Farmer Thin

Timber Sale

Logging Feasibility Report

North Nestucca EA

Hebo Ranger District

Siuslaw National Forest

Tillamook County, Oregon

_____ _____

District Ranger **Date**

Prepared by:

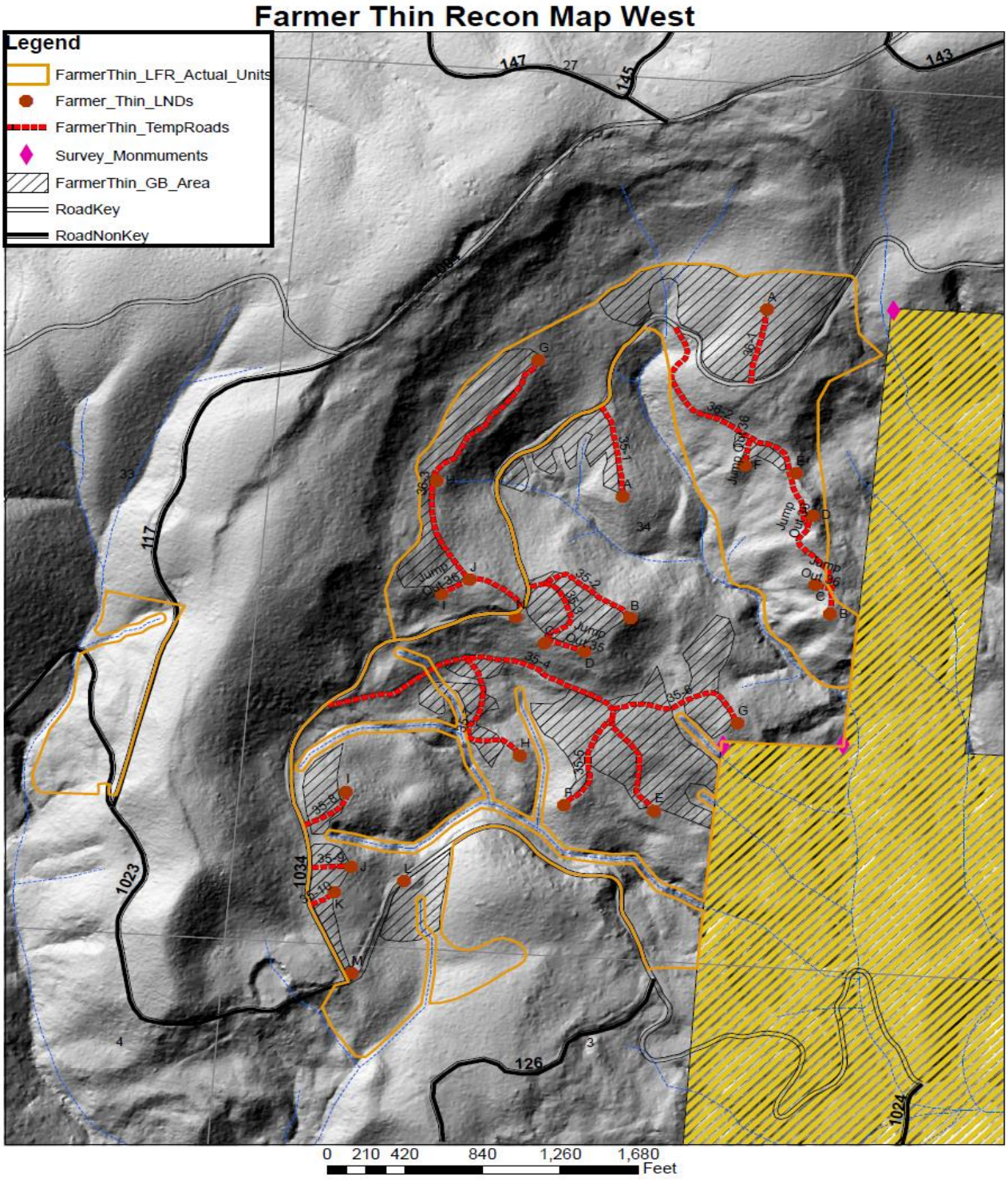
_____ _____

Logging Systems Specialist **Date**

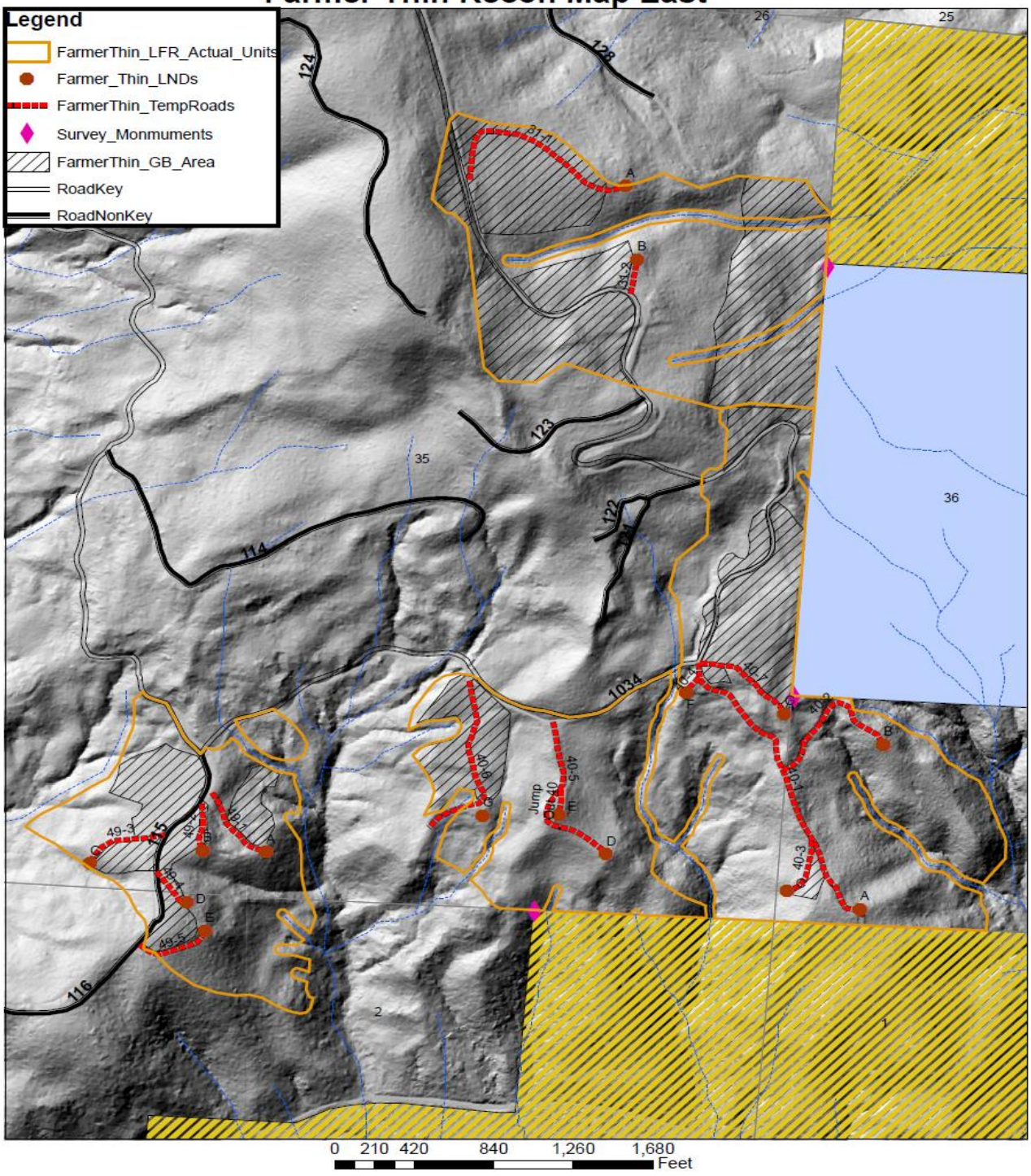
Table of Contents

1. Sale Description

The Farmer Thin Timber Sale is a commercial thinning containing approximately 324 acres of young-managed stand timber species planted from 1963-1977. The project is located in the Farmer Creek Watershed located NW of Hebo, OR. The sale is comprised of six (6) harvest units:



Farmer Thin Recon Map East



- Unit 31 – 54 acres, Sky/GB
- Unit 35 – 90 acres, Sky/GB
- Unit 36 – 63 acres, Sky/GB
- Unit 40 – 77 acres, Sky/GB
- Unit 42 – 8 acres, Sky
- Unit 49 – 32 acres, Sky/GB

2. Unit Summary

Designated timber includes Douglas-fir and Western Hemlock from 7" diameter at breast (DBH) height to a 6" top diameter inside bark (DIB). These products will be harvested from the following units (Tables 1, 2 and 3):

Acres Summary				Volume Summary (MBF)			Total	
Unit	Ground based	Skyline	Helicopter	Ground based	Skyline	Helicopter	Total Acres	Total MBF
31	36	18	0	599	299	0	54	898
35	33	57	0	543	938	0	90	1481
36	22	41	0	322	600	0	63	922
40	17	60	0	178	630	0	77	808
42	0	8	0	0	125	0	8	125
49	11	21	0	116	221	0	32	337
Total	119	205	0	1678	2892	0	324	4570

Table 1. Sale Logging Summary Table

Skyline Table								
Unit	Acres	Vol (MBF)	System	Yard Direction	Avg Slope (%)	AYD (ft)	MYD (ft)	Avg. Piece Size (bf)
31	18	299	Sky	Uphill	50-70%	420	639	150
35	57	938	Sky	Uphill	50-70%	287	750	150
36	41	600	Sky	Uphill	50-70%	261	452	150
40	60	630	Sky	Uphill	50-70%	300	753	150
42	8	125	Sky	Uphill	50-70%	383	534	150
49	21	324	Sky	Uphill	50-70%	282	697	150

Ground-based Table								
Unit	Acres	Vol (MBF)	System	Yard Direction	Avg Slope (%)	ASD (ft)	MSD (ft)	Avg. Piece Size (bf)
31	36	599	GB	Downhill	0-30%	333	1190	150
35	33	543	GB	Downhill	0-30%	226	349	150
36	22	322	GB	Downhill	0-30%	267	910	150
40	17	178	GB	Downhill	0-30%	233	338	150
49	11	116	GB	Downhill	0-30%	217	449	150

Table 1. Unit logging summary tables.

3. Product and Volume Summary

The Farmer Thin Timber Sale consists of 6 units with a net sale volume of 4,570 MBF of sawlogs (14.1 MBF/acre). See table 1.

Unit	Acres	Species	Est. # of Trees	Gross BDFT	Gross CUFT	Net BDFT	Net CUFT	Net MBF	Net CCF	Net MBF/ac (Avg.)	Net CCF/ac (Avg.)
31	54	DF	4031	688364	128841	647766	121139	648	1211	16.6	30.9
		WH	1080	267413	48768	250065	45557	250	456		
35	90	DF	9193	1584554	296393	1469883	274852	1470	2749	16.5	30.8
		WH	95	11846	2161	10993	2009	11	20		
36	63	DF	9621	1009274	196781	921770	179349	922	1793	14.6	28.5
40	77	DF	7956	854700	167758	790369	154960	790	1550	10.5	20.6
		WH	342	18564	3670	17623	3465	18	35		
42	8	DF	406	84245	15631	77601	14386	78	144	15.6	29.1
		WH	504	50668	9547	47124	8867	47	89		
49	32	DF	3774	362165	70846	336994	65791	337	658	10.5	20.6
Total	324		37002	4931793	940396	4570188	870375	4570	8704	14.1	26.7

Table 3. Unit composition and harvest volume by species.

4. Logging Systems

Several logging systems will be used to harvest the proposed area. Table lists the approximate acreage and volume by logging system. Table displays the recommended equipment for the logging systems in this sale.

System	Acres	% of Total Acres	Volume MBF
Ground based	119	36%	1844
Skyline	205	64%	3178
Helicopter	0	0%	0
Totals	324	100%	5022

Table 4. Logging system summary table.

Logging System	Description	Notes
Ground-based	Self-leveling boom mounted tracked feller bencher, grapple skidder, dangle head delimber/processer, medium size loader	Whole tree yarding
Skyline	Manual felling, yarder with a 42 foot tower, dangle head delimber/processer, medium size loader	Whole tree yarding

Table 5. Description of logging systems

Ground Based Systems

Ground based systems were generally applied to slopes less than 30% and where soil conditions are adequate. These standards were specified and analyzed in the North Nestucca Environmental Analysis. Some units may have inclusions of ground based logging on slopes greater than 30% (small local areas). In these areas, logs can be reached from flatter ground by pulling winch-line from existing skid trails, or directional felling down to where the slopes flatten out. Another option is having the self-leveling feller buncher cut the trees, and pack them down the hill to existing skid trails to be skidded out. In this case, we would still not be skidding on slopes greater than 30%, and would be following the direction in the EA. The District Ranger has been informed of this option and is ok with it in small areas.

In the local area, ground based units are generally felled by a feller buncher, and whole tree yarded to the landings by a rubber tired grapple skidder or shovel logged with a tracked shovel. We have designed our ground based units for these types of operations. We planned for favorable skids down to the road, utilizing parallel skid trail pattern. This will result in a few more landings, but they will remain on the small end, and generally won't have to be excavated, with the wood decked right along the roadside for loading. It will also eliminate the need for sidehill skidding, or excavated skid trails to get to a centralized landing, resulting in less compaction. Our maximum skidding distance is 1190' in unit 31, with an average of 640' throughout the sale. The landings will have to accommodate slash, which will be piled in the landing, and will be burned at a later date. In all cases, skid trails and landings should be pre-designated by the operator and approved by the Forest Service before logging, per the timber sale contract. Average main skid trail spacing should be at least 100' apart, and 15' wide on average.

See the logging systems maps for detailed layout and system requirements.

Ground based logging can be achieved in all units with the following equipment/machinery, or similar:

- CAT 535c Grapple Skidder
- Self-Leveling Boom-Mounted Feller Bencher – CAT 522 Track Tilt
- Dangle Head De-Limber/Processor
- Average Medium Loader
- Feller Buncher Operator
- Delimber/Processor Operator
- Loader Operator
- Skidder Operator

Skyline Systems

Skyline logging is generally applied on sustained slopes greater than 30% and/or where soil conditions are a concern. In all cases, 12" log suspension will be required in all skyline units. If logs are to be yarded across specified stream channels or wet areas, full log suspension will be required. In order to get adequate deflection in some units, the skyline may be rigged across drainages and/or existing roads or lift trees may be utilized for topographic lift.

Guyline anchors are available and adequate for all skyline landings, utilizing 16-20" Douglas-fir and Hemlock trees. Guy trees will have to be cut before use for safety. Field reconnaissance identified numerous trees available for tail trees and tail tree guyline anchors. These tree sizes range from 16" to 20"+ diameter at breast height in most locations (Douglas-fir/Hemlock). Tail tree rigging heights may be up to 30 feet, and this has been appraised for.

Skyline landings will be located on specified roads, which may need to be widened to approximately 24 feet to accommodate the landing equipment. Landing orientation will utilize centralized and parellel configurations.

With a fixed boom yarder or yoder, it is possible for a danglehead processor to clear logs from the chute while processing in an adjacent area down the road and decking "clean" logs behind it for loader access.

Roads may be blocked during yarding operations. Areas will need to be properly signed. Coordination will need to occur with other groups who will also be hauling out the same roads, so that we accommodate all uses.

The Yarder and Carriage table shows the specifications of the logging systems that were used in the analysis for this project. These systems are recommended because they are available, capable of meeting the resource management objectives and logging system requirements, reduce the number of intermediate supports needed, and are capable of doing the job economically. All skyline profiles and recommended yarding equipment were analyzed with the SkylineXL 15.0 Skyline Profile and Payload Analysis program.

Yarder		Tower height (ft)	Yarder (HP)		
Madill 6150, spcm		50	230		
Operating line	Line Dia (in)	Line type	Weight (lb/ft)	Design tension (lbs)	Line length (ft)
skyline	0.875	Swaged	1.7	31600	2000
mainline	0.625	Swaged	0.87	16133	2300
haulback	0.5	EIPS	0.46	8900	4300
slackpulling	0	0	0	0	0
Yarder		Tower height (ft)	Yarder (HP)		
Yoader, shotgun - 2 drum		40	230		
Operating line	Line Dia (in)	Line type	Weight (lb/ft)	Design tension (lbs)	Line length (ft)
skyline	0.75	Swaged	1.25	23100	1000
mainline	0.625	Swaged	0.87	16133	1500
haulback	0	0	0	0	0
slackpulling	0	0	0	0	0
Carriage		Weight (lbs)	Carriage (HP)	Skyline clamp	Slack pull method
Acme 20s, pass shack		2150	20	yes	carriage
Line	Min Dia (in)	Max Dia (in)	Length (ft)	Dia (in)	# drums required
skyline	0.75	1.375			2
mainline	0.5	0.75			Multispan capable
dropline			0	0	yes

Table 6. Recommended Yarder and Carriage Configuration

Cable logging can be achieved in all units with the following equipment/machinery, or similar:

- Madill 6150, spcm Yarder – 9/16th swaged cable (50' Tower)
- Acme 20 pass shackle carriage
- Dangle Head De-Limber/Processor
- Average Medium Loader
- Yarder Engineer
- Choker Setter
- Loader Operator
- Delimber /Processor Operator
- Rigging Slinger
- 2 Hand Fellers/Cutters

Skyline Profile Analysis

Profiles were run in the field to determine the expected payloads in the software program Skyline XL 15.0 (Table 5). The following list and figures display the profiles and analysis results:

- Unit 31 – Profile #1 – Azimuth: 105 degrees – Figure 1.
- Unit 35 – Profile #1 – Azimuth: 80 degrees – Figure 2.
- Unit 35 – Profile #2 – Azimuth: 170 degrees – Figure 3.
- Unit 36 – Profile #1 – Azimuth: 65 degrees – Figure 4.
- Unit 36 – Profile #2 – Azimuth: 152 degrees – Figure 5.
- Unit 40 – Profile #1 – Azimuth: 204 degrees – Figure 6.
- Unit 42 – Profile #1 – Azimuth: 300 degrees – Figure 7.
- Unit 49 – Profile #1 – Azimuth: 89 degrees – Figure 8.
- Unit 49 – Profile #2 – Azimuth: 328 degrees – Figure 9.

The largest log was estimated to be 1,498 pounds in all cases.

Unit	Profile #	Acres	Rigging Length (ft)	System Type	Payload Limit	Yard Direction	Guy Anchors Availability	Tails & Supports	AYD
31	1	18	790	Yarder	7,067	Uphill	DF/H 16-18”	Adequate	420
35	1	57	720	Yoder	4,053	Uphill	DF/H 16-18”	Adequate	287
35	2	57	430	Yoder	11,421	Uphill	DF/H 16-18”	Adequate	287
36	1	41	700	Yoder	6,275	Uphill	DF/H 16-18”	Adequate	261
36	2	41	840	Yarder	5,321	Uphill	DF/H 16-18”	Adequate	261
40	1	60	900	Yarder	3,905	Uphill	DF/H 16-18”	Adequate	300
42	1	8	700	Yarder	3,477	Uphill	DF/H 16-18”	Adequate	383
49	1	21	790	Yarder	5,823	Uphill	DF/H 16-18”	Adequate	282
49	2	21	840	Yarder	9,749	Uphill	DF/H 16-18”	Adeqate	282

Table 7. Skyline unit listing.

5. Logging Plan Narrative:

- All unit boundaries are marked with blue boundary tags, blue ribbon and ORANGE paint.
- All landings are marked with yellow tags and solid blue/white flagging.
- All temporary spurs (existing and new) are marked with yellow tags and striped blue/white flagging.
- Some landings are new construction while others will only require minor clearing.
- Landings are located to minimize yarding over buffered streams and headwalls.
- All roads and landings will be reviewed on the ground by a District Hydrologist and the Forest Transportation Planner for the timber sale appraisal and contract.
- Perennial and intermittent streams and headwalls exist within the units. These streams and headwalls are buffered. Buffer boundaries are marked on the ground to protect slope stability and water quality. Full log suspension is required over streams and headwalls.
- Skyline landings generally use fan-shaped and parallel settings, with most turnroads using single-span configurations. Tail-holding on opposing slopes is emphasized, where opportunities exist, to reduce the need for intermediate supports.
- Where yarding occurs over stream buffers, some areas may lack the deflection necessary to obtain full suspension of logs during whole-tree yarding. Shorter log lengths will be required over these areas.
- Ground-based logging is planned in all of the Farmer Thin units. Units will require some loader/shovel logging along roadways or on designated skid trails.
- Directional felling may be needed in several units. Extra tagline may be needed in areas that require directional felling.
- All Farmer Thin units contain ½ acre and 1 acre "gaps". All "gaps" have GPS coordinates and are identified on sale area maps. Create one-acre gaps by cutting all Designated Cut Species meeting the contract specifications **within 118 feet of a tree marked with double bands of Orange tracer paint at breast height and an Orange tracer paint mark below stump height.** Create half-acre gaps by cutting all Designated Cut Species meeting the contract specifications **within 83 feet of a tree marked with a single band of Orange tracer paint at breast height and an Orange tracer paint mark below stump height.** The Orange tracer paint marked trees at the center of "gaps" are **NOT** designated for removal.

Contract Language

C6.42# YARDING/SKIDDING REQUIREMENTS. (04/2003) Purchaser shall submit for Forest Service approval a Yarding/Skidding Plan prior to the start of felling operations. Requirements other than those specified in the following table may be approved. When appropriate, such approval shall include adjustments in Current Contract Rates and revision of the Sale Area Map. In no such case shall the adjustments result in Current Contract Rates less than Base Rates.

Location of all skid roads and trails, tractor roads, skyline corridors, mechanized harvester trails, forwarder roads, and other log skidding facilities, shall be approved prior to their use or construction.

See table below for requirements.

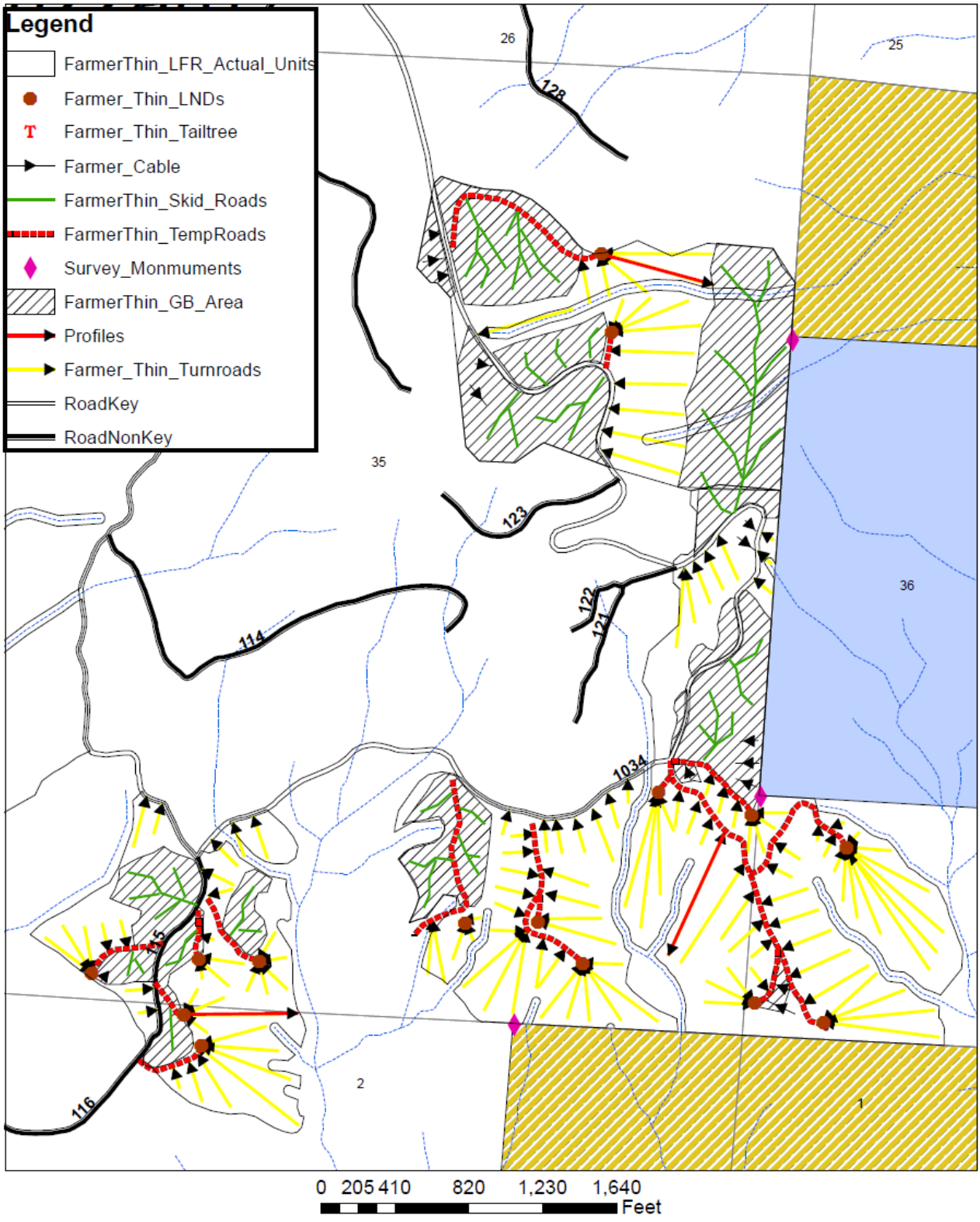
A skyline system capable of: • transporting logs at least 1,600 feet (rigging length of 2,100 feet) • keeping one end of the log suspended during inhaul(logs may drag on the ground within 100 feet slope distance of tailholds and 50 feet slope distance of landings) • lateral yarding up to 100 feet • downhill yarding • operating in a multi-span configuration • keeping the entire length of logs fully suspended above the ground 50 feet each side of the stream course during inhaul when yarding across stream courses Skyline corridors/cableways: • location shall be approved in advance of felling operations • minimum spacing shall be 120 feet at the far end • maximum width of 12 feet • no more than 20 percent of the canopy will be removed in any given 1,000-foot reach of stream when passing through riparian buffers. A carriage capable of: • maintaining a fixed position on the skyline while lateral yarding • lateral yarding up to 75 feet on either side of the skyline • passing support jacks where intermediate supports are used.
A ground-base machine capable of keeping one end of the log suspended during skidding. Skid trails: • location of skid trails shall be agreed upon prior to construction and prior to felling • maximum width of 15 feet except for turnaround areas • average trail spacing of 100 feet The ground-base machine will not be allowed on slopes greater than 30 percent. Where practical, machine shall travel on slash.
If purchaser chooses to tailhold on private land or land under other ownership, purchaser will have to get written permission from the landowner and provide the Forest Service with a copy of the written permission.

Prior to yarding, Forest Service shall approve included timber pursuant to C2.35# (tree designation).
The tops from at least 20 percent of felled trees shall be left on site (not yarded or removed), throughout the subdivision. A top is defined as that portion of the tree greater than 5 inches DIB and less than 6 inches DIB.

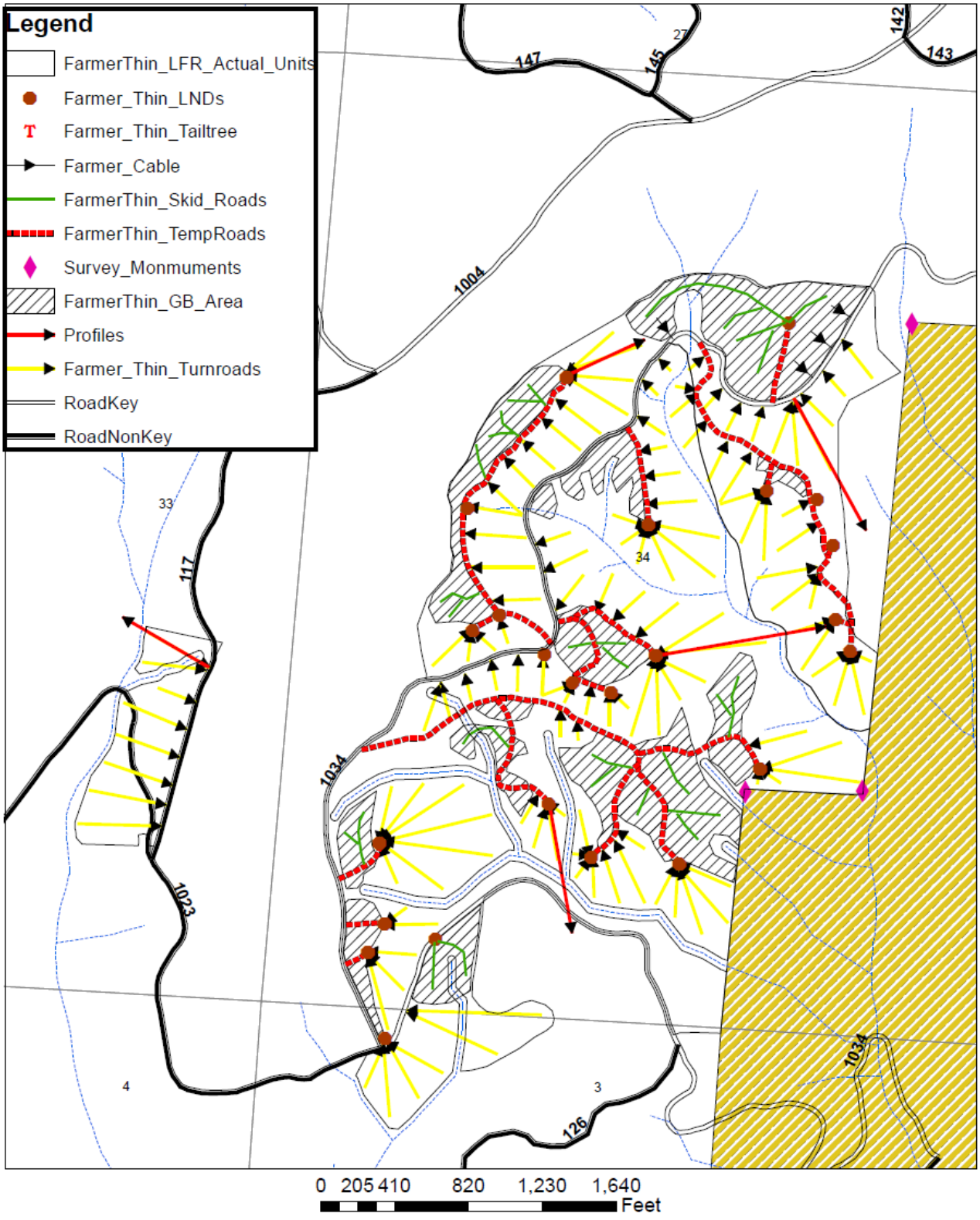
*Reference Appendix A & B for Payload Analysis and Logging System Maps.

APPENDIX A:

Farmer Thin Logging Systems Recon Map East



Farmer Thin Logging Systems Recon Map West



APPENDIX B:

SkylineXL 14.0 Skyline Analysis - Analysis Results - Standing Skyline System

<< RESULTS BASED on MAP or GIS PROFILE >>

Profile name: 3 Units: English Profile date: 7/14/16
Analysis name: Unit 31 profile 1 Analyst: Wickham
Data source: GIS

STANDING skyline analysis summary table...

Skyline analysis type	Selected yarder	Selected carriage	Minimum payload-(lbs)	At terrain point	Analysis phase
Standing	Madill 6150, spcm, 50-ft twr	Acme 20s, pass shack_ad	7,067	21	**1**

STANDING skyline rigging lengths table... *HB required*

Line	Capacity-(ft)	Required-(ft)	Notes	Chord slope span 1	Chord slope span 2	Chord slope span 3	Chord slope span 4	Average slope yarding dist for this analysis-(ft)
skyline	2,000	790	adequate					
mainline	2,300	710	adequate	13.1%				
haulback	4,300	1,360	adequate	Un-stretched skyline line length - (ft)			628.47	314

line capacities based on selected yarder

STANDING skyline analysis detail table, PHASE 1 analysis...

TP	Horizontal distance - (ft)	Net payload at TP - (lbs)	Net payload to landing - (lbs)	Skyline tension - (lbs)	Mainline tension - (lbs)	Haulback tension - (lbs)	Skyline clearance - (ft)	Log clearance - (ft)	Full susp. bottom of log above TP-(ft)
2	16	28,121	28,121	27,215	16,133	-	38.6	28.4	-
3	33	21,185	21,185	31,600	11,752	-	34.0	23.9	-
4	49	16,484	16,484	31,600	9,198	-	30.5	20.6	-
5	66	13,931	13,931	31,600	7,832	-	28.0	18.2	-
6	82	12,052	12,052	31,600	6,902	-	25.9	16.3	-
7	98	10,976	10,976	31,600	6,290	-	24.5	14.9	-
8	115	10,289	10,289	31,600	5,868	-	23.1	13.6	-
9	131	9,641	9,641	31,600	5,553	-	21.5	12.1	-
10	148	9,032	9,032	31,600	5,285	-	20.1	10.8	-
11	164	8,932	8,932	31,600	5,127	-	19.0	9.6	-
12	180	8,948	8,932	31,600	5,083	-	17.3	7.9	-
13	197	9,024	8,932	31,600	5,095	-	15.3	6.0	-
14	213	8,648	8,648	31,600	5,154	-	13.0	4.1	-
15	230	8,536	8,536	31,600	5,162	-	11.5	2.8	-
16	246	8,092	8,092	31,600	5,089	-	10.3	2.0	-
17	263	7,650	7,650	31,600	4,930	-	9.9	1.8	-
18	279	7,736	7,650	31,600	4,828	-	10.1	1.8	-
19	295	7,813	7,650	31,600	4,799	-	9.9	1.5	-
20	312	7,722	7,650	31,600	4,780	-	9.4	1.1	-
21	328	7,067	7,067	31,600	4,577	-	9.2	1.3	-
22	345	7,660	7,067	31,600	4,536	-	10.4	1.9	-
23	361	7,427	7,067	31,600	4,514	-	10.0	1.7	-
24	377	7,324	7,067	31,600	4,439	-	10.3	2.1	-
25	394	7,795	7,067	31,600	4,444	-	11.1	2.5	-
26	410	7,936	7,067	31,600	4,498	-	11.0	2.4	-
27	427	7,799	7,067	31,600	4,484	-	11.1	2.7	-
28	443	8,203	7,067	31,600	4,486	-	12.0	3.4	-
29	459	8,550	7,067	31,600	4,558	-	12.4	3.7	-
30	476	8,935	7,067	31,600	4,652	-	12.8	4.0	-
31	492	9,367	7,067	31,600	4,761	-	13.3	4.5	-
32	509	10,169	7,067	31,600	4,889	-	14.1	5.1	-
33	525	11,221	7,067	31,600	5,124	-	14.6	5.5	-
34	541	12,151	7,067	31,600	5,417	-	15.0	5.9	-
35	558	13,887	7,067	31,600	5,760	-	15.9	6.6	-
36	574	15,850	7,067	31,600	6,175	-	16.8	7.5	-
37	591	19,112	7,067	31,600	6,610	-	18.4	9.0	-
38	607	25,998	7,067	31,600	6,724	-	21.1	11.5	-

Figure 1. Skyline analysis results Unit 31 – Profile #1

SkylineXL 14.0 Skyline Analysis - Analysis Results - Standing Skyline System

<< RESULTS BASED on MAP or GIS PROFILE >>

Profile name: 4 | Units: English | Profile date: 7/14/16
Analysis name: Unit 35 profile 1 | Analyst: Wickham
Data source: GIS

STANDING skyline analysis summary table...

Skyline analysis type	Selected yarder	Selected carriage	Minimum payload-(lbs)	At terrain point	Analysis phase
Standing	Yoader, shotgun - 2 drum, 40-ft twr	Acme 20s, pass shack	4,053	10	**1**

STANDING skyline rigging lengths table... *HB required*

Line	Capacity-(ft)	Required-(ft)	Notes	Chord slope span 1	Chord slope span 2	Chord slope span 3	Chord slope span 4	Average slope yarding dist for this analysis-(ft)
skyline	1,000	720	adequate					
mainline	1,500	620	adequate	11.0%				
haulback		1,190	not adequate!	Un-stretched skyline line length - (ft)			560.86	281

line capacities based on selected yarder

STANDING skyline analysis detail table, PHASE 1 analysis...

TP	Horizontal distance - (ft)	Net payload at TP - (lbs)	Net payload to landing - (lbs)	Skyline tension - (lbs)	Mainline tension - (lbs)	Haulback tension - (lbs)	Skyline clearance - (ft)	Log clearance - (ft)	Full susp. bottom of log above TP-(ft)
2	33	14,046	14,046	23,100	7,946	-	28.0	18.2	-
3	66	8,618	8,618	23,100	4,936	-	23.0	13.7	-
4	98	6,614	6,614	23,100	3,766	-	20.6	11.3	-
5	131	5,651	5,651	23,100	3,193	-	18.3	9.0	-
6	164	4,907	4,907	23,100	2,878	-	15.4	6.5	-
7	197	4,679	4,679	23,100	2,652	-	14.0	5.0	-
8	230	4,474	4,474	23,100	2,607	-	11.3	2.6	-
9	262	4,234	4,234	23,100	2,559	-	9.4	1.1	-
10	295	4,053	4,053	23,100	2,454	-	9.2	1.1	-
11	328	4,207	4,053	23,100	2,372	-	10.3	1.8	-
12	361	4,291	4,053	23,100	2,410	-	10.1	1.8	-
13	394	4,499	4,053	23,100	2,425	-	11.3	2.9	-
14	426	4,800	4,053	23,100	2,416	-	13.6	5.1	-
15	459	5,751	4,053	23,100	2,476	-	17.4	8.3	-
16	492	7,303	4,053	23,100	2,722	-	20.0	10.7	-
17	525	10,892	4,053	23,100	3,081	-	23.8	14.1	-

Figure 2. Skyline analysis results Unit 35 – Profile #1

SkylineXL 14.0 Skyline Analysis - Analysis Results - Standing Skyline System

<< RESULTS BASED on MAP or GIS PROFILE >>

Profile name: 5 | Units: English | Profile date: 7/14/16
Analysis name: Unit 35 profile 2 | Analyst: Wickham
Data source: GIS

STANDING skyline analysis summary table...

Skyline analysis type	Selected yarder	Selected carriage	Minimum payload-(lbs)	At terrain point	Analysis phase
Standing	Yoader, shotgun - 2 drum, 40-ft twr	Acme 20s, pass shack	11,421	8	**1**

STANDING skyline rigging lengths table... *HB required*

Line	Capacity-(ft)	Required-(ft)	Notes	Chord slope span 1	Chord slope span 2	Chord slope span 3	Chord slope span 4	Average slope yarding dist for this analysis-(ft)
skyline	1,000	430	adequate					
mainline	1,500	350	adequate	10.9%				
haulback		660	not adequate!	Un-stretched skyline line length - (ft)			282.76	140

line capacities based on selected yarder

STANDING skyline analysis detail table, PHASE 1 analysis...

TP	Horizontal distance - (ft)	Net payload at TP - (lbs)	Net payload to landing - (lbs)	Skyline tension - (lbs)	Mainline tension - (lbs)	Haulback tension - (lbs)	Skyline clearance - (ft)	Log clearance - (ft)	Full susp. bottom of log above TP-(ft)
2	16	25,840	25,840	17,890	16,133	-	27.5	17.8	-
3	33	20,407	20,407	23,100	11,851	-	23.8	14.3	-
4	49	16,581	16,581	23,100	9,115	-	21.3	11.8	-
5	66	13,828	13,828	23,100	7,690	-	18.8	9.6	-
6	82	12,657	12,657	23,100	6,841	-	17.3	8.2	-
7	98	12,157	12,157	23,100	6,369	-	15.9	6.7	-
8	115	11,421	11,421	23,100	6,049	-	14.3	5.4	-
9	131	11,849	11,421	23,100	5,867	-	13.5	4.2	-
10	148	12,678	11,421	23,100	5,881	-	11.8	2.4	-
11	164	11,767	11,421	23,100	6,201	-	9.5	1.1	-
12	181	12,155	11,421	23,100	6,119	-	9.7	1.2	-
13	197	12,562	11,421	23,100	6,119	-	9.9	1.4	-
14	213	13,228	11,421	23,100	6,123	-	10.7	2.1	-
15	230	14,335	11,421	23,100	6,125	-	12.1	3.4	-
16	246	15,529	11,421	23,100	5,935	-	14.2	5.6	-
17	263	19,540	11,421	23,100	5,167	-	18.5	9.5	-

Figure 3. Skyline analysis results Unit 35 – Profile #2

SkylineXL 14.0 Skyline Analysis - Analysis Results - Standing Skyline System

<< RESULTS BASED on MAP or GIS PROFILE >>

Profile name: 6 | Units: English | Profile date: 7/14/16
Analysis name: Unit 36 profile 1 | Analyst: Wickham
Data source: GIS

STANDING skyline analysis summary table...

Skyline analysis type	Selected yarder	Selected carriage	Minimum payload-(lbs)	At terrain point	Analysis phase
Standing	Yoader, shotgun - 2 drum, 40-ft twr	Acme 20s, pass shack	6,275	14	**1**

STANDING skyline rigging lengths table... *HB required*

Line	Capacity-(ft)	Required-(ft)	Notes	Chord slope span 1	Chord slope span 2	Chord slope span 3	Chord slope span 4	Average slope yarding dist for this analysis-(ft)
skyline	1,000	600	adequate					
mainline	1,500	530	adequate	8.4%				
haulback		1,020	not adequate!	Un-stretched skyline line length - (ft)			461.74	230

line capacities based on selected yarder

STANDING skyline analysis detail table, PHASE 1 analysis...

TP	Horizontal distance - (ft)	Net payload at TP - (lbs)	Net payload to landing - (lbs)	Skyline tension - (lbs)	Mainline tension - (lbs)	Haulback tension - (lbs)	Skyline clearance - (ft)	Log clearance - (ft)	Full susp. bottom of log above TP-(ft)
2	16	27,124	27,124	22,105	16,133	-	28.4	18.8	-
3	33	16,740	16,740	23,100	9,548	-	24.8	15.4	-
4	49	13,124	13,124	23,100	7,199	-	22.6	13.3	-
5	66	10,937	10,937	23,100	5,970	-	20.5	11.3	-
6	82	9,872	9,872	23,100	5,257	-	18.7	9.5	-
7	98	8,835	8,835	23,100	4,792	-	16.7	7.7	-
8	115	7,707	7,707	23,100	4,364	-	15.2	6.6	-
9	131	7,457	7,457	23,100	4,042	-	14.9	6.1	-
10	148	7,139	7,139	23,100	3,835	-	14.0	5.2	-
11	164	6,866	6,866	23,100	3,691	-	12.9	4.2	-
12	180	6,432	6,432	23,100	3,532	-	12.1	3.6	-
13	197	6,471	6,432	23,100	3,428	-	11.9	3.2	-
14	213	6,275	6,275	23,100	3,358	-	11.2	2.7	-
15	230	6,544	6,275	23,100	3,316	-	10.9	2.2	-
16	246	6,341	6,275	23,100	3,328	-	10.0	1.6	-
17	263	6,550	6,275	23,100	3,328	-	9.8	1.3	-
18	279	6,497	6,275	23,100	3,353	-	9.4	1.1	-
19	295	6,823	6,275	23,100	3,364	-	9.6	1.2	-
20	312	7,039	6,275	23,100	3,430	-	9.5	1.1	-
21	328	7,486	6,275	23,100	3,508	-	9.7	1.1	-
22	345	7,841	6,275	23,100	3,626	-	9.8	1.3	-
23	361	8,299	6,275	23,100	3,745	-	10.2	1.7	-
24	377	9,358	6,275	23,100	3,880	-	11.1	2.3	-
25	394	10,290	6,275	23,100	4,127	-	11.6	2.9	-
26	410	12,202	6,275	23,100	4,376	-	12.9	3.8	-
27	427	14,546	6,275	23,100	4,755	-	14.1	5.0	-
28	443	20,524	6,275	23,100	4,813	-	16.7	7.1	-

Figure 4. Skyline analysis results Unit 36 – Profile #1

SkylineXL 14.0 Skyline Analysis - Analysis Results - Standing Skyline System

<< RESULTS BASED on MAP or GIS PROFILE >>

Profile name: 7 | Units: English | Profile date: 7/14/16
Analysis name: Unit 36 profile 2 | Analyst: Wickham
Data source: GIS

STANDING skyline analysis summary table...

Skyline analysis type	Selected yarder	Selected carriage	Minimum payload-(lbs)	At terrain point	Analysis phase
Standing	Madill 6150, spcm, 50-ft twr	Acme 20s, pass shack	5,321	13	**1**

STANDING skyline rigging lengths table... *HB required*

Line	Capacity-(ft)	Required-(ft)	Notes	Chord slope span 1	Chord slope span 2	Chord slope span 3	Chord slope span 4	Average slope yarding dist for this analysis-(ft)
skyline	2,000	840	adequate					
mainline	2,300	760	adequate	13.7%				
haulback	4,300	1,460	adequate	Un-stretched skyline line length - (ft)			694.87	348

line capacities based on selected yarder

STANDING skyline analysis detail table, PHASE 1 analysis...

TP	Horizontal distance - (ft)	Net payload at TP - (lbs)	Net payload to landing - (lbs)	Skyline tension - (lbs)	Mainline tension - (lbs)	Haulback tension - (lbs)	Skyline clearance - (ft)	Log clearance - (ft)	Full susp. bottom of log above TP-(ft)
2	33	19,807	19,807	31,600	11,008	-	35.3	25.4	-
3	66	12,992	12,992	31,600	7,396	-	29.0	19.4	-
4	98	11,092	11,092	31,600	6,154	-	25.4	15.7	-
5	131	9,698	9,698	31,600	5,682	-	19.8	10.6	-
6	164	8,796	8,796	31,600	5,392	-	15.6	6.9	-
7	197	8,284	8,284	31,600	5,185	-	12.7	4.2	-
8	230	7,741	7,741	31,600	5,037	-	10.1	2.0	-
9	263	6,769	6,769	31,600	4,714	-	8.6	1.1	-
10	295	5,963	5,963	31,600	4,112	-	10.4	2.8	-
11	328	6,006	5,963	31,600	3,772	-	13.4	5.1	-
12	361	5,684	5,684	31,600	3,588	-	13.7	5.4	-
13	394	5,321	5,321	31,600	3,307	-	15.4	7.2	-
14	427	5,410	5,321	31,600	3,078	-	19.0	10.2	-
15	459	5,644	5,321	31,600	2,999	-	21.1	12.0	-
16	492	6,118	5,321	31,600	3,029	-	22.4	13.1	-
17	525	6,929	5,321	31,600	3,188	-	22.8	13.3	-
18	558	8,434	5,321	31,600	3,526	-	22.2	12.4	-
19	591	10,579	5,321	31,600	4,204	-	19.7	9.9	-
20	623	14,023	5,321	31,600	5,315	-	17.3	7.6	-
21	656	20,561	5,321	31,600	7,114	-	16.3	6.9	-

Figure 5. Skyline analysis results Unit 36 – Profile #2

<< RESULTS BASED on MAP or GIS PROFILE >>

Profile name: 2 | Units: English | Profile date: 7/13/16
Analysis name: Unit 40 profile 1 | Analyst: Wickham
Data source: GIS

STANDING skyline analysis summary table...

Skyline analysis type	Selected yarder	Selected carriage	Minimum payload-(lbs)	At terrain point	Analysis phase
Standing	Madill 6150, spcm, 50-ft twr	Acme 20s, pass shack	3,905	14	**1**

STANDING skyline rigging lengths table... *HB required*

Line	Capacity-(ft)	Required-(ft)	Notes	Chord slope span 1	Chord slope span 2	Chord slope span 3	Chord slope span 4	Average slope yarding dist for this analysis-(ft)
skyline	2,000	900	adequate	12.7%				
mainline	2,300	830	adequate					
haulback	4,300	1,590	adequate	Un-stretched skyline line length - (ft)			742.44	372

line capacities based on selected yarder

STANDING skyline analysis detail table, PHASE 1 analysis...

TP	Horizontal distance - (ft)	Net payload at TP - (lbs)	Net payload to landing - (lbs)	Skyline tension - (lbs)	Mainline tension - (lbs)	Haulback tension - (lbs)	Skyline clearance - (ft)	Log clearance - (ft)	Full susp. bottom of log above TP-(ft)
2	33	14,335	14,335	31,600	7,675	-	38.9	29.0	-
3	66	9,795	9,795	31,600	5,137	-	36.2	26.2	-
4	98	8,133	8,133	31,600	4,326	-	31.7	21.7	-
5	131	7,300	7,300	31,600	3,999	-	26.0	16.2	-
6	164	6,733	6,733	31,600	3,869	-	20.1	10.6	-
7	197	6,402	6,402	31,600	3,872	-	14.8	5.8	-
8	230	5,734	5,734	31,600	3,855	-	10.4	2.3	-
9	262	5,348	5,348	31,600	3,675	-	9.1	1.2	-
10	295	4,502	4,502	31,600	3,327	-	8.5	1.1	-
11	328	4,062	4,062	31,600	2,889	-	11.7	3.8	-
12	361	4,003	4,003	31,600	2,641	-	14.8	6.4	-
13	394	4,060	4,003	31,600	2,547	-	16.0	7.2	-
14	427	3,905	3,905	31,600	2,487	-	15.8	7.3	-
15	459	4,022	3,905	31,600	2,408	-	17.8	9.0	-
16	492	4,526	3,905	31,600	2,454	-	18.8	9.4	-
17	525	4,742	3,905	31,600	2,642	-	16.9	8.0	-
18	558	5,236	3,905	31,600	2,751	-	17.6	8.6	-
19	591	6,303	3,905	31,600	2,989	-	18.1	8.7	-
20	623	8,049	3,905	31,600	3,499	-	16.5	6.9	-
21	656	9,636	3,905	31,600	4,450	-	13.8	5.0	-
22	689	12,372	3,905	31,600	5,263	-	15.3	6.6	-
23	722	20,551	3,905	31,600	5,908	-	20.8	11.8	-

Figure 6. Skyline analysis results Unit 40 – Profile #1

SkylineXL 14.0 Skyline Analysis - Analysis Results - Standing Skyline System

<< RESULTS BASED on MAP or GIS PROFILE >>

Profile name: 8 | Units: English | Profile date: 7/15/16
Analysis name: Unit 42 profile 1 | Analyst: Wickham
Data source: GIS

STANDING skyline analysis summary table...

Skyline analysis type	Selected yarder	Selected carriage	Minimum payload-(lbs)	At terrain point	Analysis phase
Standing	Madill 6150, spcm, 50-ft twr	Acme 20s, pass shack	3,477	18	**1**

STANDING skyline rigging lengths table... *HB required*

Line	Capacity-(ft)	Required-(ft)	Notes	Chord slope span 1	Chord slope span 2	Chord slope span 3	Chord slope span 4	Average slope yarding dist for this analysis-(ft)
skyline	2,000	700	adequate	8.8%				
mainline	2,300	500	adequate					
haulback	4,300	930	adequate	Un-stretched skyline line length - (ft)			543.17	207

line capacities based on selected yarder

STANDING skyline analysis detail table, PHASE 1 analysis...

TP	Horizontal distance - (ft)	Net payload at TP - (lbs)	Net payload to landing - (lbs)	Skyline tension - (lbs)	Mainline tension - (lbs)	Haulback tension - (lbs)	Skyline clearance - (ft)	Log clearance - (ft)	Full susp. bottom of log above TP-(ft)
2	16	16,612	16,612	31,600	6,686	-	40.8	Full	14.8
3	33	10,847	10,847	31,600	3,698	-	40.8	Full	14.8
4	49	8,453	8,453	31,600	2,659	-	39.0	Full	13.0
5	66	7,070	7,070	31,600	2,116	-	38.3	Full	12.3
6	82	6,160	6,160	31,600	1,781	-	38.9	Full	12.9
7	98	5,512	5,512	31,600	1,551	-	39.2	Full	13.2
8	115	5,027	5,027	31,600	1,382	-	39.1	Full	13.1
9	131	4,654	4,654	31,600	1,252	-	39.9	Full	13.9
10	148	4,361	4,361	31,600	1,148	-	40.6	Full	14.6
11	164	4,129	4,129	31,600	1,062	-	41.8	Full	15.8
12	180	3,941	3,941	31,600	990	-	40.5	Full	14.5
13	197	3,792	3,792	31,600	927	-	37.7	Full	11.7
14	213	3,689	3,689	31,600	874	-	34.9	Full	8.9
15	230	3,592	3,592	31,600	823	-	31.7	Full	5.7
16	246	3,530	3,530	31,600	779	-	30.0	Full	4.0
17	262	3,487	3,487	31,600	738	-	28.1	Full	2.1
18	279	3,477	3,477	31,600	700	-	27.6	Full	1.6
19	295	3,486	3,477	31,600	664	-	27.8	Full	1.8
20	312	3,519	3,477	31,600	628	-	27.9	Full	1.9
21	328	3,586	3,477	31,600	594	-	27.1	Full	1.1
22	345	3,664	3,477	31,600	559	-	27.8	Full	1.8
23	361	3,781	3,477	31,600	522	-	27.8	Full	1.8
24	377	3,930	3,477	31,600	483	-	28.4	Full	2.4
25	394	4,132	3,477	31,600	441	-	29.6	Full	3.6

Figure 7. Skyline analysis results Unit 42 – Profile #1

SkylineXL 14.0 Skyline Analysis - Analysis Results - Standing Skyline System

<< RESULTS BASED on MAP or GIS PROFILE >>

Profile name: 1 | Units: English | Profile date: 7/13/16
Analysis name: Unit 49 profile 1 | Analyst: Wickham
Data source: GIS

STANDING skyline analysis summary table...

Skyline analysis type	Selected yarder	Selected carriage	Minimum payload-(lbs)	At terrain point	Analysis phase
Standing	Madill 6150, spcm, 50-ft twr	Acme 20s, pass shack	5,823	20	**1**

STANDING skyline rigging lengths table... *HB required*

Line	Capacity-(ft)	Required-(ft)	Notes	Chord slope span 1	Chord slope span 2	Chord slope span 3	Chord slope span 4	Average slope yarding dist for this analysis-(ft)
skyline	2,000	790	adequate					
mainline	2,300	710	adequate	17.9%				
haulback	4,300	1,370	adequate	Un-stretched skyline line length - (ft)			632.30	316

line capacities based on selected yarder

STANDING skyline analysis detail table, PHASE 1 analysis...

TP	Horizontal distance - (ft)	Net payload at TP - (lbs)	Net payload to landing - (lbs)	Skyline tension - (lbs)	Mainline tension - (lbs)	Haulback tension - (lbs)	Skyline clearance - (ft)	Log clearance - (ft)	Full susp. bottom of log above TP-(ft)
2	16	26,689	26,689	31,600	15,932	-	39.3	29.2	-
3	33	16,990	16,990	31,600	10,008	-	35.0	25.2	-
4	49	13,537	13,537	31,600	7,937	-	32.4	22.6	-
5	66	11,998	11,998	31,600	6,967	-	29.9	20.1	-
6	82	10,538	10,538	31,600	6,309	-	26.8	17.2	-
7	98	9,306	9,306	31,600	5,785	-	24.4	15.0	-
8	115	7,947	7,947	31,600	5,177	-	22.9	13.9	-
9	131	7,260	7,260	31,600	4,726	-	22.9	13.9	-
10	148	6,850	6,850	31,600	4,415	-	23.0	13.9	-
11	164	6,507	6,507	31,600	4,178	-	22.7	13.6	-
12	180	6,590	6,507	31,600	4,092	-	22.3	12.9	-
13	197	6,455	6,455	31,600	4,041	-	20.6	11.3	-
14	213	6,448	6,448	31,600	4,034	-	19.0	9.7	-
15	230	6,295	6,295	31,600	4,045	-	17.1	8.1	-
16	246	6,824	6,295	31,600	4,114	-	15.7	6.4	-
17	262	6,774	6,295	31,600	4,294	-	12.8	4.0	-
18	279	6,537	6,295	31,600	4,393	-	10.7	2.4	-
19	295	6,260	6,260	31,600	4,352	-	9.7	1.7	-
20	312	5,823	5,823	31,600	4,188	-	9.5	1.7	-
21	328	6,264	5,823	31,600	4,201	-	10.3	2.1	-
22	344	6,449	5,823	31,600	4,282	-	9.7	1.5	-
23	361	6,182	5,823	31,600	4,271	-	8.9	1.1	-
24	377	6,187	5,823	31,600	4,221	-	9.3	1.4	-
25	394	6,347	5,823	31,600	4,220	-	9.8	1.8	-
26	410	6,635	5,823	31,600	4,283	-	10.0	1.9	-
27	426	6,674	5,823	31,600	4,325	-	10.0	1.9	-
28	443	6,994	5,823	31,600	4,416	-	10.3	2.2	-
29	459	7,603	5,823	31,600	4,578	-	10.7	2.3	-
30	476	8,024	5,823	31,600	4,786	-	10.4	2.1	-
31	492	8,295	5,823	31,600	4,957	-	10.4	2.2	-
32	508	8,255	5,823	31,600	4,964	-	11.0	3.0	-
33	525	9,113	5,823	31,600	5,094	-	12.9	4.5	-
34	541	10,343	5,823	31,600	5,374	-	14.3	5.6	-
35	558	10,747	5,823	31,600	5,507	-	15.2	6.8	-
36	574	13,065	5,823	31,600	5,895	-	17.9	8.9	-
37	590	16,620	5,823	31,600	6,540	-	19.9	10.6	-
38	607	22,836	5,823	31,600	7,179	-	22.1	12.7	-

Figure 8. Skyline analysis results Unit #49 – Profile #1

SkylineXL 14.0 Skyline Analysis - Analysis Results - Standing Skyline System

<< RESULTS BASED on MAP or GIS PROFILE >>

Profile name: 9 | Units: English | Profile date: 7/15/16
Analysis name: Unit 49 profile 2 | Analyst: Wickham
Data source: GIS

STANDING skyline analysis summary table…

Skyline analysis type	Selected yarder	Selected carriage	Minimum payload-(lbs)	At terrain point	Analysis phase
Standing	Madill 6150, spcm, 50-ft twr	Acme 20s, pass shack	9,749	24	**1**

STANDING skyline rigging lengths table… *HB required*

Line	Capacity-(ft)	Required-(ft)	Notes	Chord slope span 1	Chord slope span 2	Chord slope span 3	Chord slope span 4	Average slope yarding dist for this analysis-(ft)
skyline	2,000	840	adequate	6.3%				
mainline	2,300	530	adequate					
haulback	4,300	1,000	adequate	Un-stretched skyline line length - (ft)			692.24	223

line capacities based on selected yarder

STANDING skyline analysis detail table, PHASE 1 analysis…

TP	Horizontal distance - (ft)	Net payload at TP - (lbs)	Net payload to landing - (lbs)	Skyline tension - (lbs)	Mainline tension - (lbs)	Haulback tension - (lbs)	Skyline clearance - (ft)	Log clearance - (ft)	Full susp. bottom of log above TP-(ft)
2	16	27,653	27,653	14,526	16,133	-	34.4	24.0	-
3	33	29,493	27,653	24,594	16,133	-	27.8	17.8	-
4	49	30,718	27,653	31,355	16,133	-	23.3	13.5	-
5	66	27,142	27,142	31,600	14,182	-	19.4	9.6	-
6	82	24,248	24,248	31,600	13,294	-	15.4	6.1	-
7	98	22,035	22,035	31,600	12,550	-	12.5	3.6	-
8	115	20,194	20,194	31,600	11,931	-	10.2	1.8	-
9	131	16,079	16,079	31,600	10,511	-	8.8	1.2	-
10	148	15,697	15,697	31,600	9,593	-	10.0	1.9	-
11	164	14,837	14,837	31,600	8,887	-	10.0	1.8	-
12	180	14,630	14,630	31,600	8,455	-	9.9	1.5	-
13	197	13,539	13,539	31,600	8,050	-	9.2	1.1	-
14	213	12,110	12,110	31,600	7,392	-	9.3	1.4	-
15	230	11,501	11,501	31,600	6,821	-	10.4	2.3	-
16	246	11,565	11,501	31,600	6,466	-	11.4	2.9	-
17	262	11,155	11,155	31,600	6,178	-	11.6	3.1	-
18	279	11,283	11,155	31,600	5,994	-	11.8	3.1	-
19	295	11,145	11,145	31,600	5,906	-	11.4	2.7	-
20	312	10,672	10,672	31,600	5,758	-	11.1	2.6	-
21	328	10,838	10,672	31,600	5,616	-	11.5	2.7	-
22	344	10,376	10,376	31,600	5,489	-	11.3	2.8	-
23	361	9,939	9,939	31,600	5,249	-	11.8	3.4	-
24	377	9,749	9,749	31,600	5,019	-	12.8	4.2	-
25	394	10,078	9,749	31,600	4,863	-	14.0	5.0	-
26	410	10,886	9,749	31,600	4,813	-	14.3	4.8	-
27	426	11,186	9,749	31,600	4,948	-	13.3	3.9	-

Figure 9. Skyline analysis results Unit #49 – Profile #2