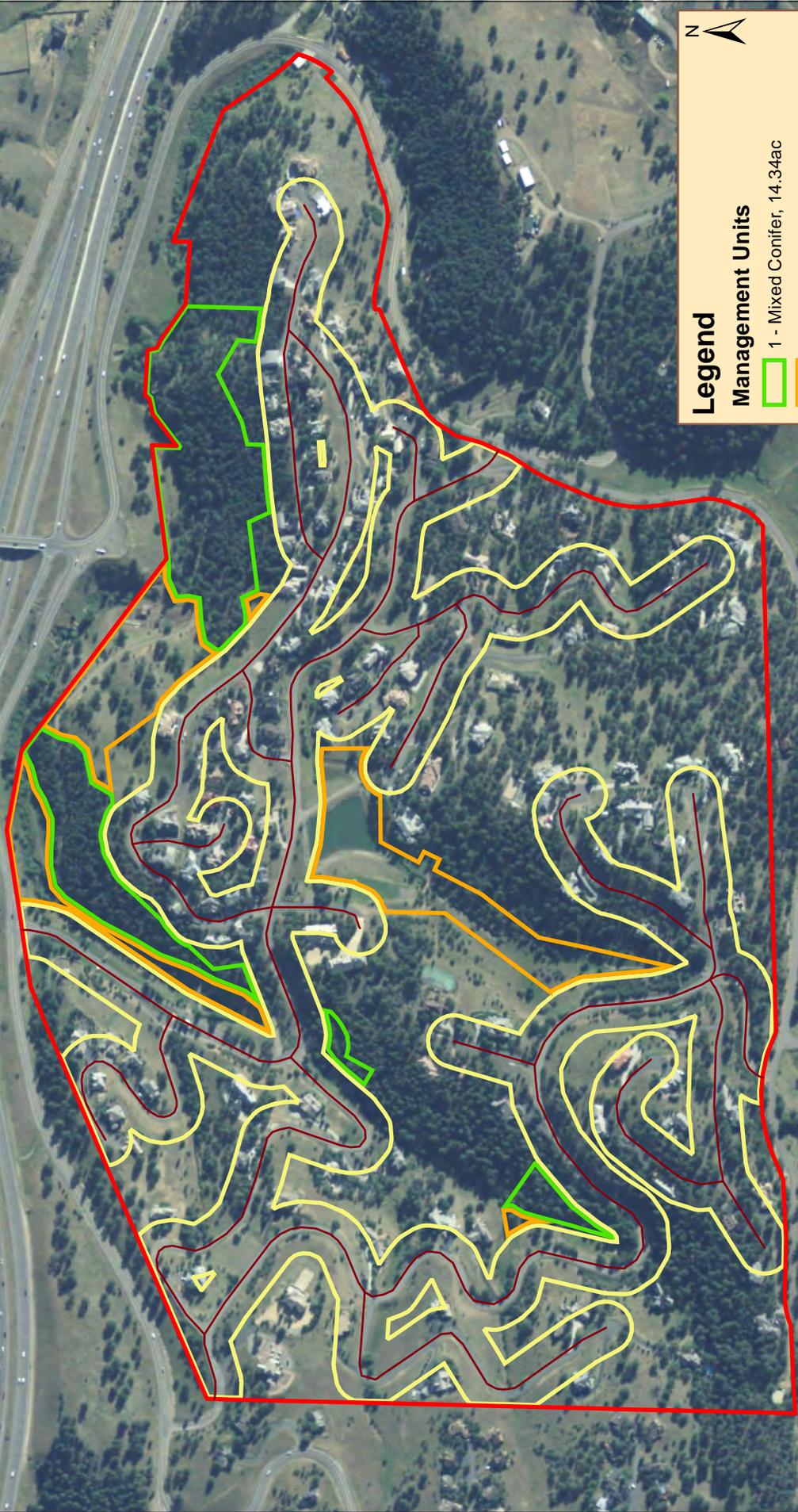
APPENDIX 8.1 – MAPS

- **Stand Map**
- **Management Unit Map**
- **Private Property Wildfire Hazard Risk Map**

Riva Chase Stand Map



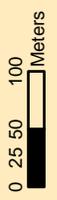
Riva Chase Management Unit Map



Legend

Management Units

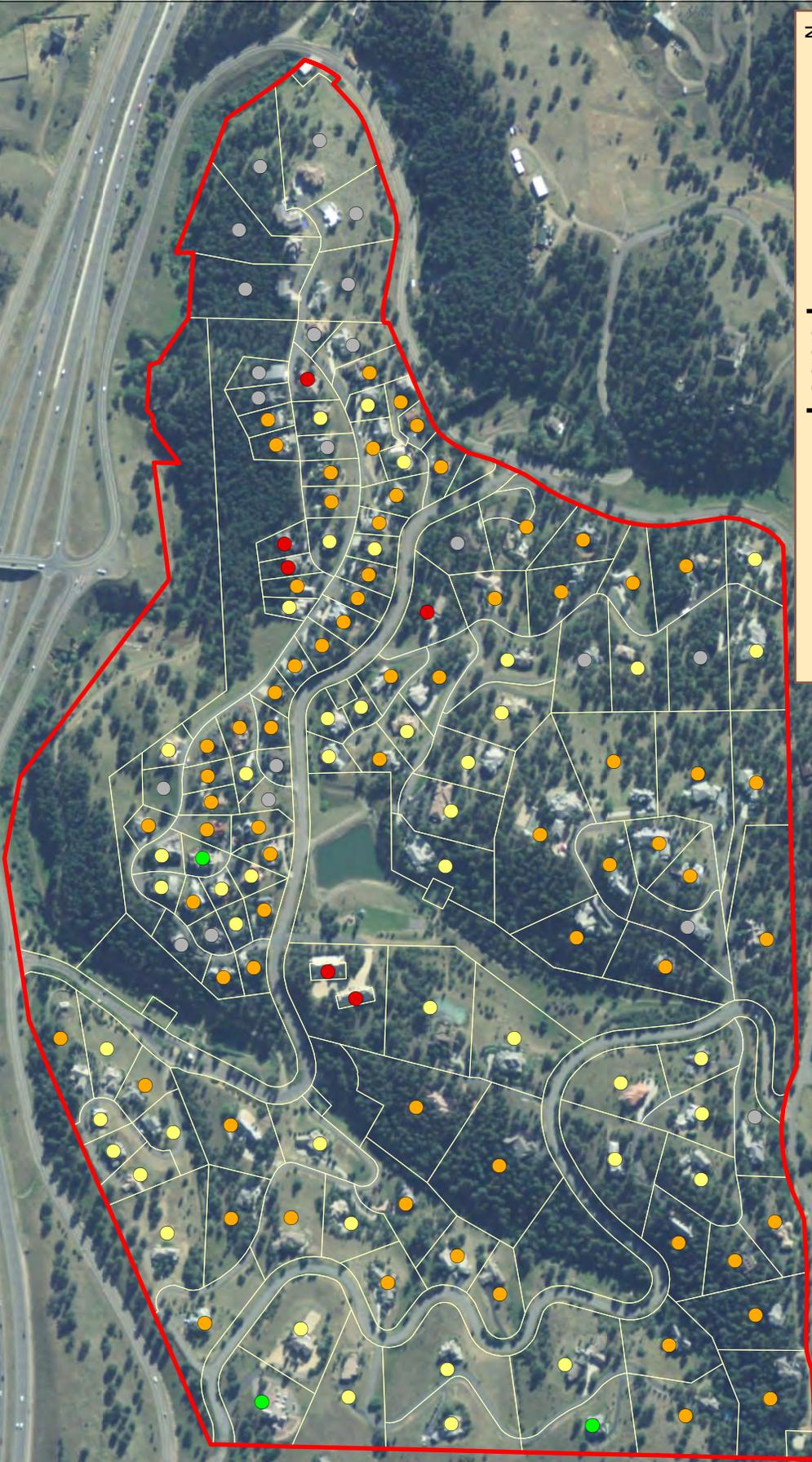
- 1 - Mixed Conifer, 14.34ac
- 2 - Partial Forested, 13.48ac
- 3 - Road Treatment Area, 101.13ac
- Roads
- Riva Chase Community



©2013 Dahl Environmental Services

Riva Chase

2008 Private Property Assessments



Legend

2008 Assessment Locations

- High (Orange dot)
- Severe (Red dot)
- NA (Grey dot)
- Parcel Boundaries (White outline)
- Riva Chase Community (Red outline)

Fire Risk

- Low (Green dot)
- Moderate (Yellow dot)

0 25 50 100 Meters

©2013 Dahl Environmental Services

APPENDIX 8.2 – FOREST INSECT AND DISEASE INFORMATION

- **Mountain Pine Beetle**
- **Ips Beetle**
- **Dwarf Mistletoe**



TREES & SHRUBS

Mountain Pine Beetle

no. 5.528

by D.A. Leatherman, I. Aguayo, and T.M. Mehall¹

Quick Facts...

Mountain pine beetles (MPB) are the most important insect pest of Colorado's pine forests. MPB often kill large numbers of trees annually during outbreaks.

Trees that are not growing vigorously due to old age, crowding, poor growing conditions, drought, fire or mechanical damage, root disease and other causes are most likely to be attacked.

For a long-term remedy, thin susceptible stands. Leave well-spaced, healthy trees.

For short-term controls, spray, cover, burn or peel attacked trees to kill the beetles. Preventive sprays can protect green, unattacked trees.

Mountain pine beetle (MPB), *Dendroctonus ponderosae*, is native to the forests of western North America. Periodic outbreaks of the insect, previously called the Black Hills beetle or Rocky Mountain pine beetle, can result in losses of millions of trees. Outbreaks develop irrespective of property lines, being equally evident in wilderness areas, mountain subdivisions and back yards. Even windbreak or landscape pines many miles from the mountains can succumb to beetles imported in infested firewood.

Mountain pine beetles develop in pines, particularly ponderosa, lodgepole, Scotch and limber pine. Bristlecone and pinyon pine are less commonly attacked. During early stages of an outbreak, attacks are limited largely to trees under stress from injury, poor site conditions, fire damage, overcrowding, root disease or old age. However, as beetle populations increase, MPB attacks may involve most large trees in the outbreak area.

A related insect, the Douglas-fir beetle (*D. pseudotsugae*), occasionally damages Douglas-fir. Most often, outbreaks are associated with previous injury by fire or western spruce budworm. (See fact sheet 5.543, *Western Spruce Budworms*). Spruce beetle (*D. rufipennis*) is a pest of Engelmann and Colorado blue spruce in Colorado. Injured pines also can be attacked by the red turpentine beetle (*D. valens*).

Mountain pine beetles and related bark beetles in the genus *Dendroctonus* can be distinguished from other large bark beetles in pines by the shape of the hind wing cover (Figure 1, top). In side view, it is gradually curved. The wing cover of *Ips* or engraver beetles, another common group of bark beetles attacking conifers, is sharply spined (Figure 1, bottom).

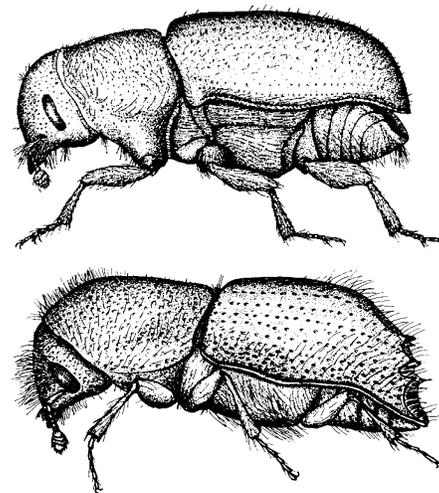


Figure 1: Adult *Dendroctonus* (top) versus *Ips* (bottom). Note gradually curved wing of *Dendroctonus*. Actual size of *Dendroctonus* from 1/8 to 1/3 inch, *Ips* 1/3 to 1/4 inch.

Signs and Symptoms of MPB Attack

- Popcorn-shaped masses of resin, called "pitch tubes," on the trunk where beetle tunneling begins. Pitch tubes may be brown, pink or white (Figures 2 and 6).
- Boring dust in bark crevices and on the ground immediately adjacent to the tree base.



Figure 2: "Pitch tubes" indicating trunk attacks by MPB. Success of the attacks is confirmed by looking under the bark with a hatchet for beetles, their tunnels and/or bluestaining.

- Evidence of woodpecker feeding on trunk. Patches of bark are removed and bark flakes lie on the ground or snow below tree.
- Foliage turning yellowish to reddish throughout the entire tree crown. This usually occurs eight to 10 months after a successful MPB attack.
- Presence of live MPB (eggs, larvae, pupae and/or adults) as well as galleries under bark. This is the most certain indicator of infestation. A hatchet for removal of bark is needed to check trees correctly (Figures 3, 5 and 8).
- Bluestained sapwood (Figure 9). Check at more than one point around the tree's circumference.

Life History and Habits

Mountain pine beetle has a one-year life cycle in Colorado. In late summer, adults leave the dead, yellow- to red-needled trees in which they developed. In general, females seek out large diameter, living, green trees that they attack by tunneling under the bark. However, under epidemic or outbreak conditions, small diameter trees may also be infested. Coordinated mass attacks by many beetles are common. If successful, each beetle pair mates, forms a vertical tunnel (egg gallery) under the bark and produces about 75 eggs. Following egg hatch, larvae (grubs) tunnel away from the egg gallery, producing a characteristic feeding pattern.



Figure 3: Top view of adult MPB (actual size, 1/8 to 1/3 inch).

Figure 4: Mountain area infested by MPB, showing three years of mortality. Old, dead trees are gray; newly killed trees are straw yellow or orange. Some trees may also be infested but do not turn color until nine months or so under attack.



MPB larvae spend the winter under the bark. Larvae are able to survive the winter by metabolizing an alcohol called glycerol that acts as an antifreeze. They continue to feed in the spring and transform into pupae in June and July. Emergence of new adults can begin in mid-June and continue through September. However, the great majority of beetles exit trees

during late July (lodgepole pine) and mid-August (ponderosa pine).

A key part of this cycle is the ability of MPB (and other bark beetles) to transmit bluestain fungi. Spores of these fungi contaminate the bodies of adult beetles and are introduced into the tree during attack. Fungi grow within the tree and assist the beetle in killing the tree. The fungi give a blue-gray appearance to the sapwood.



Figure 6: Not all pitch tubes indicate successful attacks. Note the beetle trapped in this large pitch tube. If the majority of tubes look like this, the tree may have survived the current year's attack.

Infested Trees

- Once MPB infests a tree, nothing practical can be done to save that tree.
- Under epidemic or outbreak conditions, enough beetles can emerge from an infested tree to kill at least two, and possibly more, trees the following year.
- *Ips* and related beetles that emerge early in summer often are mistaken for mountain



Figure 5: Larva of MPB (actual size, 1/8 to 1/4 inch). They are found under the bark in tunnels.



Figure 7: Checking beneath the bark for MPB. This attack was successful (note tunnels and stain).



Figure 9: Cut tree killed by MPB, showing the characteristic blue-staining pattern.



Figure 11: The appearance of a forest thinned to help prevent MPB. This can also improve mountain views and reduce fire hazard.

pine beetle, leading to early reports that “MPB is flying.” Be sure to properly identify the beetles you find associated with your trees.

- Trees from which MPB have already emerged (look for numerous round, pitch-free exit holes in bark) do not need to be treated.
- The direction and spread rate of a beetle infestation is impossible to predict. However, attacked trees usually are adjacent to or near previously killed trees.

Control

Natural controls of mountain pine beetle include woodpeckers and insects such as clerid beetles that feed on adults and larvae under the bark. However, during outbreaks these natural controls often fail to prevent additional attacks.

Extreme cold temperatures also can reduce MPB populations. For winter mortality to be a significant factor, a severe freeze is necessary while the insect is in its most vulnerable stage; i.e., in the fall before the larvae have metabolized glycerols, or in late spring when the insect is molting into the pupal stage. For freezing temperatures to affect a large number of larvae during the middle of winter, temperatures of at least 30 degrees below zero (Fahrenheit) must be sustained for at least five days.

Logs infested with MPB can be treated in various ways to kill developing beetles before they emerge as adults in summer.

One very effective way to kill larvae developing under the bark (though very labor intensive) is by peeling away the bark, either by hand or mechanically; this exposes the larvae to unfavorable conditions—the larvae will dehydrate, starve and eventually die. Logs may also be burned or scorched in a pile—preferably when there is snow on the ground (contact your local forester for assistance). They can also be buried under at least eight inches of soil, or chipped. Following beetle emergence, wood can be used without threat to other trees.

Chemical control options for MPB larvae have been greatly limited in recent years. At present, there are no labeled pesticides for use on MPB.

Solar treatments may be appropriate in some areas of Colorado to reduce beetle populations in infested trees. For the treatment to be effective, the temperature under the bark must reach 110 degrees Fahrenheit or more. Such treatments can be performed with or without plastic. This method is also labor intensive; contact your local forester for more details on solar treatments.

Prevention

An important method of prevention involves forest management. In general, MPB prefers forests that are old and dense. Managing the forest by



Figure 8: Characteristic tunnels (galleries) of mountain pine beetle made by the adults and larvae. The underbark area looks like this in late spring. Bluestained wood is caused by fungi the beetles introduce.



Figure 10: Large, uninfested pine being preventively sprayed. This protects high-value trees and should be done annually between April 1 and July 1.

creating diversity in age and structure with result in a healthy forest that will be more resilient and, thus, less vulnerable to MPB. Most mature Colorado forests have about twice as many trees per acre as those forests which are more resistant to MPB. Contact your local forester for more information on forest management practices.

Certain formulations of carbaryl (Sevin and others) permethrin (Astro, Dragnet and others), and bifenthrin (Onyx) are registered for use to prevent attacks on individual trees. These sprays are applied to living green trees in early summer to kill or deter attacking beetles. This preventive spray is generally quite effective through one MPB flight (one year). During epidemic conditions, the pressure from beetle populations may result in less satisfactory results due to several factors:

Always carefully read and follow all label precautions before applying insecticides for MPB prevention.

- Misidentification of healthy trees: Under dry conditions, trees may not produce pitch tubes when infested, therefore healthy trees are not as obvious. Time may need to be spent looking for sawdust around a tree's circumference and at the base of the tree.
- Timing of application: Trees sprayed after June may already have been attacked.
- Improper coverage: Spray may not have been applied high enough (up to where the trunk tapers to less than six inches), or spray coverage of the tree did not begin at ground level, or was not applied to the entire circumference of the tree (thus creating "windows" for beetle attack).
- Improper dosage/mixing of chemical: Low dosage—effective dosages for bark beetles are higher than the percent used for other insects. Mixture—the carbaryl and water were not fully mixed.
- Environmental conditions: Significant rain or moisture within two hours of application may wash off the insecticide. Very high temperatures may break down the chemical (this can occur when treated trees are near forest fires).
- Chemical shelf life/storage: Manufacturers guarantee stable chemical properties for at least two years after manufacturing date, if stored properly. Chemical properties of carbaryl may be altered if stored at very high or very low temperatures.
- Improper volume/formulation: Not enough spray is used to cover the bark area susceptible to beetle attack; lodgepole pine has "flaky" bark which may require more spray. The label on the chemical does not indicate bark beetle prevention (if using Sevin, SL or XLR is recommended).

Always carefully read and follow all label precautions before applying insecticides for MPB prevention.

Related Fact Sheets

5.543, *Western Spruce Budworms*

5.558, *Ips Beetles*

Contact the Colorado State Forest Service for additional information related to mountain pine beetles.



This fact sheet was produced in cooperation with the Colorado State Forest Service.

¹D.A. Leatherman, Colorado State Forest Service entomologist (retired); I. Aguayo, Colorado State Forest Service entomologist; and T.M. Mehall, Colorado State Forest Service forester.

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TREES & SHRUBS

Ips Beetles

no. 5.558

by W. Cranshaw and D.A. Leatherman¹ (11/06)

Quick Facts...

Ips is a common group of bark beetles that infests pine and spruce trees.

Ips beetles rarely attack healthy trees. Most problems with ips occur to newly transplanted pines or when plants are under stress.

Several generations of ips can occur in a season.

There are 11 species of ips beetles found in Colorado.

Ips beetles, sometimes known as “engraver beetles,” are bark beetles that damage pine and spruce trees. They develop under the bark and produce girdling tunnels that can cause dieback and kill trees. Eleven species of ips beetles occur in Colorado (see Table 1).

Ips beetles are generally not considered as destructive or aggressive as bark beetles in the genus *Dendroctonus* (mountain pine beetle, spruce beetle, Douglas-fir beetle). Normally ips beetles limit their attacks to trees that are in decline due to root injuries, wounding, or other stresses. However, under widespread conditions which allow improved survival and large population build-ups, ips beetles are a considerable threat to living trees. Two factors that recently contributed to ips beetle problems in Colorado include: prolonged drought stress; and the creation of freshly-cut wood (which is a preferred breeding site) from forest homeowner efforts to reduce wildfire hazards.

Ips beetles are small (1/8 to 3/8 inch long), reddish-brown to black beetles. They have a pronounced cavity at the rear end, which is lined with three to six pairs of tooth-like spines, depending on the species. The latter feature distinguishes them from other bark beetles (see Figure 1).

Symptoms of Ips Beetle Injury

As adult ips beetles enter trees and tunnel, a yellowish- or reddish-brown boring dust is produced and accumulates in bark crevices or around the base of the tree. When the larval tunnel, affected parts of the tree discolor (“fade”) and die. These symptoms may be limited to parts of the tree, such as a single branch or the top. However unlike mountain pine beetle, infestation by ips beetles does not necessarily mean the whole tree will die, but over time, attacks may progress as later generations “fill” the tree and then ultimately the host can die.

Small round holes in the bark of infested trees indicate the beetles have completed development in that part of the tree and the adults have exited. The presence of these holes peppering the bark show the beetles have moved to another part of the same tree or to neighboring trees.

Woodpeckers are common predators of ips beetles. Their presence may also

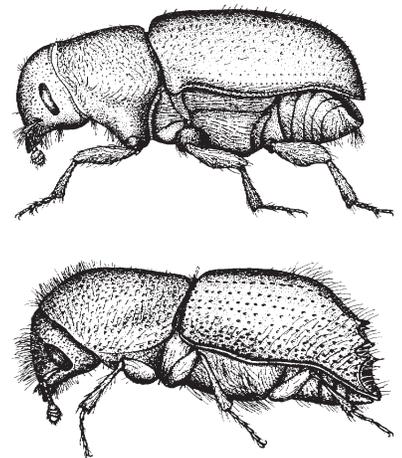


Figure 1: Adult *Dendroctonus* (top) versus *Ips* (bottom). Note gradually curved wing of *Dendroctonus*. Actual size of *Dendroctonus* from 1/8 to 1/3 inch, *Ips* 1/8 to 3/8 inch.

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Table 1. Common ips beetles (*Ips* species) affecting pines and spruce in Colorado.

Species	Hosts	Comments
<i>Ips hunteri</i>	Spruce	This is a common species affecting Colorado blue spruce in landscape settings. Upper portions of the tree are typically infested first.
<i>Ips pilifrons</i>	Spruce	A forest species often called the “spruce ips”; tends to infest the upper part of fallen trunks.
<i>Ips pini</i>	Ponderosa, lodgepole	The most common species associated with other pines in Colorado.
<i>Ips knausi</i>	Ponderosa pine	Common at base of trunk and in fresh stumps.
<i>Ips calligraphus</i>	Ponderosa pine	Largest ips species in Colorado; often in main trunk.
<i>Ips confusus</i>	Piñon, rarely other pines	Periodically kills piñons over large areas.
<i>Ips latidens</i>	3- and 5-needled pines	
<i>Ips borealis</i>	Engelmann spruce	
<i>Ips integer</i>	primarily Ponderosa pine	
<i>Ips woodi</i>	Limber pine	
<i>Ips mexicanus</i>	Lodgepole and limber pines	



Boring dust at the base of a pine tree. Reddish boring dust is caused by ips beetles. The whitish dust is from ambrosia bark beetles.



Tunneling by *Ips hunteri* in blue spruce.

Note: Concentrations of insecticides used to control bark beetles are often considerably greater than those used for insects on foliage. To avoid needle burning, try to limit the application to the bark, particularly when using liquid (emulsifiable concentrate) formulations that have increased risk of causing plant injuries.

indicate bark beetle activity. Woodpeckers often remove the tree bark in an effort to obtain this food source. This habit results in ragged holes or patches of missing bark on the tree.

Generalized Life History

Adults overwinter under the bark or in surrounding litter at the tree base. They begin to attack weakened trees in the spring. Initially the male enters the tree, constructs a cavity under the bark known as the “nuptial chamber.” Females are attracted to the tree by chemicals (pheromones) produced by the male.

After mating, females (usually three) excavate egg galleries off the central chamber. The tunnels produced by the adults appear as a “Y”- or “H”-shaped pattern. These galleries are mostly free of boring dust, which is pushed out of the entrance hole as the adult beetles work. These “cleared out” galleries have a different appearance than the debris-filled galleries of *Dendroctonus*. Eggs are laid along the gallery and young larvae soon hatch and begin tunneling smaller lateral galleries that lightly etch the sapwood. They are small grubs, about 1/4 inch long when mature, white to dirty gray, legless, with dark heads. In Colorado, two to four generations of these beetles usually develop per year.

Management

To prevent ips beetle attacks, use practices that promote vigorous tree growth. Properly siting trees in landscape plantings is important to allow optimal growing conditions as the tree matures. Adequate – but not excessive – water may be needed. Root injuries caused by mechanical damage, compaction, or disease should be avoided.

Freshly-cut material that results from pruning or thinning practices (called “slash”) should be removed from the vicinity of valuable trees. Never stack green or infested coniferous wood next to living coniferous trees. Such green woody material should be chipped or treated so that the inner bark area is destroyed. Ips larvae will not survive standard chipping or debarking treatments. Other treatments could include scattering (as opposed to piling) slash to promote rapid drying.

Trees at risk of ips attack include newly transplanted trees, trees suffering root injuries from construction, and trees surrounded by large breeding populations of ips beetles. These types of trees can benefit from preventive insecticide applications.

Insecticides are used as drenching preventive sprays on the trunks and larger branches. These insecticides need to be applied prior to adult beetle infestation. (Remember that overwintering beetles begin emerging in spring as soon as daytime temperatures consistently reach 50 F to 60 F.) However, timing can be difficult to determine since ips beetles can have multiple, overlapping generations and life cycles. Adults have been observed entering trees during warm days as early as late-February on through November. Because of this extended activity, two treatments (early spring and summer) may be needed to protect trees during high-risk conditions.



Top dieback of spruce from drought stress and ips attack.



Storing cut firewood near susceptible trees greatly increases the risk of ips beetle attack.



This fact sheet was produced in cooperation with the Colorado State Forest Service.

¹W. Cranshaw, Colorado State University Extension entomologist and professor, bioagricultural sciences and pest management; and D.A. Leatherman, Colorado State Forest Service entomologist.

Insecticides used to prevent ips include either permethrin, bifenthrin, or carbaryl (Sevin) as the active ingredient. There are many products currently on the market containing these active ingredients. Follow the manufacturer's recommendation for the proper rate for bark beetle treatment. Bark beetle applications at the labeled rate should provide at least three months control of ips beetles.

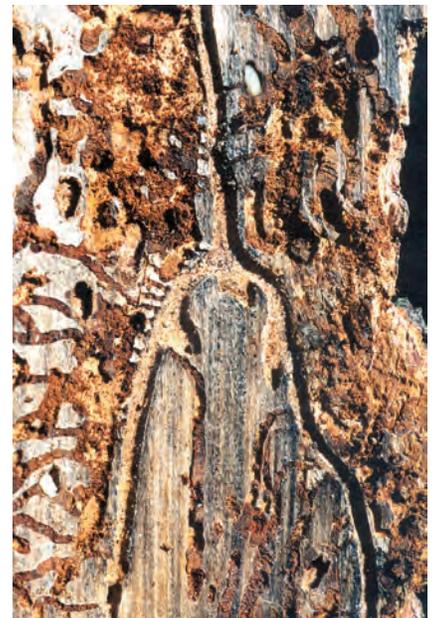
When a preventively-sprayed tree later dies of beetle attack, it is usually for one of the following reasons: 1) the tree was sprayed after it was attacked; 2) the spray was applied at too dilute a rate; 3) the entire bark surface of the susceptible part of the tree was not sprayed; or 4) the material wore off and was no longer effective.

Insecticide applications are not needed when ips beetles do not pose a serious risk to healthy trees. Ips problems are often an issue for a few years, then lessen naturally to non-threatening levels. This is the normal condition in Colorado. A rule of thumb when deciding if preventive treatments are needed is to survey for infested groups of bark beetle-killed trees (as determined by dead foliage) within sight of the live trees in question. Also, transplants or recently disturbed trees in natural forest areas or near other known sources of ips may warrant protection. Tree value, of course, is always a consideration. There is often more interest in protecting high-value trees such as those around residences, golf courses, or in other highly visible settings.

No chemical treatment exists for trees or wood already infested by ips beetles. In rare cases where it is feasible to reduce the threat to live trees by killing beetles within infested trees before they exit, treatments involve bark removal, chipping the wood into small pieces, covering piles with a double-layer of 6-mil thick clear plastic sealed around the edges with soil to heat (solarize) the wood, or physical removal of infested material from the site to an area a mile or more from susceptible trees.



Ips confusus pitch tubes on infested pinyon pine trunk.



Ips pini egg galleries under bark of ponderosa pine trunk.

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Quick Facts...

Mistletoes are parasitic flowering plants that can infect and damage many species of trees.

Dwarf mistletoes are leafless parasitic plants that infect several coniferous or evergreen tree species in many western states.

Ponderosa, lodgepole, limber, and pinyon pines and Douglas-fir are the most common trees affected by dwarf mistletoes in Colorado.

Juniper mistletoe is another type of mistletoe that can infect several juniper species in many western states.

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DISEASES

Mistletoes in Colorado Conifers

no. 2.925

by R. D. Koski, W.R. Jacobi and C.E. Swift¹ (Revised 4/09)

Dwarf mistletoes (*Arceuthobium* species) are leafless parasitic plants that infect several species of conifers (evergreen trees) in Colorado forests. Dwarf mistletoes produce rootlike structures that grow in the living tissue just under the bark (phloem) and in the wood (xylem), where they extract both nutrients and water from their host plants. Germinating seeds of mistletoes produce specialized structures called holdfasts that allow newly emerged parasitic plants to penetrate the tissues of host plants, thus infecting the host plant.

There are five species of dwarf mistletoes that infect conifers in Colorado (Table 1). While some dwarf mistletoes are relatively host-specific and generally do not infect other tree species, other species infect a wide range of coniferous tree species (Table 1). In addition, juniper mistletoe (*Phoradendron juniperinum*) is also present in Colorado and is a different type of mistletoe that is less damaging compared to dwarf mistletoes, in that it primarily acquires only water from the host tree. Juniper mistletoe is found in western Colorado and can infect several juniper species (*Juniperus* species) in many western states (Table 1).

The dwarf mistletoes and juniper mistletoe are dioecious plants with male flowers and female flowers produced on separate plants. The flowers produced by these mistletoes are small and inconspicuous.

Symptoms and Signs

When viewed from a distance, coniferous trees infected with dwarf mistletoes may appear to have yellow foliage, reduced foliage, abnormally dense green and distorted foliage or witches' brooms, and mortality of the upper portion of the affected tree (Figures 1, 2, and 3).

Closer examination of branches of affected trees will reveal the yellowish green, olive green, or reddish brown segmented shoots of the parasitic plant (Figures 4 and 5).



Figure 1: Lodgepole pine infected with dwarf mistletoe display witches' brooms and dead branches.



Figure 2: Witches' brooms – dense, multiple branches on lodgepole pine infected with dwarf mistletoe.

Table 1. Mistletoes of Colorado conifers.				
Mistletoe species	Common name	Host plant species	Common name of host	Description
<i>Arceuthobium americanum</i>	Lodgepole pine dwarf mistletoe	<u>Primary Host:</u> <i>Pinus contorta</i> var. <i>latifolia</i> <u>Occasional hosts:</u> <i>Pinus ponderosa</i> var. <i>scopulorum</i> , <i>Pinus albicaulis</i> , <i>Pinus aristata</i> , <i>Pinus flexilis</i> , <i>Pinus mugo</i> , <i>Pinus sylvestris</i> , <i>Picea engelmannii</i> , <i>Picea pungens</i> , <i>Abies lasiocarpa</i>	Lodgepole pine ponderosa pine, whitebark pine, bristlecone pine, limber pine, mugo or mountain pine, scots or scotch pine, Engelmann spruce, blue spruce, subalpine fir	Shoots are yellowish to olive green, mean shoot height 5-9 cm, with whorl-like branching; fruit is an ovoid berry, olive green and 3.5-4.5 mm long and 1.5-2.5 mm wide
<i>Arceuthobium cyanocarpum</i>	Limber pine dwarf mistletoe	<u>Primary Host:</u> <i>Pinus flexilis</i> <u>Occasional hosts:</u> <i>Pinus albicaulis</i> , <i>Pinus aristata</i> , <i>Pinus contorta</i> var. <i>latifolia</i> , <i>Pinus ponderosa</i> , <i>Pinus strobiformis</i>	Limber pine whitebark pine, bristlecone pine, lodgepole pine, ponderosa pine, southwestern white pine	Shoots are yellowish green, mean shoot height 3 cm, with fan-like branching; fruit is a bluish (cyan)-ovoid berry and 3.5 mm long and 2.0 mm wide
<i>Arceuthobium divaricatum</i>	Pinyon dwarf mistletoe	<u>Primary Host:</u> <i>Pinus edulis</i>	Pinyon pine	Shoots are olive green to brown, mean shoot height 8 cm, with fan-like branching; fruit is an ovoid berry, green/white and 3.5 mm long and 2.0 mm wide
<i>Arceuthobium douglasii</i>	Douglas-fir dwarf mistletoe	<u>Primary Host:</u> <i>Pseudotsuga menzeisii</i> <u>Occasional Hosts:</u> <i>Abies concolor</i> , <i>Abies lasiocarpa</i> , <i>Picea engelmannii</i> , <i>Picea pungens</i>	Douglas-fir white fir, subalpine fir, Engelmann spruce, blue spruce	Shoots are olive green, mean shoot height 2 cm, with fan-like branching, fruit is an ovoid berry, olive green/white, and 3.5-4.5 mm long and 1.5-2.0 mm wide
<i>Arceuthobium vaginatum</i> subsp. <i>cryptopodium</i>	Southwest dwarf mistletoe	<u>Primary Host:</u> <i>Pinus ponderosa</i> <u>Occasional Host:</u> <i>Pinus aristata</i> , <i>Pinus contorta</i> var. <i>latifolia</i> , <i>Pinus flexilis</i> , <i>Pinus strobiformis</i> , <i>Pinus sylvestris</i>	Ponderosa pine	Shoots are orange to reddish brown (sometimes very dark brown), mean shoot height 10 cm, with extensive branching; fruit is an ovoid berry, bi-colored, and 4.5-5.5 mm long and 2.0-3.0 mm wide
<i>Phoradendron juniperinum</i>	Juniper mistletoe	<u>Primary Hosts:</u> <i>Juniperus scopulorum</i> , <i>Juniperus osteosperma</i> , <i>Juniperus monosperma</i>	Rocky Mountain juniper, Utah juniper, oneseed juniper	Shoots are green to yellow green, leafless, mean shoot height 20-40 cm; plants globose, with extensive branching; fruit is an ovoid berry, pinkish-white, and 4 mm in diameter



Figure 3. Lodgepole pine with dead top and dense dwarf mistletoe-induced brooms on the lower stem.

The first symptom of dwarf mistletoe infection is a slight swelling of the bark at the infection site. The parasite is identifiable when shoots protrude two to three years after infection. Dwarf mistletoe shoots are 1/2 to 6 inches long and 1/8 to 1/4 inch in diameter (Figures 4 and 5). Douglas-fir dwarf mistletoe shoots are hard to see because they are only about 1/2 inch long. When shoots have fallen off, look for the remnants of basal cups on branches.

After initial infection, mistletoes can cause distorted branching or witches' brooms in the host tree (Figure 2). When dwarf mistletoes infect occasional hosts – hosts other than the primary host – different and unique symptoms may occur. For example, lodgepole pine dwarf mistletoe causes very large and dense witches' brooms when it infects ponderosa pine (Figure 7). Lodgepole pine dwarf mistletoe also induces on limber pine large elongate galls with rarely any shoots present.

Juniper mistletoe plants are usually seen as large yellowish-green round masses of small branches in the crown of junipers (Figure 6). Juniper mistletoe does not induce the juniper to make witches' brooms.



Figure 4: Ponderosa pine dwarf mistletoe plants.



Figure 5: Lodgepole pine dwarf mistletoe plants. Note thin green-yellow shoots.



Figure 6: Juniper mistletoe. Note the globose growth in this juniper.

Management Options:

1. Pruning and removing trees is the best management measure available to reduce or eliminate dwarf mistletoe infestations in ornamental trees or urban forests.
2. Plant resistant trees under infected trees to replace trees when infected ones are removed.
3. Use ethephon sprays in high-value areas where planting with the same species under infected trees is the only option.

Damage to Host Trees

Dwarf mistletoe witches’ brooms extract nutrients from uninfected parts of the tree, gradually reducing host tree vigor and eventually causing premature death. Dwarf mistletoe infested trees decline and die from the top down as witches’ brooms on lower branches extract more nutrients and water (Figures 1 and 3). Death of the host tree occurs slowly in most cases and depends on the severity of infection and on the vigor and size of the tree.

A measure of dwarf mistletoe infection severity is based on a two-part rating system (Tables 2a and 2b). First, a tree’s crown is divided into thirds, and each third is rated. If there are no visible infections, that third of the crown gets a 0; if 1 to 50 percent of the branches are infected in that third, the rating is 1; and if more than 50 percent of the branches are infected, the rating is 2 (Table 2a). Add the rating of each third to get a total dwarf mistletoe rating (Table 2b). Life expectancy information for trees afflicted with dwarf mistletoe is provided in Table 3.

Witches’ brooms develop over many years. Dwarf mistletoe witches’ brooms extract nutrients and water from uninfected parts of the tree, gradually reducing host tree vigor and eventually causing premature death. Junipers infested with juniper mistletoe will have clusters of the yellowish green parasitic plant growing amongst the juniper foliage (Figure 6).

Juniper mistletoe witches’ brooms extract only water from the host plant. On heavily infested trees, the parasite can cause death of portions of the tree during prolonged periods of below normal precipitation.

Spread

Dwarf mistletoes spread slowly from tree to tree. In closely spaced trees of about the same height, this spread is one to two feet per year. The spread from large to small trees can extend 60 feet, but the average usually is less than 30 feet.

The sticky seeds of *Arceuthobium* species are explosively discharged from the fruit at almost 60 miles per hour, adhering to any surface they strike. Seeds that adhere to young branches of susceptible trees germinate, and the mistletoe rootlet penetrates the bark. Dwarf mistletoe seeds generally are dispersed in August and early September. Birds can, but only occasionally, spread the seeds some distance to uninfected trees. Dwarf mistletoes have a relatively long life cycle between infection and seed production (six to eight years). This long life cycle allows for long-term disease management. Mistletoes are not common in nursery and ornamental plantings, but the parasites can be introduced into an area by planting trees unknowingly infected with mistletoe.

The fruits and seeds of *Phoradendron juniperinum* are spread by birds and consequently can be spread great distance in a single season. A number of bird species feed on the juniper mistletoe fruits and disperse the seeds by excreting or

Table 2a. Rating scale for dwarf mistletoe infection severity.	
Percent of branches infected in each crown section ¹	Tree crown section rating
0	0
1-50	1
51-100	2
¹ top third, middle third, and bottom third of tree crown.	

Table 2b. Dwarf mistletoe rating system (DMR).	
Sum of rating of each of the three crown sections	Infection severity
2-3	Light
4-5	Moderate
6	Heavy



Figure 7: Dense dark green brooms on ponderosa pine infected with lodgepole pine dwarf mistletoe.

Table 3: Approximate number of years needed to kill 50 percent of Ponderosa pine trees infected with dwarf mistletoe.¹

Tree diameter	Infection severity ²		
	Light	Moderate	Heavy
4-9 inches	30	17	7
Greater than 9 inches	60	25	10

¹Based on ponderosa pine in open, multi-aged stands.
²Infection severity based on the following:
 light = a rating of 2 or 3; moderate = a rating of 4 or 5; heavy = a rating of 6.

regurgitating them. Seeds are deposited on the top side of branches of juniper hosts. Germinating seeds produce a holdfast that penetrates the host plant.

Management

Mistletoes cause a gradual decline of plant health and do not quickly cause serious injury, thus long-term management options are feasible. However, mistletoe-infected trees may become sufficiently stressed as to attract mountain pine bark beetle (MPBB), *Ips* bark beetles, and twig beetles that may breed and kill parts (twig and *Ips*) of or the whole tree (MPBB, *Ips*). Mistletoe management options include branch pruning, tree removal, and planting resistant tree species.

Branch Pruning and Tree Removal

Pruning out the witches’ brooms and removing infected trees is the best management measure available to reduce or eliminate dwarf mistletoe infestations in stands of high-value trees. First, remove severely infected trees (trees rated 5 and 6) or those with only a few live branches. Trees with high, unreachable mistletoe infections will continue to shower seeds on nearby trees if not cut down. However, it is not necessary to completely eradicate the mistletoe, as this may require removal of all trees. Pruning infected branches and removal of a few heavily infected trees can keep a green forest on the property.

Pruning off the lower and the largest witches’ brooms from lightly to moderately infected trees (trees rated 1 to 4) can improve the health and allow these trees to survive for decades. When removing a witches’ broom, prune the entire branch at the branch collar near the trunk. Examine trees every two or three years, and remove any newly infected branches. When pruning, keep 30 percent to 40 percent of the branches on the tree (from the top down), even if that means leaving some infected branches. Mistletoe shoots die as soon as the tree branch is cut, so no special disposal of pruning debris is needed. Trunk infections are not as detrimental as branch infections, so their removal is not necessary. If space allows, create 50-foot buffer zones between infected trees and healthy trees by cutting or by planting resistant trees. Contact a professional forester, the Colorado State Forest Service, or other professionals to obtain help in these decisions.

Table 4. Recommended species to replant in mistletoe affected areas.

Mistletoe-infected species	Recommended replacement species
ponderosa pine	white fir, blue spruce, bristlecone pine, pinyon pine, limber pine, Douglas-fir, and/or Rocky Mountain juniper
lodgepole pine	subalpine fir, Engelmann spruce, bristlecone pine, limber pine, and/or Douglas-fir
Douglas-fir	Engelmann spruce, lodgepole pine, and/or ponderosa pine
juniper	ponderosa pine and/or pinyon pine

Planting Resistant Tree Species

Planting resistant or non-host tree species in areas with infected trees will ensure that trees will be in the area even after the infected trees are removed (Table 4).

NOTE: Scotch or Scots pine (*Pinus sylvestris*) is susceptible to both southwest and lodgepole pine dwarf mistletoes.

Deciduous trees and shrubs, such as birch, peashrub, ash, aspen, cottonwoods, and Gambel oak also can be planted in affected areas because dwarf and juniper mistletoe do not attack these plants. Keep in mind that site conditions and moisture availability will determine what trees and shrubs can be planted in a particular area.

Chemical Sprays

Ethephon (2-chloroethanephosphonic acid) is a growth regulating chemical that can be used to remove mistletoe shoots and reduce seed production. Ethephon is usually only used in high value areas where young trees should be protected until infected overstory trees are removed. This treatment does not kill the entire mistletoe plant, just the shoot. Retreatment is necessary until infected trees are removed, mistletoe infections are pruned from the tree, or new non-host trees are planted.

Additional Information

Colorado Master Gardener Garden Notes (available from the Colorado Master Gardener Program website, <http://cmg.colostate.edu/pubs.htm>)

- GardenNotes #618, Pruning Evergreens
- GardenNotes #633, The Science of Planting trees

Fact Sheets (available from the CSU Extension website, <http://www.ext.colostate.edu/pubs/pubs.html>)

- Fact Sheet 5.558, *Ips Beetles*
- Fact Sheet 5.528, *Mountain Pine Beetle*

Geils, B.W., Tovar, J.C., and Moody, B. 2002. *Mistletoes of North American Conifers*. Gen. Tech. Rep. RMRS-GTR-98. Ogden, UT: USDA, Forest Service, Rocky Mountain Research Station. 123p.

¹R.D. Koski, Colorado State University research associate, bioagricultural sciences and pest management; W.R. Jacobi, Colorado State University professor, bioagricultural sciences and pest management; C.E. Swift, Extension horticulture agent, Tri-River Area, Grand Junction. 2/1999. Revised 4/2009.

Colorado State University, U.S. Department of Agriculture and Colorado counties cooperating. Extension programs are available to all without discrimination. No endorsement of products mentioned is intended nor is criticism implied of products not mentioned.

APPENDIX 8.3 – COLORADO WILDFIRE RISK ASSESSMENT REPORT

Wildland Urban Interface (WUI) Risk Index

Description

The Wildland-Urban Interface (WUI) Risk Index layer is a rating of the potential impact of a wildfire on people and their homes. The key input, WUI, reflects housing density (houses per acre) consistent with Federal Register National standards. The location of people living in the wildland-urban interface and rural areas is essential for defining potential wildfire impacts to people and homes.

The WUI Risk Index is derived using a response function modeling approach. Response functions are a method of assigning a net change in the value to a *resource* or *asset* based on susceptibility to fire at different intensity levels, such as flame length.

To calculate the WUI Risk Index, the WUI housing density data was combined with flame length data and response functions were defined to represent potential impacts. The response functions were defined by a team of experts led by Colorado State Forest Service mitigation planning staff. By combining flame length with the WUI housing density data, it is possible to determine where the greatest potential impact to homes and people is likely to occur.

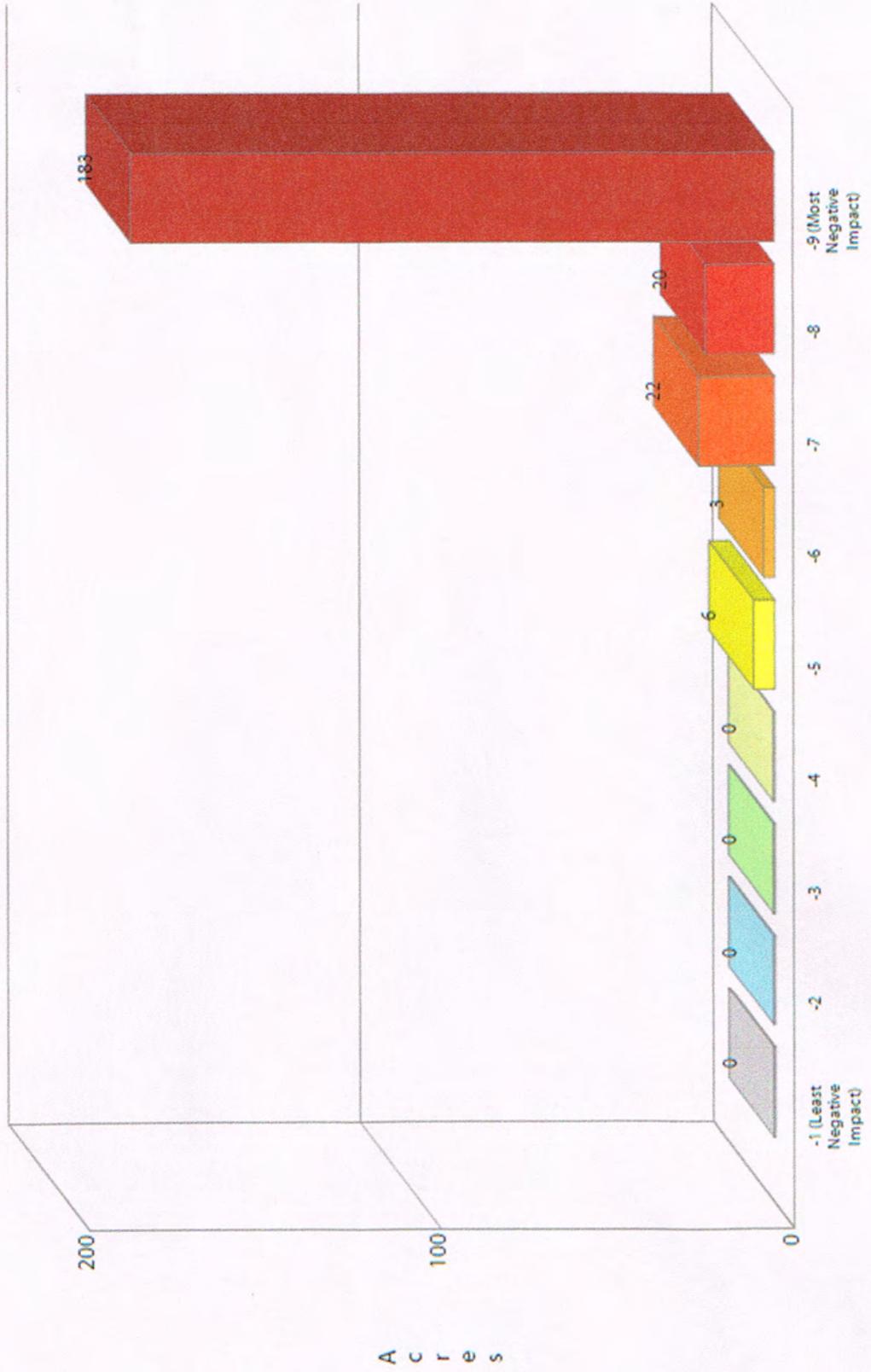
The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact. For

example, areas with high housing density and high flame lengths are rated -9, while areas with low housing density and low flame lengths are rated -1.

The WUI Risk Index has been calculated consistently for all areas in Colorado, which allows for comparison and ordination of areas across the entire state. Data is modeled at a 30-meter cell resolution, which is consistent with other Colorado WRA layers.

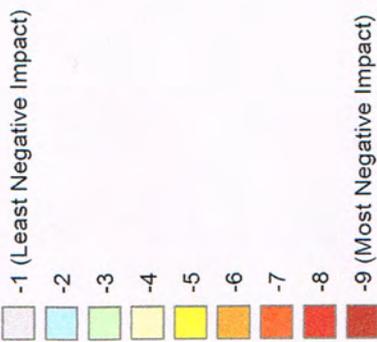
WUI Risk Class	Acres	Percent
-1 (Least Negative Impact)	0	0.0%
-2	0	0.0%
-3	0	0.0%
-4	0	0.0%
-5	6	2.6%
-6	3	1.3%
-7	22	9.3%
-8	20	8.4%
-9 (Most Negative Impact)	183	78.4%
Total	233	100.0%

Riva Chase WUI Risk Index



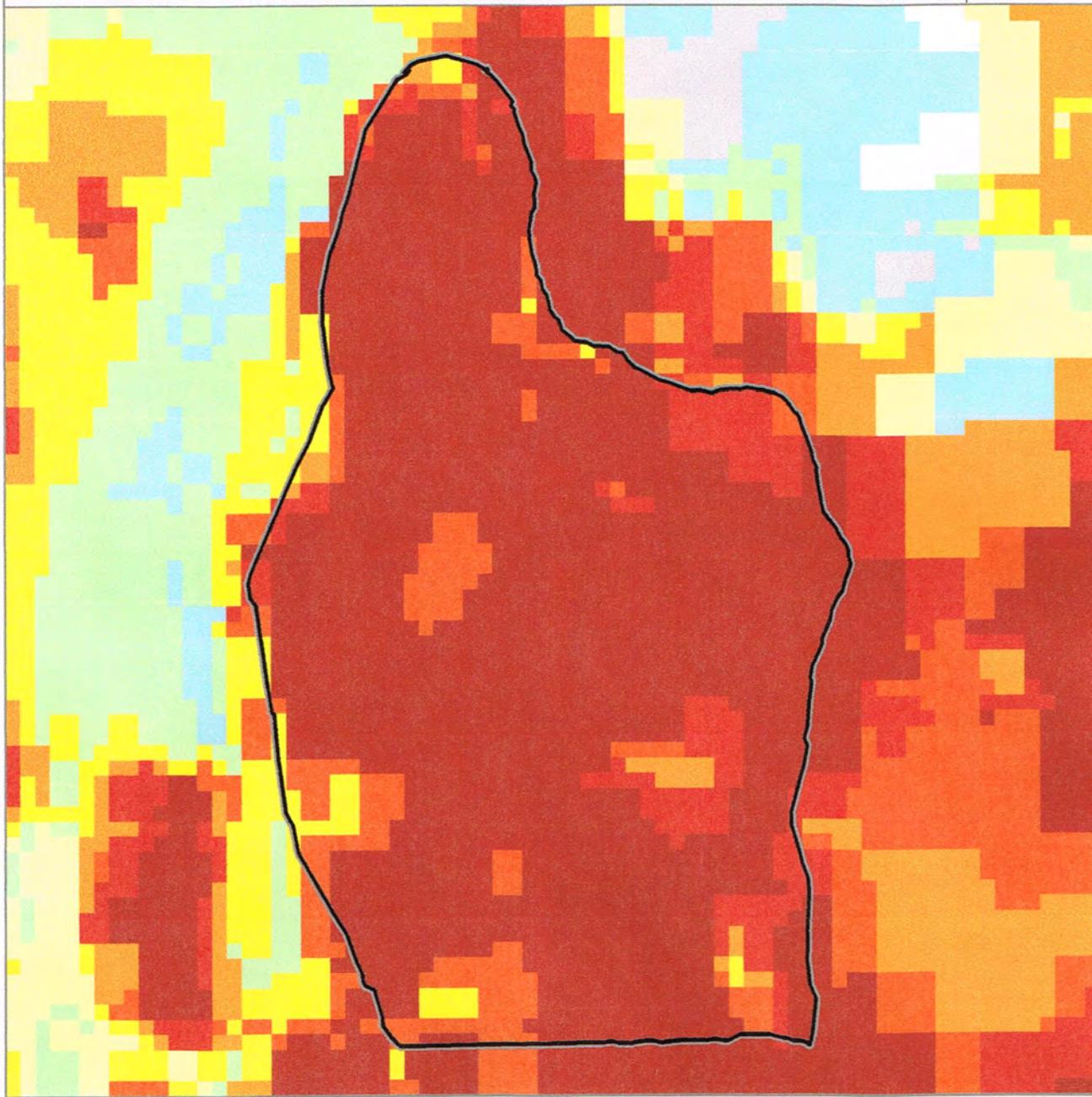
Riva Chase

WUI Risk Index



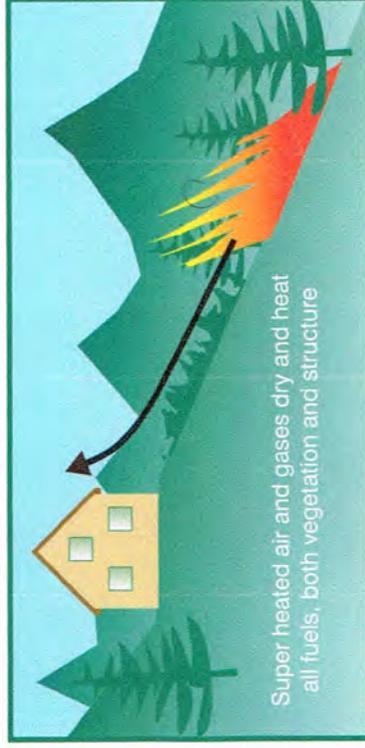
Date: 4/26/2013

Colorado Wildfire Risk Assessment
<http://www.coloradowildfirerisk.com>



Characteristic Rate of Spread

Characteristic Rate of Spread is the typical or representative rate of spread of a potential fire based on a weighted average of four percentile weather categories. Rate of spread is the speed with which a fire moves in a horizontal direction across the landscape, usually expressed in chains per hour (ch/hr) or feet per minute (ft/min). For purposes of the Colorado WRA, this measurement represents the maximum rate of spread of the fire front. Rate of Spread is used in the calculation of Wildfire Threat in the Colorado WRA.



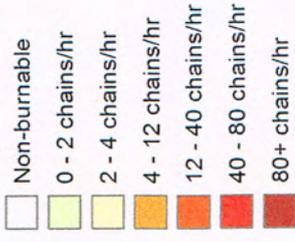
Rate of spread is a fire behavior output, which is influenced by three environmental factors - fuels, weather, and topography. Weather is by far the most dynamic variable as it changes frequently. To account for this variability, four percentile weather categories were created from historical weather observations to represent low, moderate, high, and extreme weather days for each weather influence zone in Colorado. A weather influence zone is an area where, for analysis purposes, the weather on any given day is considered uniform. There are 11 weather influence zones in Colorado.

This output represents the weighted average for all four weather percentiles. While not shown in this report, the individual percentile weather ROS outputs are available in the Colorado WRA data.

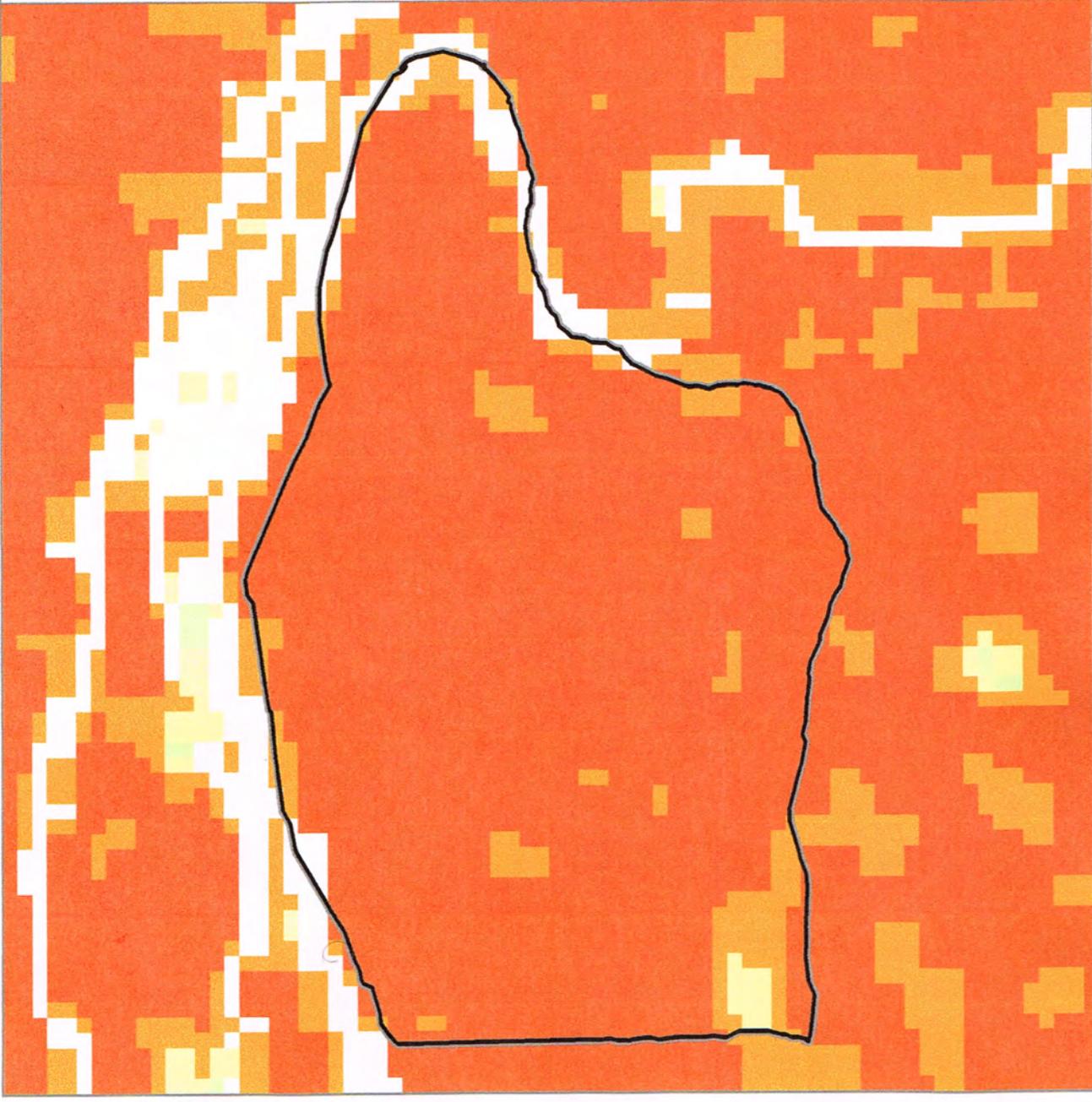
Rate of Spread	Acres	Percent
Non-Burnable	5	2.3%
Very Low (0 - 2 ch/hr)	0	0.0%
Low (2 - 4 ch/hr)	1	0.6%
Moderate (4 - 12 ch/hr)	19	8.0%
High (12 - 40 ch/hr)	208	89.1%
Very High (40 - 80 ch/hr)	0	0.0%
Extreme (80+ ch/hr)	0	0.0%
Total	233	100.0%

Riva Chase

Characteristic Rate of Spread



Date: 4/26/2013
Colorado Wildfire Risk Assessment
<http://www.coloradowildfirerisk.com>



Characteristic Flame Length

APPENDIX 8.4 – DEFENSIBLE SPACE FOR HOMESITES

- **Fire 2012 Defensible Space Guides**
- **Jefferson County Defensible Space Requirements**
- **Fire Wise Plant Materials**
- **Fire Resistant Landscapes**



QUICK GUIDE SERIES

FIRE 2012-1

Protecting Your Home from Wildfire: Creating Wildfire-Defensible Zones

Formerly CSU Extension Factsheet 6.302

If your home is located in the natural vegetation of Colorado's grasslands, shrublands, foothills or mountains, you live in the **wildland-urban interface** (WUI) and are inherently at risk from a wildfire. The WUI is any area where structures and other human developments meet or intermingle with wildland vegetative fuels. In many vegetation types, it is not a matter of *if* a wildfire will impact your home, but *when*.

Wildfires are a natural part of Colorado's varied forest ecosystems. Many rural communities are located in areas historically prone to frequent natural wildfires. Living in the wildland requires more self-reliance than living in urban areas. It may take longer for a fire engine to reach your area, and a small fire department can easily become overwhelmed during an escalating wildfire. Planning ahead and taking actions to reduce fire hazards can increase your safety and help protect your property. As more people choose to live in areas prone to wildfire, additional homes and lives are potentially threatened every year. Firefighters always do their best to protect rural residents, but ultimately, **it is YOUR responsibility to protect your life, family, animals and property from wildfire.**

The information contained in this document is for use by individual landowners to help reduce wildfire risk on their property. In order to effectively protect subdivisions and communities, all landowners must work together

to reduce fire hazards within and adjacent to communities. This includes treating individual home sites and common areas within communities, and creating fuelbreaks within and adjoining the community where feasible. This document will focus on actions individual landowners can take to reduce wildfire hazards on their property. For additional information on broader community protection, go to www.csfs.colostate.edu.



Figure 2: Colorado's grasslands, shrublands, foothills and mountains all have areas in the wildland-urban interface where human development meets wildland vegetative fuels. Photo: CSFS

In this guide, you'll read about steps you can take to protect your property from wildfire. These steps focus on beginning work closest to your house and moving outward. Also, remember that keeping your home safe is not a one-time effort – it requires ongoing maintenance. It may be necessary to perform some actions, such as removing pine needles from gutters and mowing grasses and weeds several times a year, while other actions may only need to be addressed once a year. While



Figure 1: Firefighters will do their best to protect homes, but ultimately it is the homeowner's responsibility to plan ahead and take actions to reduce fire hazards around structures. Photo: National Interagency Fire Center

This quick guide was produced by the Colorado State Forest Service to promote knowledge transfer.

October 2012
www.csfs.colostate.edu

you may not be able to accomplish ALL of the actions described in this document to prepare your home for wildfire, each completed activity will increase the safety of your home, and possibly your family, during a wildfire.

(Note: These guidelines are adapted for ponderosa pine, Douglas-fir and mixed-conifer ecosystems below 9,500 feet. See page 9 for guidelines adapted to other forest ecosystems.)

This guide primarily will help design your defensible space. **Defensible space** is the natural and landscaped area around a home or other structure that has been modified to reduce fire hazard. Defensible space gives your home a fighting chance against an approaching wildfire. Creating defensible space also reduces the chance of a structure fire spreading to the surrounding forest and other homes.

Three factors determine wildfire behavior: **fuels, weather and topography**. We cannot alter weather or topography, so we must concentrate on altering fuels. Fuels include vegetation, such as trees, brush and grass; near homes, fuels also include

such things as propane tanks, wood piles, sheds and even homes themselves. Some plant species are more flammable than others, and the flammability of vegetative fuels changes depending on the season, recent weather events, and other factors such as drought. Fuel continuity and density also play an important role in wildfire.

Wildfire often creates its own weather conditions. Hot rising air and associated winds can carry embers and other burning materials into the atmosphere for long distances, where they can ignite vegetation and structures up to several miles away. Embers have caused the loss of many homes during wildfires.

As you think about protecting your home and property from wildfire, consider how you can manage fuels on your property to prevent fire from spreading to your home and other structures.

For more information on wildfire behavior, please see [FireWise Construction: Site Design and Building Materials](http://www.csfs.colostate.edu) at www.csfs.colostate.edu.

Fuel Arrangement and Types

When fuels are abundant, a fire can be uncontrollable and destructive. But when fuels are scarce, a fire cannot build momentum and intensity, which makes it much easier to control and is more likely to be beneficial to the land.

The more dense and continuous the fuels, the bigger the threat they pose to your home. The measure of fuel hazard refers to its continuity, both horizontal and vertical. Horizontal continuity refers to fuels across the ground, while vertical continuity refers to fuels extending from the ground up into the crowns of trees and shrubs. Fuels with a high degree of both vertical and horizontal continuity are the most hazardous, particularly when they occur on slopes. Mitigation of wildfire hazards focuses on breaking up the continuity of horizontal and vertical fuels.

Heavier fuels, such as brush and trees, produce a more intense fire than light fuels, such as grass. However, grass-fueled fires travel much faster than heavy-fueled fires. Some heavier surface fuels, such as logs and wood chips, are potentially hazardous heavy fuels and also should be addressed.



Figure 3: Burning embers can be carried long distances by wind. Embers ignite structures when they land in gaps, crevices and other combustible places around the home. Photo: CSFS

Remember...

- **Reducing fuels around a home will increase the chances for survival in a wildfire, but there is no guarantee.**
- **This quick guide provides minimum guidelines. The more fuels you remove, the greater the chance your home will survive.**
- **Working with your neighbors and community will increase the effectiveness of your home's defensible space.**

Vertical/Ladder Fuels

Ladder fuels are defined as smaller trees and brush that provide vertical continuity, which allows a fire to burn from the ground level up into the branches and crowns of larger trees. Lower branches on large trees also can act as ladder fuels. These fuels are potentially very hazardous, but are easy to mitigate. The hazards from ladder fuels near homes are especially important to address. Prune all tree branches from ground level up to a height of 10 feet above ground or up to $\frac{1}{3}$ the height of the tree, whichever is less. Do not prune further up because it could jeopardize the health of the tree. Shrubs should be pruned based on specifications recommended for the species. Dead branches should be removed whenever possible.

Surface Fuels

Logs/Branches/Slash/Wood Chips

Naturally occurring woody material on the ground and debris from cutting down trees (also known as slash) may increase the intensity of fires. Increased fire intensity makes a fire harder to control and increases the likelihood of surface fires transitioning to crown fires. Dispose of any heavy accumulation of logs, branches and slash by chipping, hauling to a disposal site or piling for burning later. Always contact your county sheriff's office or local fire department first for information about burning slash piles. Another alternative is to lop and scatter slash by cutting it into very small pieces and distributing it widely over the ground. If chipping logs and/or slash, it's essential to avoid creating continuous areas of wood chips on the ground. Break up the layer of wood chips by adding nonflammable material, or allow for wide gaps (at least 3 feet) between chip accumulations. Also, avoid heavy accumulation of slash by spreading it closer to the ground to speed decomposition. If desired, two or three small, widely spaced brush piles may be left for wildlife habitat. Locate these well away from your home (NOT in Zones 1 or 2; see page 5-8 for zone descriptions).

Pine Needles/Duff Layers

Due to decades of fire suppression, decomposing layers of pine needles, twigs and other organic debris—called duff—is deeper under many large trees today than it would have been a century ago. This is especially true in ponderosa pine forests where frequent and naturally occurring fires have been absent. These large trees often are lost when fires occur, because flames burning in the duff layer can pre-heat live vegetation and ignite the trees, or the tree's roots can be damaged from the intense heat of the smoldering duff, killing the tree. It is important to rake needle or duff layers deeper than 2 inches at least 3 feet away from the base of large trees. This should be done annually, and the additional duff also should be removed from the area.

Grasses

Grasses are perhaps the most pervasive and abundant surface fuel in Colorado. Mow grasses and weeds as often as needed throughout the growing season to keep them shorter than 6 inches. This applies to irrigated lawns and wild or native grasses. This is critical in the fall, when grasses dry out, and in the spring, after the snow is gone but before plants green-up.

Be especially careful when mowing in areas with rocks. Mower blades can hit rocks and create sparks, causing fires in dry grass. Consider mowing only on days with high humidity or after recent moisture to reduce the risk of starting an unwanted fire.

When mowing around trees, be sure to avoid damaging the root system and tree trunk by using a higher blade setting on the mower and trimming grass that grows against the trunk only by hand.

Crown Fuels

An intense fire burning in surface fuels can transition into the upper portion of the tree canopies and become a crown fire. Crown fires are dangerous because they are very intense and can burn large areas. Crown fire hazard can be reduced by thinning trees to decrease crown fuels, reducing surface fuels under the remaining trees, and eliminating vertical fuel continuity from the surface into the crowns. Specific recommendations are provided in the Defensible Space Management Zones, pages 5-8.



Figure 4: Ladder fuels are shrubs and low branches that allow a wildfire to climb from the ground into the tree canopy. Photo: CSFS



Figure 5: Surface fuels include logs, branches, wood chips, pine needles, duff and grasses. Photo: CSFS



Figure 6: Tree canopies offer fuel for intense crown fires. Photo: Paul Mintier

The Home Ignition Zone



Figure 7: Addressing both components of the Home Ignition Zone will provide the best protection for your home. Credit: CSFS

Two factors have emerged as the primary determinants of a home's ability to survive a wildfire – the quality of the defensible space and a structure's ignitability. Together, these two factors create a concept called the **Home Ignition Zone (HIZ)**, which includes the structure and the space immediately surrounding the structure. To protect a home from wildfire, the primary goal is to reduce or eliminate fuels and ignition sources within the HIZ.

Structural Ignitability

The ideal time to address home ignition risk is when the structure is in the design phase. However, you can still take steps to reduce ignitability to an existing home.

The **roof** has a significant impact on a structure's ignitability because of its extensive surface area. When your roof needs significant repairs or replacement, use only fire-resistant roofing materials. Also, check with your county building department – some counties now have restrictions against using wood shingles for roof replacement or require specific classifications of roofing material. Wood and shake-shingle roofs are discouraged because they are highly flammable, and are prohibited in some areas of the state. Asphalt shingles, metal sheets and shingles, tile, clay tile, concrete and slate shingles are all recommended roofing materials.

The extension of the roof beyond the exterior structure wall is the eave. This architectural feature is particularly prone to ignition. As fire approaches the building, the exterior wall deflects hot air and gasses up into the eave. If the exterior wall isn't ignition-resistant, this effect is amplified.

Most **decks** are highly combustible. Their shape traps hot gasses, making them the ultimate heat traps. Conventional wooden decks are so combustible that when a wildfire approaches, the deck often ignites before the fire reaches the house.

The **exterior walls** of a home or other structure are affected most by radiant heat from the fire and, if defensible space is not adequate, by direct contact with flames from the fire.

Windows are one of the weakest parts of a building with regard to wildfire. They usually fail before the building ignites, providing a direct path for flames and airborne embers to reach the building's interior.

Burning embers are produced when trees and structures are consumed by wildfire. These embers sometimes can travel more than a mile. Flammable horizontal or nearly horizontal surfaces, such as wooden decks or shake-shingle roofs, are especially at risk for ignition from burning embers. Since airborne embers have caused the loss of many homes in the WUI, addressing structural ignitability is critical, even if the area surrounding a home is not conducive to fire spread.

This guide provides only basic information about structural ignitability. For more information on fire-resistant building designs and materials, refer to the CSFS *FireWise Construction: Site Design and Building Materials* publication at www.csfs.colostate.edu.



Figure 8: (above) Wood shingle roofs are highly flammable and not recommended. Photo: CSFS

Figure 9: (above right) Class A roofing materials including tile, clay, concrete, slate and asphalt shingles are fire-resistant options. Photo: CSFS



Figure 10: Decks, exterior walls and windows are important areas to examine when addressing structure ignitability. Photo: CSFS

Defensible Space

Defensible space is the area around a home or other structure that has been modified to reduce fire hazard. In this area, natural and manmade fuels are treated, cleared or reduced to slow the spread of wildfire. Creating defensible space also works in the reverse, and reduces the chance of a structure fire spreading to neighboring homes or the surrounding forest. Defensible space gives your home a fighting chance against an approaching wildfire.

Creating an effective defensible space involves a series of management zones in which different treatment techniques are used. Develop these zones around each building on your property, including detached garages, storage buildings, barns and other structures.

The actual design and development of your defensible space depends on several factors: size and shape of building(s), construction materials, slope of the ground, surrounding topography, and sizes and types of vegetation on your property. You may want to request additional guidance from your local Colorado State Forest Service forester, fire department or a consulting forester as you plan a defensible space for your property.

Defensible space provides another important advantage during a fire: increased firefighter safety. Firefighters are trained to protect structures only when the situation is relatively safe for them to do so. They use a process called “structural triage” to determine if it is safe to defend a home from an approaching wildfire. The presence or absence of defensible space around a structure is a significant determining factor used in the structural triage process, as defensible space gives firefighters an opportunity to do their job more safely. In turn, this increases their ability to protect your home.

If firefighters are unable to directly protect your home during a wildfire, having an effective defensible space will still increase your home’s chance of survival. It is important to remember that with wildfire, there are no guarantees. Creating a proper defensible space does not mean that your home is guaranteed to survive a wildfire, but it does significantly improve the odds.

Defensible Space Management Zones

Three zones need to be addressed when creating defensible space:

Zone 1 is the area nearest the home and other structures. This zone requires maximum hazard reduction.

Zone 2 is a transitional area of fuels reduction between Zones 1 and 3.

Zone 3 is the area farthest from the home. It extends from the edge of Zone 2 to your property boundaries.



Figure 11: Homesite before defensible space. Photo: CSFS



Figure 12: Homesite after creating a defensible space. Photo: CSFS

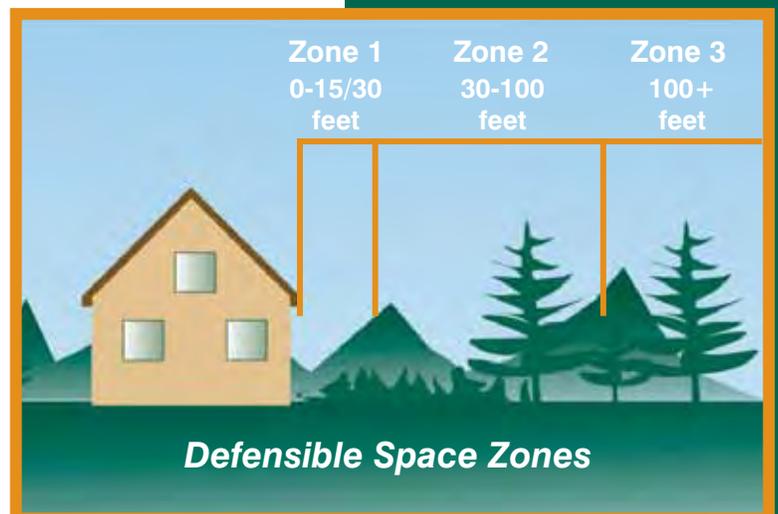


Figure 13: Defensible space management zones. Credit: CSFS

Zone 1

The width of Zone 1 extends a minimum distance of 15-30 feet outward from a structure, depending on property size. Most flammable vegetation is removed in this zone, with the possible exception of a few low-growing shrubs or fire-resistant plants. Avoid landscaping with common ground junipers, which are highly flammable.

Increasing the width of Zone 1 will increase the structure's survivability. This distance should be increased 5 feet or more in areas downhill from a structure. The distance should be measured from the outside edge of the home's eaves and any attached structures, such as decks. Several specific treatments are recommended within this zone:

- Install nonflammable ground cover and plant nothing within the first 5 feet of the house and deck. This critical step will help prevent flames from coming into direct contact with the structure. This is particularly important if a building is sided with wood, logs or other flammable materials. Decorative rock creates an attractive, easily maintained, nonflammable ground cover.
- If a structure has noncombustible siding (i.e., stucco, synthetic stucco, concrete, stone or brick), widely spaced foundation plantings of low-growing shrubs or other fire-resistant plant materials are acceptable. However, do not plant directly under windows or next to foundation vents, and be sure areas of continuous grass are not adjacent to plantings. Information on fire-resistant plants is available on the CSFS website at www.csfs.colostate.edu.
- Prune and maintain any plants in Zone 1 to prevent excessive growth. Also, remove all dead branches, stems and leaves within and below the plant.
- Irrigate grass and other vegetation during the growing season. Also, keep wild grasses mowed to a height of 6 inches or less.
- Do not store firewood or other combustible materials anywhere in this zone. Keep firewood at least 30 feet away from structures, and uphill if possible.
- Enclose or screen decks with $\frac{1}{8}$ -inch or smaller metal mesh screening ($\frac{1}{16}$ -inch mesh is preferable). Do not use areas under decks for storage.
- Ideally, remove all trees from Zone 1 to reduce fire hazards. The more trees you remove, the safer your home will be.
- If you do keep any trees in this zone, consider them part of the structure and extend the distance of the entire defensible space accordingly.
- Remove any branches that overhang or touch the roof, and remove all fuels within 10 feet of the chimney.
- Remove all pine needles and other debris from the roof, deck and gutters.
- Rake pine needles and other organic debris at least 10 feet away from all decks and structures.
- Remove slash, wood chips and other woody debris from Zone 1.

Zone 2

Zone 2 is an area of fuels reduction designed to diminish the intensity of a fire approaching your home. The width of Zone 2 depends on the slope of the ground where the structure is built. Typically, the defensible space in Zone 2 should extend at least 100 feet from all structures. If this distance stretches beyond your property lines, try to work with the adjoining property owners to complete an appropriate defensible space.



Figure 14: *This homeowner worked hard to create a defensible space around the home. Notice that all fuel has been removed within the first 5 feet of the home, which survived the Waldo Canyon Fire in the summer of 2012. Photo: Christina Randall, Colorado Springs Fire Department*



Figure 15: *Clearing pine needles and other debris from the roof and gutters is an easy task that should be done at least once a year. Photo: CSFS*



Figure 16: *Enclosing decks with metal screens can prevent embers from igniting a house. Photo: Marilyn Brown, La Plata County*

The following actions help reduce continuous fuels surrounding a structure, while enhancing home safety and the aesthetics of the property. They also will provide a safer environment for firefighters to protect your home.

Tree Thinning and Pruning

- Remove stressed, diseased, dead or dying trees and shrubs. This reduces the amount of vegetation available to burn, and makes the forest healthier.
- Remove enough trees and large shrubs to create at least 10 feet between crowns. Crown separation is measured from the outermost branch of one tree to the nearest branch on the next tree. On steep slopes, increase the distance between tree crowns even more.
- Remove all ladder fuels from under remaining trees. Prune tree branches off the trunk to a height of 10 feet from the ground or $\frac{1}{3}$ the height of the tree, whichever is less.
- If your driveway extends more than 100 feet from your home, thin out trees within a 30 foot buffer along both sides of your driveway, all the way to the main access road. Again, thin all trees to create 10-foot spacing between tree crowns.
- Small groups of two or three trees may be left in some areas of Zone 2, but leave a minimum of 30 feet between the crowns of these clumps and surrounding trees.
- Because Zone 2 forms an aesthetic buffer and provides a transition between zones, it is necessary to blend the requirements for Zones 1 and 3. For example, if you have a tree in Zone 2 with branches extending into Zone 1, the tree can be retained if there is proper crown spacing.
- Limit the number of dead trees (snags) to one or two per acre. Be sure snags cannot fall onto the house, power lines, roads or driveways.
- As in Zone 1, the more trees and shrubs removed, the more likely your house will survive a wildfire.



Figure 17: In Zone 2, make sure there is at least a 10-foot spacing between tree crowns. Credit: CSFS

Shrub Thinning/Pruning and Surface Fuels

- Isolated shrubs may be retained in Zone 2, provided they are not growing under trees.
- Keep shrubs at least 10 feet away from the edge of tree branches. This will prevent the shrubs from becoming ladder fuels.
- Minimum spacing recommendations between clumps of shrubs is $2\frac{1}{2}$ times the mature height of the vegetation. The maximum diameter of the clumps themselves should be twice the mature height of the vegetation. As with tree-crown spacing, all measurements are made from the edge of vegetation crowns.
- Example – For shrubs 6 feet high, spacing between shrub clumps should be 15 feet or more (measured from the edge of the crowns of vegetation clumps). The diameter of these shrub clumps should not exceed 12 feet.
- Periodically prune and maintain shrubs to prevent excessive growth, and remove dead stems from shrubs annually. Common ground junipers should be removed whenever possible because they are highly flammable and tend to hold a layer of duff beneath them.
- Mow or trim wild grasses to a maximum height of 6 inches. This is especially critical in the fall, when grasses dry out.
- Avoid accumulations of surface fuels, such as logs, branches, slash and wood chips greater than 4 inches deep.



Figure 18: Pruning trees will help prevent a wildfire from climbing from the ground to the tree crowns. Credit: CSFS

Firewood

- Stack firewood uphill from or on the same elevation as any structures, and at least 30 feet away.
- Clear all flammable vegetation within 10 feet of woodpiles.
- Do not stack wood against your home or on/under your deck, even in the winter. Many homes have burned as a result of a woodpile that ignited first.

Propane Tanks and Natural Gas Meters

- Locate propane tanks and natural gas meters at least 30 feet from any structures, preferably on the same elevation as the house.
- The tank should not be located below your house because if it ignites, the fire would tend to burn uphill. Conversely, if the tank or meter is located above your house and it develops a leak, gas will flow downhill into your home.
- Clear all flammable vegetation within 10 feet of all tanks and meters.
- Do not visibly screen propane tanks or natural gas meters with shrubs, vegetation or flammable fencing. Instead, install 5 feet of nonflammable ground cover around the tank or meter.



Figure 19: Keep firewood, propane tanks and natural gas meters at least 30 feet away from structures. Photo: CSFS

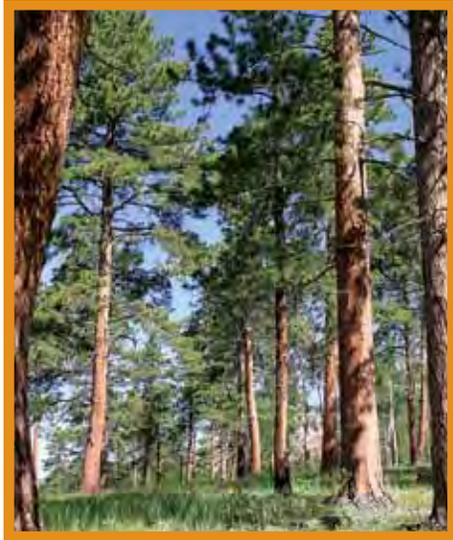


Figure 20: This ponderosa pine forest has been thinned, which will not only help reduce the wildfire hazard, but also increase tree health and vigor. Photo: CSFS

Zone 3

Zone 3 has no specified width. It should provide a gradual transition from Zone 2 to areas farther from the home that have other forest management objectives. Your local Colorado State Forest Service forester can help you with this zone.

This zone provides an opportunity for you to improve the health of the forest through proper management. With an assortment of stewardship options, you can proactively manage your forest to reduce wildfire intensity, protect water quality, improve wildlife habitat, boost the health and growth rate of your trees, and increase tree survivability during a wildfire.

In addition, properly managed forests can provide income, help protect trees against insects and diseases, and even increase the value of your property. Typical forest management objectives for areas surrounding home sites or subdivisions provide optimum recreational opportunities; enhance aesthetics; improve tree health and vigor; provide barriers against wind, noise, dust and visual intrusions; support production of firewood, fence posts and other forest commodities; or cultivate Christmas trees or trees for transplanting.

Consider the following when deciding forest management objectives in Zone 3:

- The healthiest forest is one that includes trees of multiple ages, sizes and species, and where adequate growing room is maintained over time.
- Remember to consider the hazards associated with ladder fuels. A forest with a higher canopy reduces the chance of a surface fire climbing into the tops of the trees, and might be a priority if this zone has steep slopes.
- A greater number of snags – two or three per acre, standing or fallen – can be retained in Zone 3 to provide wildlife habitat. These trees should have a minimum diameter of 8 inches. Make sure that snags pose no threat to power lines or firefighter access roads.
- While tree pruning generally is not necessary in Zone 3, it may be a good idea from the standpoint of personal safety to prune trees along trails and firefighter access roads. Or, if you prefer the aesthetics of a well-manicured forest, you might prune the entire area. In any case, pruning helps reduce ladder fuels within tree stands, thus reducing the risk of crown fire.
- Mowing grasses is not necessary in Zone 3.
- Any approved method of slash treatment is acceptable, including piling and burning, chipping or lop-and-scatter.

Other Recommendations

Windthrow

In Colorado, some tree species, including lodgepole pine, Engelmann spruce and Douglas-fir, are especially susceptible to damage and uprooting by high winds or windthrow. If you see evidence of this problem in or near your home, consider making adjustments to the defensible space guidelines. It is highly recommended that you contact a professional forester to help design your defensible space, especially if you have windthrow concerns.

Water Supply

If possible, make sure that an on-site water source is readily available for firefighters to use, or that other water sources are close by. Lakes, ponds, swimming pools and hot tubs are all possible options. If there are no nearby water sources, consider installing a well-marked dry hydrant or cistern. If your primary water source operates on electricity, be sure to plan for a secondary water source. During wildfires, structures often are cut off from electricity. For more information on how to improve the accessibility of your water source, contact your local fire department.

Recommendations for Specific Forest Types

The above recommendations refer primarily to ponderosa pine, Douglas-fir and mixed-conifer ecosystems. For other forest types, please refer to the additional recommendations below:

Aspen

Tree spacing and ladder fuel guidelines do not apply to mature stands of aspen trees. Generally, no thinning is recommended in aspen forests, regardless of tree size, because the thin bark is easily damaged, making the tree easily susceptible to fungal infections. However, in older stands, numerous dead trees may be on the ground and require removal. Conifer trees often start growing in older aspen stands. A buildup of these trees eventually will increase the fire hazard of the stand, so you should remove the young conifers. Brush also can increase the fire hazard and should be thinned to reduce flammability.

Lodgepole Pine

Lodgepole pine management in the WUI is much different than that for lodgepole pine forests located away from homes, communities and other developments. Normally, it is best to develop fuels management and wildfire mitigation strategies that are informed and guided by the ecology of the tree species. This is not the case with lodgepole pine.

Older lodgepole pine stands generally do not respond well to selective thinning, but instead respond better to the removal of all trees over a defined area to allow healthy forest regeneration. Selectively thinning lodgepole can open the stand to severe windthrow and stem breakage. However, if your home is located within a lodgepole pine forest, you may prefer selective thinning to the removal of all standing trees.

To ensure a positive response to thinning throughout the life of a lodgepole pine stand, trees must be thinned early in their lives – no later than 20 to 30 years after germination. Thinning lodgepole pine forests to achieve low densities can best be



Figure 21: During high winds, these lodgepole pine trees fell onto the house. Lodgepole pine is highly susceptible to windthrow. Photo: CSFS



Figure 22: Mature aspen stands can contain many young conifers, dead trees and other organic debris. This can become a fire hazard. Photo: CSFS



Figure 23: A young lodgepole pine stand. Thinning lodgepole pines early on in their lives will help reduce the wildfire hazard in the future. Photo: CSFS

The defensible space guidelines in this quick guide are predominantly for ponderosa pine and mixed-conifer forests. These guidelines will vary with other forest types.



Figure 24: Piñon-juniper forests are often composed of continuous fuels. Creating clumps of trees with large spaces in between clumps will break up the continuity. Photo: CSFS



Figure 25: Gambel oak needs to be treated in a defensible space at least every 5-7 years because of its vigorous growing habits. Photo: CSFS

accomplished by beginning when trees are small saplings, and maintaining those densities through time as the trees mature.

Thinning older stands of lodgepole pine to the extent recommended for defensible space may take several thinning operations spaced over a decade or more. When thinning mature stands of lodgepole pine, do not remove more than 30 percent of the trees in each thinning operation. Extensive thinning of dense, pole-sized and larger lodgepole pine often results in windthrow of the remaining trees. Focus on removing trees that are obviously lower in height or suppressed in the forest canopy. Leaving the tallest trees will make the remaining trees less susceptible to windthrow.

Another option is leaving clumps of 30-50 trees. Clumps are less susceptible to windthrow than solitary trees. Allow a minimum of 30-50 feet between tree crowns on the clump perimeter and any adjacent trees or clumps of trees. Wildfire tends to travel in the crowns of lodgepole pine. By separating clumps of trees with large spaces between crowns, the fire is less likely to sustain a crown fire.

Piñon-Juniper

Many piñon-juniper (PJ) forests are composed of continuous fuel that is highly flammable. Fire in PJ forests tend to burn intensely in the crowns of trees. Try to create a mosaic pattern when you thin these trees, with a mixture of individual trees and clumps of three to five trees. The size of each clump will depend on the size, health and location of the trees. The minimum spacing between individual trees should be 10 feet between tree crowns, with increasing space for larger trees, clumps, and stands on steeper slopes.

Tree pruning for defensible space is not as critical in PJ forests as in pine or fir forests. Instead, it is more important to space the trees so that it is difficult for the fire to move from one tree clump to the next. Trees should only be pruned to remove dead branches or branches that are touching the ground. However, if desired, live branches can be pruned to a height of 3 feet above the ground. Removing shrubs that are growing beneath PJ canopies is recommended to reduce the overall fuel load that is available to a fire.

It is NOT recommended to prune live branches or remove PJ trees between April and October, when the piñon ips beetle is active in western Colorado. Any thinning activity that creates the flow of sap in the summer months can attract these beetles to healthy trees on your property. However, it is acceptable to remove dead trees and dead branches during the summer months.

For more information, please refer to the CSFS [Piñon-Juniper Management Quick Guide](http://www.csfs.colostate.edu) at www.csfs.colostate.edu.

Gambel Oak

Maintaining Gambel oak forests that remain resistant to the spread of wildfire can be a challenge because of their vigorous growing habits. Gambel oak trees grow in clumps or groves, and the stems in each clump originate from the same root system. Most reproduction occurs through vegetative sprouts from this deep, extensive root system. You may need to treat Gambel oak near your home every five to seven years. Sprouts also should be mowed at least once every year in Zones 1 and 2. Herbicides can be used to supplement mowing efforts for controlling regrowth.

For more information, please refer to the CSFS [Gambel Oak Management](http://www.csfs.colostate.edu) publication at www.csfs.colostate.edu.

Note: This publication does not address high-elevation spruce-fir forests. For information on this forest type, please contact your local CSFS district office.

Maintaining Your Defensible Space

Your home is located in a dynamic environment that is always changing. Trees, grasses and shrubs continue to grow, die or are damaged, and drop their leaves and needles each season. Just like your home, the defensible space around it requires regular, ongoing maintenance to be effective. Use the following checklists to build and maintain your defensible space.

Defensible Space: Initial Projects

- Properly thin and prune trees and shrubs within Zones 1 and 2.
- Dispose of slash from tree/shrub thinning.
- Screen attic, roof, eaves and foundation vents, and periodically check them to ensure that they are in good condition.
- Screen or wall-in stilt foundations and decks; screens should be 1/8-inch or smaller metal mesh (1/16-inch mesh is best).
- Post signs at the end of the driveway with your last name and house number that are noncombustible, reflective and easily visible to emergency responders.
- Make sure that the driveway is wide enough for fire trucks to enter and exit, and that trees and branches are adequately cleared for access by fire and emergency equipment. Contact your local fire department or check the CSFS website for information specific to access.
- Take pictures of your completed defensible space for comparison of forest growth over time.



Figure 26: Keeping the forest properly thinned and pruned in a defensible space will reduce the chances of a home burning during a wildfire. Photo: CSFS

Defensible Space Tasks: Annual Requirements

- Clear roof, deck and gutters of pine needles and other debris. *
- Mow grass and weeds to a height of 6 inches or less. *
- Rake all pine needles and other flammable debris away from the foundation of your home and deck. *
- Remove trash and debris accumulations from the defensible space.*
- Check fire extinguishers to ensure that they have not expired and are in good working condition.
- Check chimney screens to make sure they are in place and in good condition.
- Remove branches that overhang the roof and chimney.
- Check regrowth of trees and shrubs by reviewing photos of your original defensible space; properly thin and prune trees and shrubs within Zones 1 and 2.
- Dispose of slash from tree/shrub thinning. *

*Address more than once per year, as needed.

Be Prepared

- Complete a checklist of fire safety needs inside your home (these should be available at your local fire department). Examples include having an evacuation plan and maintaining smoke detectors and fire extinguishers.
- Develop your fire evacuation plan and practice family fire drills. Ensure that all family members are aware of and understand escape routes, meeting points and other emergency details.
- Contact your county sheriff's office and ensure that your home telephone number and any other important phone numbers appear in the county's Reverse 911 or other emergency notification database.
- Prepare a "grab and go" disaster supply kit that will last at least three days, containing your family's and pets' necessary items, such as cash, water, clothing, food, first aid and prescription medicines.
- Ensure that an outdoor water supply is available. If it is safe to do so, make a hose and nozzle available for responding firefighters. The hose should be long enough to reach all parts of the house.



Figure 27: Sharing information and working with your neighbors and community will give your home and surrounding areas a better chance of surviving a wildfire. Photo: CSFS

Preparing your home and property from wildfire is a necessity if you live in the wildland-urban interface. It is important to adequately modify the fuels in your home ignition zone. Remember, every task you complete around your home and property will make your home more defensible during a wildfire.

Always remember that creating and maintaining an effective defensible space in the home ignition zone is not a one-time endeavor – it requires an ongoing, long-term commitment.

If you have questions, please contact your local CSFS district office. Contact information can be found at www.csfs.colostate.edu.

List of Additional Resources

- The Colorado State Forest Service, <http://www.csfs.colostate.edu>
- CSFS wildfire-related publications, <http://csfs.colostate.edu/pages/wf-publications.html>
- Community Wildfire Protection Planning, <http://csfs.colostate.edu/pages/community-wf-protection-planning.html>
- Colorado's "Are You FireWise?" information, <http://csfs.colostate.edu/pages/wf-protection.html>
- National Fire Protection Association's Firewise Communities USA, <http://www.firewise.org>
- Fire Adapted Communities, <http://fireadapted.org/>
- Ready, Set, Go!, <http://wildlandfirersg.org/>



Figure 28: *This house has a high risk of burning during an approaching wildfire. Modifying the fuels around a home is critical to reduce the risk of losing structures during a wildfire. Photo: CSFS*



Figure 29: *This house survived the Fourmile Canyon Fire in 2010. Photo: CSFS*



Figure 30: *Firefighters were able to save this house during the 2012 Weber Fire because the homeowners had a good defensible space. Photo: Dan Bender, La Plata County*

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How Do I

Create a defensible space around my homesite to meet the County's Wildfire regulations?



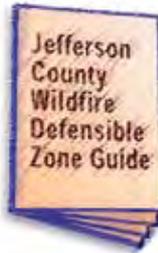
1. Talk with the Planning & Zoning Department

A Defensible Space Permit is required for:

- A new dwelling.
- Replacing an existing dwelling.
- An addition over 400 square feet of space.

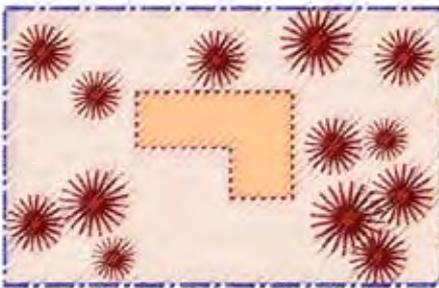
2. Defensible Zone Guide and a Checklist

When obtaining the permit, the Planning & Zoning Department will provide you with an requirements guide on creating a "Wildfire Defensible Zone" and a checklist of steps to follow to complete the Defensible Space Permit.

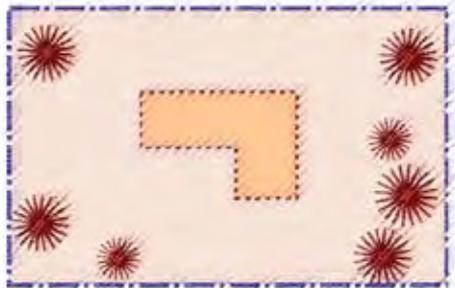


3. Start permit with County

- Contact one of the Approved Defensible Space Contractors from the list provided by Planning & Zoning to schedule appointment.
- Your chosen Forester will meet with you on the subject property and mark trees.
- Remove the marked trees from the property and call the Forester for a second inspection.
- The Forester inspects the property and sends a notice to the County if work is completed.



Before



After



4. Completion

Planning & Zoning lifts the restriction off the Building Permit and closes the Defensible Space Permit.



FORESTRY

FireWise Plant Materials

no. 6.305

by F.C. Dennis¹

Quick Facts...

FireWise landscaping can be aesthetically pleasing while reducing potential wildfire fuel.

Plant choice, spacing and maintenance are critical.

Your landscape, and the plants in it, must be maintained to retain their FireWise properties.

Creating a “defensible space” around your home is one of the most important and effective steps you can take to protect you, your family and your home from catastrophic wildfire. Defensible space is the area between a structure and an oncoming wildfire where nearby vegetation has been modified to reduce a wildfire’s intensity. (See fact sheet 6.302, *Creating Wildfire-Defensible Zones.*)

Many people resist creating defensible space around their homes because they believe these areas will be unattractive and unnatural. This is far from true. With careful planning, FireWise landscaping can be aesthetically pleasing while reducing potential wildfire fuel. It can actually enhance beauty and property values, as well as personal safety.

Many native plants are highly flammable during different seasons of the year. At such times, left unmanaged, they can accelerate the spread of a wildfire through your neighborhood, threatening homes, property and lives.

All vegetation, naturally occurring and otherwise, is potential fuel for fire. Its type, amount and arrangement has a dramatic effect on fire behavior. There are no truly “fireproof” plant species, so plant choice, spacing and maintenance are critical to defensible space landscaping. In fact, **where** and **how** you plant may be more important than **what** you plant. However, given alternatives, choose plant species that tend to be more resistant to wildfire.

General concepts to keep in mind when choosing and planting FireWise species are:

- A plant’s moisture content is the single most important factor governing its volatility. (However, *resin* content and other factors in some species render them flammable even when the plant is well-watered.) Conifers tend to be flammable due to their oil and pitch content, regardless of their water content.
- Deciduous plants tend to be more fire resistant because their leaves have higher moisture content and their basic chemistry is less flammable. Also, when deciduous trees are dormant, there is less fuel to carry fire through their canopies.

In some cases, there is a strong correlation between drought tolerance and fire resistance. For example, a plant may shed its leaves or needles during extreme drought. Other drought-tolerant species may have smaller leaves or thick, succulent leaves. These plants offer less fuel or have a higher moisture content, both of which help reduce fire hazard.

There also appears to be a correlation between a plant’s salt tolerance and natural fire resistance. Plants adapted to salty conditions, and actually growing in salty situations, may better resist burning.

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Putting Knowledge to Work

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FireWise Plant List

The following list was prepared by Phil Hoefer, Colorado State Forest Service. It was reviewed by Jim Knopf, a landscape architect in Boulder, and two landscape architects on Colorado's Western Slope. Bloom time is approximate (observed in Boulder at 5,600 feet).

Key: Water needs: VL = very low L = low M = medium H = high
 Sun/Shade: S = sun PS = part sun Sh = shade
 Elevation: Y = Yes N = No ? = Questionable or unknown

Scientific Name	Common Name	Approx.	Approx.	Elevation					Approx.	
		Water Needs	Sun/Shade Preference	Mature Height	(1,000 ft.)	5	6	7	8	9
Flowers and Ground Covers										
<i>Achillea lanulosa</i> ^a	Native yarrow	L-H	S/PS	1.5 - 2'	Y	Y	Y	Y	Y	Jul
<i>Achillea tomentosa</i> ^b	Woolly yarrow	M-H	S/PS	.5'	Y	Y	N	N	N	Jul
<i>Aconitum</i> spp. ^c	Monkshood	M-H	S	2'	Y	Y	Y	Y	Y	Jun-Jul
<i>Aconitum columbianum</i> ^{ac}	Columbian monkshood	M-H	S	2'	Y	Y	Y	Y	Y	Jun-Jul
<i>Ajuga reptans</i> ^b	Bugleweed	H	Sh	< .5'	Y	Y	Y	Y	Y	Jun-Jul
<i>Alchemilla</i> sp.	Lady's mantle	M-H	PS/Sh	1'	Y	Y	Y	Y	?	Jun-Jul
<i>Allium cernuum</i> ^{ac}	Nodding onion	L-H	S/PS	1'	Y	Y	Y	Y	Y	Jun
<i>Allium geyeri</i> ^{ac}	Geyer onion	L-H	S/PS	1'	Y	Y	Y	Y	?	Jun
<i>Anaphalis margaritacea</i> ^a	Pearly everlasting	L-H	S	1.5 - 2.5'	Y	Y	Y	Y	?	Aug
<i>Anemone blanda</i>	Windflower	M-H	S/PS	1'	Y	Y	Y	Y	?	Apr-May
<i>Antennaria parvifolia</i> ^{ab}	Small-leaf pussytoes	M	S/PS	<.5'	Y	Y	Y	Y	Y	Jun
<i>Antennaria rosea</i> ^{ab}	Rosy pussytoes	M	S/PS	<.5'	Y	Y	Y	Y	Y	Jun
<i>Aquilegia</i> spp.	Columbine	M-H	S/PS	1 - 2'	Y	Y	Y	Y	Y	Jun-Jul
<i>Aquilegia coerulea</i> ^a	Colorado blue columbine	M-H	S/PS	1 - 2'	Y	Y	Y	Y	Y	Jun-Jul
<i>Aquilegia chrysantha</i> ^a	Yellow columbine	M-H	S/PS	1 - 2'	Y	Y	Y	Y	Y	Jun-Aug
<i>Arabis</i> sp. ^b	Rockcress	L-H	S	< 1'	Y	Y	Y	Y	Y	May-Jun
<i>Armeria maritima</i>	Sea thrift	L-H	S/PS	.5'	Y	Y	Y	Y	Y	Apr-Jun
<i>Artemisia caucasica</i>	Caucasian sage	L-M	S/PS	1 - 2'	Y	Y	Y	?	?	n/a
<i>Artemisia frigida</i> ^{ac}	Fringed sage	L-M	S	1 - 1.5'	Y	Y	Y	Y	Y	n/a
<i>Artemisia ludoviciana</i> ^a	Prairie sage	L-M	S	1 - 1.5'	Y	Y	Y	?	?	n/a
<i>Aster laevis</i> ^a	Smooth aster	L-H	S/PS	1 - 3'	Y	Y	Y	Y	?	Aug-Sep
<i>Aster porteri</i> ^a	Porter aster	L-M	S	1'	Y	Y	Y	?	?	Aug-Sep
<i>Aubrieta</i> sp. ^b	False rockcress	M	S	1'	Y	Y	Y	Y	Y	Apr-May
<i>Aurinia</i> sp. ^b	Basket of gold	M	S/PS	1'	Y	Y	Y	Y	Y	Apr-May
<i>Calochortus gunnisonii</i> ^a	Mariposa lily	M-H	S	.5 - 2'	Y	Y	Y	Y	?	Jul-Aug
<i>Campanula rotundifolia</i> ^a	Common harebell	M-H	S	.5 - 1'	Y	Y	Y	Y	Y	May-Oct
<i>Centranthus ruber</i>	Jupiter's beard	L-H	S/Sh	2 - 2.5'	Y	Y	Y	Y	?	May-Oct
<i>Cerastium strictum</i> ^{ab}	Mouse ear chickweed	M	S/PS	1'	Y	Y	Y	Y	?	May-Jun
<i>Cerastium tomentosum</i> ^b	Snow-in-summer	L-M	S/PS	1'	Y	Y	Y	Y	Y	May-Jun
<i>Claytonia lanceolata</i> ^a	Spring beauty	M	Sh	.5 - 1.5'	Y	Y	Y	?	?	Mar-Apr
<i>Convallaria majalis</i> ^{bc}	Lily-of-the-valley	H	Sh	< 1'	Y	Y	Y	Y	?	May-Jun
<i>Delosperma nubigenum</i> ^b	Hardy yellow iceplant	M-H	S	.5'	Y	Y	Y	?	?	Jun
<i>Delphinium</i> spp. ^c	Delphinium	M-H	S/PS	.5 - 3'+	Y	Y	Y	Y	Y	Jun-Jul
<i>Dianthus</i> spp.	Pinks	L-H	S	<.5' - 2'	Y	Y	Y	Y	Y	May-Aug
<i>Doronicum</i> sp.	Leopard's bane	H	S/PS	2 - 3'	Y	Y	Y	Y	?	Jul-Aug
<i>Echinacea purpurea</i> ^a	Purple coneflower	M	S	2 - 3'	Y	Y	Y	Y	Y	Jul-Aug
<i>Epilobium angustifolium</i>	Fireweed	H	S/PS	3'	N	Y	Y	Y	Y	Jul-Aug
<i>Erigeron flagellaris</i> ^a	Whiplash daisy, trailing fleabane	L-M	S	< 1'	Y	Y	?	?	?	Jun-Jul
<i>Eriogonum umbellatum</i> ^a	Sulphur flower	M	S/PS	<.5'	Y	Y	Y	Y	Y	Jun-Jul
<i>Erysimum asperum</i> ^a	Western wallflower	M	S/PS	1'+	Y	Y	Y	Y	?	Jun-Jul
<i>Gaillardia aristata</i> ^a	Blanket flower	L-M	S	1 - 1.5'	Y	Y	Y	Y	Y	Jul-Sep
<i>Galium boreale</i> ^{ab}	Northern bedstraw	M-H	Sh	<1'	Y	Y	Y	Y	Y	May-Jun
<i>Geranium</i> spp.	Hardy geraniums	M	Sh/PS	2'	Y	Y	Y	Y	Y	May-Oct
<i>Geranium caespitosum</i> ^a	Wild geranium	M	Sh/PS	2'	Y	Y	Y	Y	Y	May-Oct
<i>Geum triflorum</i>	Prairie smoke	M-H	S/PS	1.5'	Y	Y	Y	?	?	Jun
<i>Helianthella quinquenervis</i> ^a	Aspen sunflower	M	S	1'	?	?	?	Y	Y	?
<i>Helianthemum nummularium</i>	Rockrose	M-H	S	< 1'	Y	Y	Y	?	?	May-Jun
<i>Helianthus pumilus</i> ^a	Small sunflower	M	S	1 - 2'	Y	Y	Y	?	?	Jun-Jul
<i>Heuchera</i> spp.	Coral bells	M-H	PS/Sh	1 - 2'	Y	Y	Y	Y	Y	Jun-Aug
<i>Ipomopsis aggregata</i> ^a	Scarlet gilia	M	S/PS	1 - 2'	Y	Y	Y	Y	Y	Jun-Aug
<i>Iris germanica</i>	Bearded iris	L-M	S	1 - 3'	Y	Y	Y	Y	Y	May-Jun

Scientific Name	Common Name	Approx. Water Needs	Sun/Shade Preference	Approx. Mature Height	Elevation (1,000 ft.)					Approx. Bloom Month
					5	6	7	8	9	
<i>Iris missouriensis</i> ^{ac}	Missouri iris	M-H	S	1 - 2'	Y	Y	Y	Y	Y	May
<i>Lamium</i> sp. ^b	Dead nettle	M-H	Sh	< 1'	Y	Y	Y	Y	?	May-Jun
<i>Lavandula</i> spp.	Lavender	L-M	S	1 - 2'	Y	Y	Y	?	?	Jun-Nov
<i>Leucocrinum montanum</i> ^a	Sand lily	L-M	S	< 1'	Y	Y	Y	?	?	May
<i>Liatris punctata</i> ^a	Dotted gayfeather	VL-L	S	1 - 2'	Y	Y	Y	Y	Y	Aug-Oct
<i>Linum lewisii</i> ^{ac}	Wild blue flax	L-H	S/PS	1 - 2'	Y	Y	Y	Y	Y	May-Sep
<i>Lupinus argenteus</i> ^{ac}	Silver lupine	M	Sh/PS	1 - 3'	Y	Y	Y	Y	Y	Jun-Jul
<i>Mertensia lanceolata</i> ^a	Narrow-leaved chiming bells	M-H	Sh/PS	1 - 2'	Y	Y	Y	Y	Y	May-Jun
<i>Mimulus guttatus</i> ^a	Yellow monkey-flower	H	Sh	1'	?	Y	Y	Y	Y	?
<i>Monarda fistulosa</i> ^a	Native beebalm	M-H	S/PS	1 - 2'	Y	Y	Y	Y	Y	Jul-Oct
<i>Oenothera caespitosa</i> ^a	White stemless evening primrose	L-M	S	1 - 2'	Y	Y	Y	Y	Y	Jun-Aug
<i>Papaver orientale</i>	Oriental poppy	H	S/Sh	2 - 3'	Y	Y	Y	Y	Y	May-Jun
<i>Penstemon caespitosus</i> ^{ab}	Mat penstemon	L-M	S	< .5'	Y	Y	Y	Y	Y	Jun
<i>Penstemon secundiflorus</i>	Sidebells	L-M	S	1 - 2'	Y	Y	Y	Y	?	May-Jun
<i>Penstemon teucrioides</i> ^a	Germander penstemon	L-M	S	.5'	Y	Y	Y	?	?	Jun-Jul
<i>Penstemon virens</i> ^{ac}	Blue mist penstemon	M	S/PS	.5'	Y	Y	Y	Y	Y	May-Jun
<i>Phlox subulata</i>	Moss phlox	M	S	< .5'	Y	Y	Y	Y	Y	May
<i>Polemonium</i> sp.	Jacob's ladder	H	S/PS	1 - 2'	Y	Y	Y	Y	Y	May-Aug
<i>Potentilla fissa</i> ^a	Leafy potentilla	M-H	PS	1'	Y	Y	Y	Y	?	?
<i>Potentilla verna</i> ^b	Spring potentilla	M-H	PS	< .5'	Y	Y	Y	Y	Y	Mar-May
<i>Pulsatilla patens</i> ^a	Pasque flower	M	S/PS	1'	Y	Y	Y	Y	Y	Mar-May
<i>Ratibida columnifera</i> ^a	Prairie coneflower	L-M	S	2'	Y	Y	Y	Y	Y	Jul-Sep
<i>Rudbeckia hirta</i> ^a	Black-eyed Susan	M-H	S	2 - 3'	Y	Y	Y	Y	Y	Jul-Sep
<i>Salvia officinalis</i>	Cooking sage	L-M	S/PS	2'	Y	Y	Y	Y	?	Jun
<i>Saxifraga hirsuta</i>	Saxifrage	H	S/PS	.5'+	Y	Y	Y	Y	Y	May-Jun
<i>Scutellaria brittonii</i> ^a	Skullcap	M	S/PS	.5 - 1'	Y	Y	Y	Y	?	Aug-Sep
<i>Sedum</i> spp. ^b	Stonecrop	M	S/PS	1 - 1.5'	Y	Y	Y	Y	Y	Jul-Aug
<i>Sedum lanceolatum</i> ^a	Yellow stonecrop	M	S/PS	.5'	Y	Y	Y	Y	Y	Jul-Aug
<i>Sempervivum</i> sp.	Hens and chicks	L-M	S/PS	.5'	Y	Y	Y	Y	Y	n/a
<i>Senecio spartioides</i> ^{ac}	Broom groundsel	VL-L	S	2 - 3'	Y	Y	?	?	?	Sep-Oct
<i>Solidago missouriensis</i> ^a	Smooth goldenrod	L-M	S	1 - 2'	Y	Y	Y	Y	?	Jul-Aug
<i>Thalictrum fendleri</i> ^a	Fendler meadowrue	H	S/PS	2 - 3'	?	?	Y	Y	Y	Jul-Aug
<i>Thermopsis divaricarpa</i> ^a	Spreading golden banner	M-H	S/PS	2'	Y	Y	Y	Y	?	May
<i>Tradescantia occidentalis</i> ^a	Western spiderwort	M	S/PS	1.5'	Y	Y	Y	Y	?	Jun-Aug
<i>Thymus</i> spp. ^b	Thyme	L-M	S	< .5'	Y	Y	Y	Y	Y	Jun-Jul
<i>Veronica pectinata</i>	Speedwell	L-M	S	< .5'	Y	Y	Y	Y	Y	Apr-Jul
<i>Vinca minor</i> ^b	Periwinkle, myrtle	H	Sh	< 1'	Y	Y	Y	Y	?	Apr-Jun
<i>Waldsteinia</i> sp. ^b	Barren strawberry	M-H	Sh/PS	< 1'	Y	Y	Y	Y	?	May-Jun

Shrubs

<i>Arctostaphylos nevadensis</i> ^{ab}	Pinemat manzanita	M	S/PS	1 - 2'	Y	Y	Y	N	N	n/a
<i>Arctostaphylos patula</i> ^a	Greenleaf manzanita	M	S/PS	3 - 4'	Y	Y	Y	N	N	n/a
<i>Arctostaphylos uva-ursi</i> ^{ab}	Kinnikinnick, bearberry	M	S/Sh	1'	Y	Y	Y	Y	Y	n/a
<i>Betula glandulosa</i> ^a	Bog birch	H	S/PS	6 - 8'	Y	Y	Y	Y	Y	n/a
<i>Calluna</i> sp.	Heather	H	S/PS	2'	Y	Y	Y	?	?	Jul-Aug
<i>Ceanothus fendleri</i> ^a	Buckbrush, mountain lilac	M	S	2'	Y	Y	Y	?	?	Jul
<i>Cercocarpus intricatus</i> ^a	Little-leaf mountain mahogany	VL-L	S	4 - 6'	Y	Y	Y	Y	?	n/a
<i>Cercocarpus montanus</i> ^{ac}	True mountain mahogany	L-M	S	4 - 6'	Y	Y	Y	Y	?	n/a
<i>Chrysothamnus</i> spp. ^a	Rabbitbrush	VL-L	S	2 - 6'	Y	Y	Y	Y	Y	Jul-Aug
<i>Cornus stolonifera</i> ^a	Redtwig dogwood	H	S/Sh	4 - 6'	Y	Y	Y	Y	Y	n/a
<i>Cotoneaster horizontalis</i>	Spreading cotoneaster	M	S/PS	2 - 3'	Y	Y	Y	Y	?	May-Jun
<i>Daphne burkwoodii</i>	Burkwood daphne	M	S/PS	2 - 3'	Y	Y	Y	?	?	Apr-Jun
<i>Erica</i> sp.	Heath	H	S/PS	1'	Y	Y	Y	?	?	Jan-Mar
<i>Euonymus alatus</i>	Burning bush euonymus	M	S/Sh	1 - 6'	Y	Y	Y	?	?	n/a
<i>Fallugia paradoxa</i> ^a	Apache plume	VL-L	S	2 - 4'	Y	Y	Y	Y	Y	Jun-Oct
<i>Holodiscus dumosus</i> ^a	Ocean spray, cliff/rock spirea	L-M	S/PS	4'	Y	Y	Y	Y	Y	Jun
<i>Jamesia americana</i> ^a	Wax flower	M-H	S/Sh	2 - 6'	Y	Y	Y	Y	Y	Jun
<i>Lonicera tatarica</i>	Tatarian honeysuckle	M	S/PS	4 - 6'	Y	Y	Y	Y	Y	May-Jun
<i>Mahonia aquifolium</i>	Oregon grape holly	M-H	S/Sh	4 - 6'	Y	Y	Y	?	?	May-Jun

Scientific Name	Common Name	Approx. Water Needs	Sun/Shade Preference	Approx. Mature Height	Elevation (1,000 ft.)					Approx. Bloom Month
					5	6	7	8	9	
<i>Mahonia repens</i> ^{ab}	Creeping grape holly	L-H	S/Sh	1 - 2'	Y	Y	Y	Y	Y	Mar-May
<i>Philadelphus microphyllus</i> ^a	Little-leaf mockorange	M	S	2 - 3'	Y	Y	Y	Y	?	Jun
<i>Physocarpus monogynus</i> ^a	Mountain ninebark	M	S/Sh	2 - 4'	Y	Y	Y	Y	Y	Jun
<i>Potentilla fruticosa</i> ^a	Shrubby cinquefoil	M	S/PS	2 - 3'	Y	Y	Y	Y	Y	May-Sep
<i>Prunus besseyi</i> ^a	Western sand cherry	L-M	S	1 - 3'	Y	Y	Y	Y	?	May
<i>Purshia tridentata</i> ^a	Antelope bitterbrush	L-M	S	1 - 2'	Y	Y	Y	?	?	Jun-Aug
<i>Ribes aureum</i> ^a	Golden currant	M	S/PS	2 - 3'	Y	Y	Y	Y	Y	Apr-May
<i>Rosa woodsii</i> ^a	Woods' or native wild rose	M	S/PS	2 - 3'	Y	Y	Y	Y	Y	Jun-Jul
<i>Shepherdia canadensis</i> ^d	Russet buffaloberry	M-H	S	5 - 6'	Y	Y	Y	Y	Y	n/a
<i>Symphoricarpos</i> spp. ^d	Snowberry, coralberry	M	S/PS	2 - 3'	Y	Y	Y	Y	Y	n/a
<i>Viburnum edule</i> ^a	Highbush cranberry	H	S	6 - 8'	Y	Y	Y	Y	Y	May-Jun
<i>Yucca baccata</i> ^a	Banana or broad-leaf yucca	VL-L	S/PS	2 - 3'	Y	Y	Y	N	N	Jun
<i>Yucca filamentosa</i>	Adam's needle	M	S/PS	2 - 3'	Y	Y	Y	N	N	Jun
<i>Yucca glauca</i> ^a	Spanish bayonet, small soapweed, Great Plains yucca	VL-L	S/PS	2 - 3'	Y	Y	Y	Y	?	Jun

Large Shrubs and Trees

<i>Acer ginnala</i>	Ginnala maple	M-H	S	6 - 10'	Y	Y	Y	Y	Y	n/a
<i>Acer glabrum</i> ^a	Rocky Mountain maple	M-H	S/Sh	6 - 10'	Y	Y	Y	Y	Y	n/a
<i>Acer grandidentatum</i> ^a	Wasatch maple	M	S/PS	10 - 20'	Y	Y	Y	Y	?	n/a
<i>Alnus tenuifolia</i> ^a	Thinleaf alder	H	S/PS	6 - 8'	Y	Y	Y	Y	Y	Apr
<i>Amelanchier alnifolia</i> ^{ac}	Saskatoon alder-leaf serviceberry	M	S/PS	6 - 8'	Y	Y	Y	Y	Y	Apr-May
<i>Amelanchier utahensis</i> ^a	Utah serviceberry	VL-M	S	4 - 6'	Y	Y	N	N	N	May
<i>Betula fontinalis</i> ^a	River birch	H	S/PS	6 - 8'	Y	Y	Y	Y	?	n/a
<i>Cercocarpus ledifolius</i> ^a	Mountain mahogany	VL-L	S	6 - 15'	Y	Y	?	N	N	n/a
<i>Corylus cornuta</i> ^a	Filbert, beaked hazelnut	H	S/Sh	5 - 6'	Y	Y	Y	?	?	n/a
<i>Crataegus</i> spp. ^a	Hawthorn (several native)	M	S	6 - 8'	Y	Y	Y	Y	?	May
<i>Fraxinus pennsylvanica</i>	Green ash	M-H	S	20 - 25'	Y	Y	Y	Y	?	n/a
<i>Gleditsia triacanthos</i>	Honeylocust	M-H	S	60 - 70'	Y	Y	N	N	N	May
<i>Malus</i> sp.	Crabapple	M	S	10 - 15'	Y	Y	Y	Y	N	Apr-May
<i>Physocarpus opulifolius</i> ^a	Tall ninebark	M	S/PS	4 - 6'	Y	Y	Y	?	N	May
<i>Populus tremuloides</i> ^a	Aspen	M	S	8 - 25'	Y	Y	Y	Y	Y	n/a
<i>Prunus americana</i> ^a	American wild plum	M	S/PS	4 - 6'	Y	Y	Y	Y	N	Apr
<i>Prunus cerasifera</i> ^c	Flowering plum	M	S/PS	8 - 10'	Y	Y	Y	?	N	Apr
<i>Prunus pensylvanica</i> ^{ac}	Pin/fire/wild/red cherry	M	S/PS	6 - 8'	Y	Y	Y	?	N	May
<i>Prunus virginiana melanocarpa</i> ^{ac}	Western chokecherry	M-H	S/PS	6 - 8'	Y	Y	Y	Y	Y	Apr-May
<i>Rubus deliciosus</i> ^a	Boulder raspberry, thimbleberry	M	S/Sh	4 - 6'	Y	Y	Y	Y	Y	Apr-May
<i>Salix amygdaloides</i> ^a	Peachleaf willow	H	S/PS	20 - 30'	Y	Y	Y	Y	?	n/a
<i>Shepherdia argentea</i> ^a	Silver buffaloberry	M	S/PS	4 - 6'	Y	Y	Y	Y	?	Apr
<i>Sorbus scopulina</i> ^a	Western mountain ash	M-H	S/Sh	6 - 8'	Y	Y	Y	Y	?	May
<i>Syringa vulgaris</i>	Common lilac	M	S	6 - 8'	Y	Y	Y	Y	Y	May

^a Native species.

^b Ground cover plant.

^c This species, or some species in this genus, may be poisonous to livestock, pets, wildlife and/or people under some conditions. Before planting, check with Colorado State University Cooperative Extension, Colorado State Forest Service, or other knowledgeable personnel.

^d Several species of *symphoricarpos* are native.

Plants for a FireWise Landscape

Plants that are more resistant to wildfire have one or more of the following characteristics:

- They grow without accumulating large amounts of combustible dead branches, needles or leaves (example: aspen).
- They have open, loose branches with a low volume of total vegetation (examples: currant and mountain mahogany).
- They have low sap or resin content (examples: many deciduous species).
- They have high moisture content (examples: succulents and some herbaceous species).
- They grow slowly and need little maintenance (do not need frequent pruning).
- They are short and grow close to the ground (examples: wildflowers and groundcovers).
- They can resprout following fire, thus reducing relandscaping costs (example: aspen).



Conifers

In Colorado, conifers make up much of our natural forest. Because of their high resin content, they are more susceptible to fire.

Even though conifers are flammable, you do not need to remove all of them from around your home. Wildfire hazards usually can be effectively reduced through proper thinning and pruning of existing trees and shrubs.

When choosing conifers for your defensible space, consider those with characteristics that make them better able to survive fire:

- thick bark,
- long needles, or
- self-pruning. (Self-pruning trees lose lower branches naturally, leaving a greater distance between ground and canopy.)

Additional FireWise Guidelines

Some additional tips to follow when planning a FireWise landscape include:

- Landscape according to the recommended defensible-space zones. The plants nearest your home should be more widely spaced and smaller than those farther away.
- Plant in small, irregular clusters and islands, not in large masses.
- Break up the continuity of the vegetation (fuel) with decorative rock, gravel and stepping stone pathways. This will help modify fire behavior and slow its spread across your property.
- Plant a variety of types and species. Besides being aesthetically pleasing, this will help ensure a healthier forest by reducing insects and diseases. Healthy, vigorous, thinned forests can better resist catastrophic fires than unhealthy ones with insect and disease problems.
- In the event of drought and water rationing, prioritize the plants you wish to save. Provide supplemental water to those nearest your home, perhaps using “gray water.”
 - Mulch to conserve moisture and reduce weed growth. Mulch can be organic (wood chips or small bark pieces) or inorganic (gravel or rock). Avoid pine bark, thick layers of pine needles or other materials that can easily carry fire.



Don't Forget Maintenance

A landscape is a dynamic, constantly changing system. Plants considered “fire resistant” and that have low fuel volumes can lose these characteristics over time. Your landscape, and the plants in it, must be maintained to retain their FireWise properties.



FIREWISE is a multi-agency program that encourages the development of defensible space and the prevention of catastrophic wildfire.

Be aware of the growth habits of the plants on your land and of the changes that occur seasonally. Keep a watchful eye for the need to reduce fuel volumes and fuel continuity.

- Remove annual, herbaceous plants after they have gone to seed or when the stems become overly dry.
- Rake up and dispose of litter as it builds up over the season.
- Mow or trim grasses to a low height within your defensible space. This is especially important as they begin to cure and dry.
- Remove plant parts damaged by snow, wind, frost or other agents.
- Timely pruning is critical. It not only reduces fuel volume but also maintains healthier plants with more succulent, vigorous growth.

Additional FireWise Publications

Cooperative Extension

The following publications are available from The Other Bookstore, Colorado State University Cooperative Extension, 115 General Services Bldg., Fort Collins, CO 80523-4061; (970) 491-6198; resourcecenter@ucm.colostate.edu. Printed copies cost \$1; they are available free on our Web site at www.cerc.colostate.edu:

- 6.302, *Creating Wildfire-Defensible Zones*
- 6.303, *Fire-Resistant Landscaping*
- 6.304, *Fire Safety, Evacuation and Home Defense*
- 6.306, *Grass Seed Mixes for the Reduction of Wildfire Hazard*
- 7.205, *Pruning Evergreens*
- 7.206, *Pruning Shrubs*
- 7.207, *Pruning Deciduous Trees*
- 7.402, *Protecting Trees During Construction*

Colorado State Forest Service

The following publication is available from the Colorado State Forest Service, Colorado State University, Fort Collins, CO 80523-5060; (970) 491-6303:

- *Home Fire Protection in the Wildland Urban Interface*, CSFS #142-399



This fact sheet was produced in cooperation with the Colorado State Forest Service.

¹ *Wildfire Hazard Mitigation Coordinator, Colorado State Forest Service.*

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FORESTRY

Fire-Resistant Landscaping

no. 6.303

by F.C. Dennis¹

Quick Facts...

More people are moving into Colorado's rural areas, increasing the chances of wildfire.

"Defensible space" is the primary determinant of a structure's ability to survive wildfire.

Native species are generally the best plant materials for landscaping in defensible space, but others can be grown successfully in Colorado.

To be a FireWise homeowner, plan well, plant well and maintain well.

Colorado's population is growing, its urban areas are rapidly expanding, and people are building more homes in what was once natural forest and brushlands. Newcomers to rural areas need to know how to correctly landscape their property to reduce wildfire hazards.

Improper landscaping worries land managers and fire officials because it can greatly increase the risk of structure and property damage from wildfire. It is a question of *when*, not *if*, a wildfire will strike any particular area.

Vegetative clearance around the house (defensible space) is a primary determinant of a home's ability to survive wildfire. Defensible space is, simply, room for firefighters to do their job. If grasses, brush, trees and other common forest fuels are removed, reduced, or modified to lessen a fire's intensity and keep it away from the home, chances increase that the structure will survive. It is a little-known fact that in the absence of a defensible space, firefighters will often bypass a house, choosing to make their stand at a home where their safety is more assured and the chance to successfully protect the structure is greater.

Landscaping Defensible Space

People often resist creating defensible space because they believe that it will be unattractive, unnatural and sterile-looking. It doesn't have to be! Wise landowners carefully plan landscaping within the defensible space. This effort yields a many-fold return of beauty, enjoyment and added property value. Development of defensible space is outlined in fact sheet 6.302, *Creating Wildfire-Defensible Zones*.

Colorado has great diversity in climate, geology and vegetation. Home and cabin sites can be found from the foothills through 10,000-foot elevations. Such extremes present a challenge in recommending plants. While native plant materials generally are best, a wide range of species can be grown successfully in Colorado.

Many plant species are suitable for landscaping in defensible space. Use restraint and common sense, and pay attention to plant arrangement and maintenance. It has often been said that *how* and *where* you plant are more important than *what* you plant. While this is indeed true, given a choice among plants, choose those that are more resistant to wildfire.

Consider the following factors when planning, designing and planting the FireWise landscape within your home's defensible space:

- Landscape according to the recommended defensible-space zones. That is, the plants near your home should be more widely spaced and lower growing than those farther away.
- Do not plant in large masses. Instead, plant in small, irregular clusters or islands.

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The best tree species to plant generally are those naturally occurring on or near the site.

Mow grass short around shrubs.

Plant low-growing, nonresinous shrubs near structures.

Keep grass mown around structures to a maximum of 8 inches.

Plant wildflowers near structures only if they are well-irrigated and cut back during the dormant season.

Gravel area or mow grass short next to the structure.

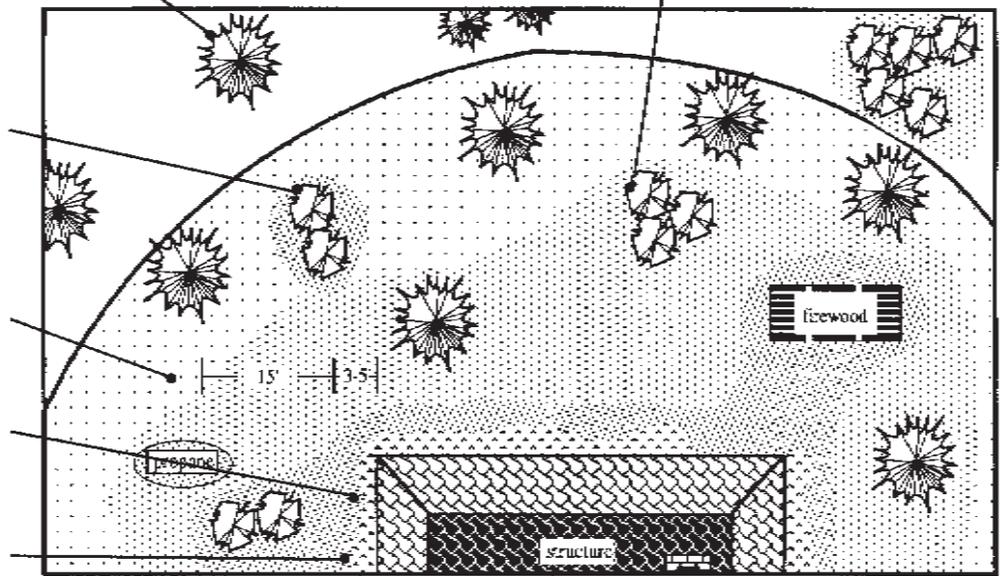


Figure 1: Forested property surrounding a homesite; shows optimum placement of vegetation near the structure.

- Use decorative rock, gravel and stepping stone pathways to break up the continuity of the vegetation and fuels. This can modify fire behavior and slow the spread of fire across your property.
- Incorporate a diversity of plant types and species in your landscape. Not only will this be visually satisfying, but it should help keep pests and diseases from causing problems within the whole landscape.
- In the event of drought and water rationing, prioritize plants to be saved. Provide available supplemental water to plants closest to your house.
- Use mulches to conserve moisture and reduce weed growth. Mulch can be organic or inorganic. Do not use pine bark, thick layers of pine needles or other mulches that readily carry fire.
- Be creative! Further vary your landscape by including bulbs, garden art and containers for added color.

References

- 6.302, Creating Wild-Fire Defensible Zones
- 6.304, Forest Home Fire Safety
- 6.305, FireWise Plant Materials
- 6.306, Grass Seed Mixes to Reduce Wildfire Hazard
- 7.205, Pruning Evergreens
- 7.206, Pruning Shrubs
- 7.207, Pruning Deciduous Trees
- 7.233, Wildflowers for Colorado
- 7.406, Flowers for Mountain Communities
- 7.423, Trees and Shrubs for Mountain Areas
- 7.413, Ground Covers for Mountain Communities

Grasses

During much of the year, grasses ignite easily and burn rapidly. Tall grass will quickly carry fire to your house. Mow grasses low in the inner zones of the defensible space. Keep them short closest to the house and gradually increase height outward from the house, to a maximum of 8 inches. This is particularly important during fall, winter and before green-up in early spring, when grasses are dry, dormant and in a “cured” fuel condition. Given Colorado’s extremely variable weather, wildfires can occur any time of the year. Maintenance of the grassy areas around your home is critical.

Mow grasses low around the garage, outbuildings, decks, firewood piles, propane tanks, shrubs, and specimen trees with low-growing branches.

Ground Cover Plants

Replace bare, weedy or unsightly patches near your home with ground covers, rock gardens, vegetable gardens and mulches. Ground cover plants are a good alternative to grass for parts of your defensible space. They break up the monotony of grass and enhance the beauty of your landscape. They provide a



Figure 2: Ladder fuels enable fire to travel from the ground surface into shrubs and then into the tree canopy.

variety of textures and color and help reduce soil erosion. Consider ground cover plants for areas where access for mowing or other maintenance is difficult, on steep slopes and on hot, dry exposures.

Ground cover plants are usually low growing. They are succulent or have other FireWise characteristics that make them useful, functional and attractive. When planted in beds surrounded by

walkways and paths, in raised beds or as part of a rock garden, they become an effective barrier to fire spread. The ideal groundcover plant is one which will spread, forming a dense mat of roots and foliage that reduces soil erosion and excludes weeds.

Mulch helps control erosion, conserve moisture and reduce weed growth. It can be organic (compost, leaf mold, bark chips, shredded leaves) or it can be inorganic (gravel, rock, decomposing granite).

When using organic mulches, use just enough to reduce weed and grass growth. Avoid thick layers. When exposed to fire, they tend to smolder and are difficult to extinguish. Likewise, while your property might yield an abundance of needles from your native pines or other conifers, don't use them as mulch because they can readily catch and spread wildfire. Rake, gather and dispose of them often within your defensible space.

Wildflowers

Wildflowers bring variety to a landscape and provide color from May until frost. Wildflower beds give a softer, more natural appearance to the otherwise manicured look often resulting from defensible space development.

A concern with wildflowers is the tall, dense areas of available fuel they can form, especially in dormancy. To reduce fire hazard, plant wildflowers in widely separated beds within the defensible space. Do not plant them next to structures unless the beds are frequently watered and weeded and vegetation is promptly removed after the first hard frost. Use gravel walkways, rock retaining walls or irrigated grass areas mowed to a low height to isolate wildflower beds from each other and from other fuels.

Shrubs

Shrubs lend color and variety to the landscape and provide cover and food for wildlife. However, shrubs concern fire professionals because, as the next level in the "fuel continuum," they can add significantly to total fuel loading. Because of the woody material in their stems and branches, they are a potential source of fire brands. When carried in the smoke column ahead of the main fire, fire brands can rapidly spread the fire in a phenomenon known as "spotting."

But the primary concern with shrubs is that they are a "ladder fuel" – they can carry a relatively easy-to-control surface grass fire into tree crowns. Crown fires are difficult, sometimes impossible, to control (see Figure 2).

To reduce the fire-spreading potential of shrubs, plant only widely separated, low-growing, nonresinous varieties close to structures. Do not plant them directly beneath windows or vents or where they might spread under wooden decks. Do not plant shrubs under tree crowns or use them to screen propane tanks, firewood piles or other flammable materials. Plant shrubs individually, as specimens, or in small clumps apart from each other and away from any trees within the defensible space.

Mow grasses low around shrubs. Prune dead stems from shrubs annually. Remove the lower branches and suckers from species such as Gambel oak to raise the canopy away from possible surface fires.

Structural Elements of a FireWise Landscape

When building a deck or patio, use concrete, flagstone or rock instead of wood. These materials do not burn and do not collect flammable debris like the space between planks in wooden decking.

Where appropriate on steeper ground, use retaining walls to reduce the steepness of the slope. This, in turn, reduces the rate of fire spread. Retaining walls also act as physical barriers to fire spread and help deflect heat from the fire upwards and away from structures.

Rock or masonry walls are best, but even wooden tie walls constructed of heavy timbers will work. Put out any fires burning on tie walls after the main fire front passes.

On steep slopes, consider building steps and walkways around structures. This makes access easier for home maintenance and enjoyment. It also serves as a physical barrier to fire spread and increases firefighters' speed and safety as they work to defend your home.



FIREWISE is a multi-agency program that encourages the development of defensible space and the prevention of catastrophic wildfire.



This fact sheet was produced in cooperation with the Colorado State Forest Service.

¹Wildfire Hazard Mitigation Coordinator, Colorado State Forest Service.

Trees

Trees provide a large amount of available fuel for a fire and can be a significant source of fire brands if they do burn. Radiant heat from burning trees can ignite nearby shrubs, trees and structures.

Colorado's elevation and temperature extremes limit tree selection. The best species to plant generally are those already growing on or near the site. Others may be planted with careful selection and common sense.

If your site receives enough moisture to grow them, plant deciduous trees such as aspen or narrow-leaf cottonwood. These species, even when planted in dense clumps, generally do not burn well, if at all. The greatest problem with these trees is the accumulation of dead leaves in the fall. Remove accumulations close to structures as soon as possible after leaf drop.

When site or available moisture limits recommended species to evergreens, carefully plan their placement. Do not plant trees near structures. Leave plenty of room between trees to allow for their growth. Spacing within the defensible space should be at least 10 feet between the edges of tree crowns. On steep ground, allow even more space between crowns. Plant smaller trees initially on a 20- to 25-foot spacing to allow for tree growth. At some point, you will have to thin your trees to retain proper spacing.

As the trees grow, prune branches to a height of 10 feet above the ground. Do not overprune the crowns. A good rule of thumb is to remove no more than one-third of the live crown of the tree when pruning. Prune existing trees as well as ones you planted.

Some trees (for example, Colorado blue spruce) tend to keep a full crown. Other trees grown in the open may also exhibit a full growth habit. Limit the number of trees of this type within the defensible space. Prune others as described above and mow grasses around such specimen trees.

Maintenance

A landscape is a dynamic system that constantly grows and changes. Plants considered fire resistant and that have low fuel volumes can lose these characteristics over time. Your landscape, and the plants in it, must be maintained to retain their FireWise properties.

- Always keep a watchful eye towards reducing the fuel volumes available to fire. Be aware of the growth habits of the plants within your landscape and of the changes that occur throughout the seasons.
- Remove annuals and perennials after they have gone to seed or when the stems become overly dry.
- Rake up leaves and other litter as it builds up through the season.
- Mow or trim grasses to a low height within your defensible space. This is particularly important as grasses cure.
- Remove plant parts damaged by snow, wind, frost or other agents.
- Timely pruning is critical. Pruning not only reduces fuel volumes but also maintains healthier plants by producing more vigorous, succulent growth.
- Landscape maintenance is a critical part of your home's defense system. Even the best defensible space can be compromised through lack of maintenance. The old adage "An ounce of prevention is worth a pound of cure" applies here.

Colorado State University, U.S. Department of Agriculture, and Colorado counties cooperating. Cooperative Extension programs are available to all without discrimination. No endorsement of products mentioned is intended nor is criticism implied of products not mentioned.

APPENDIX 8.5 – BIOCRUZ INVENTORY

Riva Chase Stand Table

BioCruz Program

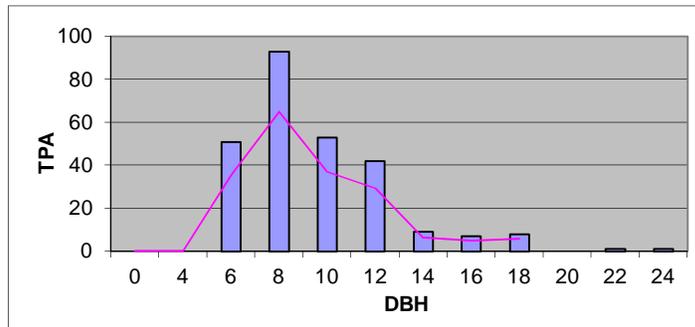
BAF:20 Points Sampled:6 Avg # Trees/Plot:7

Stand Name: Mixed Conifer Species:All Species

Limit of error at 1 Standard Deviation= 15%

Living and Dead Trees

	DBH	10	20	30	40	50	60	TOTAL
Stems	4	0	0	0	0	0	0	0
CUVOL	4	0	0	0	0	0	0	0
SCRIB	4	0	0	0	0	0	0	0
Stems	6	0	0	0	0	51	0	51
CUVOL	6	0	0	0	0	227	0	227
SCRIB	6	0	0	0	0	254	0	254
Stems	8	0	10	36	0	48	0	93
CUVOL	8	0	35	163	0	381	0	579
SCRIB	8	0	76	256	0	1013	0	1346
Stems	10	0	0	17	5	12	18	53
CUVOL	10	0	0	131	56	160	273	620
SCRIB	10	0	0	302	178	546	969	1995
Stems	12	0	0	17	12	0	13	42
CUVOL	12	0	0	175	176	0	270	621
SCRIB	12	0	0	491	607	0	1041	2139
Stems	14	0	0	3	6	0	0	9
CUVOL	14	0	0	48	120	0	0	169
SCRIB	14	0	0	169	455	0	0	625
Stems	16	0	0	2	2	2	0	7
CUVOL	16	0	0	47	52	66	0	166
SCRIB	16	0	0	180	215	278	0	674
Stems	18	0	0	0	2	6	0	8
CUVOL	18	0	0	0	52	210	0	262
SCRIB	18	0	0	0	221	905	0	1126
Stems	20	0	0	0	0	0	0	0
CUVOL	20	0	0	0	0	0	0	0
SCRIB	20	0	0	0	0	0	0	0
Stems	22	0	0	0	0	1	0	1
CUVOL	22	0	0	0	0	72	0	72
SCRIB	22	0	0	0	0	332	0	332
Stems	24	0	0	0	0	0	1	1
CUVOL	24	0	0	0	0	0	88	88
SCRIB	24	0	0	0	0	0	448	448
Stems	TOTAL	0	10	76	27	120	32	265
CUVOL	TOTAL	0	35	565	457	1116	630	2803
SCRIB	TOTAL	0	76	1399	1677	3329	2458	8939



Pink Line is Harvest Schedule

APPENDIX 8.6 – FUELBREAK GUIDELINES



Fuelbreak Guidelines for Forested Subdivisions & Communities

By

Frank C. Dennis



Knowledge to Go Places

This publication was developed for use by foresters, planners, developers, homeowners' associations and others. Implementation of these measures cannot *guarantee* safety from all wildfires, but will greatly increase the probability of containing them at more manageable levels.



Inadequate fire planning can result in loss of life or property and costly suppression activities.



Colorado's forested lands are experiencing severe impacts from continuing population increases and peoples' desire to escape urban pressures. Subdivisions and developments are opening new areas for homesite construction at an alarming rate, especially along the Front Range and around recreational areas such as Dillon, Vail, and Steamboat Springs.

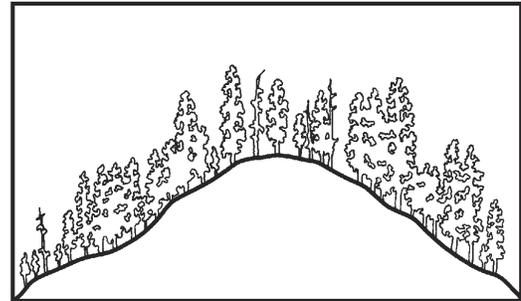
But with development inevitably comes a higher risk of wildfire as well as an ever-increasing potential for loss of life and property. Methods of fire suppression, pre-suppression needs, and homeowner and fire crew safety must all be considered in the planning and review of new developments as well as for the "retrofitting" of existing, older subdivisions.

Fuelbreaks should be considered in fire management planning for subdivisions and developments; however, the following are guidelines **only**. They should be customized to local areas by professional foresters experienced in Rocky Mountain wildfire behavior and suppression tactics.

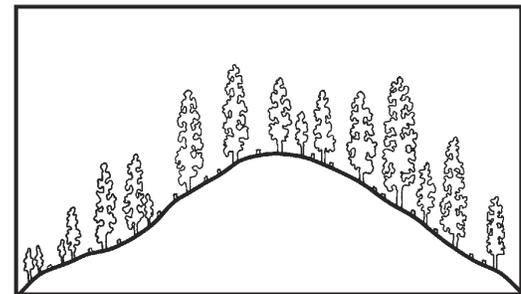
Fuelbreak vs Firebreak

Although the term fuelbreak is widely used in Colorado, it is often confused with firebreak. The two are entirely separate, and aesthetically different, forms of forest fuel modification and treatment.

- A firebreak is strip of land, 20 to 30 feet wide (or more), in which all vegetation is removed down to bare, mineral soil each year prior to fire season.



Above, cross section of mixed conifer stand before fuelbreak modification. Below, after modification.



- A fuelbreak (or shaded fuelbreak) is an easily accessible strip of land of varying width (depending on fuel and terrain), in which fuel density is reduced, thus improving fire control opportunities. The stand is thinned, and remaining trees are pruned to remove ladder fuels. Brush, heavy ground fuels, snags, and dead trees are disposed of and an open, park-like appearance is established.

The following is a discussion of the uses, limitations, and specifications of fuelbreaks in wildfire control and fuels management.

Fuelbreak Limitations

Fuelbreaks provide quick access for wildfire suppression. Control activities can be conducted more safely due to low fuel volumes. Strategically located, they break up large, continuous tracts of dense timber, thus limiting uncontrolled spread of wildfire.

Fuelbreaks can aid firefighters greatly by slowing fire spread under normal burning conditions. However, under extreme conditions, even the best fuelbreaks stand little chance of arresting a large



Before and after photos of a forest stand thinned to reduce fuel loads.

fire, regardless of firefighting efforts. Such fires, in a phenomenon called “spotting,” can drop firebrands 1/8-mile or more ahead of the main fire, causing very rapid fire spread. These types of large fires may continue until there is a major change in weather conditions, topography, or fuel type.

It is critical to understand: A fuelbreak is the line of defense. The area (including any homes and developments) between it and the fire may remain vulnerable.

In spite of these somewhat gloomy limitations, fuelbreaks have proven themselves effective in Colorado. During the 1980 Crystal Lakes Subdivision Fire near Fort Collins, crown fires were stopped in areas with fuelbreak thinnings, while other areas of dense lodgepole pine burned completely. A fire at O’Fallon Park in Jefferson County was successfully stopped and controlled at a fuelbreak. The Buffalo Creek Fire in Jefferson County (1996) and the High Meadow Fire in Park and Jefferson Counties (2000) slowed dramatically wherever intense forest thinnings had been completed. During the 2002 Hayman Fire, Denver Water’s entire complex of offices, shops and caretakers’ homes at Cheesman Reservoir were saved by a fuelbreak with no firefighting intervention by a fuelbreak.



Burned area near Cheesman Reservoir as a result of the Hayman Fire. Note the unburned green trees in the middle right of the photo, a treated fuelbreak.

The Need For A Fuelbreak

Several factors determine the need for fuelbreaks in forested subdivisions, including: (1) potential problem indicators; (2) wildfire hazard areas; (3) slope; (4) topography; (5) crowning potential; and (6) ignition sources.

Potential Problem Indicator

The table below explains potential problem indicators for various hazards and characteristics common to Colorado’s forest types. All major forest types, except aspen, indicate a high potential for wildfire hazard.

Fuel Type	Characteristics			Hazards			
	Aesthetics	Wildlife	Soil	Wildfire	Avalanche	Flood	Climate
Aspen	2	3	3	2	4	3	2
Douglas-fir	2	2	3	5	2	2	3
Greasewood-Saltbrush	4	2	2	2	1	3	3
Limber-Bristlecone Pine	3	2	4	3	4	2	5
Lodgepole Pine	2	2	3	5	4	2	4
Meadow	5	4	4	2	3	4	3
Mixed Conifer	2	1	1	5	3	1	3
Mountain Grassland	5	3	4	3	3	2	4
Mountain Shrub	3	5	4	4	2	2	3
Piñon-Juniper	2	3	4	4	2	3	2
Ponderosa Pine	2	3	1	5	2	2	3
Sagebrush	4	4	3	3	3	2	3
Spruce-Fir	2	3	3	4	5	3	4

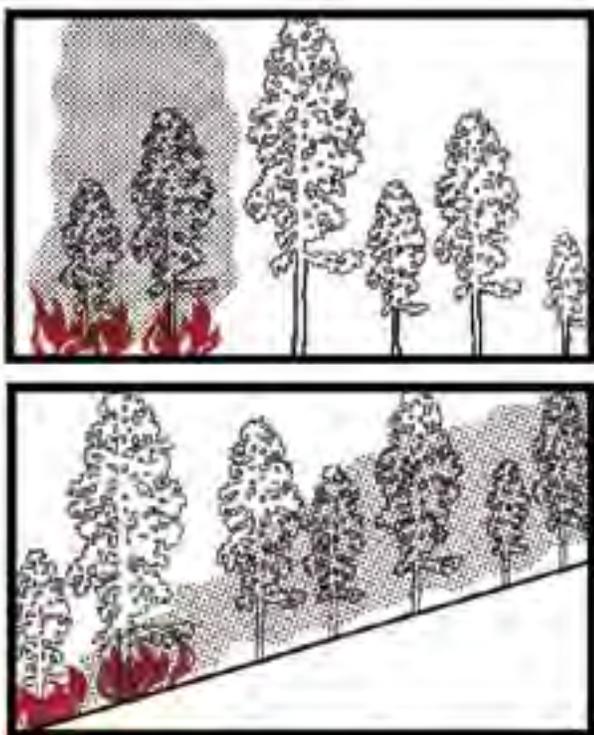
Legend: 5 – Problem may be crucial; 4 – Problem very likely; 3 – Exercise caution; 2 – Problem usually limited; 1 – No rating possible

Wildfire Hazard Maps

The Colorado State Forest Service (CSFS), numerous counties and some National Forests have completed wildfire hazard mapping for many areas within Colorado, particularly along the Front Range. These maps typically consider areas with 30 percent or greater slope; hazardous fuel types; and hazardous topographic features such as fire chimneys. Wildfire Hazard Ratings may be depicted in several ways. Whatever system is used, areas rated moderate or higher should be considered for fuel modification work.

Slope

Rate of fire spread increases as the slope of the land increases. Fuels are preheated by the rising smoke column or they may even come into contact with the flames themselves.



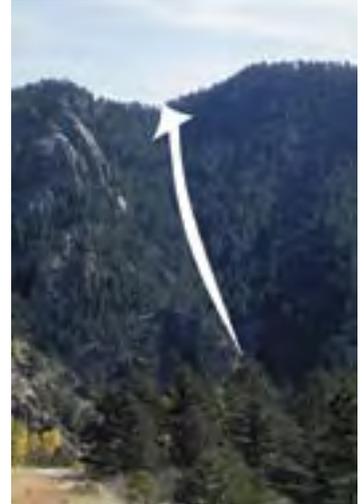
Fire effects, flat vs steep terrain. Note preheating of fuels on steep ground from passage of smoke column.

At 30 percent slope, rate of fire spread doubles compared to rates at level ground, drastically reducing firefighting effectiveness. **Areas near 30 percent or greater slopes are critical and must be reviewed carefully.**

Topography

Certain topographic features influence fire spread and should be evaluated. Included are fire chimneys, saddles, and V-shaped canyons. They are usually recognized by reviewing standard U.S.G.S. quad maps.

- Chimneys are densely vegetated drainages on slopes greater than 30 percent. Wind, as well as air pre-heated by a fire, tends to funnel up these drainages, rapidly spreading fire upslope.



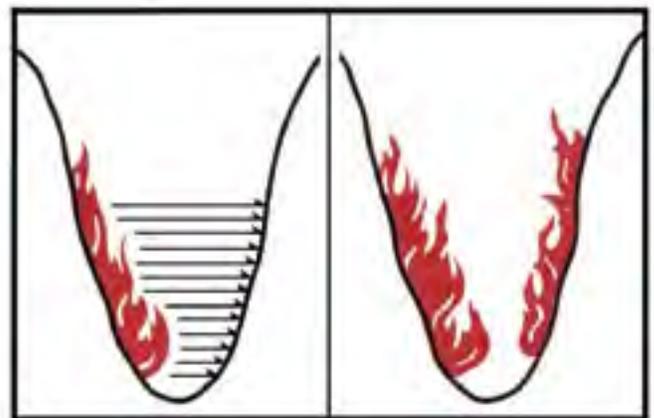
Chimney.

- Saddles are low points along a main ridge or between two high points. Like chimneys, they also funnel winds to create a natural fire path during a fire's uphill run. Saddles act as corridors to spread fire into adjacent valleys or drainages.



Saddle.

- Narrow, V-shaped valleys or canyons can ignite easily due to heat radiating from one side to the other. For example, a fire burning on one side of a narrow valley dries and preheats fuels on the opposite side until the fire "flashes over." The natural effect of slope on fire then takes over and fire spreads rapidly up drainage and uphill along both sides of the valley.



Flashover in V-shaped valley.

Crowning Potential

An on-site visit is required to accurately assess crowning potential. A key, below, helps determine this rating. Fuel modification is usually unnecessary if an area has a rating of 3 or less.

Crowning Potential Key

	Rating
A. Foliage present, trees living or dead — B	
B. Foliage living — C	
C. Leaves deciduous or, if evergreen, usually soft, pliant, and moist; never oily, waxy, or resinous.	0
CC. Leaves evergreen, not as above — D	
D. Foliage resinous, waxy, or oily — E	
E. Foliage dense — F	
F. Ladder fuels plentiful — G	
G. Crown closure > 75 percent	9
GG. Crown closure < 75 percent	7
FF. Ladder fuels sparse or absent — H	
H. Crown closure > 75 percent	7
HH. Crown closure < 75 percent	5
EE. Foliage open — I	
I. Ladder fuel plentiful	4
II. Ladder fuel sparse or absent	2
DD. Foliage not resinous, waxy, or oily — J	
J. Foliage dense — K	
K. Ladder fuels plentiful — L	
L. Crown closure > 75 percent	7
LL. Crown closure < 75 percent	4
KK. Ladder fuels sparse or absent — M	
M. Crown closure > 75 percent	5
MM. Crown closure < 75 percent	3
JJ. Foliage open — N	
N. Ladder fuels plentiful	3
NN. Ladder fuels sparse or absent	1
BB. Foliage dead	0

The majority of dead trees within the fuelbreak should be removed. Occasionally, large, dead trees (14 inches or larger in diameter at 4 1/2 feet above ground level) may be retained as wildlife trees. If retained, all ladder fuels must be cleared from around the tree's trunk.

Ignition Sources

Possible ignition sources, which may threaten planned or existing developments, must be investigated thoroughly. Included are other developments and homes, major roads, recreation sites, railroads, and other possible sources. These might be distant from the proposed development,

yet still able to channel fire into the area due to slope, continuous fuels, or other topographic features.

Fuelbreak Locations

In fire suppression, an effective fire line is connected, or "anchored," to natural or artificial fire barriers. Such anchor points might be rivers, creeks, large rock outcrops, wet meadows, or a less flammable timber type such as aspen. Similarly, properly designed and constructed fuelbreaks take advantage of these same barriers to eliminate "fuel bridges." (Fire often escapes control because of fuel bridges that carry the fire across control lines.)

Since fuelbreaks should normally provide quick, safer access to defensive positions, they are necessarily linked with road systems. Connected with county-specified roads within subdivisions, they provide good access and defensive positions for firefighting equipment and support vehicles. Cut-and fill slopes of roads are an integral part of a fuelbreak as they add to the effective width of modified fuels.

Fuelbreaks without an associated road system, such as those located along strategic ridge lines, are still useful in fire suppression. Here, they are often strengthened and held using aerial retardant drops until fire crews can walk in or be ferried in by helicopter.

Preferably, fuelbreaks are located along ridge tops to help arrest fires at the end of their runs. However, due to homesite locations and resource values, they can also be effective when established at the base of slopes. Mid-slope fuelbreaks are least desirable, but under certain circumstances and with modifications, these too, may be valuable.

Fuelbreaks are located so that the area under management is broken into small, manageable units. Thus, when a wildfire reaches modified fuels, defensive action is more easily taken, helping to keep the fire small. For example, a plan for a subdivision might recommend that fuelbreaks break up continuous forest fuels into units of 10 acres or less. This is an excellent plan, especially if defensible space thinning is completed around homes and structures, and thinning for forest management and forest health are combined with the fuelbreak.

When located along ridge tops, continuous length as well as width are critical elements. Extensive long-range planning is essential in positioning these types of fuelbreaks.

Aesthetics

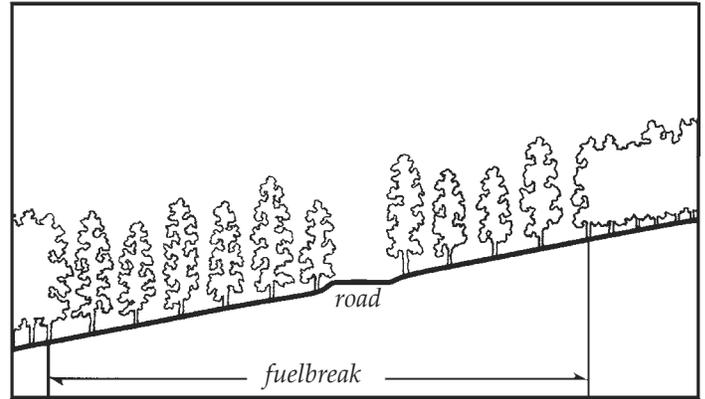
Improperly planned fuelbreaks can adversely impact an area's aesthetic qualities. Careful construction is necessary when combining mid-slope fuelbreaks with roads involving excessive cut-and-fill.



These photos, far- and near- views of the same site, illustrate that forest can be thinned without impacting aesthetics.

Care must also be taken in areas that are not thinned throughout for fuel hazard reduction. In such cases the fuelbreak visually sticks out like a "sore thumb" due to contrasting thinned and unthinned portions of the forest. (Especially noticeable are those portions of the fuelbreak above road cuts).

These guidelines are designed to minimize aesthetic impacts. However, some situations may require extensive thinning and, thus, result in a major visual change to an area. Additional thinning beyond the fuelbreak may be necessary to create an irregular edge and to "feather," or blend, the fuelbreak thinning into the unthinned portions of the forest. Any thinning beyond the fuelbreak improves its effectiveness and is highly recommended.



Cross-section of a typical fuelbreak built in conjunction with a road.

Constructing the Fuelbreak

Fuelbreak Width and Slope Adjustments

Note: Since road systems are so important to fuelbreak construction, the following measurements are from the toe of the fill for downslope distances, and above the edge of the cut for uphill distances.

The minimum recommended fuelbreak width is approximately 300 feet for level ground. Since fire activity intensifies as slope increases, the overall fuelbreak width must also increase. However, to minimize aesthetic impacts and to maximize fire crew safety, the majority of the increases should be made at the bottom of the fuelbreak, below the road cut.

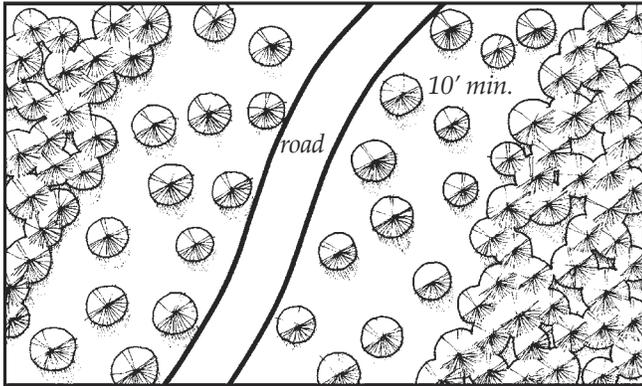
Widths are also increased when severe topographic conditions are encountered. Guidelines for fuelbreak widths on slopes are given below:

Fuelbreak Width/Slope			
Percent Slope (%)	Minimum Uphill Distance (ft)	Minimum Downhill Distance (ft)	Total Width of Modified fuels (ft)*
0	150	150	300
10	140	165	303
20	130	180	310
30	120	195	315
40	110	210	320
50	100	225	325
60	100	240	340

*As slope increases, total distance for cut-and-fill for road construction rapidly increases, improving fuelbreak effective width.

Stand Densities

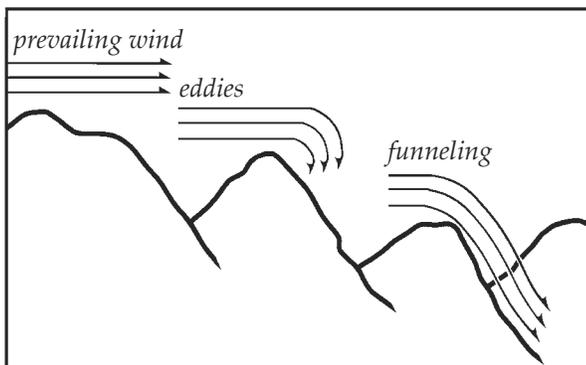
Crown separation is a more critical factor for fuelbreaks than a fixed tree density level. A *minimum* 10-foot spacing between the edges of tree crowns is recommended on level ground. As slope increases, crown spacing should also increase. However, small, isolated groups of trees may be retained for visual diversity. Increase crown spacing around any groups of trees left for aesthetic reasons and to reduce fire intensities and torching potential.



Plan view of fuelbreak showing minimum distance between tree crowns.

In technical terms, a fuelbreak thinning is classified as a heavy “sanitation and improvement cut, from below.” Within fuelbreaks, trees that are suppressed, diseased, deformed, damaged, or of low vigor are removed along with all ladder fuels. Remaining trees are the largest, healthiest, most wind-firm trees from the dominant and co-dominant species of the stand.

Because such a thinning is quite heavy for an initial entry into a stand, prevailing winds, eddy effects, and wind funneling must be carefully evaluated to minimize the possibility of windthrow. It may be necessary to develop the fuelbreak over several years to allow the timber stand to “firm-up” — this especially applies to lodgepole pine and Engelmann spruce stands.



Topography affects wind behavior – an important consideration during fuelbreak construction.

Area-wide forest thinnings are recommended for any subdivisions. Such thinning is not as severe as a fuelbreak thinning, but generally should be completed to fuelbreak specifications along the roads (as outlined on page 6.) In addition, “defensible space thinnings” are highly recommended around all structures (see CSU Coop. Extension Fact sheet 6.302, *Creating Wildfire-Defensible Zones*).

Debris Removal

Limbs and branches left from thinning (slash) can add significant volumes of fuel to the forest floor, especially in lodgepole pine, mixed-conifer, or spruce/fir timber types. These materials can accumulate and serve as ladder fuels, or can become “jackpots,” increasing the difficulty of defending the fuelbreak during a wildfire. **Slash decomposes very slowly in Colorado and proper disposal is essential.** Proper treatment reduces fire hazard, improves access for humans and livestock, encourages establishment of grasses and other vegetation, and improves aesthetics.

Three treatment methods are commonly used. These are lopping-and-scattering, piling and burning, and chipping. Mulching of small trees and slash using equipment similar to Hydro-axes or Timbcos equipped with mulching heads are becoming a popular method of treatment. Size, amount, and location of slash dictates the method used, in addition to cost and the final desired appearance. The method chosen will also depend on how soon an effective fuelbreak is needed prior to construction in new developments.



Lop and scatter: slash should be no deeper than 12” above ground surface.



Chipping is the most desirable, but also the most expensive method of slash disposal.



Piled slash can be burned but only during certain conditions, such as after a snowfall.

Fuelbreak Maintenance

Following initial thinning, trees continue to grow (usually at a faster rate). The increased light on the forest floor encourages heavy grass and brush growth where, in many cases, where little grew before. The site disturbance and exposed mineral soil created during fuelbreak development is a perfect seed bed for new trees that, in turn, create new ladder fuels. Thus, in the absence of maintenance, fuelbreak effectiveness will decrease over time.



Fuelbreak maintenance is essential. Ingrowth, shown above, will minimize the effectiveness of this fuelbreak within a few years.

Fuelbreak maintenance problems are most often the result of time and neglect. Misplaced records, lack of follow-up and funding, and apathy caused by a lack of fire events are some of the major obstacles. In addition, the responsibility for fuelbreak maintenance projects is often unclear. For example, control of a fuelbreak completed by a developer passes to a homeowner's association, usually with limited funds and authority to maintain fuelbreaks.

If fuelbreak maintenance is not planned and completed as scheduled, consider carefully whether the fuelbreak should be constructed. An un-maintained fuelbreak may lead to a false sense of security among residents and fire suppression personnel.

Conclusion

An image of well-designed communities for Colorado includes:

- Forested subdivisions where the total forest cover is well-managed through carefully planned, designed, and maintained thinnings. This contributes to reduced wildfire hazards and a much healthier forest — one that is more resistant to insects and disease.
- A system of roads and driveways with their associated fuelbreaks that break up the continuity of the forest cover and fuels. These help keep fires small, while also providing safer locations from which to mount fire suppression activities. In addition to allowing fire personnel in, they will allow residents to evacuate if necessary.
- Individual homes that all have defensible space around them, making them much easier to defend and protect from wildfire, while also protecting the surrounding forest from structure fires.

Creation of such communities is entirely feasible if recognition of the fire risks, a spirit of cooperation, an attitude of shared responsibility, and the political will exists.

*Colorado's mountains comprise diverse slopes, fuel types, aspects, and topographic features. This variety makes it impossible to develop general fuelbreak prescriptions for all locations. **The previous recommendations are guidelines only.** A professional forester with fire suppression expertise should be consulted to "customize" fuelbreaks for particular areas.*

APPENDIX 8.7 – COLORADO BEST MANAGEMENT PRACTICES

RESOLUTION NO. ____

A RESOLUTION APPROVING A LOAN FROM THE COLORADO WATER RESOURCES AND POWER DEVELOPMENT AUTHORITY; AUTHORIZING THE FORM AND EXECUTION OF THE LOAN AGREEMENT AND A GOVERNMENTAL AGENCY BOND TO EVIDENCE SUCH LOAN; AUTHORIZING THE EXECUTION AND DELIVERY OF DOCUMENTS RELATED THERETO; AND PRESCRIBING OTHER DETAILS IN CONNECTION THEREWITH.

WHEREAS, the Forest Hills Metropolitan District (the “District”), in the County of Jefferson and State of Colorado, is a quasi-municipal corporation and a political subdivision of the State of Colorado, duly organized, existing, and operating pursuant to the Colorado Constitution and laws of the State of Colorado, in particular Title 32, Article 1, Colorado Revised Statutes; and

WHEREAS, the members of the Board of Directors of the District (the “Board”) have been duly elected or appointed and qualified; and

WHEREAS, the District has heretofore determined and undertaken to operate, and maintain its water treatment facility and wastewater treatment facility as a public utility and income-producing project (the “System”); and

WHEREAS, the District has previously determined and does hereby determine that the System constitutes an “enterprise” (the “Enterprise”) under Article X, Section 20 of the Colorado Constitution (“TABOR”) and Title 37, Article 45.1, C.R.S. (the “Water Enterprise Act”); and

WHEREAS, the Board has heretofore determined that the interest of the District and the public interest and necessity demand and require the construction of certain improvements to the System, including installation/replacement of a booster pump station and associated appurtenances for the District’s distribution and any other costs incidental thereto (the “Project”); and

WHEREAS, the Board has also heretofore determined that in order to finance the Project, it was necessary and advisable and in the best interests of the District to enter into a loan agreement (the “Prior Loan Agreement”) with the Colorado Water Resources and Power Development Authority (“CWRPDA”), a body corporate and political subdivision of the State of Colorado, and the District previously adopted a resolution on August 24, 2020 (the “Prior

Resolution”) authorizing the Prior Loan Agreement pursuant to which CWRPDA agreed to loan the District an amount of not to exceed \$490,148 (the “Prior Loan”) for such purposes; and

WHEREAS, the CWRPDA has, since the execution of the Prior Loan Agreement, agreed to make an additional loan amount of \$150,000 at an interest rate of 2.25% (the “Additional Loan”) available to the District, in order to accommodate additional unforeseen costs of the Project, and the Additional Loan will be evidenced by an additional loan agreement reflecting the Additional Loan amount (the “Additional Loan Agreement”); and

WHEREAS, the repayment obligations under the Additional Loan Agreement shall be evidenced by a governmental agency bond (the “Bond”) to be issued by the District to CWRPDA; and

WHEREAS, the Bond and the Additional Loan Agreement (collectively, the “Financing Documents”) shall be a revenue obligation of the District payable from the Pledged Property (as defined in the Additional Loan Agreement) and pursuant to TABOR may be approved by the Board without an election; and

WHEREAS, under TABOR, the Enterprise is a government-owned business authorized to issue its own revenue bonds and receiving under 10% of annual revenue in grants from all Colorado state and local governments combined; and

WHEREAS, in 2020, the Enterprise, as operated by the District, received grants from all Colorado state and local governments combined which were less than 10% of the annual revenue of the Enterprise; and

WHEREAS, the Financing Documents shall constitute revenue obligations of the District, payable from the Pledged Property (as defined in the Loan Agreement); and

WHEREAS, except for the Prior Loan, the District has not pledged nor hypothecated the Pledged Property to the payment of any bonds or for any other purpose, with the result that the Pledged Property may now be pledged lawfully and irrevocably to the payment of the Governmental Agency Bond; and

WHEREAS, there have been presented to the Board the forms of the Financing Documents; and

WHEREAS, the Board desires to approve and authorize the undertaking and completion of the Project and to approve the forms of the Financing Documents and authorize the execution thereof.

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE FOREST HILLS METROPOLITAN DISTRICT, JEFFERSON COUNTY, COLORADO:

Section 1. Approvals, Authorizations, and Amendments. The forms of the Financing Documents presented at this meeting are incorporated herein by reference and are hereby approved. The District shall enter into and perform its obligations under the Financing Documents in the forms of such documents, with such changes as are not inconsistent herewith and as are hereafter approved by the Chairman of the Board and President of the District (the “Chairman”). The Chairman and the Secretary of the District (the “Secretary”), and in their absence, the Vice Chairman and/or Assistant Secretary of the District, are hereby authorized and directed to execute the Financing Documents and to affix the seal of the District thereto, and further to execute and authenticate such other documents or certificates as are deemed necessary or desirable in connection therewith. The Financing Documents shall be executed in substantially the forms approved at this meeting.

The execution of any instrument or certificate or other document in connection with the matters referred to herein by the Chairman and the Secretary, and in their absence, the Vice Chairman and/or Assistant Secretary of the District, shall be conclusive evidence of the approval by the District of such instrument.

Section 2. Election to Apply Supplemental Act. Section 11-57-204 of the Supplemental Public Securities Act, constituting Title 11, Article 57, Part 2, C.R.S. (the “Supplemental Act”) provides that a public entity, including the District, may elect in an act of issuance to apply all or any of the provisions of the Supplemental Act to the Supplemental Loan. The Board hereby elects to apply all of the provisions of the Supplemental Act to the Financing Documents, except Section 11-57-211, C.R.S.

Section 3. Delegation.

(a) Pursuant to Section 11-57-205 of the Supplemental Act, the Board hereby delegates to the Chairman, the Vice Chairman and the District Manager the authority to make the following determinations relating to and contained in the Financing Documents, subject to the restrictions contained in paragraph (b) of this Section 3:

- (i) The interest rate on the Additional Loan;
- (ii) The principal amount of the Additional Loan;

(iii) The amount of principal of the Additional Loan maturing in any given year and the final maturity of the Additional Loan;

(iv) The dates on which the principal of and interest on the Additional Loan are paid; and

(v) The existence and amount of reserve funds for the Additional Loan, if any.

(b) The delegation in paragraph (a) of this Section 3 shall be subject to the following parameters and restrictions:

(i) the interest rate on the Additional Loan shall not exceed 2.25%;

(ii) the principal amount of the Additional Loan shall not exceed \$150,000; and

(iii) the final maturity of the Additional Loan shall not be later than December 31, 2055.

Section 4. Conclusive Recital. Pursuant to Section 11-57-210 of the Supplemental Act, each of the Financing Documents shall contain a recital that the document is issued pursuant to certain provisions of the Supplemental Act. Such recital shall be conclusive evidence of the validity and the regularity of the issuance of the each of the Financing Documents and the Bond after its delivery for value.

Section 5. Pledge of Revenues. The creation, perfection, enforcement, and priority of the pledge of revenues to secure or pay the Financing Documents provided herein shall be governed by Section 11-57-208 of the Supplemental Act and this Resolution. The amounts pledged to the payment of the Financing Documents shall immediately be subject to the lien of such pledge without any physical delivery, filing, or further act. The lien of such pledge shall have the priority described in the Loan Agreement. The lien of such pledge shall be valid, binding, and enforceable as against all persons having claims of any kind in tort, contract, or otherwise against the District irrespective of whether such persons have notice of such liens.

Section 6. Limitation of Actions. Pursuant to Section 11-57-212 of the Supplemental Act, no legal or equitable action brought with respect to any legislative acts or proceedings in connection with the Financing Documents shall be commenced more than thirty days after approval of this Resolution.

Section 7. Limited Obligation; Special Obligation. The Financing Documents are payable solely from the Pledged Property and the Financing Documents do not constitute a debt within the meaning of any constitutional or statutory limitation or provision.

Section 8. No Recourse against Officers and Agents. Pursuant to Section 11-57-209 of the Supplemental Act, if a member of the Board, or any officer or agent of the District acts in good faith, no civil recourse shall be available against such member, officer, or agent for payment of the principal of or interest on the Bond or the fulfillment by the District of its obligations under the Additional Loan Agreement. Such recourse shall not be available either directly or indirectly through the Board or the District, or otherwise, whether by virtue of any constitution, statute, rule of law, enforcement of penalty, or otherwise. By the acceptance of the Additional Loan Agreement and the Bond and as a part of the consideration of the sale or purchase of the Bond, CWRPDA specifically waives any such recourse.

Section 9. Disposition and Investment of Additional Loan Proceeds. The proceeds of the Additional Loan shall be applied only to pay the costs and expenses of acquiring, constructing and equipping the Project, including costs related thereto and reimbursement to the District for capital expenditures heretofore incurred and paid from District funds in anticipation of the incurrence of long-term financing therefor, and all other costs and expenses incident thereto, including without limitation the costs of obtaining the Additional Loan. Neither CWRPDA nor any subsequent owner(s) of the Additional Loan Agreement shall be responsible for the application or disposal by the District or any of its officers of the funds derived from the Additional Loan. In the event that all of the proceeds of the Additional Loan are not required to pay such costs and expenses, any remaining amount shall be used for the purpose of paying the principal amount of the Additional Loan and the interest thereon.

Section 10. District Representative. Pursuant to Exhibit B of the Additional Loan Agreement, the Chairman, the Treasurer and the District Manager are hereby designated as the Authorized Officers (as defined in the Additional Loan Agreement) for the purpose of performing any act or executing any document relating to the Additional Loan, the District, or the Additional Loan Agreement. A copy of this Resolution shall be furnished to CWRPDA as evidence of such designation.

Section 11. Direction to Take Authorizing Action. The appropriate officers of the District, the members of the Board, and the District Manager are hereby authorized and

directed to take all other actions necessary or appropriate to effectuate the provisions of this Resolution, including but not limited to such certificates and affidavits as may reasonably be required by CWRPDA.

Section 12. Ratification and Approval of Prior Actions. All actions heretofore taken by the officers of the District and members of the Board, not inconsistent with the provisions of this Resolution, relating to the Financing Documents, or actions to be taken in respect thereof, are hereby authorized, ratified, approved, and confirmed.

Section 13. Repealer. All acts, orders, or resolutions, or parts thereof, in conflict herewith are hereby repealed to the extent of such conflict.

Section 14. Severability. Should any one or more sections or provisions of this Resolution be judicially determined invalid or unenforceable, such determination shall not affect, impair, or invalidate the remaining provisions hereof, the intention being that the various provisions hereof are severable.

Section 15. Resolution Irrepealable. After said Bond is issued, this Resolution shall be and remain irrepealable until said Bond and the interest thereon shall have been fully paid, satisfied and discharged.

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ADOPTED on May 19, 2021.

FOREST HILLS METROPOLITAN
DISTRICT

Chairman and President of the Board of Directors of
Forest Hills Metropolitan District

[SEAL]

Attest:

Secretary, Forest Hills Metropolitan District

STATE OF COLORADO)
COUNTY OF JEFFERSON) SS.
FOREST HILLS METROPOLITAN DISTRICT)

I, Ronda Zivalich, the duly qualified and acting Secretary of Forest Hills Metropolitan District, Jefferson County, Colorado (the “District”), do hereby certify:

(a) The foregoing pages are a true and correct copy of a resolution (the “Resolution”) passed and adopted by the Board of Directors (the “Board”) of the District at a regular meeting held on May 19, 2021.

(b) The Resolution was duly moved and seconded and the Resolution was adopted at the regular meeting of May 19, 2021, by an affirmative vote of a majority of the members of the Board, as follows:

<u>Name</u>	<u>“Yes”</u>	<u>“No”</u>	<u>Absent</u>	<u>Abstain</u>
Craig Weinberg, President/Chairman				
Mike Swartzlander, Treasurer				
Gary Carson, Director				
Mike Oakley, Director				
Julie Noonan, Director				

(c) The members of the Board were present at such meeting and voted on the passage of such Resolution as set forth above.

(d) The Resolution was approved and authenticated by the signature of the Chairman of the Board and President, sealed with the District seal, attested by the Secretary and recorded in the minutes of the Board.

(e) There are no bylaws, rules or regulations of the Board which might prohibit the adoption of said Resolution.

(f) Notice of the regular meeting of May 19, 2021, in the form attached hereto as Exhibit A was posted on the website of the District at least 24 hours in advance of the meeting in accordance with law.

WITNESS my hand and the seal of said District affixed this 19th day of May,
2021.

(SEAL)

Secretary

EXHIBIT A

(Attach Notice of Meeting)